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## Crop Conditions

Following a very early warm-up, temperatures cooled off the middle of March slowing crop development and bringing us back closer to normal. In southern areas, peaches are in full bloom, but only just showing a little pink in more northern areas. Apples are still in tight cluster and probably at least 10 days from full bloom. We are seeing hardly any bud damage across the state and at this point crops are looking very promising. Brambles are the one exception where damage might be a concern.

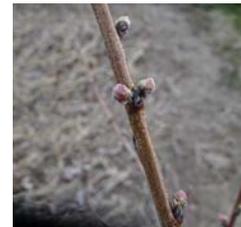
In Lafayette, early varieties of grapes are at early swell or “doeskin”. Peaches are at bud swell, almost pink. Apples range from tight cluster to dormant. Cherries are still dormant. Blueberry buds are swollen, but have not broken. Strawberries have new leaves emerging. Brambles are at various stages of development. Some cultivars have 3/4 to 1-inch shoots. Freeze damage to the leaves is obvious and cut buds show signs of damage to the growing point. So there will be some crop loss in brambles.

We are very fortunate that the recent cold weather slowed development and helped us avoid freeze injury (so far). We still have a ways to go, but the situation

looks a lot better now than it did a couple of weeks ago.



Apple tight cluster



Peach at bud swell



Live peach flower



Heritage red  
raspberry leaves  
with freeze  
damage



Heritage red  
raspberry bud

with cold injury



Cherry at swollen bud stage

## Spring is in the air

Spring is in the air, and soon, ascospores, basidiospores, and conidia will be as well—Now is the time for disease management! Not sure what to spray or when to spray it? There is always the Midwest Fruit Pest Management Guide, available at:

<https://ag.purdue.edu/hla/Hort/Documents/ID-465.pdf>



Midwest Fruit Pest Management Guide 2017

For those of you who would like a different approach and layout, try this (only available for apples, for now!):

<http://tinyurl.com/kdl6cw7>

### 2017 Indiana Disease Management Program for Apples

By Janna Beckerman, Extension Plant Pathologist  
Purdue University

Application rates in the tables are based on the amount of product to apply per acre. Successful application and control depends on many factors, including the type of application equipment, how well that equipment is maintained, proper spray volume, tree phenology, tree height, row width, target pest, tractor speed, humidity of application, the appropriate pesticide, and the chemical rate per acre used. For some products, the label requires minimum or maximum accumulations for applying the amount of water to use per acre when spraying. As always, please read and follow the label directions, warnings and cautions. MATERIALS ARE LISTED ALPHABETICALLY.

**Delayed Dormant—Diseases controlled and labeled rates. Apply before bud scale drop to minimize injury.**

Product and formulation	FRAC Code	Tree Height	Preparation Concentration and volume	ESL Rate	Maximum Accumulation per year	Max. applications per year	Remarks
<b>Fixed Copper*</b>							
Bordeaux mixture, 8.8-10	G	8 ft	24	N/A			If fire blight was severe last year, fixed copper spray at silver tip is suggested. Do not apply copper after 14-inch green leaf stage or when drying conditions are cool and slow because severe injury can occur. Many fixed copper fungicides are registered for use on apples. Fixed coppers can be mixed with oil. However, never combine copper sulfate alone with dormant oil. See labels for rates and restrictions. Oil also provide modest early season scale control in high inoculum orchards. Only use dormant application per season.
Cherry Fruitcake	G	5.3-10 ft	24	80.0			
Cherry WG	G	8-12 ft	24	80.0			
C-O-C-B-WDG	G	6-11.7 ft	24	31	1		
Cupula Ultra 40 Dispers	G	5.7-8 ft	24	40			
Kocide	G	5.7-8 ft	24	50			
Urea (40-0-0)	N/A	N/A	N/A	0	500	1	The suggested application rate is a 44 lb bag of agricultural grade urea per 100 gallons of water.
Abound Gold SL	4	8"	2.0	2.0 or 1.5 (oil)	7.0		Apply to soil in early spring before growth and in the fall after harvest but before the ground freezes. Needs soil irrigation to move material into root zone.

\*Efficacy ratings: E = excellent, G = good, F = fair, P = Poor, - = Not Effective  
\*Resistant pathogens will lower the effectiveness of these fungicides.

Trunk diameter at 12 inches above the soil line	Quantity of Diluted Mixture
<1 inch	1 qt.
1.0-1.9 inches	3 qt.
>1.9 inches	4 qt.

### 2017 Indiana disease Management Program for Apples

**Green Tip through Half-Inch Green Diseases (efficacy rating\* and amount per acre)**

Although all these fungicides are labeled for use at this time, it is recommended that the use of systemic fungicides (FRAC code 3 and 11) be delayed until more leaf tissue is present and disease pressures are higher to improve management while staying within recommended application numbers per season.

Product and formulation	FRAC Code	Tree Height	Preparation Concentration and volume	ESL Rate	Maximum Accumulation per year	Max. applications per year	Remarks
Aprivite	7	0"	12.5	27.6 oz	-	-	This is a new SDMI fungicide. Do not apply more than 2 sequential applications.
Captan	M	0"	35.0	40 lb	8	8	No more than 40 lb per acre per year.
Fit 50WG	11	G	12.5	11 oz	4	4	Do not apply more than 2 sequential applications.
Fonitiaz 1.675C	7	F-G*	12.5	61 oz	-	-	When used for scale, tank-mix with another fungicide from a different resistance management group. Do not mix with thinning agents. Do not apply more than 2 sequential applications.
Indar 2F	3	G*	12.5	32 oz	4	4	Addition of a wetting agent is helpful.
Inspire Super	3+9	G	12.5	60 oz	8	8	Do not apply more than 2 sequential applications.
Luna Sensation	7+11	G*	12.5	21 oz	4	4	Do not apply more than 2 sequential applications.
Luna Tranquility	7+9	G-G*	12.5	54.7 oz	-	-	Do not apply more than 2 sequential applications.
Mancosb 750F*	M2	G	12.5	27.6 oz	4.8	4.8	Amount depends upon protectant or extended protectant program. Do not combine the 6-lb product or 3-lb adhesion mancozeb schedule. See labels for details and page 1 for more information.
Merion 2.055C	7+11	G	12.5	22 oz	4	4	Do not apply more than 2 sequential applications. Do not use with EC formulated products or with Captan.
Omega 500F	29	G	12.5	8.8 lbs	10	10	This product also controls mites.
Polyram 800F	M3	G	12.5	27.6 oz	4.8	4.8	Amount depends upon protectant or extended protectant program. See page X.
Procuve 400SC	3	G*	12.5	64 oz	-	-	When used for scale, tank-mix with another fungicide from a different resistance management group.

### Green Tip through Half-inch Green Diseases

As always, please let me know if there are any errors or questions regarding disease management in either guide. I can be reached at [janna@purdue.edu](mailto:janna@purdue.edu). As you all know, keeping up and keeping track of labels is a challenge—your help in improving this guide for everyone is greatly appreciated!

## Straw removal on strawberries:

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 earlier than average with soil temperatures well into the 50s in early March, but they dropped back below 40 during the cold spell in the middle of the month. Recently they have maintained 40 or above consistently. 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.

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## Avoiding spring freeze injury in grapes

Spring freeze damage can be a significant economic problem for Midwest grape growers. Widespread damage occurred in 2007 and 2012 when warm temperatures in March were followed by freezing temperatures in April. Obviously this year we have had a very warm February, but more normal March. 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 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 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. In Indiana, we normally accumulate only 25-30 GDDs by April 1. 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 900-1,000 chilling hours in mid February this year. So vines have been 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 250 in southern Indiana, about 100 in central Indiana, and 50-75 in northern Indiana. Some of those likely occurred before chilling was satisfied.

Fortunately growers have some options to manage freeze risk. 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.

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.

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. This was the case in our research plots in 2012 and we were able to produce a full crop on most varieties, despite essentially complete loss of all primary shoots. Dr. Imed Dami presented his research on this topic at the Indiana Horticultural Congress this year as well. While this procedure requires more labor, it can

mean the difference between a full crop and little or no crop.

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## Pruning brambles

March is a good time to finish pruning summer-bearing brambles. Last years fruited canes should be removed now if they were not removed last summer or fall. Remove weak or spindly floricanes and thin to 4-6 canes per foot of row. Laterals on blackberries and black raspberries should be shortened to about pencil diameter on thornless blackberries, or to 6 to 12 inches on black raspberries to promote flowering on strong wood. Red raspberry canes can be tipped if desired, but should not be tipped more than 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 mowed to the ground now for a fall-only harvest. If a summer and fall crop is desired, remove the fruited tips and thin out weak floricanes. Remove and destroy the prunings to help prevent anthracnose and Botrytis gray mold. There may be some spring freeze injury this year in raspberries. I recently cut buds that had emerged early and they showed damage from the cold temperatures experienced in mid-March. The outer leaves were burned and on some cultivars the growing point was dead. It's too early to tell how much crop loss to expect.

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## Raspberry Anthracnose

Anthracnose, caused by *Elsinoe veneta*, is a common fungal disease of brambles. It is mainly a problem 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. However, if you grow a susceptible variety, it is important to control this disease. 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 have budded out early this year and are at the appropriate

stage for treatment now. 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.

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## Managing Mites in a BMSB World

### Managing Mites in a BMSB World

For several decades, apple growers in Indiana and elsewhere in the Midwest have used a highly effective system to manage European red mites that is based on conservation of the predatory mite, *Amblyseius fallacis*, along with timely applications of either preventive or rescue miticides. The rationale behind this approach was that the predatory mites would provide the majority of the control of ERM, with miticides used as supplemental controls as needed. One of the primary tenets of the system was that growers should refrain, if possible, from using insecticides that were highly toxic to the predators. One group of insecticides that exhibited this high level of toxicity to predatory mites were the pyrethroids. Therefore, growers were frequently reminded to avoid using those products for fear of initiating a mite outbreak.

Table 1 shows the toxicity of many of our insecticides to predatory mites.



European red mite adult

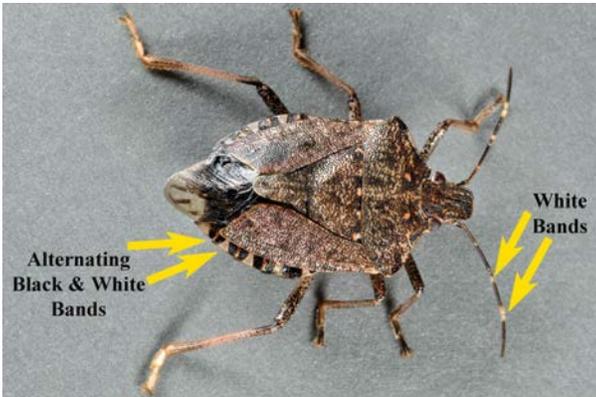
Not Toxic	Slightly Toxic	Moderately Toxic	Highly Toxic
Bt	Diazinon	Lorsban	Asana
Cyd-X	Imidan	Supracide	Baythroid
Virosoft	Assail	Actara	Danitol
	Centaur	Admire Pro	Permethrin
	Confirm	Belay	Proaxis
	Esteem	Avaunt	Warrior
	Intrepid	Delegate	Carzol
	Neem	Surround	Lannate
	Rimon		Sevin
	Altacor		Vydate

Table 1. Toxicity of insecticides to predatory mites.



Predatory mite, *Amblyseius fallacis* – Purdue University

One of the reasons this system was effective was that all of our pest insects could be controlled well with products that were not highly toxic to predatory mites. However, we now have to deal with an invasive pest, the brown marmorated stink bug (BMSB), that is very difficult to control. Products such as the pyrethroid insecticides are likely to be needed to manage this pest. BMSB can be severe, as evidenced by the tremendous losses experienced by fruit and vegetable growers on the eastern seaboard over the past 5-10 years.



Brown marmorated stink bug, John Obermeyer

BMSB was first detected in Indiana in Elkhart County in November 2010. Since that time, it has spread to all corners of Indiana. When invading a new region, BMSB typically will first become a household pest since it likes to overwinter inside homes to avoid our cold winters. Later, it will become a pest of fruits, vegetables, ornamental plants, corn and soybeans. Over the past

several years, we have had sporadic reports of damage to various crops such as soybeans, sweet corn, and tomatoes, although in most cases, the damage was not severe. Now, for the first time, we have significant losses in a fruit crop, in this case apple. One Indiana grower reported losses up to 30% in some blocks of late maturing apples in 2016.



Brown marmorated stink bug damage to apples, Washington State University

BMSB is capable of causing such significant losses that growers will need to do whatever is necessary to protect their crops, even if it means using products that will kill predator mites and potentially flare ERM populations. So, how does this change in pesticide use affect our European red mite management program? Here are my suggestions.

- Monitor your crops for BMSB. Don't spray for them unless you have some evidence that they are there. You can use various types of traps or direct observations to determine their presence. Protect your crop from BMSB and deal with the consequences (ERM) later.

Insecticide	Rate/A	PHI	Limitations
Lannate SP	0.5 - 1 lb.	14	5 lbs. 7 days between applications
Lannate LV	1.5 - 3 pt.	14	15 pts. 7 days between applications
Danitol 2.4EC	16 - 21.33 fl. oz.	14	42.67 fl. oz.
Mustang Maxx 0.8 EC	1.28 - 4 fl. oz.	14	24 fl. oz. 7 days between applications
Proaxis 0.5EC	2.56 - 5.12 fl. oz.	21	25.6 fl. oz. 20.48 fl. oz. after bloom
Warrior 1CS	2.56 - 5.12 fl. oz.	21	25.6 fl. oz. 20.48 fl. oz. after bloom
Endigo ZC	5 - 6 fl. oz.	35	28 fl. oz. 10 days between applications
Leverage 360	2.4 - 2.8 fl. oz.	7	28 fl. oz.

Table 2. Insecticide options for products on apples with stink bugs on the label.

Insecticide	Rate/A	PHI	Limitations
Actara	2 - 5.5 oz.	14 - 35	16.5 oz. 10 days between applications
Assail 30 SG	6 - 8 oz.	7	4 applications; 12 days between applications
Admire Pro	1.4 - 7 fl. oz.	7	14 fl. oz. 10 days between applications

Table 3. Insecticide options for products on apples

without stink bugs on the label.

- If last year's experience is indicative of what we can expect in the future, the need to control BMSB may be after we have stopped worrying about ERM for that season, so there may be no effect on ERM for that year.
- If possible, apply a Superior oil spray during the season after spraying for BMSB. If you are using captan prior to bloom, you will not want to apply oil.
- If you have sprayed for BMSB the previous year, you should seriously consider the use of one of the preventive miticides, Apollo, Savey, Agri-Mek, or Zeal, on the blocks you sprayed for BMSB.

<b>Good</b>	<b>Excellent</b>
Agri-Mek	Apollo Savey Zeal

Table 4. Effectiveness of preventive miticides against European red mites.

- Beginning shortly after petal fall, begin scouting for ERM in the blocks that you sprayed for BMSB last year or where you would normally expect to see them first. Follow the spray threshold guidelines and treat with a rescue miticide if you exceed the threshold.

<b>Fair</b>	<b>Good</b>	<b>Excellent</b>
Acramite	Agri-Mek	Envidor
M-Pede	Nexter	Kanemite
Summer Oils	Nealta	Portal
Vendex	Onager	Zeal
Dicofol		

Table 5. Effectiveness of rescue miticides against European red mites.

- Given the loss of predatory mites, you may need to apply more than one rescue miticide. If more than one application is necessary, choose a miticide with a different mode of action to avoid the development of resistance.

For more complete information about mite management, see

<https://extension.entm.purdue.edu/publications/E-258/E-258.pdf>.

April 13, 2017

Belgian Horse Winery Middletown, IN  
For further information contact Jill Blume at [blume@purdue.edu](mailto:blume@purdue.edu)

Indiana Horticultural Society Field Day  
June 28, 2017

Tuttle Orchard  
Greenfield, IN

More details to come but mark the date on your calendar and plan to attend

Indiana Horticultural Congress  
February 13-15, 2018

Indianapolis Marriott East  
Indianapolis, IN

For further information contact Lori Jolly-Brown  
[@ljollybr@purdue.edu](mailto:ljollybr@purdue.edu) or visit [www.inhortcongress.org](http://www.inhortcongress.org)  
for more details

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## Spring temperatures

The temperature data shown in Figure 1 will come as no surprise to anyone. This spring we had a very early warm period, much earlier than anytime this decade and even earlier than 2012. This started in mid February and continued for a couple of weeks. Thankfully since the start of March, we returned to cooler, more typical weather and the accumulation of Growing Degree Days virtually stopped. We have seen another warming trend in the last week or so, which still ranks this year as one of the earliest in memory, with apples in southern areas starting to bloom. Dave Byers in Bedford says this is only the second time he has ever seen apples bloom in March. So is this good news or bad news? Well the answer depends a little on your viewpoint. I would say a little of both - it's not looking as dire as it did a month ago and looking considerable better than 2012, which many recall did not end well for us. Having said that, this is still looking like an abnormally early year with the consequent risk of early development and then a late frost.

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## Upcoming Events

Wine Grape Team Spring Workshop

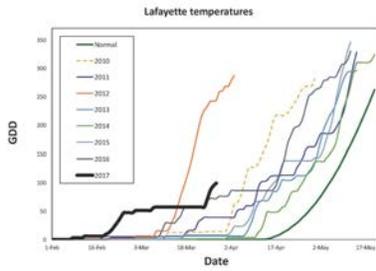


Figure 1

## New study: Diet contributes to brain size

**The results of a historical primate behavior analysis suggest that species with fruit-filled diets evolved larger brains.**

A popular theory among evolutionary biologists is that we have our sociability to thank for our big brains. This “social brain hypothesis” suggests that the mental effort involved in interacting with others eventually increased our cognitive capacity. However, the results of a study published Monday (March 27) in [Nature Ecology & Evolution](#) suggest that diet, rather than social complexity, is the key to bigger brains seen in some primates.

A team at New York University analyzed data on the diets and social lives of more than 140 primate species, including monkeys, apes, and lemurs. This revealed that

measures of social complexity, such as group size or mating systems (monogamy vs. promiscuity) did not seem to contribute to bigger brains. But dietary preferences did. Most notably, animals that feasted on fruits had larger brains than their leaf-eating counterparts.

“If you are foraging on harder-to-access food, like fruit instead of leaves, then you need to have all the cognitive strategies to deal with that,” coauthor Alex DeCasien, a PhD student at New York University told NPR’s [The Salt](#). “All of that is so much more complicated than just grabbing a leaf and eating it.”

“I have been very skeptical about the social brain hypothesis from the outset,” Robert Martin, a biological anthropologist at the Field Museum of Natural History in Chicago who was not involved in the study, told [Scientific American](#). “As far as I am concerned, the new paper by DeCasien and colleagues effectively eliminates that theory. It convincingly shows that there is no meaningful association between brain size and social organization whereas there is good evidence for a relationship between brain size and diet.”

However, Robin Dunbar, a psychologist at the University of Oxford, U.K., who was one of the creators of the social brain hypothesis, does not think this new work discredits his theory. “In order to have a bigger brain, you have to have a change in diet,” Dunbar told [Science](#). Diet and sociality “are not alternative explanations” for larger brains, he added.

(Diana Kwon, the-scientist.com)

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