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Crop Conditions

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

Warm temperatures over the last week or so have accelerated growth rapidly. In Lafayette, apples are nearing green tip, and strawberries at full bloom. Blackberries are pushing half-inch green. Further south in the state, temperatures are in the mid 70's, apricots are in full bloom and peaches not quite at pink (thanks to Applacres for the update). Generally, we expect plants to start development when daily average temperatures are over 50 F. In Lafayette, we've been experiencing temperatures over 50 F since March 3 and are accumulating growing degree days. In fact, crops are at similar stages of development as they were at the same time last year.

Although we had widespread frost damage to crops around the state last year, it's interesting to note that this wasn't because of an early spring pushing crop development. Actually, last year was one of the later years we've had over the last 10 years. What got us was the late freezes on April 15 and 16. So what's the take home message? Actually, there are 2:

1. So far so good
2. We still have a long, long way to go. Stay tuned.

1.



Pear

1.



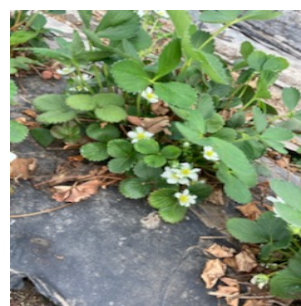
Blackberry

1.



Elderberry

1.



Strawberry

Climate and Weather Lions, Lambs, and La Niñas

(Beth Hall, hall556@purdue.edu)

The old adage says that March comes in like a lion and out like a lamb. The first few days of March started off quite normal and then quickly transitioned to lamb-like (not an official meteorological term) conditions. Then the roller coaster ride began with above-normal temperatures, followed by cooler, stormier conditions, followed by milder temperatures.

Typical Indiana.

Will March end on a calmer, warmer note? According to the national Climate Prediction Center, temperatures from March 29th through April 2nd should be near normal with slight chances of above-normal temperatures in the northern part of Indiana. Precipitation is favored to be above normal during this time. Of course, there's another adage that says April showers bring May flowers, so hopefully this increased chance for rain will be just enough to moisten without flooding the area.

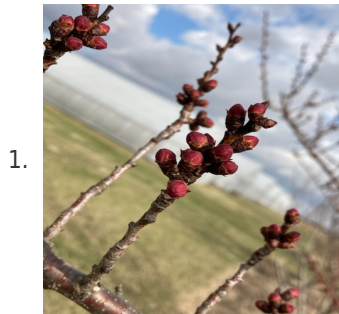
La Niña is still ongoing in the tropical Pacific Ocean, though models are predicting that it should weaken to more neutral conditions later this spring and early summer. While the sample size for past La Niña springs is low, the average pattern has been warmer-than-normal and wetter-than-normal conditions. Climate outlooks seem to be picking up on this pattern and predicting the same for this year.

Perennials are starting to wake up after their winter dormancy. Chilling hours – based on temperatures between 35°F and 45°F – have accumulated between 900-1000 units in the northern part of the state to over 1200 units in southern counties along the Ohio River (Figure 1). This is near- to slightly-above normal for this time of year. Hopefully, this will translate to abundant yields for fruit growers!

Based on climatology, the average date of the last hard freeze (28°F or colder) has occurred sometime between April 3rd and April 10th (Figure 2). The climate outlooks for early April indicate enhanced probabilities for above normal temperatures. Barring any unusual polar air mass quickly moving into the region, the risk for one more hard-freeze event should be very low for the rest of this spring season.



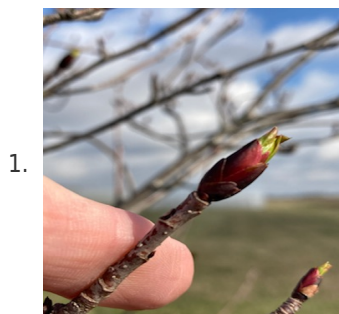
Apple



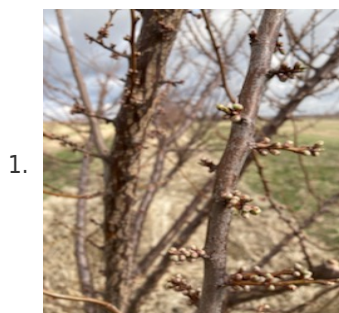
Apricot



Black Current



Aronia Viking



Plum

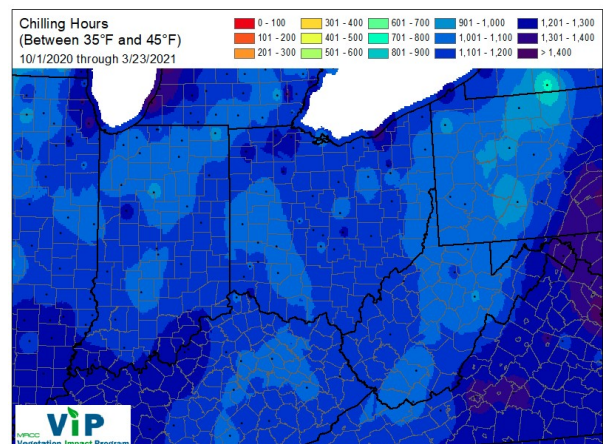


Figure 1. Accumulated chilling hours since October 1, 2020 for temperatures between 35°F and 45°F. Source: Midwestern Regional Climate Center;

Average Date of Last Spring Frost
28 F or Lower

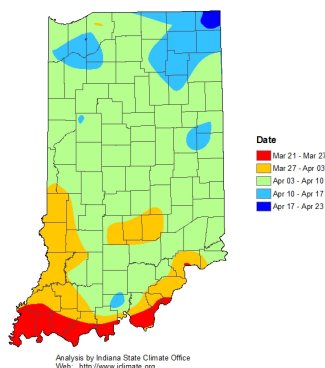


Figure 2. Average date of the last hard spring freeze. Source: Indiana State Climate Office;
<https://ag.purdue.edu/indiana-state-climate/freeze-frost-probability-growing-season-length/>.

The IR-4 Project and Indiana Growers

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

Did you know that almost half of the food we consume every day comes from crops the USDA categorizes as “minor” or “specialty” crops? Compared to the acreage of corn and soybean in the Midwest, fruit and vegetable crops are only a small percentage of crops grown. Not surprisingly, agrochemical companies focus their effort on the large acreage crops where they can get a return on their investment for the products they sell. With the development and registration of fungicides averaging about \$256M dollars, there simply isn’t an incentive to invest in the data required by the EPA to register a pesticide when the crop value is ‘only’ a few million dollars.

The IR4 Project was created to address this gap, and generate the data required to register a pesticide for use on specialty crops. The Project has evolved and also includes activities in pollinator protection, pesticide regulation, environmental horticulture, organic and biorational products, and animal and plant health.

IR-4 Projects chosen by a nomination process. This process begins when crop management issues are submitted by researchers and growers looking for potential products, or by industry representatives requesting trials to evaluate a new pesticide. Projects are then voted on to identify which research priorities are addressed. In this way, IR-4 has assisted in the registration of nearly 50,000 additional crops uses, allowing specialty crop growers to improve pest management, reduce crop damage, and minimize food waste.

The 2020 priority-setting meeting concluded with 422 project requests, with a resulting 59 funded projects for 2021. Through this process, Tristand Tucker and I, along with colleagues from

NCSU and UGA were provided funds to evaluate the efficacy and timing of SDHI fungicides to improve bitter rot management in apples. Our trial in Indiana in 2020, was cut short because of the freeze, but we will be repeating our work here in 2021. Later this season, I’ll share the results of my colleagues, Drs. Phil Brannen and Sara Villani.

Grower input is very important to this process. The 2021 Food Use Workshop will take place [virtually](#) on September 13 – 16. Please consider getting involved to get your voice heard, and or by becoming a member of the Commodity Liaison Committee (CLC). This group of volunteers works to educate policy advisors, industry, and IR- 4 personnel, about the specific needs of your commodity group. In the last two years, actions of the CLC have resulted in a potential increase in funding for IR-4, which has remained flat at approximately \$12M annually for the last decade. Competing budget proposals now before Congress will, hopefully add 3 – 7 million dollars per year to the IR- 4 budget, which will enable the organization to expand the number of tools available to growers. If you want to find out more about the IR-4 and its work, see

<https://www.ir4project.org/fc/food-crop-successes-stories/>.

Strawberry Disease Management

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

One of our earliest harvested fruit crops in Indiana are strawberries. This is good and bad news, depending upon the occurrence of a late spring freeze. Strawberries are very susceptible to these freezes for a number of reasons: Air temperature at ground level is often colder than the reported low temperature, low spots may be even colder, and rural locations, lacking the heat island we see in bigger cities are even colder than the temperatures reported in most ‘local’ news outlets

Our early and fluctuating spring weather presents a problem for growers. Like other fruit crops, strawberry flowers are susceptible to different temperature extremes at different times. They are most susceptible to freeze damage at open flower. The critical temperature for flower buds as they emerge from the crown is ~10°F. That critical value rises to ~22°F when flower buds have elongated but blossoms are tightly closed. When the flowers petals become visible (popcorn), the critical temperature is 26°F . Open flowers can tolerate freezes down too ~30°. Developing green fruit better tolerates cold temperatures than buds or blossoms, to ~ 28°F.

To determine if your flower buds suffered frost or freeze damage (Fig.1), cut through the buds; cold-damaged flower buds/blossoms will have a black center.



Figure 1 Strawberry freeze damage

Monitor fields for disease. Scout fields when dry (afternoon, evening) to reduce the risk of pathogen spread. Scout fields weekly for infected plants, especially when conditions are warm and wet. If conditions are wet, eliminate (or minimize) overhead irrigation

Implement sanitation. Reduce the inoculum of disease-causing fungi or bacteria by removing infected leaves and fruit. If disease levels begin to run high, infection foci ('hot spots') need to be eradicated (remove and destroy). This includes any and all infected plants, in addition to plants within ~ 5 ft. radius of the infected area. Harvest all known areas of infection last to minimize the spread of the disease.

Early and regular sprays. Fungicide applications work best when applied early and often, sometimes as often as 7-10 days depending on disease pressure. See the Midwest Fruit Pest Management Guide at <https://ag.purdue.edu/hla/Hort/Documents/ID-465.pdf> or the draft of the new version of the guide that follows. **The label is the law: Follow all pesticide labels**

Fungicide applications protect plants from infection, and subsequent disease build-up that spreads to additional plants. The choice of fungicide is based upon:

1. The plant growth stage (phenology), and
2. The weather forecast.

If the forecast predicts multiple days of rain around or during bloom, begin applications of captan to protect the crop, adding a FRAC 7, FRAC 11 or FRAC 7+11 fungicide if needed. Save that one application of iprodione (Meteor/Rovral) to protect against botrytis until bloom. Follow up with captan or another fungicide that is effective against both botrytis anthracnose. Keep in mind that freeze damage will make damaged tissues more susceptible to infection by the botrytis and anthracnose fungi, and may warrant earlier use of a Pristine, Merivon, or Luna Sansation (FRAC7+11) fungicide, to protect fruit, and more importantly, the crown of the plant. Use the new schedule to see if any additional fungicides are needed to protect against other potential disease problems. One upshot of the FRAC 7+11 fungicides is their broad range of activity against a number of strawberry pathogens.

Root rot Management

If your field has a history of Phytophthora diagnoses, then an

application of Ridomil Gold SL may be necessary. Phytophthora root and crown rots, along with leather rot, thrive in wet conditions. Up to 3 applications can be used per year (last column of table), so it is important properly time applications for maximum effectiveness. This means one application in the spring after the ground thaws but before first bloom, and a second application in the fall. For supplemental control of leather rot, an application may be made at fruit set.

Understand the proper timing of fungicide applications is critical to strawberry disease management. Unfortunately, most of the diseases that impact strawberry develop symptoms when fruit is ripening. The time to protect against infection occurred even before the first flower opened, through bloom. Hopefully, the new layout of the guide will provide clearer instruction on what to apply and when to apply it. Please send any question or comments to janna@purdue.edu

[Strawberry Spray Schedule](#)

Grower Survey to Assess Herbicide Drift Damage in the North Central U.S.

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

A special project group of the North Central Integrated Pest Management (IPM) Center wants to learn about your concerns and experiences with herbicide drift. The group is surveying growers of fruits, vegetables, and other specialty crops in the upper Midwest.

To truly understand the frequency, severity, and economic impact of herbicide drift on specialty crops, we need to hear from growers: growers who have experienced drift damage, growers who can share their concerns around this issue, and even growers who have not dealt with drift but who grow sensitive crops in drift-prone regions. Survey responses are needed to establish herbicide drift as a serious economic and regulatory concern in Indiana and across our region.

Please complete the survey at go.osu.edu/drift10.

Who should take this survey?

The study is for commercial growers of fruits, vegetables, and other specialty crops in IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, SD, or WI. Even if you have never experienced herbicide damage, we would still like to hear from you if you grow specialty crops in one of these states.

Why is this survey necessary?

Dicamba and 2,4-D drift damage has made headlines in recent years, but no study to-date has attempted to quantify the overall impact drift has on the specialty crop industry. While all states have a way for growers to file a drift complaint, the process and requirements are inconsistent and may involve time and information that a grower does not have. In most states, for instance, the source of the drift must be identified. Research has found that dicamba and 2,4-D both have the potential to travel for

miles in specific weather conditions, making source identification difficult.

What good will this survey do?

This study is designed to assess the potential and actual frequency of drift damage, along with the severity and economic impact of such damage. The survey includes questions on grower awareness, experience, actions, and decisions related to herbicide drift and drift-risk management. The responses will help establish needs for research on drift mechanisms, prevention, and remediation; and/or the need to review current policy and reporting requirements.

How long will it take?

The survey takes 5-20 minutes to complete, depending on your experience with drift damage.

How will this data be shared?

Summarized survey data will be shared broadly with regulatory agencies, university educators and researchers, agricultural policy makers, grower support organizations, and the general public using news articles, report summaries, and peer-reviewed journal articles. While this study is administered by The Ohio State University, it was planned in partnership with industry experts across the region who will assist with sharing results. Participants may also request a copy of the study summary.

How will my data be used and protected?

Your privacy is important. No individual survey data will be released or shared beyond the limited group of project staff. The survey questions and procedures have been reviewed by the institutional review board at The Ohio State University and are designed to protect your data and identity. Additional details on privacy and confidentiality are provided at the beginning of the survey.

How can I learn more?

The North Central IPM Center's special project group created a series of fact sheets on herbicide drift especially for specialty crop growers. The series includes: Overview of Dicamba and 2,4-D Drift Issues, Frequently Asked Questions, Preparing for Drift Damage, and Responding to Drift Damage. Fact sheets and more information about our special project group and study are available at go.osu.edu/ipm-drift.

This study is facilitated by The Ohio State University and is funded by the USDA National Institute of Food and Agriculture through agreement 2018-70006-28884. This study is being conducted in cooperation with regional universities and non-profit grower organizations, including Purdue University.



A word on thinning

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

With many orchards suffering severe frost damage last year, our expectation is for very heavy flowering this spring. We'll talk more about thinning next time, but it's a pretty safe prediction that flowering will be heavy and so growers will really need to have their act together regarding thinning. So make sure now that your spraying equipment is in good shape and ready to go, and that you have thinning materials on hand. It's still too early to predict what this spring has in store for us, but now is the time to get prepared.

Plan ahead to protect young fruit trees from 17-year periodical cicadas emerging in May

(Elizabeth Yim Long, long132@purdue.edu)

A natural wonder will occur in 15 states this year: the emergence of the Brood X, 17-year periodical cicadas! Also known as "17-year or 13-year locusts" the last mass emergence of these insects occurred in 2004. Now, 17 years later, the immature cicadas will emerge from the ground, molt one last time to gain wings, and "sing" loudly to find mates and lay eggs in trees and woody shrubs.

Periodical cicadas

There are six known species of periodical cicadas and five of them occur in Indiana. **Brood X will emerge late May through June in all Indiana counties, but activity will be heaviest in south-central Indiana.** You will see two distinct life stages of these charismatic insects: the nymphs and the adults.

Although there is no single degree day model to predict the emergence accurately across regions, it's generally agreed that when soil temperatures warm up to 65 °F or so, the nymphs will begin to emerge from the soil. The nymphs are wingless, *just a bit*

creepy, and dark golden-brown in color (Figure 1). After emerging from the ground, nymphs crawl up tree trunks and items like patio furniture, to molt – leaving behind their cast skin (exoskeleton).

The adults are 1.5 to 2-inches long, with black bodies and reddish-colored legs, wing margins, and eyes (Figure 2). Newly emerged adults may appear pale or white in color until the exoskeleton has hardened and darkened (Figure 3). Adult periodical cicadas live for ~1 month, and during this time the males produce shrill “songs” to attract females using vibrating organs called tymbals – *how romantic!* Females cut slits into twigs of woody plants to lay eggs that hatch in 6-7 weeks. After hatching, the next generation of 17-year cicada nymphs drop to the ground and dig down into the soil, where they will remain for another 17 years feeding on sap from tree roots.



Figure 1. Periodical cicada nymph (cast ‘skin’). Photo: John Obermeyer



Figure 2. An adult periodical cicada on my arm.



Figure 3. A newly emerged adult periodical cicada, before its exoskeleton has hardened and darkened. Photo: Jane Chandler

Why the mass emergence? This is a life history strategy to satiate predators (Figure 4, they can’t eat them all!) and maximize the chances that the majority of periodical cicadas will survive to mate and lay eggs.



Figure 4. Periodical cicadas have many predators, including chipmunks. Photo: Emily Keith

Damage

- The good news is **periodical cicadas do not bite or sting people, or pets.**
- The bad news is **females lay eggs in 200+ woody tree species and can cause severe damage to young trees** (Figure 5). (See [Periodical Cicada in Indiana](#) to learn more about landscape and ornamental plants that are attacked by periodical cicada).



Figure 5. Cutting/slitting egg laying damage caused by female periodical cicadas on grapevines. Photo: E. Y. Long

In orchards: apples, cherries, peaches, plums, and grapevines are at high risk, because these hosts are preferred for egg laying by female cicadas. **However, any young trees with main branches and stems between 3/16” and 7/16” in diameter are susceptible to damage, and so these trees should be the main focus of protective efforts.**

Egg laying physically weakens and damages branches, which may turn brown, die, and break off (“flagging”). Under heavy attack, the loss of branches can cause serious damage or death to young trees. It is also possible that nymphs feeding on tree roots reduces vigor.

Management

Step #1: Cultural control

- Delay new plantings in 2021, either until the emergence has ended, or next spring.
- Plan accordingly for future emergence of periodical cicadas broods in Indiana (Table 1, below).

Table 1. When and where 13-year and 17-year periodical cicadas will emerge in Indiana in the future.

Brood number	Race	Year to appear	Where they will appear
VI (6)	17-year	2034	Reported in all IN counties in 2017, but may be a "shadow brood" of brood X.
X (10)	17-year	2021	All counties, but heaviest in south-central IN; largest of 17-yr broods.
XII (12)	17-year	2023	Allen & Orange counties; scarce in IN.
XIII (13)	17-year	2024	Lake, LaPorte, & Porter counties.
XIV (14)	17-year	2025	40 counties, but heaviest in SW IN; dense swarms expected in Brown & Warrick.
XIX (19)	13-year	2024	8 western counties, from Posey & Warrick on the south to Newton and Jasper on the north.
XXIII (23)	13-year	2028	21 counties, mostly in SW IN, with Fountain, Tippecanoe, & Fayette the northern limits.

Step #2: Mechanical control (recommended for small orchards/backyard fruit trees/organic production)

1. **Net trees with mesh screening (no larger than 1/2-inch openings), when first males begin singing (before egg laying begins),** to prevent females from accessing trees to deposit eggs.

Cover trees and tie the netting to the trunk below the lower branches (Figure 6). Remove after adult periodical cicada activity ends.



Figure 6. A small tree that has been covered with netting to prevent egg laying by female periodical cicadas. Photo: Gardensalive.com

2. **Prune branches after egg laying ends,** to remove damaged wood and infested branches from the orchard. *Remove pruned, infested branches 4-6 weeks after egg laying to prevent nymphs from entering soil and feeding on tree roots.*

Step #3: Chemical control (recommended for settings where netting is not feasible, like large/commercial orchards)

IMPORTANT: Chemical control is not as effective as netting. While netting is applied once to exclude egg-laying females, insecticides must be applied repeatedly against "waves of

cicadas" during the ~1-month activity period of adults to prevent or reduce injury to trees.

Insecticides are not recommended to protect large trees, because these trees can tolerate egg laying damage. **However, insecticide applications can reduce periodical cicada injury to small trees:**

1. **Once egg laying begins,** insecticides may be applied:

- o **Every 3-4 days,** to help prevent injury, or
- o **Every 7-10 days,** to help reduce injury
- o Soil-applied, systemic insecticides are not effective against periodical cicadas.

Scout orchards every 2-3 days during egg laying to evaluate how well insecticide applications are protecting young trees.

Pyrethroid insecticides are recommended against periodical cicadas because they have fast knock down and good residual activity; however, commercial producers should beware flare-ups of spider mites when using pyrethroid insecticides like Baythroid XL (active ingredient: cyfluthrin), and Mustang Maxx (active ingredient: zeta-cypermethrin) against periodical cicadas, because they also kill beneficial, predatory mites that typically keep spider mites at bay.

Commercial producers can refer to the [2021-2022 Midwest Fruit Pest Management Guide](#) for insecticide recommendations.

Homeowners can use products with active ingredients permethrin (Bonide Eight), zeta-cypermethrin (GardenTech Sevin), or gamma-cyhalothrin (Spectracide Triazicide Concentrate for Lawns and Landscapes) against periodical cicada on backyard fruit and ornamental trees and shrubs.

For your safety, always read and follow the instructions on pesticide labels.

In summary, here are some quick "take home messages:"

- o 17-year cicada emergence will occur in all Indiana counties late May through June, but will be heaviest in south-central Indiana.
- o Female cicadas damage twigs and branches 3/16" to 7/16" in diameter by cutting into them to lay eggs.
- o If you have an orchard or backyard fruit trees: prepare to take action when you hear the first males begin to "sing."
- o Focus protective efforts (netting, insecticide applications) on young trees, because they are most vulnerable.
- o Select and use insecticides judiciously to reduce flare-ups of secondary pests, like spider mites.

Extension Events

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

Small Farm Education Field Day July 29th, 2021 at the Purdue Student Farm.

Small Farm Education Field Day Webinar Series August 2, 4, 6, 9,

11, 13, 2021.

Watch for details at the Purdue Student Farm website
<https://www.purdue.edu/hla/sites/studentfarm/>

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