PURDUE UNIVERSITY

FACTS FOR FANCY FRUIT

Issue: 25-02
April 17, 2025

A Newsletter for Commercial and Advanced Amateur fruit growers.

In This Issue

Crop conditions

(Wil Brown-Grimm, wbrowngr@purdue.edu)

Welcome to our second update of crop conditions this season. Since the start of the month, our peach trees and plums have bloomed. The hard frosts we had out here last week killed many of those flowers as shown in the plum photo. They still have more yet to open, so not all is lost! Thankfully we are expecting mild lows for the next week or so. We made our second fungicide application in the orchard, and plan on the third for early next week.

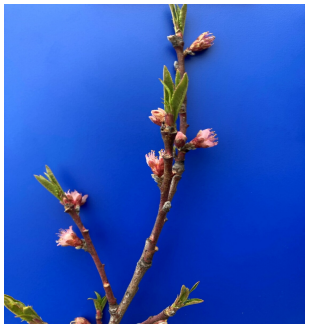
Blackberry: Bud development

Black Currant: Bud development

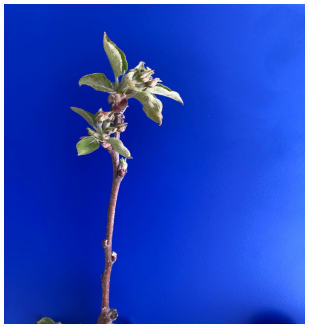
Apple (Pixie Crunch): Tight cluster

Grapes: Dormant

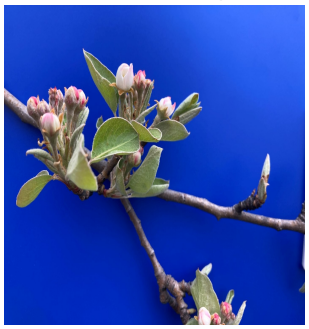
Plum: Bloom



Peach: Bloom



Apple (Rosalee): Tight cluster



Pear: White Bud

Pawpaw: Bud burst

Strawberries: Vegetative growth

Weather from the Indiana State Climate Office

(Austin Pearson, pearsona@purdue.edu)

Wet pattern to return

Despite the wet start to the month, the entire state saw less than 50 percent of normal rainfall from April 10 to 16, and in some cases, less than 10 percent of normal rainfall (Figure 1). This was helpful, especially as some locations still deal with river flood warnings and ponded and saturated fields. This has severely limited most field activity this month.

Overnight temperatures have been cold enough for the National Weather Service (NWS) to issue freeze warnings and frost advisories because vegetation is actively growing and vulnerable to freeze damage. As a reminder, we won't escape the risk of frost until mid-May, so you may need to keep covering your perennials. Pay attention to the latest alerts from your local NWS office.

As of April 16, the seven-day average 2-inch soil temperatures under sod have risen above 50°F in southern Indiana over the past week. Posey County has the warmest 2-inch soil temperature at 54.1°F, while LaPorte County has the coolest at 45.8°F (Figure 2), which is on track for the climatologically expected dates for this to occur. March temperatures were 5.7°F above normal, making it the 11th warmest March on record, which helped soil temperatures warm. However,

temperatures have averaged 1-3°F below normal for the first 15 days of April, slowing the progress of soil temperature warming. The same can be said for the impact on modified growing degree days (50F, 86F) as accumulations are more than 25 units below normal for the entire state (Figure 3).

Shifting to the outlook, temperatures are expected to bounce back, and so will precipitation. Over the next seven days, warmer temperatures will remove the threat of a hard freeze, with highs in the 60s and 70s across the state. Forecast precipitation totals from April 17-24 look to be heaviest in west-central Indiana, with totals ranging from 1 to 4 inches (Figure 4). This will fall on saturated topsoil and thus create a continued concern for flooding and delayed field progress. Hopefully, we can kick the current abnormally dry conditions across north-central Indiana to the curb. The Climate Prediction Center is confident that above-normal temperatures and above-normal precipitation will continue until the month's end, so fieldwork windows will be short and minimal (Figure 5).

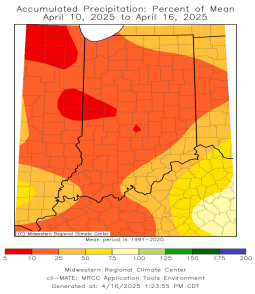


Figure 1: April 10-16, 2025, accumulated precipitation represented as the percent of the 1991-2020 climatological normal.

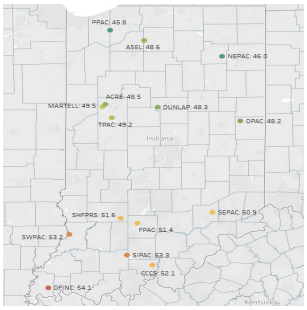


Figure 2: April 16, 2025, 7-day average 2-inch soil temperature under sod.

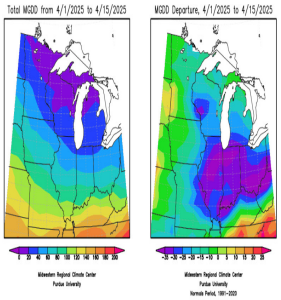


Figure 3: Left – Accumulated modified growing degree days from April 1-15, 2025. Right – Accumulated modified growing degree days from April 1-15, 2025, represented as the departure from the 1991-2020 climatological normal.

Figure 4: The Weather Prediction Center's 7-day quantitative precipitation forecast from April 17-24, 2025.

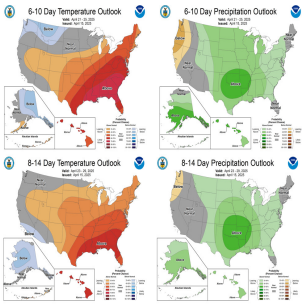


Figure 5: The Climate Prediction Center's 6-10 and 8-14 temperature and precipitation outlooks released on April 15, 2025.

Indiana spring temperatures

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

The earlier and warmer spring temperatures we have been seeing the last few years in Indiana are continuing this year. See Figure 1. What we see is that for each year in the past 15 years temperatures have warmed up earlier than the long term average. Luckily only one year over this period was extremely early and you'll remember how that ended! In 2012 we started having warm days in mid March and so crop started leafing out and flowering. The inevitable

happened and a freeze occurred resulting in widespread damage to many fruit crops and the worst apple crop seen in 70 years in the state. The problem wasn't so much the time of the freeze but that crops were at an advanced, and sensitive, stage of development when the freeze occurred.

This year is still on the early side with apples in Lafayette around tight cluster. Recent freezes were of short duration and because flowers were still at tight cluster they were too sensitive to the cold. I haven't seen any widespread freeze damage so far. Yes I say "so far" because we're not out of the woods yet.

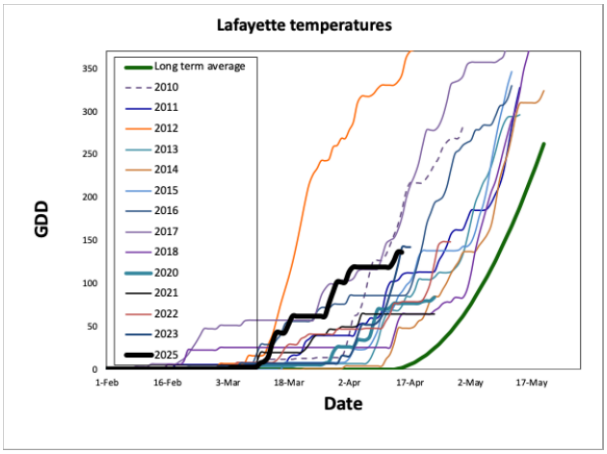


Figure 1. Temperatures in Lafayette, IN. Temperatures are expressed as Growing degree Days (GDD) with a base of 50F. We assume that trees don't develop below 50F so track the temperatures above this baseline.

2025 Midwest Fruit Pest Management Guide Update

(Miranda Purcell, mrpurcel@purdue.edu)

The 2023-2024 Midwest Fruit Pest Management Guide is still up-to-date with the addition of an addendum which can be found on the last pages of the pdf available for download below. The addendum lists important updates to pesticide labels, pesticide trade names, and crop uses for small fruit and tree fruit.

Download here:
https://edustore.purdue.edu/id-465-w.html

Download instructions:
1. Click 'Add to Cart'
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Lygus bugs

(Isabela Arias, iarias@purdue.edu) & *(Laura Ingwell, lingwell@purdue.edu)*

Lygus is a genus of insects within the family Miridae (Order: Hemiptera, piercing-sucking true bugs) that often feed on common horticultural crops. These small insects have rather large eyes, heavily patterned, neutrally colored wings, and long spindly antennae. The diet of *Lygus* bugs, as they are colloquially called, is incredibly

diverse ranging from cotton and alfalfa to strawberry and tomato. *Lygus lineolaris* (Fig. 1), or the Tarnished Plant Bug, is one of the most prominent species distributed throughout the U.S.

Figure 1: L. lineolaris adult on a strawberry flower (Photo by Eric Burkness)

Lygus bugs are paurometabolous insects, meaning they undergo three life stages: egg, nymph, and adult. Adult females lay their eggs in the early spring, often on the stem, leaves. or blooms of the host plant. On average, it takes about 2 weeks for nymphs to emerge from eggs, however, this is highly dependent on species as well as temperature. Nymphs are often easy to spot, sporting ribbed oval bodies and black-spotted backs, often green or red-brown in color (Fig. 2). Nymphs occupy the same niche as adults, consuming the same type and amount of plant material as their counterparts. *Lygus* bugs reach full maturity around mid-summer, and overwinter in leaf litter during the colder months, emerging in early Spring to lay eggs.

Figure 2: L. lineolaris various nymphal stages (Photo by Eric Burkness)

Lygus bugs can cause impressive damage to a wide range of host plants, inserting their stylet-like mouthparts into no specific area—they can consume anything from leaf to flower to seed plant tissue—leading to their status as a pest in many crops. One of the most prominent commodities *Lygus* bugs can be found on is strawberries (Fig. 3). Often feeding on buds and seeds, causing strawberry fruits to be deformed (often called cat-facing), reducing yield (Figs. 4-5).

Figure 3: L. lineolaris adult on a underdeveloped strawberry (Photo by Eric Burkness)

Figure 4: “Cat-faced” strawberry. The result of Lygus feeding on the developing akenes. (Photo by Eric Burkness)

Figure 5: Comparison of regular strawberries (left hand side) to “cat-faced” strawberry (far right) (Photo by Eric Burkness)

To control *Lygus* bugs, there are several options for biological control. *Lygus* bugs find enemies in parasitoid wasps, tiny insects that target their eggs. These are not available commercially but can be found alongside the pest, making them a non-commercial form of biological control. More commonly, it is recommended to use lady beetles, green lacewings or damsel bugs, all of which are commercially available. These predatory insects feed on all stages of *Lygus* bugs and many different species, making them a good investment for management when it comes to high pest populations. For chemical control options refer to the Midwest Vegetable Production Guide or the Midwest Fruit Pest Management Guide, depending on your crop. Always read the label of any product you apply.

Understanding the Impact of Organic Matter on Free Available Chlorine (FAC) Concentration in Postharvest Water

(Hansel Mina, hminacor@purdue.edu), (Diana Sarria, dsarriaz@purdue.edu) & *(Amanda Deering, adeering@purdue.edu)*

Introduction

Ensuring the microbial safety of fresh produce is a critical step in preventing foodborne illnesses and safeguarding public health. Fresh produce is often exposed to contaminants during various stages of production, including growing and harvesting, where it can come into contact with soil, irrigation water, compost and wildlife (Dogan et al., 2023; Rock et al., 2019). One effective way to reduce the risk of contamination is by using sanitizers, including free-available chlorine (FAC), during fresh produce postharvest washing. However, the presence of organic matter can significantly impact the effectiveness of chlorine-based sanitizers (Gombas et al., 2017; Gurtler et al., 2022).

This Extension publication aims to help growers understand the sensitivity of FAC concentrations to soil buildup in postharvest water used for fresh produce washing and why managing organic load is crucial for maintaining effective sanitation practices.

Organic matter buildup can affect free available chlorine concentration

During a dump tank washing procedure, multiple batches of fresh produce are immersed in the same solution, contributing to the buildup of organic matter (Macarisin et al., 2017). Figure 1

demonstrates a rapid decline in FAC concentration as organic matter increases, indicating that even small amounts of organic debris can significantly reduce available chlorine. The fresh chlorine solution started at 1200 ppm FAC, and that value dropped to 0 ppm when the concentration of organic matter increased to 2.5 and 3%, emphasizing the importance of minimizing the organic load to maintain adequate sanitizer levels.

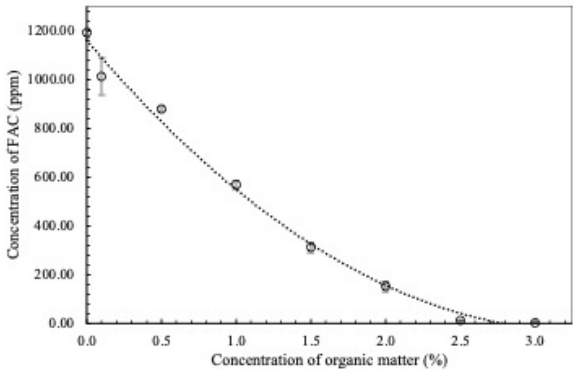


Fig. 1. FAC concentration during organic matter buildup in wash water

More sanitizer doesn't always fix the problem

Organic matter, such as soil, leaves and debris, is commonly present on fresh produce surfaces. When produce is washed, organic matter enters the wash water, which impacts the concentration of FAC. This is because organic matter reacts with free chlorine, decreasing its availability in the solution. This reaction reduces the sanitizer's efficacy, making the washing process less effective in controlling pathogens. For instance, in our study, adding just 1% vegetable organic matter to chlorinated water (Table 1) caused a significant reduction in FAC levels. At an initial concentration of 100 ppm, the available chlorine dropped to ~1.8 ppm after adding organic matter, illustrating the susceptibility of FAC to organic load.

Table 1. Effect of organic matter addition on FAC concentration

Free available chlorine concentration (ppm FAC)

Initial FAC concentration (ppm)	FAC concentration after 1% organic matter (ppm)
100	1.8±0.26
200	2.3±0.22
500	7.9±0.31
1000	568.33±18.34

Organic matter inhibits the ability of FAC to reduce human pathogens in postharvest wash water

Figure 2 illustrates the reduction in *Salmonella* Typhimurium, *E. coli* O157:H7, and *Listeria monocytogenes* concentrations (in log CFU/ml) following the application of different free available chlorine concentrations (0, 100, 200, 500, and 1000 ppm) with 1% vegetable organic matter. At higher FAC concentrations (1000 ppm), complete inactivation of pathogens is achieved within 90 seconds, even when organic matter is present. However, at lower FAC concentrations, pathogen reduction is less effective, especially in the presence of organic matter. For example, at 500 ppm FAC, it takes up to 10 minutes to significantly reduce pathogen levels. This graph underscores the importance of maintaining higher FAC concentrations to ensure rapid and effective microbial inactivation, especially when organic matter is present. These results highlight the impact of organic matter on FAC concentration and pathogen reduction, reinforcing the need for effective organic matter management and proper monitoring of chlorine levels in wash water.

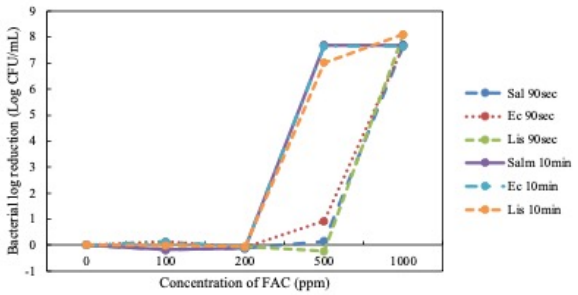


Fig. 2. Pathogen reduction in response to different FAC concentrations with 1% organic matter.

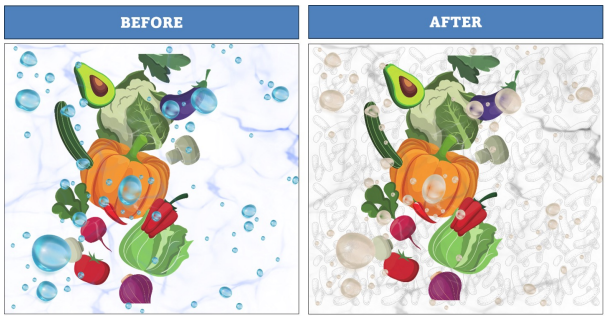
These results have implications for the management of FAC in washing water. Although monitoring FAC levels and organic matter load in washing water may be tedious and expensive, results indicate that maintaining adequate FAC (and product efficacy) is necessary to reduce pathogenic bacteria concentrations.

Practical tips for growers

1. **Pre-rinse to reduce organic matter**: Before the main wash, consider using a pre-rinse step to remove excess soil and debris from produce. This can help reduce the organic load entering the chlorinated wash water.
2. **Monitor chlorine levels regularly**: Use chlorine test strips or a chlorine meter to monitor the FAC concentration in the wash water frequently. Maintaining adequate chlorine levels is essential for effective pathogen control. Always to use the chlorine concentration recommended on the label.
3. **Replace or filter wash water as needed**: Recirculated wash water can accumulate organic matter, reducing the efficacy of FAC. Periodically replace or filter the wash water to control the level of organic material and ensure effective sanitization.
4. **Optimize water pH**: FAC is most effective at a pH between 6.5 and 7.5. Keeping the pH within this range will help maintain effective chlorine activity, especially in the presence of organic matter.
    - **Lower pH:** If the pH is above 7.5, add a food-grade acid, such as citric acid or acetic acid, to bring the pH down. Add the acid slowly while continuously measuring the pH until it reaches the desired range.
    - **Raise pH:** If the pH is below 6.5, add a food-grade base, such as sodium carbonate or sodium bicarbonate, to increase the pH.

Conclusion

Organic matter significantly impacts the concentration and efficacy of free available chlorine in postharvest water. By managing organic load, growers can better maintain adequate levels of FAC and better ensure the safety of their produce. Regular monitoring of FAC concentration, pre-rinsing to reduce organic matter, and managing water quality are essential to optimize the antimicrobial effect of chlorine-based sanitizers. Additionally, managing postharvest water helps growers maintain high produce safety standards, reduce microbial risks, and ensure safe fruit and vegetables for consumers.



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Chemical thinning

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

We’re getting close to the time when growers need to make chemical thinning decisions – for many the most perplexing and risky decision they will make all year. This is usually a tricky call to make, even more so when we have had spring frosts. Luckily in most places the spring frosts have not been severe enough to affect crops to any great extent.

As apple crops approach petal fall, it’s time to start chemical thinning. Take into account pollination weather and bee activity. Bee activity and pollination success is highest when we have warm, sunny days. High pollination success generally means high fruit set and more chemical thinning will be required.

The effectiveness of a chemical thinner application depends on many factors, and to hit it just right takes as much art as science. That’s a fancy way of saying that we don’t really understand why different orchards respond differently to a given thinner application. But we know they do. That’s why it’s impossible to develop a recipe approach to thinning. So let me explain a little about how thinners work, then discuss some specific strategies.

From the time of bloom and for the next month or so, there are thousands of flowers and developing fruitlets on the tree, struggling to get enough resources to grow. By resources I mean food in the form of carbohydrates. These carbohydrates come from stored sources in the tree but especially from leaves taking light energy and converting it to carbohydrates through the photosynthetic process. At this time of the year, leaf area for photosynthesis is limited, so there is a shortage in the supply of carbohydrates. Because the demand exceeds the supply, fruitlets compete for carbohydrates and the strong survive. The weak flowers or fruitlets lose out and drop off, which we call fruit drop or June drop. The thinners we commonly use in Indiana exacerbate this shortage, so that even more fruitlets drop off. Some, like NAA, reduce photosynthesis so there is less carbohydrate supply. Others (such as Sevin) decrease the flow of carbohydrates from leaves to fruitlets, thereby also decreasing the supply. The Maxcell-type thinners increase respiration, burning up more carbohydrates so less is left over for developing fruitlets. So in these 3 different ways, thinners increase the shortfall of carbohydrates resulting in increased fruit drop. Keeping this in mind allows growers to predict the response to thinners from year to year. For example, a lot of cloudy weather soon after bloom means less light for photosynthesis, less carbohydrate and increased fruit drop. In that situation growers may want to back off a little with their thinner rates. Thinners work best when the weather is

warmer. The optimal temperature is around 70˚F and below 60 you may as well not bother – most thinners are not going to have much effect when it's that cool. When the temperature is 80˚F or above, be careful – thinners can have very strong effects at those temperatures.

It turns out that some of our most biennial varieties (Fuji, Golden Delicious) are also some of the more difficult to thin. So not only is thinning more difficult, the consequences of inadequate thinning are greater. Keep in mind your own experience on your orchard, but with Fuji you might want to start with a full rate of Maxcell soon after petal fall. Wait a full 2 weeks to see the response to the thinner application before applying more thinners. If another application is needed, I'd suggest ONE of the following, depending on how aggressive you want to be. In order from conservative to most aggressive, I'd suggest:

Maxcell again

Sevin

Maxcell + sevin

Maxcell + ethrel

Maxcell + oil

Keep in mind these are general thoughts based on my experience and published research, but as you know things work a little differently on different farms, so mix these thoughts with your own experience to come up with a plan. Most products do not thin Fuji enough. I'd put NAA/NAD, carbaryl and ethephon in this category. I'd stay away from NAA and NAD because of the tendency to form pygmies. Starting at petal fall gives you some time for a follow up application 2 weeks later if necessary and spreads the risk. The single application approach is putting all your eggs in one basket and too risky for many growers.

Pollination – a refresher

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

Once flowers open in the spring, we're hoping for warmer weather so the bees will transfer pollen and for rapid pollen tube growth.

As we all know, apples require cross pollination, so for example Golden Delicious pollen will not fertilize Golden Delicious flowers. We rely on bees and other insects to transfer pollen from one apple variety to another. Most apples will successfully pollinate most other varieties, with the exception of triploid varieties such as Jonagold and Winesap. Once the pollen is transferred to the stigmatic surface of a flower, the pollen needs to be recognized and then grow down the style to fertilize the ovule resulting in a seed and fruit set. Generally, without seeds, apple fruits will not develop adequately. The problem here is that the ovule is only receptive for a few days so rapid pollen tube growth down the style is necessary. And this all depends on the temperature. When it's 50-60 F, pollen tube growth is slow, and pollen tubes hardly grow at all when it's cooler than 50F. Above 60 F and pollen tube growth is much quicker and fruit set is much more likely. So when we have open flowers, we're hoping for days above 60, and preferably in the 70s.

Indiana Hort Society Field Day

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

The summer field day of the Indiana Horticultural Society will be held July 9 at Chandler Orchard in Fillmore, IN just west of Indianapolis. More detail about the farm is on their website:

https://www.chandlersorchard.com

We'll have more information on the field day later but for now put the date on your calendar

and plan to attend. The field day is open to all who are interested.

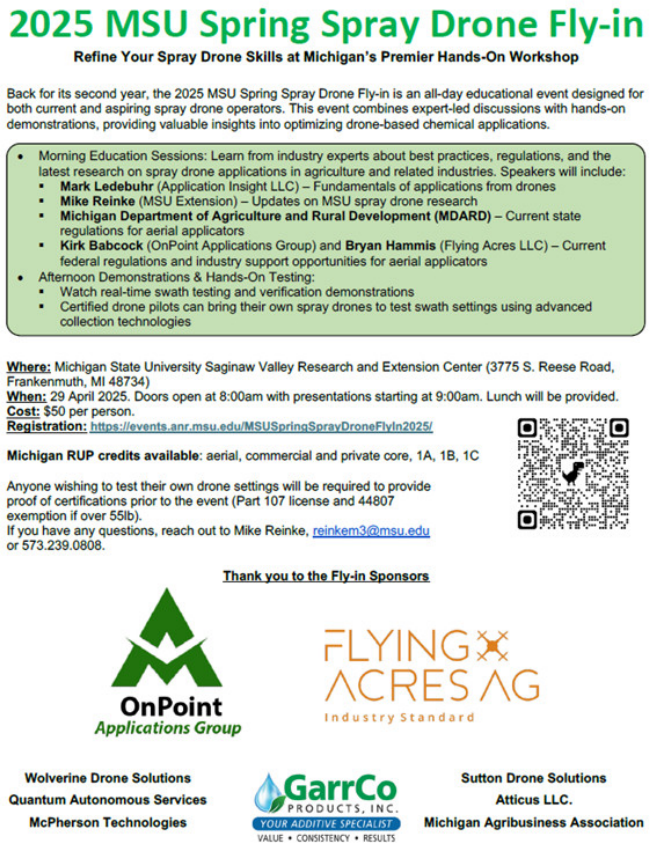
MSU Spring Spray Drone Fly-in | April 29

(Miranda Purcell, mrpurcel@purdue.edu)

Michigan State University is hosting an all-day educational event designed for both current and aspiring spray drone operators. This event combines expert-led discussions with hands-on demonstrations, providing valuable insights into optimizing drone-based chemical applications.

Where: Michigan State University Saginaw Valley Research and Extension Center (3775 S. Reese Road,
Frankenmuth, MI 48734)
When: 29 April 2025. Doors open at 8:00am with presentations starting at 9:00am. Lunch will be provided.
Cost: $50 per person.
Registration:
https://events.anr.msu.edu/MSUSpringSprayDroneFlyIn2025/

Morning Education Sessions: Learn from industry experts about best practices, regulations, and the
latest research on spray drone applications in agriculture and related industries. Speakers will include:
Mark Ledebuhr (Application Insight LLC) – Fundamentals of applications from drones
Mike Reinke (MSU Extension) – Updates on MSU spray drone research
Michigan Department of Agriculture and Rural Development (MDARD) – Current state regulations for aerial applicators
Kirk Babcock (OnPoint Applications Group) and Bryan Hammis (Flying Acres LLC) – Current federal regulations and industry support opportunities for aerial applicators*Afternoon Demonstrations & Hands-On Testing:*
Watch real-time swath testing and verification demonstrations
Certified drone pilots can bring their own spray drones to test swath settings using advanced collection technologies



All Upcoming Events

(Miranda Purcell, mrpurcel@purdue.edu)

2025 MSU Spring Spray Drone Fly-in
Tuesday, April 29th at 8 AM at MSU Saginaw Valley Research and Extension Center (3775 S. Reese Rd Frankenmuth, MI 48734)
For more information and to register:
https://events.anr.msu.edu/event.cfm?eventID=EC8914D7AC338E8A96AE650E65D58DB7C22F4399CE1B5F4465CB88997AF33A3A

Tree Fruit Success for Home & Small Farm
Wednesday, April 30th at 6:30 PM at Kercher's Sunrise Orchards (19498 CR 38 Goshen, IN

46526)
To register, call 574-533-0554 or email Mark Evans (mevans@purdue.edu).

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