



PENNSYLVANIA VEGETABLE MARKETING & RESEARCH PROGRAM

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Pennsylvania Vegetable IPM Weekly Update

September 1, 2021

These are cooperative projects involving Penn State University researchers, Penn State Cooperative Extension educators, growers, the Pennsylvania Department of Agriculture, the Pennsylvania Vegetable Marketing and Research Program and the Pennsylvania Vegetable Growers Association.

PA Vegetable and Berry Current Issues

Beth Gugino, Shelby Fleischer, and Kathy Demchak

General conditions as of August 31: Significant rainfall is anticipated across much of central and southern Pennsylvania as the remnants of Hurricane Ida pass over the region. The region could see rainfall totals of 3 to 5 inches and possibly up to 7 inches in some locations. While time to prepare now is limited. Take note of fields and areas on the farm where the soils are slow to drain and work on developing a plan to improve drainage in those locations for the future. Also note if water is running into or through your high tunnel(s). It is not uncommon for issues such as a Pythium root rot to develop in low areas in high tunnels that drain poorly. Many soilborne diseases like Phytophthora blight can also spread within and between flooded fields so notes about water movement can help inform crop rotations and preventative management strategies as well.

FIELD PRODUCTION

In addition to the previous reports in Ohio and Kentucky, **downy mildew was confirmed on pumpkin in central New Jersey this past weekend**. This means that the

Clade I strain of the pathogen is in the region which places pumpkins, squash, and watermelon at risk. Up to this point, Clade II affecting cucumber and cantaloupe had only been reported. Given the forecasted weather, all cucurbit crops are now at risk, should be scouted regularly and maintained on a regular fungicide program. The closer the crop is to harvest, the less yield loss downy mildew is likely to cause. **Powdery mildew** is also continuing to be reported on a wide variety of cucurbit crops. Keep in mind that the targeted conventional fungicides used to manage powdery and downy mildew are completely different. On pumpkin, it is important to maintain a fungicide program for powdery mildew until close to harvest to protect the handles from becoming brown and shriveled thus reducing marketability. With the forecasted rain, it is anticipated that post-harvest fruit rots will continue to increase. Accurately identifying the cause of the fruit rot can help in form future management decisions.



Powdery mildew on pumpkin handle will eventually cause it to shrivel and turn brown. (Photo: Beth K. Gugino)



Severe symptoms of black rot throughout a cabbage field and characterized by V-shaped lesions along the leaf edges. (Photo: Beth K. Gugino)

Black rot is being reported a many fall brassica crops including cabbage, broccoli, and cauliflower. The bacteria initially seedborne, can be spread during transplant production, and further splash dispersed within a field by rain. It typically takes 8 to 12 days for symptoms to develop following infection. Foliar lesions are usually yellow and V-shaped from the leaf margin towards the mid-rib. As the disease progresses, the veins in the symptomatic tissue will become black. Optimal conditions include extended periods of wet weather with temperatures from 77 to 86°F. In the field, the application of copper-based fungicides tank mixed with mancozeb will protect the plant surface from bacteria that may be splash dispersed during rain events or moved around if working in the fields when the plants are wet. There are no treatments once the bacteria are in the plant. Plant activators such as Actigard or Regalia that boost the plants defense mechanisms may be of benefit, but applications need to start early in the season before symptoms are observed in the field.



Corn earworm (left) has a light-colored head capsule. Fall armyworm (right) has a prominent upside-down 'Y' on the head capsule, due to the light band on the edges of chitinous plates. (Photos: G. Dively, Univ. of MD)

The very high rate of trap capture of **corn earworm (CEW)** and **fall armyworm (FAW)**, which has continued for the past several weeks, slowed a bit this past week. However, counts are still high – when averaged across locations, these might be the highest recorded in the sweet corn pest monitoring program for the last ~ 25 years. If you have ‘worms’ in your sweet corn, tomatoes, or other crops, you can distinguish between CEW and FAW by the colors and patterns on the head capsule. Other possible related species are **yellow-striped armyworm**, or other armyworm species. We sometimes have problems with wheathead armyworm showing up in high numbers in FAW pheromone traps. One way to help distinguish fall armyworm (FAW) from the non-target wheathead armyworm, is to look at the ‘hair pencils’ at the tip of the abdomen. Hair pencils are tufts of hair at the tip that the male pushes out during mating efforts. Although wheatheads have white, bordered by brown, hair pencils, in FAW the white color is much more consistent among all the hair pencils, and much more prominent. Both CEW and FAW exhibit resistance to pyrethroids. Other options include spinosyns (IRAC group 5: Blackhawk, Radiant) and diamides (IRAC group 28: Coragen, Vantacor). These also control ECB, but not sap beetles, silk-clipping beetles (adult Western corn rootworm), or stink bugs – pyrethroids are often used for these. Premixes that include pyrethroids and diamides (Beseige, Elevest) are options.



High FAW trap catch in the bottom of a UniTrap, specimens exertina white hair pencils. (Photos: S. Fleischer)

We are also seeing aphids in sweet corn. Usually these are **corn leaf aphid**, which feeds on many grass species and is not expected to overwinter here. Migrants initiate populations, which can develop rapidly and go through multiple generations. Tasels within whorls are typical infestation sites, and as the tasels unfurl the aphids will be found over a larger area of the plant. They will feed on tasels, silk, and leaves, can cause poor kernel fill, and produce honeydew. Populations tend to be well controlled by a community of generalist predatory and parasitoid insect species, but can erupt to pest status if insecticides – often pyrethroids – have killed off the beneficials. Avoiding unnecessary insecticides, especially early in the season, and avoiding pyrethroids, will usually take care of corn leaf aphid outbreaks.



Corn leaf aphid. (Photo: F. Gildow, Penn State)

We are also seeing flea beetles in turnips, and stink bug damage in tomatoes. Sunflowers are in bloom, and growers are reminded that this is a valued resource for bumble bees and a wide range of long-horned bees.

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BERRY CROPS

The extremely warm, humid, and wet conditions that most of the state has been experiencing means that conditions are perfect for disease development of all kinds in berry crops. After a welcomed respite from fruit anthracnose for the main strawberry production season, **anthracnose fruit rot** is now being reported sporadically in plantings of day-neutral strawberries, and in some fields, fruit, runners, and leaves are showing symptoms.

Growers who are planting new plasticulture plantings of strawberry plugs this year should take a pro-active approach to managing diseases, as the nearly tropical conditions existing while the plants were being propagated means that any inoculum present was nearly certain to multiply despite use of a solid fungicide program. Here is an in-depth article that outlines the diseases to watch for, which cultivars are most susceptible to them, and how to best manage them. <https://extension.psu.edu/disease-management-recommendations-for-fall-planted-strawberry-plug-plants>

One new strawberry pest to watch for, which has been in the state, is **carmine mite**. This pest is common on strawberries grown further South. Even though this mite looks different from two-spotted spider mite, it turns out that this is actually the same species as two-spotted spider mite according to some recent research. This is fortunate because this means that the same controls can be used for its management. It is the same size and shape, is usually found on strawberry leaf undersides, forms webbing, and causes stippling as you would expect to see from the two-spotted spider mite.

Now is the time of year when **late leaf rust** can become a problem on primocane fruiting raspberries, both red and black. This is not a systemic rust, so plants do not need to be pulled out. Fungicides in categories 3 or 11 should assist in clearing up the infection. The rust shows up on both leaf undersides and on fruit.

Vegetable Disease Updates

Beth Gugino, Extension Vegetable Pathologist, Penn State University

GENERAL UPDATES:

- **No reports of late blight** on tomato or potato in the mid-Atlantic region or elsewhere this past week. If you suspect late blight on your farm, please let me know either by email at bkgugino@psu.edu or by phone at 814-865-7328 or contact your local Extension Office. Additional information about late blight can be found on the USABlight website (<https://usablight.org>).
- **Downy mildew was confirmed on pumpkin in New Jersey** this past weekend. This means that Clade I strain of the pathogen is in the region which places pumpkins, squash, and watermelon at risk. Up to this point, Clade II affecting cucumber and cantaloupe had only been reported and is considered widespread across the region. Given the forecasted weather, all cucurbit crops are now at risk, should be scouted regularly and maintained on a regular fungicide program. The closer the crop is to harvest, the less yield loss downy mildew is likely to cause. To date in PA, downy mildew has been confirmed on cucumber and/or cantaloupe in Centre, Huntingdon, Mifflin, Juniata, Luzerne, Lehigh, Bucks, Lancaster, Chester, and Lackawanna, Erie, and Butler



Petiole lesion from anthracnose showing salmon-colored sporulation taking place. (Photo: K. Demchak)



Carmine mite and eggs on strawberry leaf underside. (Photo: K. Demchak)



Late leaf rust on 'Josephine' red raspberry. (Photo: K. Demchak)



Angular yellow lesions on the upper surface and purplish sporulation on the underside of pumpkin leaves infected with downy mildew. (Photo: Beth K. Gugino)



Black soot (sporulation) characteristic of black mold on onion caused by the fungal pathogen *Aspergillus niger*. (Photo: Tom Butzler, Penn State Extension)



Concentric rings and shot hole appearance of *Alternaria* leaf spot lesions on cabbage. (Photo: Beth K. Gugino)

Counties. Epidemic spread is highly likely as the remnants of hurricane Ida pass over the region. As you finish with a planting, burning down the crop will reduce spread other plantings. Once the plant tissue is dead, the pathogen is dead. If you suspect downy mildew on your farm, please let me know either by email at bkgugino@psu.edu or by phone at 814-865-7328 or contact your local Extension Office. Knowing where the disease is an important component for area-wide management. See <https://cdm.ipmpipe.org> for the latest reports and disease risk forecasts.

- Ever wonder what the blackish powder is that develops between the outer scales of an onion post-harvest? Well, it is **black mold** caused by the fungal pathogen *Aspergillus niger*, which is a common inhabitant of the soil and plant residue and affects many vegetable crops. It is primarily a post-harvest problem when the bulbs remain hot under high relative humidity (>80% RH) or there are fluctuations in temperature (e.g. coming out of cold storage) that result in the formation of condensation on the bulbs while in the bins and then exposure to high temperatures. Weather conditions this season have been favorable for this disease. Reducing exposure to high temperatures and storing a low humidity will help manage black mold.

ALTERNARIA LEAF SPOT AND BLACK ROT ON COLE CROPS

Alternaria diseases are common on many vegetable crops but the fungal pathogen that causes the disease is very host specific so the Alternaria that causes early blight on tomato and potato is specific to those crops and the Alternaria that causes purple blotch on onion is specific to Allium crops. This is also true for **Alternaria leaf spot on cole crops** including cauliflower, broccoli, kale, Brussel sprouts, etc. as well as cruciferous weeds and cover crops. The lesions start as small dark spots that can expand into 2 to 3-inch tan lesions with a concentric ring pattern (similar to many other Alternaria diseases). The concentric ring pattern results from changes in the environmental conditions that either favor or disfavor the production of spores of the pathogen. Affected broccoli and cauliflower heads have small black to brown discolored spots that can easily colonized by secondary soft rotting bacteria. The disease is favored by extended periods of wetness and temperatures between 75 to 82°F.

The pathogen survives on crop residue and cruciferous weeds and may also be seedborne. Many of the cultural practices recommended for the other diseases will also help to manage Alternaria leaf spot. Some research has shown that mulches and other barriers that reduce soil splash can help with disease management. Protection of the broccoli and cauliflower heads is important especially once symptoms are observed in the field. Previous research from New York found differences in fungicide sensitivity between fungal isolates collected from different fields. The isolates also varied in their ability to cause disease with some being more severe while others less severe. Despite these differences, fungicides programs can be effective, but timing is

critical. Once the disease becomes established, it can be difficult to manage so scouting is an essential part of disease management. Although at varying price points per acre, products that have been demonstrated to be effective include Priaxor (FRAC 7 + 11), Switch (FRAC 9 + 12; more commonly used in strawberry production), Endura (FRAC 7), Quadris (FRAC 11) as well as Quadris Top (FRAC 3 + 11). Always double check the fungicide label to make sure the specific cole crop you are treating is labelled and rotate FRAC codes for resistance management. For example, Luna Experience is only

labelled on brassica leafy greens which includes kale, spinach bok choy, etc. and not broccoli, cauliflower, and cabbage. Additional recommendations can be found in the [2020-21 Mid-Atlantic Commercial Vegetable Production Recommendations](#).

Black rot is another disease common for cole crops in our region. This bacterial disease primarily affects the above-ground portions of the plant and can move systemically within the plant after it enters through either wounds or natural openings in the leaf. Plants can become infected at any growth stage and can be seedborne. Depending on the weather, symptoms may be visible within 8 to 12 days or it may take much longer. Foliar lesions are usually yellow and V-shaped from the leaf margin towards the mid-rib. As the disease progresses, the veins in the symptomatic tissue will become black. Optimal conditions include extended periods of wet weather with temperatures from 77 to 86°F.



Black rot lesion results from infection of a hydathode on the edge of a cabbage leaf. The lesions are initially yellow before turning tan. (Photo: Beth K. Gugino)

Similar to *Alternaria* leaf spot, the bacterial pathogen can survive associated with crop residue, cruciferous weeds and on seed. The bacteria are not thought to survive long in the soil in the absence of host tissue. The bacteria associated with the seed will infect the cotyledon leaves (first leaves following germination) and then the first true leaves through the hydathodes (natural opening along the leaf edge). As the bacteria multiply inside the leaf they move through the xylem (water conducting tissue) towards the stem. During the growing season, the bacteria are moved between plants through rain or irrigation splashing, blowing of detached leaves, insects, cultivation equipment or people working in the field especially when the plants are wet. In the field, the application of copper-based fungicides tank mixed with mancozeb will protect the plant surface from bacteria that may be splash dispersed during rain events or moved around if working in the fields when the plants are wet. There are no treatments once the bacteria are in the plant. Plant activators such as Actigard or Regalia that boost the plants defense mechanisms may be of benefit, but applications need to start early in the season before symptoms are observed in the field.

RECRUITING HIGH TUNNEL TOMATO GROWERS FOR A STATEWIDE TARGETED SOILBORNE DISEASE SURVEY

Thanks to those growers who have participated in 2021, so far we have sampled from 19 high tunnels but we are still looking to sample from more!

We are still recruiting grower collaborators from across the state for a soilborne disease survey of high tunnels that have been in continuous tomato production for more than two years. Reduced plant vigor and yield losses due to soilborne diseases are often attributed to other issues that arise during the production season such as nutritional deficiencies. Our previous survey work in 2019 and 2020 suggests that soilborne diseases such as corky root rot (*Pyrenochaeta lycopersici*), black dot root rot (*Colletotrichum coccodes*), and root-knot nematodes (*Meloidogyne* spp.) are increasingly problematic in PA high tunnel tomatoes and may be contributing to reduced yields.



Top: Typical high tunnel tomato production in PA (Photo: Elisa Lauritzen, Penn State)

Bottom: Root galling on tomato roots caused by root-knot nematodes. The root damage can lead to reduce plant vigor and yield (Photo: Elisa Lauritzen, Penn State)

We are interested in collecting a composite soil sample (about ½ gallon total) that will be tested for soilborne pathogens at no charge. Participants will receive a report indicating which soilborne pathogens are present in your high tunnel soils and suggested disease management recommendations.

This survey will help us to identify which soilborne pathogens are affecting high tunnel tomato production systems across the state and develop more targeted soilborne disease management strategies for our growers.

For more information or if you are interested in participating, please contact Elisa Lauritzen, jel412@psu.edu or 385-234-0579 for instructions on how to collect and submit a soil sample. We will be using several of the produce auctions as sample drop-off locations for your convenience.

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Where trade names appear, no discrimination is intended, and no endorsement by Penn State Extension is implied.

Sweet Corn Insect Pest Monitoring

Shelby Fleisher, Extension Vegetable Entomologist, Penn State University



Corn earworm (Photo H. Fescmeyer)

Corn earworm (CEW) catches moderated a bit from last week but remained very high.

Also, there are fewer reporting sites: some of the very high sites from last week probably don't need to check traps. Counts suggest a 3-4-day spray interval in 11 of 16 sites, a 4-5-day interval at 3 sites, and 2 sites were below threshold. We rarely see any site reaching a 2-3-day interval in PA.



Fall armyworm (Photo R. Bessin)

Fall armyworm (FAW) also continues to be high. We are also hearing of defoliation in turf and landscapes from FAW or related cutworms that also migrate in from southern areas. Last year we had field scale defoliation in potatoes from one such relative, the **yellow striped armyworm (YSAW)**. I don't think you will get YSAW in sweet corn, but check your other vegetables, especially tomatoes or potatoes. We really don't have good thresholds for FAW. At this time of year FAW

larvae bore rapidly into the ear, from the base, side or tip. I suggest using the same thresholds as CEW, so I color coded the counts using the CEW thresholds.

Pyrethroid resistance is important for both CEW and FAW late in the season. Other options include spinosyns (IRAC group 5: Blackhawk, Radiant), diamides (IRAC group 28: Coragen, Vantacor), or premixes that include pyrethroids and diamides (Beseige, Elevest). Diamides have low bee toxicity. Pyrethroids are needed in the mix if you need to also control sap beetles, silk-clipping beetles adult Western corn rootworm), or stink bugs.

If you are finding larvae in your corn, you can distinguish if it is CEW or FAW. CEW come in many color morphs but are usually lighter in color than FAW. A definitive character comes from looking closely at the chitinous plates that make up the head capsule. CEW will be light greenish or yellow/tan in color, with no strong band along the edge of the plates. FAW have a strong color band on the edge of the plates, resulting in an upside-down 'Y' pattern on their head.

European corn borer (ECB) is low. Sprays for CEW or FAW work against ECB.



Yellow striped armyworm feeding on potatoes (top photo: B. Leiby) and close up photos of larvae (photos: B. Lingbeek).

Average weekly catch –moving average for the last 7 days.

County	Trap Name	CEW			ECB			FAW		
		17-Aug	24-Aug	31-Aug	17-Aug	24-Aug	31-Aug	17-Aug	24-Aug	31-Aug
Blair	Tyrone		90	88		10	0		15	52
Bedford	Martinsburg		215	248		0	5		182	276
Bucks	Bedminster	118	330	237	0			0		
Butler	Jones Farm	34	86							
Centre	State College	231	323	167	3	2	8		476	50
Centre	Rock Springs		132	44					301	130
Clinton	Loganton	0	2		1	0				
Erie	Fairview	400	194					292	414	
Erie	Lake City	294	385					785	765	
Indiana	Brush Valley	76	38					175	109	
Indiana	Creekside	31	12	12				45	228	34
Juniata	Port Royal	24	100	50				1	1	1
Juniata	Greenbar		112							
Lancaster	Landisville	54	259	96	0	1	1	29	129	7
Lancaster	Neffsville	30	131	81	1	0	0	8	21	1
Lancaster	New Danville	42	142	59	0	0	0	12	37	5
Lehigh	Germansville	29	89	138	4.7	6	1	7	24	47
Luzerne	Drums	10			0			0		
Lycoming	Linden	0						2		
Lycoming	Montoursville	10	135					4	3	
Lycoming	Muncy	7	110	83				0	0	0
Mifflin	Belleville	15	150	75	0	2	1	7	25	59
Montour	Washingtonville	75	98		0	4				
Northampton	Nazareth	92			0			21		
Schuylkill	Tower City		0			4				
Susquehanna	Montrose	2	9	6	6	12	10	26	24	9
Union	Winfield	60	151	145	3	8	5			
Washington	Venetia	246	247							
York	York	70	51	73	0	0	0	42	50	15

THRESHOLDS: Reproductive (tassel/silk) and late vegetative corn attracts moths. Shorten spray schedules when populations increase. If CEW is not a problem, then consider ECB.

	CEW		ECB	
	Catch/Week	Spray Frequency (days)	Catch/Week	Spray Frequency (days)
Almost Absent	≤13	7 or more	<15	7 or more
Very low	14-35	5-6	15-35	6
Low	36-70	4-5	36-70	5
Moderate	71-349	3-4	>70	4
High	>350	2-3		