PURDUE UNIVERSITY

FACTS FOR FANCY FRUIT

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A Newsletter for Commercial and Advanced Amateur fruit growers.

In This Issue

Crop Conditions

(Chloe Rose Henscheid, richa267@purdue.edu)

The Purdue Meigs Horticulture Facility in Lafayette, Indiana just south of campus is looking lively this time of the year. All our fruit crops and trees have begun development. I know last year I said we had a warm winter and early spring but this year was much warmer and earlier. I was working fields in a cab-less tractor, in February, wearing a tee shirt on an 80-degree day this year. Our fruit crops and trees woke up about 3-4 weeks earlier than last year. The majority, of the grape varieties are dormant but the early varieties are showing bud swell. Apples are anywhere from silver tip to full pink, with a majority at green tip. Plums, peaches, pears, blackberries, and currants have begun development. Our field strawberries are actively developing new leaves. We have Strawberries in the high tunnels that started blooming about a month ago.

Field Strawberries

High Tunnel Strawberries: Bloom

Paw Paws: Bud Swell

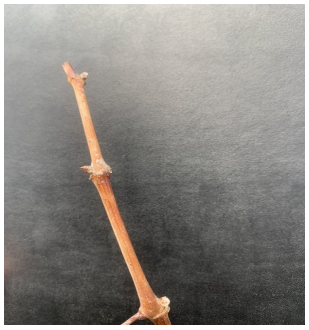
Plums: Full Bloom

Peaches: Calyx Red

Pears: First White

Apple (Rosalee): Green Tip

Apples (Pixie Crunch): Half Inch Green



Grapes: Dormant

Black Currant: Bud Development

Blackberry: Bud Development

Aronia: Bud Development

Climate & Weather

(Austin Pearson, pearsona@purdue.edu)

The 2023-2024 meteorological winter (December, January, and February) has concluded, but it seems as if we only experienced a couple weeks of winter-like weather this season. Indiana’s average temperature was 35.8°F, which was 5.3°F above normal. This was good for Indiana’s second warmest winter since records began in 1895. The warmest winter on record was 1931-1932 with an average temperature of 37.4°F, an astonishing 1.6°F warmer than this winter. As for the Midwest, it was the warmest winter on record (32.7°F). Interestingly, it was the first time on record that the winter temperatures averaged

above the freezing mark.

Indiana's winter precipitation was nearly normal totaling 8.26 inches (0.18 inches below normal). The bigger story was the lack of snowfall as the majority of the state ran 5-10 inches below normal, and in some cases 10-25 inches below normal, for the winter (Figure 1). The Midwestern Regional Climate Center's Accumulated Winter Season Severity Index (AWSSI) objectively quantifies the relative severity of the winter season by accounting for the intensity and persistence of cold weather, the amount of snow, and the amount and persistence of snow on the ground. Most of the Midwest, like Indianapolis, experienced near record mild conditions this winter (Figure 2).

On a positive note, drought conditions have improved throughout the winter (Figure 3). In December, over 44 percent of the state was in moderate drought (D1). Drought monitor conditions improved throughout the winter, as all that remained at winter's end was abnormally dry (D0) conditions in central and southern Indiana.

As for more recent conditions, the first 27 days of March have continued to run 6.3°F above the 1991-2020 climatological average. We have had some impressive precipitation totals in the first week of March as Adams and Daviess Counties measured around 3.75 inches in the first week of the month. Heavy precipitation totals were rather localized, as portions of central and southern Indiana recorded below-normal precipitation (Figure 4). Since February, though, precipitation totals have been less than 75 percent of normal for central and southern Indiana. Abnormally dry conditions in this week's US Drought Monitor are expanding in southern Indiana as a result (Figure 5).

Rain forecast totals range from just under an inch (southern Indiana) to just over 2 inches (northern Indiana) from March 28-April 4, much of which is needed (Figure 6). Whether this actually happens is to be determined. The Climate Prediction Center (CPC) has slightly elevated chances of below-normal temperatures and increased confidence in below-normal precipitation from April 2-6. April 4-10, the CPC has higher confidence in above-normal temperatures and above-normal precipitation. If you missed Hans Schmitz's Indiana spring 2024 climate outlook, titled "Kiss from a Rose on El Nino's Grave", be sure to check it out.

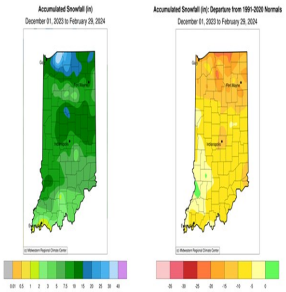


Figure 1: Left – Winter 2023-2024 snowfall totals from December 1 – February 29. Right – Winter 2023-2024 snowfall totals represented as a departure from the 1991-2020 climatological average snowfall.

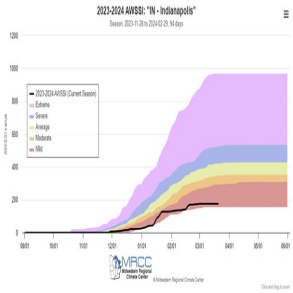


Figure 2: MRCC's AWSSI for Winter 2023-2024 for Indianapolis, IN. This winter has been a near-record mild winter for Indianapolis.

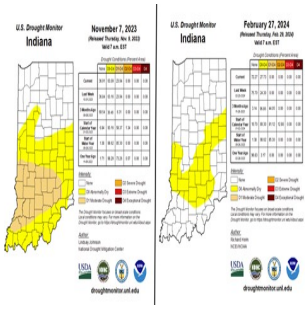


Figure 3: Left – US Drought Monitor from December 5, 2023. Right – US Drought Monitor

from February 27, 2024.

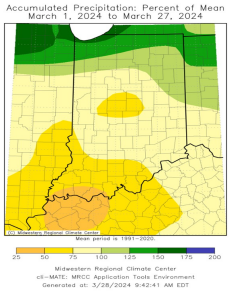


Figure 4: March 1-27, 2024 accumulated precipitation represented as a percent of the 1991-2020 climatological average.

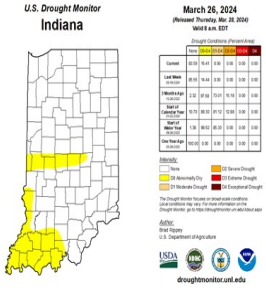


Figure 5: US Drought Monitor – Indiana Map, released March 29, 2024.

Figure 6: NOAA's quantitative precipitation forecast for March 28-April 4, 2024.

Where to Find "Special" Indiana Pesticide Registrations

(Stephen Meyers, slmeyers@purdue.edu)

Many of the pesticide products Indiana farmers use do not include specialty crops on the container's label. These uses are often added through 24C Special Local Need (SLN) labels or supplemental labels, which can be difficult to locate. In response to this, the Office of the Indiana State Chemist created a "Pesticide Products- Special State Registrations" webpage with pdf files for each product. To access the webpage, click this address (https://oisc.purdue.edu/pesticide/special_state_registrations.html) or scan this QR code:

This webpage includes all special registrations from biological insecticides for hemp, to insecticide for emerald ash borers, to herbicides for use in various fruits, vegetables, and ornamentals. For example, the 24C label for Dual Magnum® herbicide expands its use in approximately 70 vegetable, fruit, herb, and ornamental crops. According the Office of the Indiana State Chemist, the webpage will grow to include Section 18 (emergency exemption labels) and Experimental Use Permits (EUPs).

Blueberries are one of many fruit and vegetable crops that benefit from "special" herbicide registrations in Indiana. Photo credit: SL Meyers

Early season disease management

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

As of right now, we simply do not know if we will

have crops from our woody fruit producing plants, from apples to grapes to peaches. Remember: The ability to produce fruit is determined in the spring with flower development. Any factor, whether abiotic, insect or pathogen, that interferes with flower development will impact fruit set. Nothing affects flower development and fruit set like a spring freeze, with flower damage resulting when a critical temperature threshold (32 degrees F or less) is reached. The incidence and severity of this damage to flower buds is often variable even when critical temperature thresholds are reached (or exceeded!). The reasons for damage variability are due in part to the fact that:

1. **1**. Different species and cultivars of trees have different requisite chilling hours (hours needed to break dormancy). Apples require 800 and 1750 hours of temperatures below 45 degrees to break dormancy; peaches require 300-1000 chilling hours.
2. **2**. The actual number of chilling hours achieved that season. For a map of this, see https://mrcc.purdue.edu/VIP/indexChillHours2
3. Individual trees of all cultivars vary in their sensitivity to budbreak based upon predisposing stresses (excess crop in previous year, root rot, inappropriate late season fertilization, etc);
4. Each bud varies in its dormancy/hardening off.

That's a lot of variables, and although it helps in our understanding of why freeze damage occurs, it doesn't provide us with a lot of actionable strategies to manage to prevent this problem, besides good plant health management, especially proactive thinning and avoiding excess N fertilizer.

Uneven bud break is affecting some of the apple varieties at Meigs (Fig. 1). This is usually associated with apples that grow in areas with mild winters, like the one we just had. Apple trees in warmer climates often demonstrate uneven bud breaking and bloom times. With the combination of early bloom, coupled with trees exhibiting everything from silver tip to pink, the question must be asked: To spray, or not to spray? This is quickly followed by what do you decide to spray?

No one should be surprised that my vote is to spray. Depending upon timing, light freezes are helpful in thinning heavy crops, and it won't be until May when we will know if we have a crop. In examining leaf litter, pseudothecia are already developing and preparing to shoot ascospores. Although this is early in the season, spores will infect bud scales just like they infect leaves, and in this case, may infect both at the same time! There may be only 5% of the pseudothecia producing mature ascospores, but infection can and will occur. And each one of those ascospores can produce a lesion with almost 100,000 more conidia (asexual spores). A few ounces of prevention now will yield tons of cure later!

Based upon the presence of so many shoots at pink, copper is not an option. With future rains in the forecast, captozeb (captan+mancozeb) is probably your best bet, until more green tissue is there. If the weather stays cool, include Vanguard and Scala early in the rotation. Save FRAC 3:DMI fungicide application (Inspire, Indar, Rally, etc.), FRAC 11:strobilurin (Flint, Sovran), FRAC 7+11: premix (Merivon, Luna Sensation, Pristine), or FRAC 7:SDHI (Fontelis, Aprovia) until more green tissue is present—this will be a more strategic use for your systemic fungicides.

Despite the potential or real loss of crop, it is imperative to maintain a least a minimum spray program to protect future harvests. Failure to do so will result in defoliated trees that fail to produce next year or may not survive the next

winter, or break bud earlier than usual. Normally, the greatest risk of scab would be right now, from pink to bloom. However, nothing is normal about this year (or maybe global weirding is our new normal!). For these reasons, I am recommending:

- EDBC fungicide (3 lb/acre) program through bloom.
- If the crop is lost, alternate with copper or sulfur from second cover on to remain under label limits. Remember to stay within the 21.0 lb/acre/season limit for your EBDCs., like mancozeb I like the EBDCs as they also protect against bitter rot, black rot and white rot. Use this schedule if cedar-apple rust is a particular problem.
- Alternatively, Captan can be used earlier in the season for better scab control instead of the EBDCs. Keep in mind that captan provides no control of rust or powdery mildew. If these appear to be a problem, applications of FRAC 3: DMI fungicides (Rally, Indar, Cevya, etc.) in rotation should take care of scab, rust and powdery mildew.
- **NOTE:** Do not use Captan in combination with or closely following or in alternation with wettable sulfur products, or oil. Sulfur sensitive varieties of apples such as Red Delicious, Staymen, and Baldwin, can suffer severe injury and defoliation. Captan 50 WP has a 64 lb limit per acre per year; Captan 80WDG has a 40lb per acre per year limit.

One other option that can be used is copper (0.2 – 0.6 lb metallic copper per acre based on tree row volume) + sulfur (6-30 lb/acre depending on brand/formulation) every 10-14 days between now until the first week in June, depending upon weather conditions after a crop is lost. Suggested sulfur formulations include Thiolux, Microthiol Disperss, or Microfine Wettable sulfur. This spray program protects against scab and mildew, and slightly against rust. Remember, copper can russet fruit, and should not be used if you want to use your crop for anything except cider. **Do not use sulfur if temperatures are going to exceed 90 degrees F, or drying conditions are extremely poor. Do not use sulfur or copper within two weeks of an oil application.** Neither of these programs is going to provide complete scab control but should reduce leaf infections. Organic trials in both Michigan and North Carolina regularly apply 6 lbs of sulfur per treatment without any reported phytotoxicity due to temperature.

Managing Diseases on Stone Fruits:

Late spring freezes and severe winter cold regularly causes stone fruit crop losses to approach 100%. In 2024, stone fruit have already faced temperatures below -11 in the north, which may have already eliminated a fruit crop. With this level of irregular cropping, disease management must focus on protecting foliage to ensure a good potential crop for next year, while reducing overwintering spore loads. Copper is fairly phytotoxic to peaches and should be avoided (Fig. 2). A great article about bacterial spot and copper injury can be found at: https://onfruit.ca/2020/06/15/see-spots-run-bacterial-spot-and-peach-scab-season-is-here/

- Bravo is a low(er) cost alternative should disease pressure become high, but fruit is absent. Use at 1 pint/100 gal
- Captan at the 1.3 lb/ 100 gallon rate should sufficiently control brown rot twig blight, scab on peaches and cherry leaf spot.
- If the season is excessively wet, higher rates of captan or Bravo may be required.
    - Captan will not control powdery mildew.
- Wettable sulfur at the 6 lb per 100 gallon

rate is probably the least expensive material you can use and provides excellent control of powdery mildew of all stone fruit
    - Wettable sulfur should aid in controlling brown rot twig blight, and peach scab but keep expectations tempered.
    - Flame Out (Oxytetracycline) or Mycoshield should be used to control bacterial spot on peaches particularly if the weather is wet in late June and July.

As always, forewarned is forearmed! We can't control the weather, but we can control how we manage the trees, with an eye for future crops. For more information, see: BP-179 Disease Management for Fruit Trees After Crop Loss at https://www.extension.purdue.edu/extmedia/BP/BP-179-W.pdf

Figure 1. Uneven bud break is often associated with trees grown in climates with milder winters resulting in asynchronous phenology of many fruit trees. Note the variation from silver to tight cluster. Photo by Janna Beckerman.

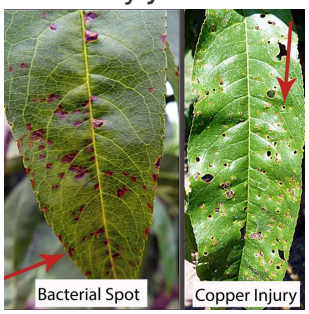


Figure 2. Copper injury on peaches can be mistaken for bacterial spot. Photo by Wendy McFadden-Smith.

Overwintering insects on high tunnel strawberry and impacts on yield

(Samantha Anne Willden, swillden@purdue.edu), (Laura Ingwell, lingwell@purdue.edu) & *(Wenjing Guan, guan40@purdue.edu)*

Overwintering strawberries in high tunnels can jumpstart plant growth in the spring and protect developing flowers from frost damage and disease. However, this protected environment is also ideal for some pests, like spider mites and aphids, that can successfully overwinter and build their populations. We conducted an experiment on 'Chandler' strawberry where it was grown in high tunnels from September 2022 for a May 2023 harvest at the Throckmorton and Southwest Purdue Agricultural Research Stations. Both crops were overwintered under row covers that were left in place until they were removed in Feb / Mar 2023 when flowers were forming. We identified the most common pests at both farms, and used a degree-day approach (i.e., quantifying heat accumulation) to measure the impact of aphid accumulation ('aphid-days') on strawberry yield at TPAC only.

Pest presence. The overwhelming number of pests we identified at TPAC were aphids (over 99 %), followed by spider mites (Fig 1). However, this trend was flipped at SWPAC where spider mites were most common (75 % of counts) followed by aphids (23 % of counts) (Fig 1). This was not surprising as the previous crop at SWPAC (cucumber) had high spider mite infestation before strawberries were transplanted that was not observed at TPAC. At both farms, aphids peaked in density during mid-February, and at SWPAC spider mites were at low pressure until mid-April after which they peaked in abundance

by late May. Pest pressure was considerably higher at SWPAC (9 pests per strawberry leaflet) compared to TPAC (2 pest per leaflet). There could be many factors that led to higher pest pressure at SWPAC, including surrounding landscape complexity, crop management, and higher ambient temperatures. This indicates that farms are likely to vary in the relative density of pests on overwintering strawberries, but aphids and spider mites are likely to be the most common.

Pest impacts on strawberry yield. Strawberry yield per plant was negatively correlated with increasing aphid accumulation that started in Jan 2023 at TPAC (Fig 2). However, strawberry marketability was not impacted by increased aphid accumulation. This indicates that aphids through their piercing and sucking feeding habit reduced overall plant vigor and productivity early in the season, but their excrement, often called honeydew, did not significantly impact marketability later in the season. By the time we harvested, however, aphid populations were lower than at the beginning of the season. Unfortunately, such an analysis could not be performed for spider mite pressure at SWPAC. Among the unmarketable berries, most were small and malformed that may be an indication of poor pollination or severe tarnished plant bug damage. Indeed, when strawberry flowers were bagged and therefore pollinators were excluded, fruit set was significantly lower compared to unbagged flowers (Fig 3).

Aphid management. We released several biocontrol agents against aphids at TPAC, including Adalia lady beetles, green lacewings, and minute pirate bugs, and none of them had a significant impact on aphid accumulation on strawberry. However, the biorational spray PyGanic appeared to provide 3 weeks of protection against aphids (Fig 4). After 3 weeks, aphid populations started to increase indicating that another application may be necessary. It is important to note that pollinators can be impacted by insecticide sprays, and especially PyGanic, so all insecticide applications should be made carefully when pollinators are not active (i.e., during the evening and early in the spring season if possible). Follow all label instructions and greenhouse application rates if such information is present.

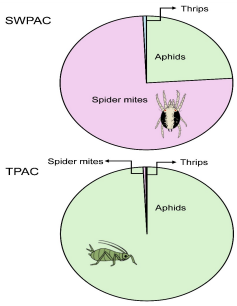


Figure 1. Relative proportion of pests that were identified as spider mites, aphids and thrips on overwintering ‘Chandler’ strawberries under high tunnels at the Southwest (top) and Throckmorton (bottom) Purdue Research Farms.

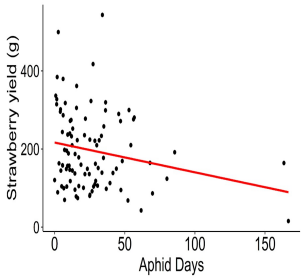


Figure 2. A correlation between aphid accumulation starting in Jan 2023 (‘aphid days’) and strawberry yield (grams of fruit per plant) that were harvest in May 2023.

Figure 3. Dominant forms of strawberry damage that rendered them unmarketable during the 2023 May harvest at TPAC.

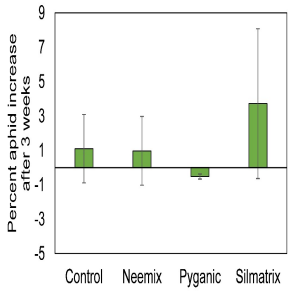


Figure 4. Percent aphid increase 3 weeks following biorational sprays against aphids at TPAC in February 2023.

Strawberry Agricultural Mulches Survey

(Wenjing Guan, guan40@purdue.edu)

Attention strawberry growers,

A group of scientists are conducting a survey about growers' current practices and opinions about agricultural mulches in their strawberry fields. They hope growers could share with the research team information about current practices and opinions about different types of agricultural mulches by completing a short online survey.

The survey is located here: https://opinion.wsu.edu/strawberries24

Responses to this survey are voluntary and your answers will be kept completely confidential. The survey is being conducted by Washington State University's Social and Economic Sciences Research Center and is certified exempt by the WSU IRB 20193-001. No individual or business will ever be identified in the results.

If you have any questions about why this survey is being done, about accessing the survey, or anything else related to the survey, please contact the SESRC at strawberry.survey@wsu.edu or call them toll free at 1-800-833-0867.

Thank you for considering our request and we hope to hear from you soon.

Purdue Fruit and Vegetable Field Day 2024

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

SAVE THE DATE!

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