VEGETABLE CROPS HOTLINE

A newsletter for commercial vegetable growers prepared by the Purdue University Cooperative Extension Service

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In This Issue

Extension Organic Agriculture Specialist begins Work at Purdue

Ashley Adair

Ashley Adair began work as Purdue's Extension Organic Agriculture Specialist earlier this month. Ashley's role will provide support and resources to the public, county extension educators, campus faculty, programming partners, and other stakeholders on issues in organic agriculture. Prior to holding this position, Ashley was the Ag and Natural Resources Educator at Purdue Extension – Montgomery County for 5 years. Before that, she completed a M.S. in Crop Sciences from the University of Illinois at Urbana-Champaign, studying cover crops in organic systems. She is housed in the Department of Horticulture and Landscape Architecture and looks forward to building an organic extension program with an emphasis on conservation practices.

Bacterial Canker of Tomato

(Dan Egel, egel@purdue.edu, (812) 886-0198)

Bacterial canker has been observed in late season tomato crops. This article will serve as a review of this important disease.

The symptoms of bacterial canker vary considerably. In most cases, the edges of the leaves may turn yellow and/or brown. That is, the margins of the leaves may become chlorotic and/or necrotic (Figure 1). This symptom, which is sometimes known as 'firing', may be more common in a field situation than in a greenhouse. Tomato plants may wilt as a result of bacterial canker. The inside of the stem of affected plants may be discolored brown (Figure 2). The fruit may have bird's-eye spots- this symptoms is more common in field outbreaks (Figure 3). In the greenhouse adventitious root development may be observed on the stems of affected plants. That is, the stems may develop a 'bumpy' appearance where extra roots are starting to develop. However, this symptom may also develop from stresses other than bacterial canker .

Figure 1. Bacterial canker may cause leaf margins to become necrotic and chlorotic.

Figure 2. Bacterial canker may cause the stem of tomato plants to be discolored.

Figure 3. Bacterial canker of tomato sometimes will result in fruit symptoms such as shown here.

The bacterium which causes bacterial canker of tomato may survive in seed, crop debris, volunteer tomatoes and equipment such as wooden stakes. The pathogen may spread from plant to plant by splashing. This is most likely during transplant production in the greenhouse. Once infected, tomato plants may continue to develop symptoms, which may give the appearance of spread in the field. Bacterial canker may be observed in the field or high tunnel/greenhouse situation.

The most important factor in managing bacterial canker of tomato is to avoid seed contaminated with the pathogen or transplants that have symptoms. Heat treatment of seed to reduce contamination is possible; see the **Midwest Vegetable Production Guide for Commercial Growers 2021**. Use only new or sterilized planting stakes, transplant trays and other planting equipment. The use of copper and mancozeb products for management of bacterial canker of tomato is more effective in greenhouse transplant production than in the field.

It is important to manage greenhouse transplants carefully.

1. Treat seedlings in the greenhouse starting at about the first true leaf stage and at 5 to 7-day intervals. Use a combination of copper and mancozeb. Streptomycin products such as Firewall® or Harbour® may be used starting at the 2-leaf stage. Do not apply streptomycin products in the field.

    1. Peroxide products such as Oxidate® may be used in addition to the ones mentioned above. Be careful with mixing the Oxidate® with other products. For example, if you mix copper and Oxidate®, mix Oxidate® at 0.33%. If you apply Oxidate® alone, use 1.0%. Oxidat®e has no residue. Therefore, it is best to apply this product frequently. Do not substitute Oxidate® for copper or any other product.
    2. I have thoughts on how to apply products by hand. I favor a backpack sprayer rather than a garden sprayer. See this video about the use of backpack vs garden sprayers.
2. If you grow different varieties, separate them in the greenhouse so that there is no splash between varieties. If you have different lot numbers of the same variety, also separate these.
3. Scout the plants for symptoms.

The severity of bacterial canker depends in part on when the plant is affected. If transplants are infected, the disease is likely to be quite severe. If the disease affected plants after first fruit, then the disease may not be severe until late in the season. It is important to either avoid bacterial canker in your operations or delay the disease as much as possible.

Observations of Sweet Corn Lodging in No-till and Tilled Plots at Pinney Purdue

(Liz Maynard, emaynard@purdue.edu, (219) 548-3674) & (Joe Rorick, jdrorick@purdue.edu)

In an article earlier this year we looked at soil under a rye cover crop destined for no-till sweet corn and pumpkin production. At the August 10 Vegetable Field Day at Pinney Purdue, Joe demonstrated how soil in no-till plots where rye had been killed by roller-crimping held together better than soil from the plots which had been tilled in April and kept tilled until planting sweet corn in June.

Overnight after the field day, storms brought heavy rain events (0.2 and 0.4 inch/hour) and strong wind (gusts over 20 and 30 mph with the rain), and by Aug. 11 the drawbacks of full tillage were visible in how much more lodging occurred in tilled plots (Figure 1) than in no-till plots (Figure 2).

Figure 1. Aug. 11. Sweet corn in conventionally tilled plot.

Figure 2. Aug. 11. Sweet corn that was no-till seeded into winter rye roller-crimped before seeding.

There were two varieties of sweet corn in each plot, and the earlier-maturing variety consistently showed more lodging–but for both varieties, lodging appeared worse in the tilled plots. When harvest began the following week, corn had turned upright somewhat, but in the tilled plots there were many ears touching the ground and hand harvest was much slower than usual. The difference in lodging was still visible, as seen in the drone photo in Figure 3. On a vegetable farm this degree of lodging would mean significantly more labor expense for hand harvest, probably make it impossible to machine harvest, and possibly lead to lower value due to dirty husks.

Figure 3. Sweet corn plots a week after wind caused lodging, showing differences in plots where corn was no-tilled into winter rye that had been killed with herbicide in mid-May (left), seeded into soil where winter rye was killed by multiple tillage passes beginning in April (center), or no-tilled into winter rye that was roller-crimped a shortly before corn was planted on June 11.

This story illustrates how soil with good structure can reduce risk on a vegetable farm. It might have been that the no-till plots had improved water infiltration, or deeper rooting, or more strength to support roots against the force of wind. Many practices can improve soil structure; using cover crops and reducing tillage is one option. In our region we expect to see heavy rainfall and wind more frequently in the coming years. Improving soil is one way to prepare for that. The Midwest Cover Crops Council has a wealth of resources on cover crops, and it is not too late to plant something this fall. Find conversations with vegetable farmers about their cover crop use at the HAT Soil Health Podcast.

Evaluating Insect Communities on Seven Varieties of Carrots During the 2021 Growing Season

(Emily Justus, ejustus@purdue.edu) & *(Elizabeth Long, eylong@purdue.edu, (765) 796-1918)*

Carrots are a wonderfully diverse crop with a wide array of varieties available to growers. Within this diversity lies the potential for identifying varieties that have higher natural resistance to particular kinds of insect pests. Although it is not a major pest in Indiana, the carrot weevil (*Listronotus oregonensis*) (Figure 1A) is a serious pest of carrots, parsley, and celery that the Long Lab has been researching for several years. Growers of these crops in the Great Lakes and Mid-Atlantic regions of North America struggle to manage the carrot weevil using insecticides alone, so we wanted to explore if different crop varieties might have natural resistance to this beetle. Carrot weevils lay eggs in the stem or crown of plants (Figure 1B), and when larvae hatch, they tunnel throughout the root, killing young plants and making carrots and celery unmarketable (Figure 2). Exploring whether insect communities differ on certain crop varieties and if these varieties differ in their susceptibility to damage from plant-feeding insects could help inform decisions to use resistant crop varieties as part of a pest management plan.

Figure 1A: Adult carrot weevil. Photo by John Obermeyer,

Figure 1B. Carrot weevil egg scars on a parsley stem. Photo by Steve Upperman.

Figure 2. Characteristic damage by carrot weevil larvae on carrot root. Photo by Steve Upperman.

During May-August 2021, we used a D-Vac suction sampler (Figure 3)to evaluate insect communities on seven varieties of carrots (Table 1) planted in small field plots in Demotte and Lafayette, Indiana, where the carrot weevil is less prevalent, and Willard, Ohio, where the carrot weevil is a key pest. We aimed to learn if 1) carrot weevil damage differed across carrot varieties, and 2) the abundance and diversity of pest and beneficial (predatory) insects differed throughout the season among carrot varieties at each location.

Figure 3. Zach Serber, a Master's student in the Long Lab, operating a D-vac insect suction sampler at Meigs Purdue Agriculture Center. Photo by Emily Justus.

Table 1. Seven carrot varieties and the color of the root used in small plot field trials across Indiana and Ohio in 2021.

Carrot Varieties	
VARIETY	**COLOR**
Danvers 126	Orange
Resistafly	Orange
Cosmic Purple	Purple
Red Cored Chantenay	Orange with red core
White Satin	White
Yellowstone	Yellow
Scarlet Nates	Red

Table 1.

We sampled insects in carrot plots four times during the season, counted carrot weevil egg scars (Figure 1), and on our final sampling date we harvested carrots and measured yield, as well as severity of tunneling root damage by carrot weevil larvae.

Carrot weevil activity: Carrot weevil egg scars and tunneling damage were found at all three locations this summer. Interestingly, Cosmic Purple was the only carrot variety that had tunneling damage at all three sites.

Plant-feeding insects found on carrots: One of the most common insect groups we collected from carrots were leafhoppers. These piercing-sucking insects damage plants by feeding on the phloem. One particular leafhopper of interest that we found is the aster leafhopper (*Macrosteles quadrilineatus*) (Figure 4) which is considered a significant pest because it acts as a vector of aster yellows disease (*Candidatus spp.*). Aster yellows phytoplasma commonly causes yellowing (chlorosis) and stunting, leading to yield and quality loss in many different crops. Carrots that are infected with aster yellows may also develop denser root hairs (unsightly to consumers) and can have a bitter taste.

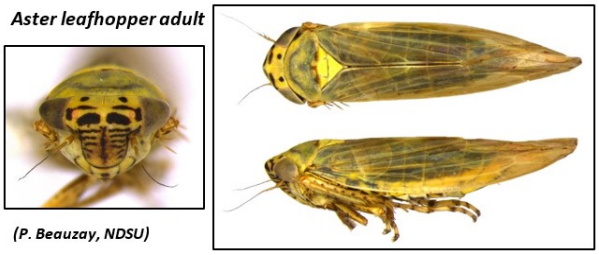

Figure 4. Aster leafhopper adult. Photo credit by P. Beauzay.

The most charismatic plant-feeding insect we spotted in carrot plots this season were Eastern black swallowtail (*Papilio polyxenes asterius*) caterpillars. These caterpillars camouflage themselves as bird poop when they are young (Figure 5), but as they grow, they develop into large green, black, white, and yellow caterpillars. These caterpillars are not typically pests in carrot, parsley, or celery cropping systems. We also found other chewing insects in our carrots, including the red-headed flea beetle (*Systena frontalis*) (Figure 6) and several kinds of grasshoppers.

Figure 5. Young eastern black swallowtail caterpillar. Photo by Elizabeth Y. Long.

Figure 6. Red-headed flea beetle on carrot foliage. Photo by Elizabeth Y. Long.

Predatory insects found on carrots: Where there are prey there are often predators, and this season we found lady beetles, lacewing larvae, parasitoid wasps, and minute pirate bugs (Figure 7). These beneficial insects seek out and feed on a variety of life stages of other soft-bodied pest insects, including eggs, nymphs, and caterpillars.

Figure 7. Minute pirate bug on plant foliage. Photo by Gbohne, Flickr.

We will continue counting and identifying the insects we collected from our carrot plots over the summer to see if differences exist in the number and type of insects on each carrot variety throughout the season, and whether a relationship exists between pest insects and carrot damage/yield. We hope this information will provide us with a better understanding of the relationship between crop variety and the potential for pest insect damage.

Will La Niña Return Again this Winter?

(Beth Hall, hall556@purdue.edu)

Last winter, earth was in a La Niña phase. While the relationships between El Niño – Southern Oscillation (ENSO) phases and Midwest climate are not strong, historically the La Niña phase has been weakly associated with milder and wetter winters. Timing is everything, though, and winters are climatologically defined as December, January, and February. When that 3-month season is broken down further during La Niña events, this tends to favor and milder (i.e., warmer and drier than normal) December and early January and more active (i.e., snowier and colder than normal) late January and February. The 2020-2021 winter seemed to follow this pattern where the greatest snowfall events occurred in February, December and January were warmer than normal, and February ended up being significantly colder than normal. Will the 2021-2022 winter season be the same? While a La Niña is predicted to peak sometime around November or December, most models have its strength being relatively weak. This suggest much more uncertainty on whether or not classic La Niña impacts will prevail again this winter. We will just have to wait and see.

The most recent climate outlooks for the October through December period is slightly favoring above-normal temperatures (Figure 1) with equal chances for above-normal, below-normal, or normal precipitation across Indiana (Figure 2). The climate

outlooks for October are more strongly favoring above-normal temperatures across the state with precipitation being only slightly favored for the northeastern part of the state. The rest of Indiana's precipitation outlook was too uncertain to favor either above- or below-normal conditions. Given these outlooks, it may be tempting to assume that the first hard freeze will be late this year. However, short-lived, yet damaging freeze events can pass through and not be picked up in the longer period climate outlooks. Therefore, at this point it is too uncertain when the first hard freeze event will occur. Figure 3 illustrates the average date of the first hard freeze (28°F) across Indiana.

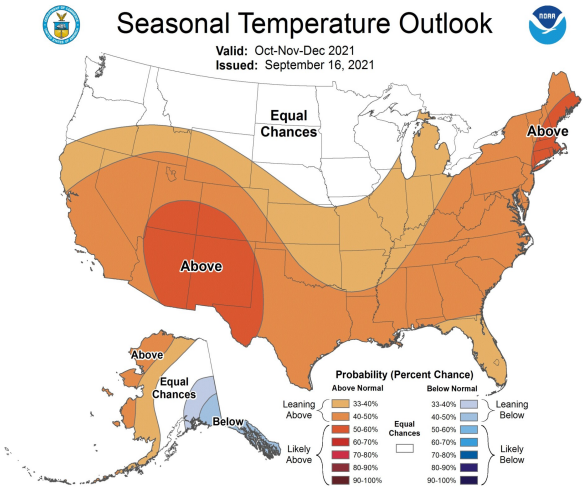

Figure 1. Three-month climate outlook for temperature representing October through December.

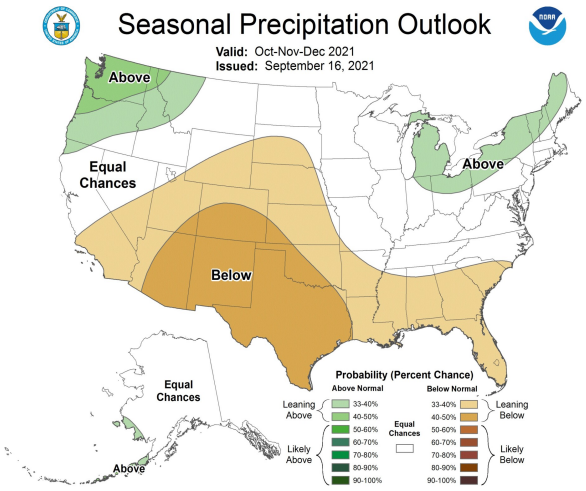

Figure 2. Three-month climate outlook for precipitation representing October through December.

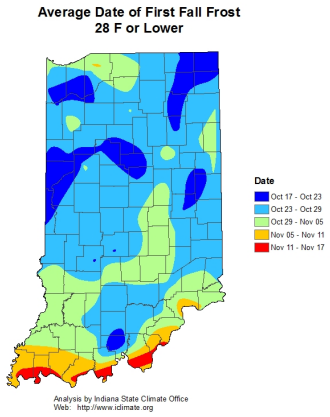

Figure 3. Average date of the first hard freeze in the fall.

Accumulated modified growing degree-days (MGDDs) for April 1 through September 15, 2021 range from around 2700 units in northern Indiana to around 3400 units in southern Indiana (Figure 4). This is slightly ahead of climatological normal accumulations for the northern two-thirds of the state and slightly behind in the southern part of the state. Figure 5 compares this year's accumulated MGDDs to recent years.

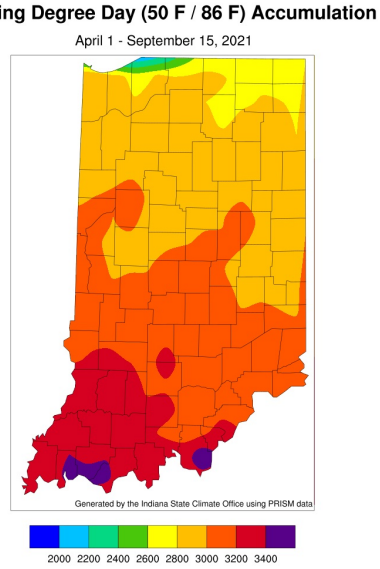

Figure 4. Modified growing degree day accumulations from April 1 to September 15, 2021.

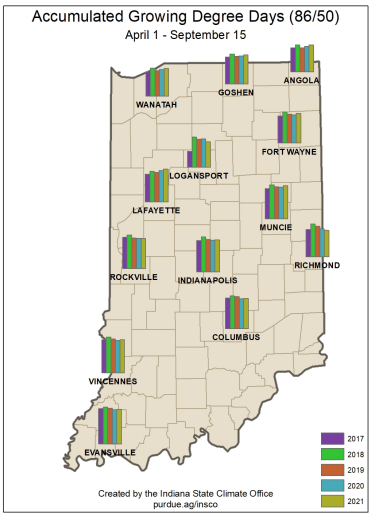

Figure 5. Comparison of 2021 modified growing degree day accumulations from April 1 – September 15 to the past four years.

What do You Want to See at Purdue Vegetable Programs this Year?

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Purdue specialists and educators are starting to plan winter programs. What topics and speakers would you like to see? Join a conversation on Thursday, Sept. 16, 8 pm to 9 pm Eastern/7 pm to 8 pm Central by phone or internet. Or, add ideas to online form here

You can reach us by sending emails to Liz Maynard (emaynard@purdue.edu) or Wenjing Guan (guan40@purdue.edu) and we will send you the link for the virtual meeting. Hope to hear from you. Thank you!

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