PURDUE UNIVERSITY
PURDUE EXTENSION
FACTS FOR Fancy Fruit
Issue: 20-04
May 8, 2020

In This Issue

Crop Conditions

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

Growth and development in fruit crops is continuing slowly across the state due to cool temperatures and resulting low growing degree day accumulation. It's been a rough start to spring to say the least. Frost and freeze damage from the April 15-16 events has become more obvious, and there are still risks of freezing temperatures in the near future. Currently in the Lafayette area apples are mostly past full bloom and into petal fall. A few varieties are still near full bloom. Frost damage is visible on the petals of many varieties. Grapes are at bud break to about 3 inch shoots. The earlier varieties are showing some damage from the earlier frosts, but for the most part we escaped major damage. Blackberries are at 2 to 4 inch shoots and flowers are now visible on some shoots. Those will be susceptible to freeze injury though the leaf tissue will likely survive. While we have, so far, been fortunate in the Lafayette area, that is not true for growers in the southern part of the state where crops were more advanced and freeze injury in April was much worse. But until all danger of frost is past and we can fully access the extent of the damage, there's no sense worrying. Tree fruit growers should hold off on thinning until we know how much crop is left. It is still possible that most fruit crops will produce a good crop.

Apple in full bloom

Apple at petal fall

Grape at 1 inch shoot. Cluster already visible

Grape at 3 inch shoot. Note frost damaged bud on spur past shoot.

Grape at 4 inch shoot. Note freeze injury (brown spots) on first few leaves.

Blackberry shoot with flowers visible. Those will be susceptible to freeze damage.

Ready for Winter to Be Over

(Beth Hall, hall556@purdue.edu)

The earth's position and movement around the sun welcomed the spring equinox on March 19th, and meteorologists in the northern hemisphere welcomed spring on March 1st. Unfortunately, the atmosphere – particularly over the midwestern and Great Lakes states – refused to acknowledge those dates to offer us a more traditional spring. Sure, Indiana's spring 2020 has been drier than 2019. The compromise to that gift, however, came with periods of below normal temperatures, and potentially below *freezing*, damaging conditions this Friday across much of state (Figure 1). This may not even be a one-and-done phenomenon as the National Weather Service is predicting a risk of much below-normal temperatures for the far northern counties in Indiana for May 13-15. Is Mother Nature aspiring to break low temperature records? The record latest dates for 32°F or lower minimum temperatures are mostly after May 15th, so we will just have to watch and see.

In addition to being unwelcomely cold, these below-normal temperatures have had two other effects. First, growing degree days are accumulating at a slower rate. Currently, Indiana is about 50-80 units below normal modified growing degree-day accumulations (Figures 2 and 3). This has slowed a lot of plant growth and also kept soil temperatures cooler. The other effect is the reduction to evapotranspiration rates (Figure 4). April was drier than normal and May has not yet started to compensate for that. Looking at precipitation alone might lead one to assume agricultural drought is developing. However, cooler temperatures are helping to keep that moisture in the ground longer than what would otherwise be normal given the decreased precipitation.

The climate outlook for May is predicting below-normal temperatures. The precipitation outlook is split across the state where the models are showing weak confidence for below-normal precipitation in the northern half of the state and too much uncertainty for the southern half (Figure 5).

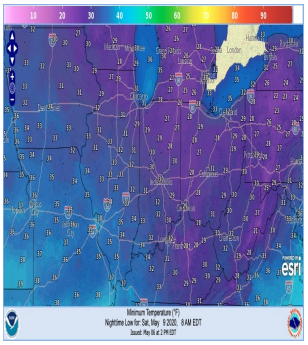


Figure 1. Forecasted minimum temperatures for early morning Saturday, May 9, 2020

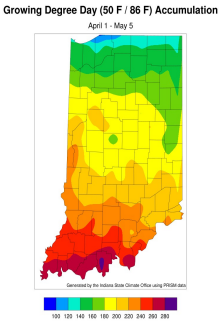


Figure 2. Modified growing degree-day accumulation for April 1 – May 5, 2020

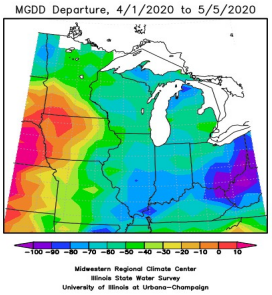


Figure 3. Modified growing degree-day departure from normal for the accumulations between April 1 – May 5, 2020

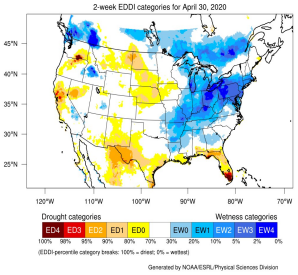


Figure 4. Two-week Evaporative Drought Demand Index (https://psl.noaa.gov/eddi/) representing April 17 – April 30, 2020

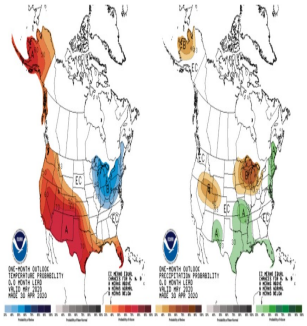


Figure 5. Climate outlooks for May 2020 that indicate the level of confidence for above- or below-normal conditions. Temperature outlook is on the left; precipitation outlook is on the right

Using Row Cover or Sprinkler Irrigation for Cold Protection of Strawberries

(Wenjing Guan, guan40@purdue.edu)

Strawberries growing in the matted-row system are in the blooming stage. Open flowers cannot tolerate temperatures lower than 30°F (Figure 1). Strawberry growers should be prepared for the coming low temperatures this week.

Figure 1. Strawberry flowers were killed by frost.

Row covers (Figure 2) can be effective in protecting strawberry flowers. In our earlier trial, 1.5 oz/sq row covers provided 4-6 degrees protection and successfully protected strawberry blooms in the earlier frost happened in middle April (the recorded lowest temperature was 24.5 °F at Southwest Purdue Agricultural Center). Lighter row covers (0.05-1.0 oz/sq) provided fewer degrees of protection and double layers can be more effective. When using row covers for frost protection, be sure to have good soil moisture, sometimes running water through the drip line may add heat in the system. Apply row covers in the early afternoon to attract more heat before temperature drops. Although row covers can be effective in protecting strawberry blossom from frost damage, the drawback is they have to be pulled back during the day following a night of cold protection, as flowers need to be pollinated either by wind or insects.

Figure 2. Covering a strawberry field with a row cover.

Sprinkler irrigation is another option. It might be cheaper, less labor-intensive, and cover a larger area. When atmospheric condition is dry, start sprinkling when blossom temperature reaches 32 to 33 °F. Keep running water past the sunrise, do not stop before the blossom temperature is registering 32 °F. When using sprinkler irrigation for frost protection, it is critical to accurately measure blossom temperatures to guide the decision of when to start and shut off irrigation. Atmospheric temperatures may not always reflect actual blossom temperatures. Dr. Barclay Poling at NCSU recommended using a digital thermometer to measure blossom temperatures. Here is a video of Dr. Poling showing how to use the digital thermometer.

Spring temperatures

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

As we've talked about previously, once winter chilling is fulfilled, the rate of tree growth and development is largely dependent on temperature. This is clearly evident in the data over the last 10 years (see Figure 1). In 2012, we had an extremely early and warm spring, rapid accumulation of Growing Degree Days, and very early development. Fruit crops in Lafayette flowered in March, about a month early. As we all remember this was followed by spring freezes resulting in extensive crop loss.

OK, so enough of the history lesson. What's happening this year? Well spring started at about the mid-range of the last few years then cooler temperatures arrested bud development. Normally having the latest spring for 10 years would be a good thing, because it reduces the risk of freeze damage. But the problem we have this year is that early warm temperatures pushed buds to the flowering stage or a little beyond, and now we need warm conditions for pollination, fertilization, fruit set and chemical thinning. So here we are with orchards full of trees in bloom or even past petal fall, and cool conditions forecast for the 5-7 days. On top of that, freezing conditions are predicted for tomorrow evening.

We know that most of our chemical thinners are not very effective when applied in cool temperatures (below 65 F). Research by Dr. Rich Marini at Penn. State University showed that it's not just the temperature at the time of application that's important, but the

temperatures two days earlier through to one day after application, so we need about a four-day window of warm temperatures for thinning to be most effective. In most places in the state, we don't have that now and are unlikely to have this for another week or so. The good news is that with cooler conditions, fruit will not be growing very much, so hopefully most fruitlets will not outgrow the thinning window of around 12 mm diameter during this cool spell.

As for the freeze damage, well we already experienced quite a bit of damage around the state on April 15-16, with lows in the lower 20's. For the predicted upcoming freeze, the amount of damage depends on many factors, but the most important are 1. How cold it gets 2. The stage of crop development, and 3. How long the temperatures stay below freezing. Fruit are killed when the ovule or developing seeds are killed by cold. As the fruitlets develop, they have an increased amount of tissue around seeds to protect them, and are less likely to be killed by freezing conditions. However, temperatures below freezing can also cause cosmetic damage to fruit, sometimes resulting in the classic russeted frost rings (Figure 2). In many cases, this will render fruit into cider apples, but some slight amount of cosmetically-damaged fruit may be saleable at farm markets.

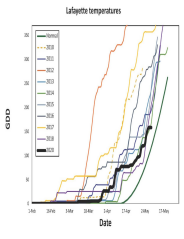


Figure 1

Figure 2

Average Temperature[1]		Wetting Period (hr)[2]	Incubation Period (days)[3]
F	C		
79	26	11.3	—
77	25	8	—
75	24	6.1	—
73-63	23-17	6	9-10
61	16	6.1	9-10
59-57	14-15	7	12-13
55	13	8	14
54	12	8.3	14
52	11	9	15
50	10	11	16
48	9	12.2	17
46	8	13.4	17
44	7	15.4	17
43	6	18	17
40	5	21.2	—
39	4	27.8	—
37	3	29.6	—
35	2	34.7	—
34	1	40.5	—

[1]Average temperature during the wetting period in Fahrenheit or Celsius
[2]Minimum wetting period needed to achieve infection
[3]Time in days until visible symptoms appear

Apple Scab

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

The recent spate of cool, wet weather has left one organism happy, *Venturia inaequalis*, the fungus that causes apple scab. Most of the state just underwent an extreme scab period, and unfortunately, few of us could do anything about it because of the combination of rain and wind. The revised Mill's table (from http://www.fruit.cornell.edu/tfabp/revmills.htm)identifies this period as taking anywhere from 8 up to 30 hours. Unfortunately, days of rain provide the perfect infection period. The kicker is the fact that infection develops really slowly under these cool, wet conditions. This means symptoms may not show up for another two to three weeks. At this point, everyone is thinking 'Fungicide resistance!', as opposed to what really happened—heavy rains that washed off any trace of fungicide, plus a long, cool wet infection period that delayed symptom development.

Obviously, we are past the point of rescue sprays. Furthermore, for those of you with the heaviest rains, you may have needed a canoe, kayak or small boat to get into the orchard. Heavy winds might (or should) have prevented spraying, too. So, what is a grower to do?

Keeping fruit protected is the key. Heavy rains will work against powdery mildew, but drive apple scab. The summer rots (bitter, black, white) require warm, wet conditions according to the literature. In my experience, fungi are not very good at reading the literature, and inoculum load by way of mummies has a lot to do with infection, along with cultivar susceptibility. Alternating between the DMI fungicides (FRAC 3; Inspire, Cevyam Indar, Topguard, and Rally if you don't have significant resistance) , strobilurins (FRAC 11; Flint, Sovran), FRAC 11+7 Pristine, Merivon, Luna Sensation) and SDHIs (FRAC 7; Aprovia, Fontelis); these fungicides will control scab, and have varying efficacy on powdery mildew, rust and some summer rots. For those varieties still under the 77-day PHI, I cannot stress the use of mancozeb enough to provide a tank mix partner (where needed), as it provides good scab control plus excellent summer rot protection. Plus, in this period of crazy tank mixes (petal fall to 2nd cover), minimizing captan use (and risk) is always a good thing. Frost rings are a real concern this weekend, why add russetting (Fig.

1)?

There's not much we can do about the weather. "May and June. Soft syllables, gentle names for the two best months in the garden year: cool, misty mornings gently burned away with a warming spring sun, followed by breezy afternoons and chilly nights. The discussion of philosophy is over; it's time for work to begin." –Peter Loewer

Figure 1. Frost ring. Photo by Janna Beckerman

Ready, Set, Monitor! Traps are set to detect key pests of tree fruit: Codling moth and Oriental fruit moth

(Elizabeth Yim Long, long132@purdue.edu)

The horticultural entomology team is happy to report that we're continuing efforts to support Indiana apple growers by monitoring tree fruit pests and reporting what we find!

Figure 1. Oriental fruit moth monitoring trap in 'Gold Rush' block at Meigs Purdue Agricultural Center (Lafayette, IN). Photo: E. Y. Long

On April 22, 2020, we placed pheromone-baited monitoring traps for two important tree fruit pests, the ***codling moth*** and ***Oriental fruit moth*** at the Meigs Purdue Agricultural Center in Lafayette, IN (Figure 1). This is the tree fruit research orchard nearest to Purdue's West Lafayette campus, with roughly 20 acres of tree fruit: mostly apples, but also pears, peaches, and plums.

Now, a bit about the pests and why we monitor them: the codling moth (CM) and Oriental fruit moth (OFM) are known as Tortricid or 'leafroller' moths, a group that includes more than 10,000 described species! Although monitoring efforts in the orchard are focused on the adult moths, the damaging life stage of these insects is the caterpillar. Both CM and OFM caterpillars burrow into fruits to feed (Figure 2), often leaving behind a trail of solid insect waste, known as frass. This feeding damage can destroy fruits entirely or lead to misshapen fruits that drop prematurely. Additionally, caterpillar feeding wounds on fruits can make them more vulnerable to fruit diseases.

Figure 2. Caterpillar damage to apple. Photo: John Obermeyer, Purdue University

Pheromone monitoring traps work by attracting male moths to a lure that mimics the smell of a female moth. As males fly through the orchard searching for a mate, they are attracted to the lure, thinking it is a female! When they arrive at the trap, they land in a sticky substance that prevents them from leaving. This makes it much easier to detect adult moth activity: anyone who checks the trap will see if adult moths are present, and once you see them you know it's time to take action to protect the trees and fruit. There are several generations of CM and OFM each year, so use of

pheromone monitoring traps can dramatically improve detection and thus protection of your tree fruit crop! To further enhance knowledge of CM and OFM activity and their progress through the life cycle, you can track degree days to predict how quickly these insects are developing based on daily high and low temperatures. Because insect development is temperature dependent, progress from one life stage to the next (for example, the egg stage to the caterpillar stage) may speed up or slow down depending on daily temperatures. Tracking degree days may be especially useful this season, given the cool-wet weather and fluctuating spring temperatures.

Figure 3. Adult codling moth (left) and Oriental fruit moth (right) trapped on bottom of sticky monitoring trap. Photo: John Obermeyer, Purdue University

The ultimate goal of pheromone trap monitoring and tracking degree days is to keep track of peak adult flight activity and egg hatch, so that you can properly time insecticide applications to target newly-hatched caterpillars, which are most susceptible to insecticides. Pheromone traps for these moths are relatively inexpensive ($10.50 each at Great Lakes IPM online store) and are just as useful for backyard orchards with only a few trees.

As of May 4, 2020, we have not detected any codling moths or Oriental fruit moths in our monitoring traps. But when we do, you can count on us to let you know via our Purdue Fruit & Veg IPM Facebook page, Purdue Extension Entomology Twitter feed, and the Purdue Extension Entomology Fruit IPM website (once it's updated and live)! In the meantime, please remember that as long as fruit trees are blooming, they are attractive to pollinators! So please help protect them and do not spray insecticides or miticides during bloom.

Here's to a happy fruiting season! Feel free to reach out with any questions you might have!

Videos Highlighting Grower Partnerships by Laura Ingwell and Ian Kaplan

(Laura Ingwell, lingwell@purdue.edu)

Very happy to share these videos, produced by the Extension Entomology team, highlighting our collaboration with the Indiana melon industry on pollinators and pesticides. We are always looking for partners, just reach out to your Extension Specialists to find out how.

Click here for video

Click here for video

Click here for video

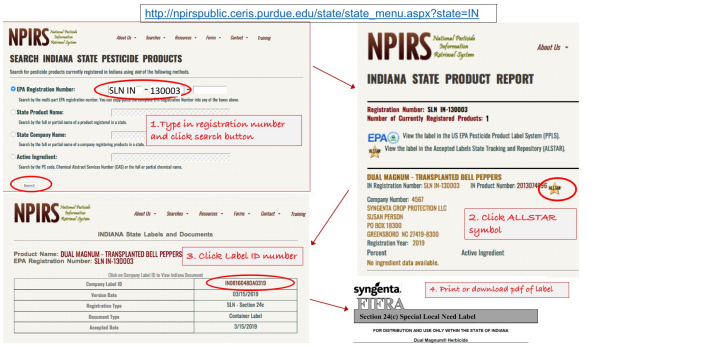
Instructions on Finding the Indiana 24(c) Dual Magnum® Herbicide Label for Small Fruits Stephen Meyers and Liz Maynard

(Stephen Meyers, slmeyers@purdue.edu)

Dual Magnum is registered for use in numerous row crops and specialty crops in the state of Indiana. While some vegetable crops (beans, peas, potatoes, pumpkins, rhubarb, and tomatoes) appear on the specimen or national label (Section 3 label), fruit crops do not. Numerous specialty crops that do not appear on the specimen label are included in the 24(c) special local need label, including many of the "small fruits" (cane berries, bush berries, and strawberries). But finding the 24(c) label, which was recently updated in 2019, can be difficult.

The new 24(c) label is available on the National Pesticide Information Retrieval System web site: **http://npirspublic.ceris.purdue.edu/state/state_menu.aspx?state=IN**. To find it, type "SLN IN" and "130003" in the first two boxes for "EPA Registration Number" and click the search button. The product report will show "DUAL MAGNUM – TRANSPLANTED BELL PEPPERS." Click on the ALLSTAR symbol. On the page that opens, click on the Company Label ID number "IN0816048DA0319." This will open a pdf of the label.

The active ingredient in Dual Magnum is *S*-metolachlor. It is a soil-applied herbicide with activity on a wide range of grass and small-seeded broadleaf weeds. It is also one of few herbicides registered in specialty crops with pre-emergence activity on yellow nutsedge. However, it will not control emerged weeds and requires a rainfall or irrigation event to be "activated" (moved into the soil where weeds seeds are actively germinating). Be aware that although generics of metolachlor (for example, Me-Too-Lachlor™) are available, their labels often do not include the crops covered by the Dual Magnum 24(c) label. Consult each product label for information about registered uses and application rates. There may also be confusion with Dual II Magnum (or variants thereof), which contains a safener specifically to improve crop safety when used in corn grown in cool soil conditions. For more information on chemical control of weeds, consult the Midwest Fruit Pest Management Guide at https://ag.purdue.edu/hla/hort/documents/id-465.pdf.



Due to the COVID crisis, all Purdue Extension meetings have been cancelled until further notice. Some may be offered by distance education, but no in-person meetings will be allowed. Most Purdue Extension staff are working from home. We are available to answer your questions by email, phone or through social media. Our contact information is at the end of the newsletter.

June 30, 2020 Indiana Hort Society summer field day
(Virtual, hosted by Beasley's Orchard)

July 30, 2020 Small Farm Education Field Day
Daniel Turf Center, Purdue Student Farm
Contact Lori Jolly-Brown, ljollybr@purdue.edu

September 10-12, 2020 Purdue Extension Master Gardener State Conference
Sponsored by the Hamilton and Howard County Master Gardener Associations
Hamilton County Fairgrounds, Noblesville, IN (September 10 and 11)
Tours of Howard County gardens, Kokomo, IN (September 12)
https://hcmga.org/2020sc
(Registration open to Purdue Extension Master Gardener volunteers and Extension staff only)

September 10, 2020 Hydroponics Workshop
Deans Auditorium/HLA Greenhouse
Contact Lori Jolly-Brown, ljollybr@purdue.edu

October 16, 2020 Indiana Flowers Growers Association Conference
Daniel Turf Center
Contact Lori Jolly-Brown, ljollybr@purdue.edu

January 19-21, 2021 Indiana Green Expo
Indiana Convention Center, Indianapolis, IN
Contact Brooke Ponder, bponder@purdue.edu

January 20 & 21, 2021 Indiana Horticultural Conference & Expo
Indianapolis Marriott East
Contact Lori Jolly-Brown, ljollybr@purdue.edu

Extension Events

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

Facts for Fancy Fruit © Purdue University - fff.hort.purdue.edu
Editor: Peter M Hirst | Department of Horticulture and Landscape Architecture, 625 Agriculture Mall Dr., West Lafayette, IN 47907 | (765) 494-1323