In This Issue

From The Editor's Desk

(Petrus Langenhoven, plangenh@purdue.edu, (765) 496-7955)

Dear Valued VCH Readers,

Welcome to this week's edition of the Vegetable Crops Hotline! As spring field activities continue to be limited by the recent wet conditions, we have several timely updates to share. In this issue, we explore the impact of organic matter on chlorine sanitizers in postharvest washing, spotlight the troublesome Lygus bugs affecting various crops, and provide the latest weather forecast, as wetter patterns are expected to return. For high tunnel growers, we highlight the beneficial insects helping combat aphids in spinach production. Finally, don't miss our Clearspring Produce Auction price update, which includes details on pricing and volumes, their regular schedule, and services for the growing season. We hope these insights help you navigate the challenges and opportunities of this critical time in the growing season.

Growers and Purdue Extension Educators

Your input and expertise make this newsletter a truly useful resource. If you have hot topics you'd like us to cover, success stories to share, or questions for our Extension specialists, please get in touch with us at plangenh@purdue.edu or contact the specialist directly. We also welcome high-quality photos of pest issues, unusual symptoms, or innovative production practices you've implemented on your farm.

Website Links in Newsletter Articles

We frequently include links to websites or online publications. If you are unable to access these resources, please don't hesitate to contact your local Purdue Extension office or us to request a hard copy of the information.

Midwest Vegetable Production Guide

The 2025 Midwest Vegetable Production guide is now available for growers to visit online at **mwveguide.org**, or you can download and print a guide from your computer at **mwveguide.org/guide**. The guide can also be purchased for $15 per copy. Contact your Extension Office or Stephen Meyers (slmeyeres@purdue.edu) directly to buy a copy.

Midwest Vegetable Trial Reports

Are you still considering purchasing vegetable seeds? The Midwest Vegetable Trial Reports feature many articles to help you make an informed decision. The resource also hosts production-related research results.

Best regards,

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

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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.

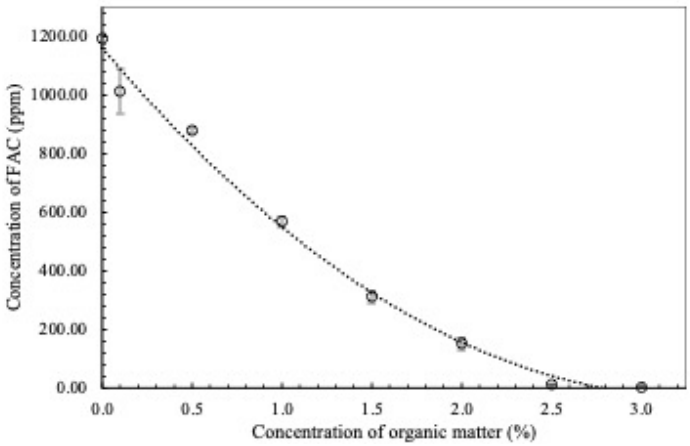


Figure 1. FAC concentration during organic matter buildup in wash water.

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.

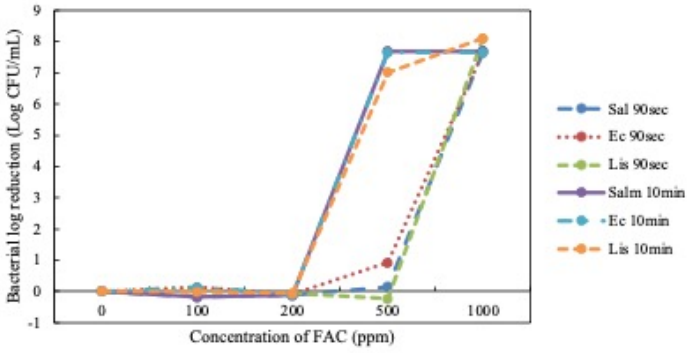


Figure 2. Pathogen reduction in response to different FAC concentrations with 1% organic matter.

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

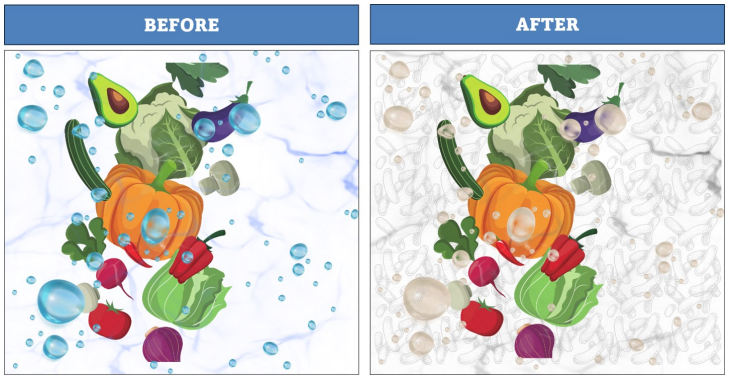
1. **Pre-rinse to reduce organic matter**: Before the main wash, consider using a pre-rinse step to remove excess soil and debris from produce. This can help reduce the organic load entering the chlorinated wash water.
2. **Monitor chlorine levels regularly**: Use chlorine test strips or a chlorine meter 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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Insect Spotlight: Lygus Bugs

(Isabela Arias, iarias@purdue.edu) & (Laura Ingwell, lingwell@purdue.edu, (765) 494-6167)

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* (Figure 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).

Figure 2. L. lineolaris various nymphal stages (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 stems, 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 both species and temperature. Nymphs are often easy to spot, sporting ribbed oval bodies and black-spotted backs, often green or red-brown in color (Figure 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 3. L. lineolaris adult on an underdeveloped strawberry (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 *on which Lygus* bugs can be found is strawberries (Figure 3). They often feed on buds and seeds, causing strawberry fruits to be deformed (often referred to as cat-facing), which reduces yield (Figure 4).

Figure 4. Comparison of regular strawberries (left hand side) to “cat-faced” strawberry (far right) (Photo by Eric Burkness).

To control *Lygus* bugs, several options for biological control are available. *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.

Wet Pattern to Return

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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 since some locations are still dealing with river flood warnings and ponded, saturated fields. This has severely limited most field activity this month.

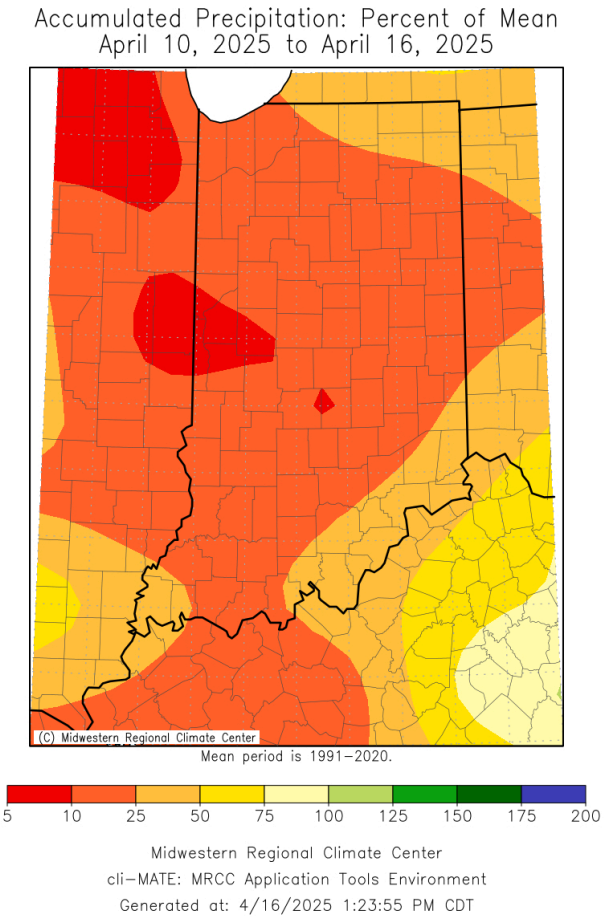

Figure 1: April 10-16, 2025, accumulated precipitation represented as the percent of the 1991-2020 climatological normal.

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 contributed to warmer soil temperatures. 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 (50°F, 86°F), as accumulations are more than 25 units below normal for the entire state (Figure 3).

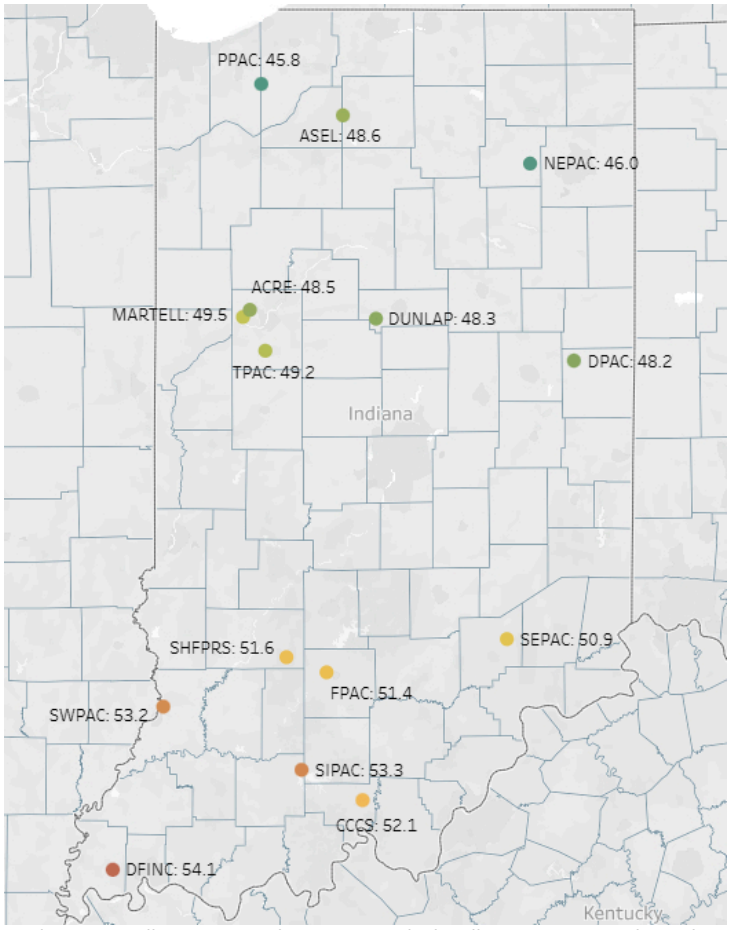

Figure 2: April 16, 2025, 7-day average 2-inch soil temperature under sod.

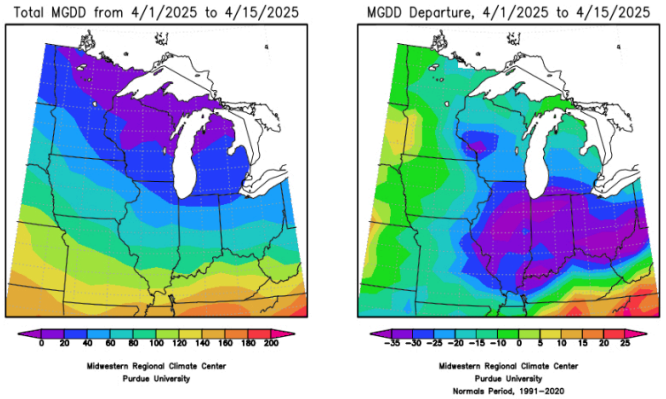

Figure 3: Left – Accumulated modified growing degree days from April 1-15, 2025. Right – Accumulated modified growing degree days from April 1-15, 2025, represented as the departure from the 1991-2020 climatological normal.

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).

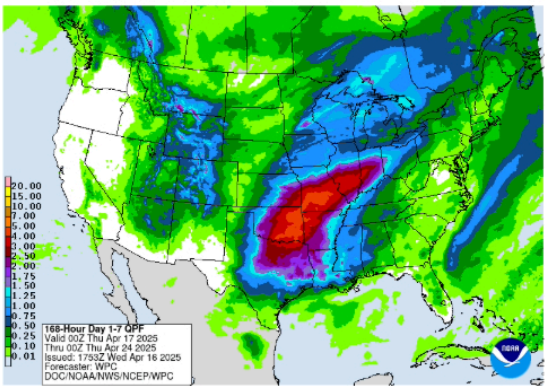

Figure 4: The Weather Prediction Center's 7-day quantitative precipitation forecast from April 17-24, 2025.

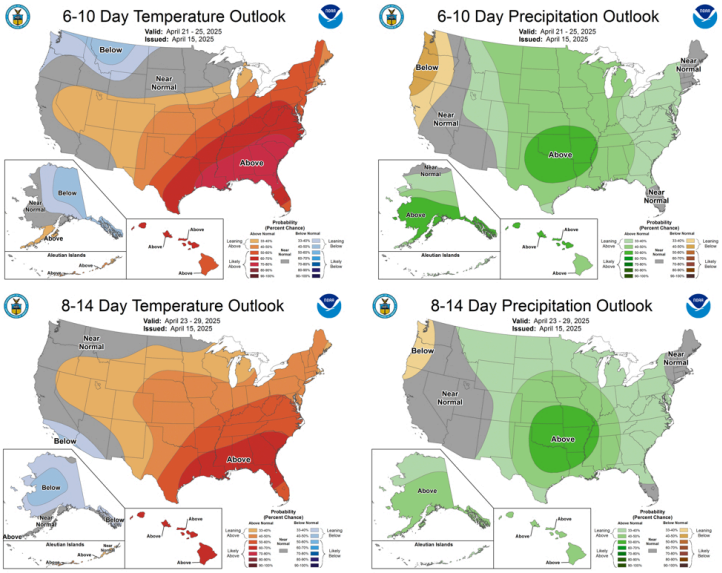

Figure 5: The Climate Prediction Center's 6-10 and 8-14 temperature and precipitation outlooks released on April 15, 2025.

Clearspring Produce Auction Price Update

(Jeff Burbrink, jburbrink@purdue.edu)

The Clearspring Produce Auction is located just 2 miles south of US 20 in Clearspring Township in the Heart of the LaGrange-Elkhart Amish Settlement. It is within easy driving distance of the towns of Shipshewana, Topeka, Emma, and LaGrange.

Produce is sold three days a week (Tuesday, Thursday, and Friday) throughout most of the growing season, with a hay sale on Saturdays. Office hours are Monday and Wednesday, 1:00 to 4:00 p.m., and Tuesday, Thursday, and Friday, 8:00 a.m. to 4:00 p.m. An auction report can be heard by calling (260) 463-4131.

Besides the produce and hay auctions, Clearspring has an on-site equipment and supply business for growers.

April 11, 2025

Tiny Allies in the Tunnels

(Allison Zablah) & *(Laura Ingwell, lingwell@purdue.edu, (765) 494-6167)*

As spring brings life back into our high tunnels, it also awakens more than just our crops. This year, our spinach beds became an early battleground in the age-old story between pests and their natural enemies. From the first warm days, we began spotting tiny green aphids clustering on young spinach leaves, sucking sap, and threatening tender growth. But we weren't the only ones who noticed them; nature had already sent back up.

Along with the green, thriving aphids were mummies—aphid bodies that had turned brown and swollen, a clear sign that parasitoid wasps were at work. Shortly after, the real stars of the story arrived: syrphid flies (Figure 1). Also known as hoverflies, syrphids are often mistaken for bees. Their superpower lies not only in pollination (they help with that, too!) but in pest control. The species we've seen most often is *Eupeodes americanus* (Figure 2), a striking hoverfly with banded markings and a fierce appetite, at least in its larval stage. While adults hover among flowers, sipping nectar and helping with pollination, their larvae are busy hunting aphids.

Figure 1. Syrphid fly egg, larva, and adult (Photo by Allison Zablah).

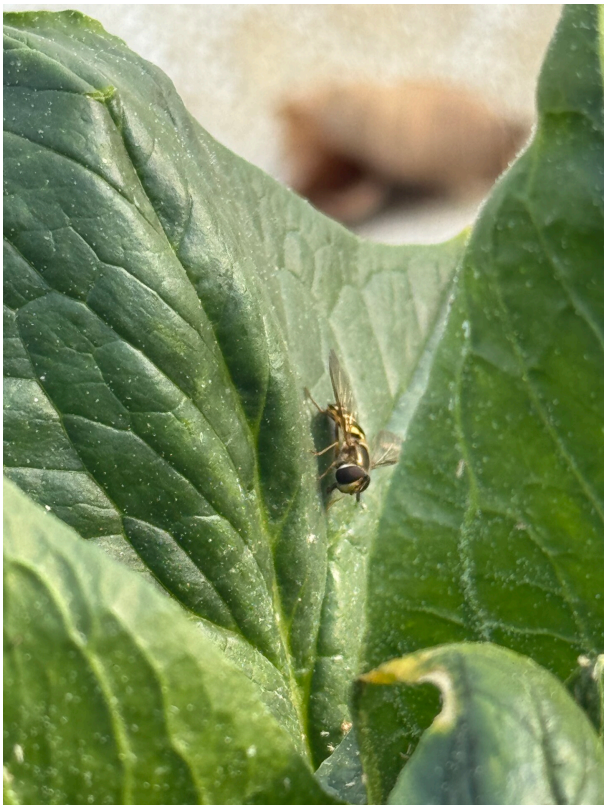

Figure 2. Eupeodes americanus (Photo by Allison Zablah).

And hunt they did. In some tunnels, aphids had exploded into large colonies, curling spinach leaves and weakening plants. Yet, within just a few weeks, the balance shifted. We began seeing fewer aphids, more mummies, and syrphid larvae actively feeding. In some tunnels, these natural enemies brought aphid numbers down to manageable levels, without us having to intervene.

What's truly remarkable is how quickly this natural control kicked in. While chemical sprays may work fast, they don't bring the long-term balance that beneficial insects do. Syrphids are a grower's friend: they're native, abundant, easy to encourage through the integration of flowers, and they do the job of managing aphids quietly.

So, if you're seeing aphids in your spinach this spring, don't panic—look closer. Do you see brown mummies? Are tiny maggots crawling near aphid clusters? Maybe you'll spot a syrphid fly hovering near your flowers. These are signs that nature is already responding (Figure 3), and your job might just be to observe and let nature take its course.

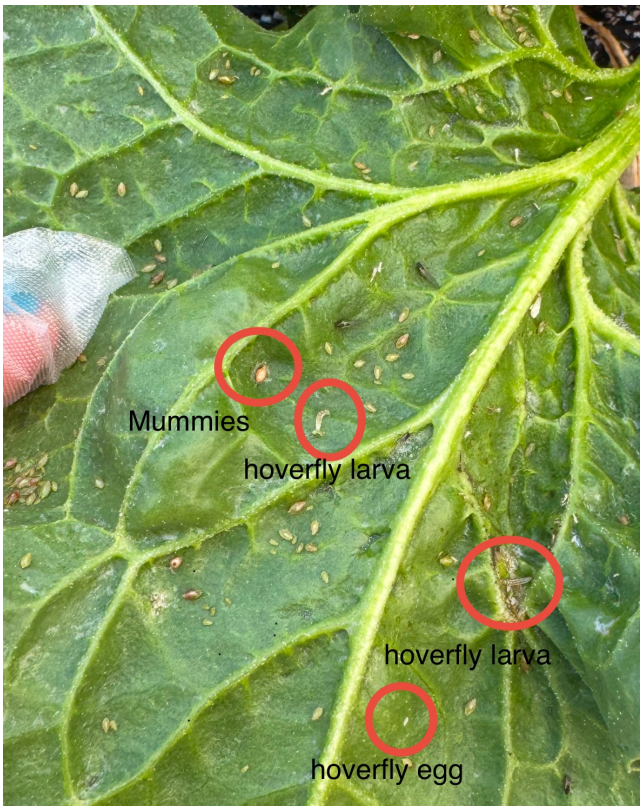

Figure 3. Natural enemies- mummified aphid, syrphid eggs and larvae (Photo by Allison Zablah).

In high tunnels, where enclosed spaces can shift pest dynamics, having syrphids active early in the season is a good sign. Keep track of what you see. Plant companion flowers, such as alyssum, to support adult syrphids, along with other beneficial insects, by providing nectar and pollen. This encourages them to stay nearby and continue to offer their pest management services.

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