

Supporting  Fruit Production

# OHIO FRUIT NEWS

Research and Recommendations from Experts at The Ohio State University

March 2023

## Prescription Strawberry Nutrient Management

By Brad Bergefurd, OSU Extension Specialty Crop Specialist, Assistant Professor Emeritus, Technical Agronomist BRANDT Agriculture

As we enter Spring 2023, the Ohio strawberry crop is shaping up to be one of the best since we began growing annual plasticulture strawberries in Ohio over 20 years ago. High tunnel strawberry research being conducted at OSU South Centers at Piketon between OSU, Purdue and BRANDT are looking good and harvest started the week of March 20<sup>th</sup> (Figure 1). To maximize yield, quality, and profit from your strawberry crop the key is to optimize crop nutrient needs in a timely manner. Growers must be willing to utilize available tools to assist with prescribing and managing strawberry crop nutrient needs. Two of these essential agronomic tools include soil testing and plant tissue analysis.

**Soil testing** is a pre-plant tool and should be a common routine to track historical field test results and manage availability of macro and minor soil nutrients to our crops. Soil testing should be performed 6 months to a year in advance of planting the strawberry crop to give adequate time to make the necessary fertilizer or lime applications during mid-summer land preparation activities and allow soil pH adjustment to occur, if needed. Pre-plant fertilizer applications should be based on your fields soil test recommendations rather than a fixed rate application which may result in over or under



2023 Harvest!



Figure 1. High tunnel strawberry harvest at Piketon March 23, 2023. (Photos courtesy of Thom Harker, OSU South Centers)

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applying the nutrients needed by our strawberry crop.

A common plant tissue nutrient tracking tool, **plant tissue analysis**, determines the level of nutrients that the strawberry plants are taking up at the time of sampling. Most commercial soil testing labs are equipped to analyze and measure concentrations of essential nutrients within strawberry leaves and compare them to established target concentrations at each growth stage. In the spring, the first tissue testing routinely begins when row covers are removed and spring growth begins, and again every 10 days to 2 weeks throughout blooming and fruiting plant growth stages so fertigation programs can be adjusted to meet the plants partitioning and nutrient uptake demands (see **Figure 2** by Tagliavini, 2004). With plant tissue analysis, petiole nitrate-nitrogen and nutrient concentrations are measured, and nutrient deficiencies can be detected and corrected before visual symptoms show and prior to a crops yield, quality, or both are impacted.

Many growers use tissue analysis in the fall as well, to make sure the nutrient load of the plant is adequate going into the winter months. If needed, additional nutrients can be applied during early to late fall. Tissue testing provides the basis for precise nutrient rate recommendations throughout all strawberry growth stages.

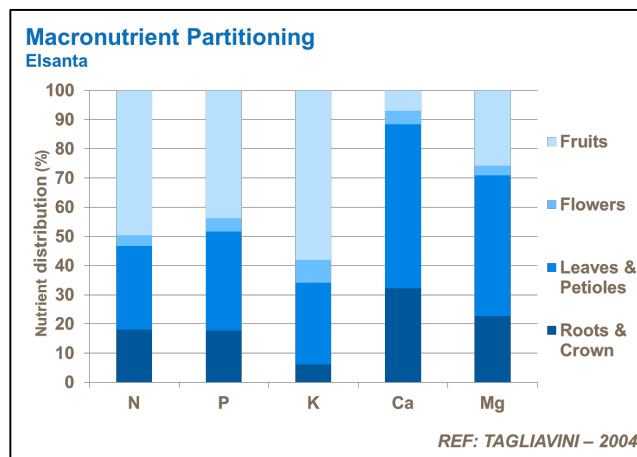


Figure 2. Macronutrient partitioning in strawberry. Tagliavini et al. 2004. DOI: 10.17660/ActaHortic.2004.649.36

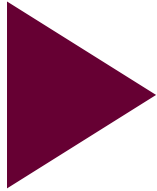
## Grower's Corner

### Is lime sulfur the same as lime and sulfur?

This is a common question I get as bud break of fruit crops draws near. Lime sulfur is not the same as lime and sulfur. Lime sulfur (or Sulforix) is calcium polysulfide. After lime sulfur is applied to the crop it breaks down and releases sulfur. The sulfur burns the tissue and fungi that are overwintering on the tissue. It can also burn insect pests that overwinter on the host. Lime sulfur is used during the dormant season on brambles, grape, blueberry, apple and pear. Other dormant sprays include Bordeaux mixture (copper and lime) and oils. For rates and timing check the label before applying a dormant spray.



Lime sulfur can be used to manage Phomopsis twig blight of blueberry.



# what's bugging you?

## Q/A and considerations for the 2023 season

► **Is there an insecticide that I can use to control fruit flies (for sour rot control) that is not a restricted use pesticides (RUP)?**

**A:** Sour rot is a tricky complex to manage. **Entrust (OMRI approved) or Delegate (both group 5)** control Spotted Wing Drosophila (SWD) so they should also work well for Vinegar flies that are associated with sour rot. You might also consider **GardenTech Sevin** which contains Zeta-Cypermethrin. In commercial trials, Mustang Maxx (RUP) which also contains Zeta-Cypermethrin controlled vinegar flies and sour rot. However, please note that GardenTech Sevin contains different levels of Zeta-Cypermethrin so I would not necessarily expect the same level of control.

Also, **make sure you scout!** Timely insecticide applications that consider vinegar fly number and climatic conditions will prove to be one of your best tools in managing sour rot in grapes.

► **Is it ok to make multiple applications of Sevin (carbaryl) during the growing season?**

**A:** It depends on what “multiple applications” means and when those applications occur and what pest is being targeted. Per label restrictions (I’m using the Carbaryl 4L label) you are “allowed” 5-10 applications. However, I would be cautious about overusing this compound because many insects have developed insecticide resistance. For example, reports from PA and NY reported that grape berry moth populations are resistant to Carbaryl (and this was back in 2002!). Overall, I would say 2-3 applications is okay and more than that may cause long-term problems.

If targeting **Japanese beetle** here are some additional recommendations. High amounts of defoliation (exceeding 30% leaf area loss) are needed to see negative impacts, but that level of damage tends to be uncommon. Chemical options are unfortunately limited to the pyrethroid, neonicotinoid, or organophosphate classes (=broad-spectrum products). Details below:



Product	Rate	Pre-harvest Interval
Danitol	10-21 oz.	21 days
Imidan	1-2 lbs.	7-14 days
Brigade	3.2-6.4 oz.	30 days
Carbaryl 4L	1-2 quarts	7 days
Assail	2.5-5.3 oz.	3 days
Avaunt	3.5-6 oz.	7 days

► **How can I control yellow jackets and white-faced wasps in the vineyard?**

**A:** Bees and wasps can be a nuisance at harvest. They are often attracted to overripe fruit and will feed on grape clusters. The first step is prevention. **Make sure you remove overripe and damaged fruit** which should lessen the attraction of wasps and stinging insects to the vineyard. There are currently no insecticides labeled to control stinging insects in the vineyards. But there are some insecticide options that may suppress populations late in the season. Christelle Guédot has reported some insecticides that have activity against wasps (link to data located below). **Delegate and Entrust** (spinosyn- group 5) have efficacy against wasps but beware of the 7-day Pre-harvest interval (PHI). **Mustang Maxx** (pyrethroid- group 3) is effective and has a PHI of 1 day. Imidan (organophosphate) also has a high level of control but also has a longer PHI of 7 days. If you are interested in Christelle Guédot’s work, [click here](#).



► **I struggle with grape phylloxera. What are the best management practices for this pest?**

**A:** Grape phylloxera is a common and widespread problem in cold-hardy grape production. Their life cycle is pretty complex and involves both root and foliar feeding stages. If you deal with this pest, make sure you scout! This pest is temperature sensitive and is typically active in the early spring and fall when temperatures are about 64 degrees. Make sure you start control early (late spring/early summer). There are two best options with this pest (at least chemically) both of which require two applications.

Product	Application timing	Rate	PHI	Comments
Movento	4- to 10-in shoot	6-8 oz	7 days	Max of 12.5 oz per season
	30 days later			
Danitol	Pre-bloom	10-21 oz	21 days	Max of 2 applications
	10-14 days later			

- Ashley Leach, [leach.379@osu.edu](mailto:leach.379@osu.edu)  
**The label is the law. Please consult your label before making a pesticide application.**



# Think About Inspecting Your Vehicle or Buggy for Spotted Lanternfly this Summer

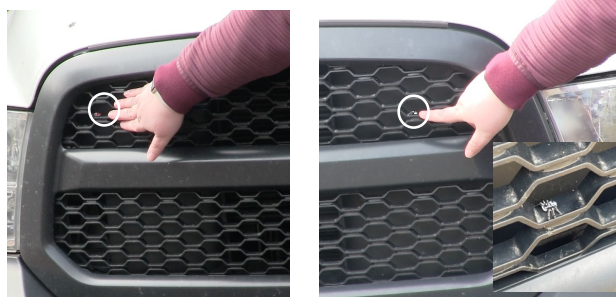
By James (Jim) Jasinski, Professor, Extension Fruit Pathologist and IPM Program Coordinator; Ashley Kulhanek, OSU Extension Educator; Amy Stone, OSU Extension Educator; Ann Chanon, OSU Extension Educator and; Carri Jagger, OSU Extension Educator – Ohio State University Extension

Several Extension educators including Ashley Kulhanek (Medina county) of Ohio State University, talked to a group of industry, regulatory and members of the general public on March 6<sup>th</sup>, 2023, about the need to closely inspect your vehicle if stopping in or traveling through an area known to have spotted lanternfly (SLF) populations.

As part of the training session, several Extension educators used tacky tape to stick 3D printed egg masses and painted plastic insects that resemble SLF nymphs and adults onto a truck for a faux inspection activity by the people who were at the training event. Each group was given a two-minute time frame to inspect and find as many SLF stages as possible. After five groups went through the exercise, the best scoring team only found 48% of the 60 possible insect stages on the truck. The lowest scoring team only found 15% of the insect stages on the truck. The bottom line is some of these stages are hard to find and rest in places hard to see, so knowing where to look is important.

Chief areas of concern include grill area, wheels, rims, wheel well area, top of vehicle, doors, mirrors and windshield wiper area. If the vehicle is a truck, don't forget about the bed or cab, or space between the vehicle and the cab. If the vehicle is a horse drawn buggy, look on and under the seat, doors, roof and floor; maybe even a quick inspection of the horse might reveal a nymph or adult! Some images were clipped from the inspection video (see page 9) to help guide your search; we hope they help.

**The grill area**



**The wheels, rims, and wheel wells**



**The bed, cab, and space between the bed and cab**



# OSU Good Agricultural Practices (GAPs) Online Course

*An educational course that covers good agricultural practices or 'GAPs', which help reduce the risk of on-farm produce contamination*

- This self-paced on-line course provides produce growers with the knowledge and tools needed to implement best management practices to reduce microbial food safety hazards in vegetable and fruit operations.
- Participants will receive a certificate of participation after completing this course.
- The cost of the course is \$50.

**To register for the course, go to  
[go.osu.edu/gapcourse](https://go.osu.edu/gapcourse)**

For questions about the course contact Ashley Kulhanek  
at [kulhanek.5@osu.edu](mailto:kulhanek.5@osu.edu)

Attending the OSU GAPs class does not equate to being "GAPS Certified" or fulfill the FSMA 7-hour training requirement. The class gives you the skills and knowledge to reduce on-farm food safety risks.





# Strategies for Effective Management of Botrytis and Anthracnose Fruit Rot of Strawberry

By Melanie L. Lewis Ivey, Associate Professor, Extension Fruit Pathologist, Department of Plant Pathology

Resistance to some fungicides can make the management of Botrytis and anthracnose fruit rot (Figure 1) extremely challenging. As with most crops using an integrated disease management program is recommended to prevent or slow fungicide resistance development. Cultural practices that keep inoculum levels low and maximize air circulation and foliage drying are first steps to managing Botrytis and anthracnose fruit rot. Spring conditions (cool and wet) are not only optimal for strawberry growth but also for Botrytis. If foliage stays wet for 12-14 hours Botrytis infections will occur. If possible, removal of dead and dying leaves in the spring will reduce the chances of Botrytis infections as will good weed control. If straw was used for winter cold protection it should be removed when soil (top 2 inches) temperatures stay above 40 F for two days. Harvesting frequently and when plants are dry will reduce the spread of inoculum through the planting and minimize the chances of an unmanageable outbreak in the field.

Fungicides play a critical role in controlling Botrytis and anthracnose fruit rots. How you use fungicides to control anthracnose and Botrytis will depend on your production system and the environmental conditions. Producers using a matted row system may need to focus on Botrytis more than anthracnose, while producers using plasticulture may need to focus more on anthracnose than Botrytis. If overhead irrigation is used for frost protection the risk of Botrytis infections is high, especially if the foliage remains wet for 14 hours or more.

For **Botrytis**, fungicide applications begin at early bloom and continue through harvest. Botrytis is very good at developing resistance to single site fungicides (see side box page 6). Therefore, using multi-site fungicides (as indicated by a 'M' in the FRAC code) such as thiram or captan, is preferable.

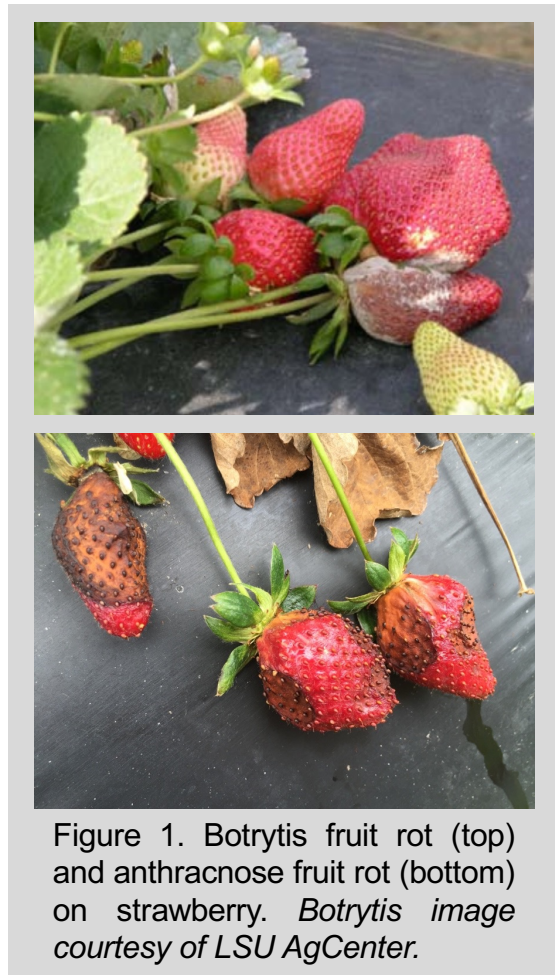


Figure 1. Botrytis fruit rot (top) and anthracnose fruit rot (bottom) on strawberry. *Botrytis* image courtesy of LSU AgCenter.

Thiram and captan are protectants and can be used alone or mixed with single site fungicides, thus they are considered the backbone of your spray program (Figure 2). Thiram is more effective than captan at controlling Botrytis, while captan is more effective than thiram at controlling anthracnose. During extended periods of wet conditions, disease pressure is high, so the addition of single-site fungicides is recommended. No resistance has been reported to SDHI (FRAC 7), fenhexamid (FRAC 17), cyprodinil (FRAC 9) or fludioxonil (FRAC 12) fungicides. In the southern United States resistance to Topsin M (FRAC 1) is widespread in Botrytis and is likely widespread throughout the United States.

Continued on page 6

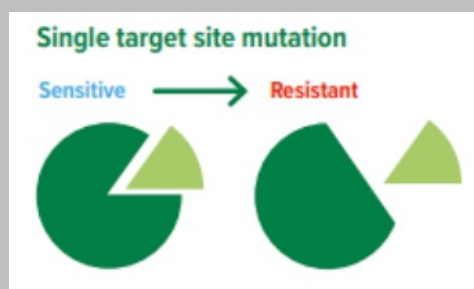
Resistance to FRAC 11 and 7 fungicides has been reported in many strawberry producing states but has not been confirmed in the Midwest, including Ohio.

For **anthracnose** fruit rot fungicide applications begin a bit later than Botrytis applications as optimal fungal growth occurs at warmer temperatures (75-82 °F). Captan is very effective at controlling anthracnose and there is no risk of resistance developing in the fungus. However, if anthracnose is a recurring problem in the planting or symptoms begin to appear on green fruit single site fungicides should be added to the program. Captan can cause phytotoxicity at bloom, so it is important to read the label carefully and to avoid mixing with products that have EC or SC formulations. The strobilurin fungicides (FRAC 11) are very effective against *Colletotrichum* spp., the fungus that causes anthracnose, but in Ohio resistance to the strobilurin fungicides (FRAC 11) has been reported. Therefore, mixing FRAC 11 with captan and only using FRAC 11 fungicides two times (not consecutively) in the season is recommended. If you know you have FRAC 11 resistance, then FRAC 11 fungicides should only be used once in the season. Testing for FRAC 11 resistance is available at Clemson University in South Carolina. Information on this service is provided on page 8.

Continued on page 7

### Box 1. Single-site fungicides

Single site fungicides are highly specific acting at only one site within the metabolic pathway of the fungal pathogen. For example, they may target a critical enzyme or protein required for fungal growth. Because single-site fungicides are highly specific fungi can easily overcome the action of the fungicide; this is called resistance. As a rule of thumb, fungicides that have a number for their FRAC code (i.e., 3, 7 or 11) are single-site fungicides. Fungicides with a letter for their FRAC code (i.e., M) are multi-site fungicides and fungi are unlikely to develop resistance to these fungicides.



Ireland et al. 2021. ISBN: 978-1-922342-17-1

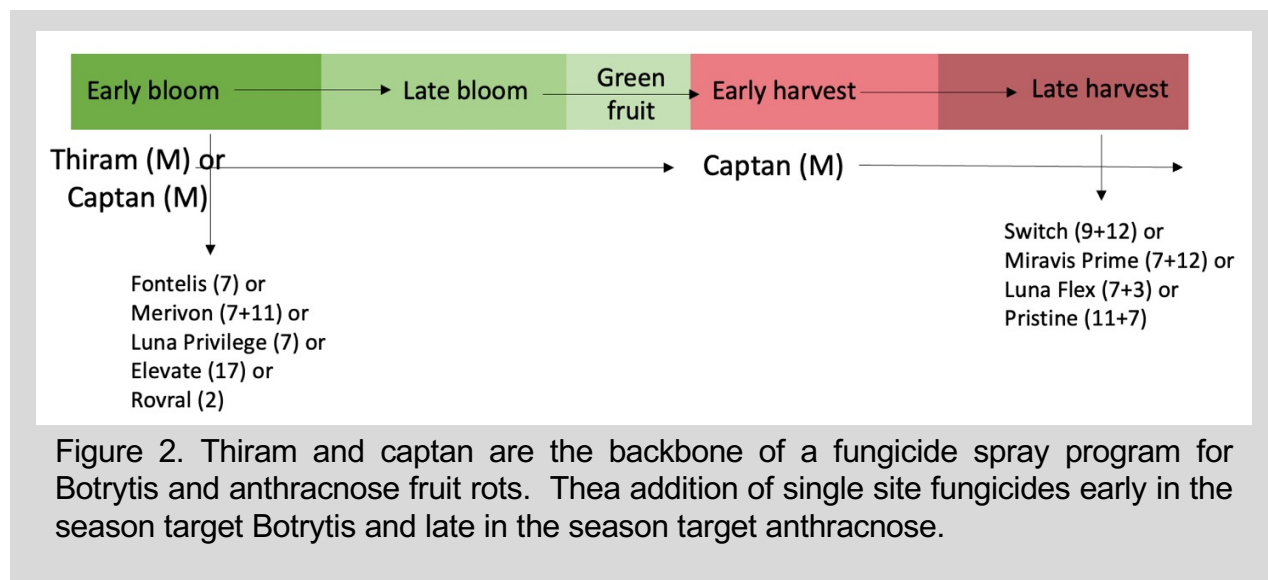


Figure 2. Thiram and captan are the backbone of a fungicide spray program for Botrytis and anthracnose fruit rots. The addition of single site fungicides early in the season target Botrytis and late in the season target anthracnose.

Table 1 lists examples of products that are registered for Botrytis and anthracnose fruit rot control and have an efficacy rating of good or excellent. The timing of products recommended for Botrytis should be used in combination with captan or thiram during the early season (bloom). The products recommended for anthracnose should be reserved for use during harvest and

combined with captan. For more information on fungicides recommended for Botrytis and anthracnose management consult the 2023-2024 Midwest Fruit Pest Management Guide.

Table 1. List of fungicides for management of anthracnose and Botrytis fruit rots. A complete list of fungicides is available in the Midwest Fruit Pest Management Guide.

Trade Name (Product)	Common Name (FRAC)	Recommended Target Disease
Cabrio	Pyraclostrobin (11)	Anthracnose
Captan 80WDG	Captan (M)	Botrytis Anthracnose
Elevate 50 WDG	Fenhexamid (17)	Botrytis
Flint Extra	Trifloxystrobin (11)	Anthracnose
Fontelis	Penthiopyrad (7)	Botrytis
Inspire Super	difenoconazole + cyprinil (3+9)	Anthracnose
Intuity	Mandestrobin (11)	Botrytis
Kenja 400SC	Isofetamid (7)	Botrytis
Luna Flex	Fluopyram + difenaconazole (7+3)	Botrytis Anthracnose
Luna Sensation	fluopyram + trifloxystrobin (7+11)	Botrytis
Luna Tranquility	fluopyram + pyrimethanil (7+9)	Botrytis
Merivon 2.09SC	fluxapyroxad + pyraclostrobin (7+11)	Botrytis Anthracnose
Miravis Prime	pydiflumetofen + fludioxonil (7+12)	Botrytis Anthracnose
OSO 5% or PhD	polyoxin D (19)	Botrytis Anthracnose
Pristine	pyraclostrobin + boscalid (11+7)	Anthracnose
Quadris Top	difenoconazole + azoxystrobin (11+3)	Anthracnose
Quilt Excel	azoxystrobin + propiconazole (11+3)	Anthracnose
Rovral 4 Flowable	Iprodione (2)	Botrytis
Scala SC	Pyrimethanil (9)	Botrytis
Switch 62.5 WG	cyprodinil + fludioxonil (9+12)	Botrytis Anthracnose
Thiram	Thiram (M)	Botrytis Anthracnose
Topguard EQ	azoxystrobin + flutriafol (11+3)	Anthracnose



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OPGMA Summer Tour


June 20, 2023 in Columbus, OH at the Controlled Environment Agriculture Research Complex


# 2023 OPGMA SUMMER TOUR

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More information will be available soon!

### **Botrytis and Colletotrichum Fungicide Resistance Testing**

Resistance testing is available through Clemson University – Molecular Pathogen and Pest Detection Lab (Pendleton, SC).

**Botrytis:** A panel of ten fungicides are tested. The cost is \$100, and the lab accepts tissue samples (flowers, leaves, fruit, stems or runners) or swabs with spores. A sample submission form for Botrytis can be found [here](#) or you can call the lab at (864) 646-2133.

**Colletotrichum (anthracnose):** Resistance testing is for strobilurins (QoI fungicides) only. These are FRAC code 11 fungicides. The cost is

\$100, and the lab accepts freshly collected fruits (15-20 fruit per sample) with typical anthracnose symptoms. A sample submission form for anthracnose can be found [here](#) or you can call the lab at (864) 646-2133.

As with all living tissue samples, they should be shipped to the lab at Clemson University using expedited shipping services. For assistance in interpreting the results of the tests you can contact Dr. Melanie Lewis Ivey ([ivey.14@osu.edu](mailto:ivey.14@osu.edu); 330-263-3849). You can also include my contact information on the submission form so that I receive the results.



**Bacterial spot** of peach is caused by *Xanthomonas arboricola pv. pruni*. The bacterium causes leaf and fruit symptoms. On the fruit small water soaked spots are the first symptoms to appear. The spots become yellow (chlorotic) with a small dark center. Bacterial spot can easily be confused with peach scab, which is caused by a fungus. Planting resistant varieties is the superior management strategy but if you have susceptible varieties copper and the antibiotic oxytetracycline can be applied during fruit development to slow disease progression and reduce the inoculum load. Spray recommendations for bacterial spot on fruit begin on page 113 of the 2023-2024 Midwest Fruit Pest Management Guide.

## **CFAES Upcoming Events-2023**

On-line Webinar – New Pesticide Application Training – April 12 link [here](#)

New Pesticide Application Training – May 10 link [here](#)

Plant Discovery Day – May 13 link [here](#)

OPGMA Summer Tour – June 20 link [here](#)

New Pesticide Application Training – August 16 link [here](#)

\*Contact your county Extension office to register for events by phone.

For a list of CFAES events and schedule changes go to the [CFAE Events Page](#)

## Grower Resources:

- OSU Fruit Pathology website ([u.osu.edu/fruitpathology](http://u.osu.edu/fruitpathology))
- OSU Fruit and Vegetable Safety website (<https://producesafety.osu.edu>)
- OSU Fruit and Vegetable Pest Management website ([entomology.osu.edu](http://entomology.osu.edu))
- OSU Fruit and Vegetable Diagnostic Laboratory ([u.osu.edu/vegetablediseasefacts/](http://u.osu.edu/vegetablediseasefacts/))
- OSU Bramble: Production Management and Marketing Guide (Bulletin 782) ([extensionpubs.osu.edu](http://extensionpubs.osu.edu))



To view the video of the vehicle inspection process, it's posted on the OSU IPM YouTube channel at <https://youtu.be/OkRDKfteyYE>.

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