

VEGETABLE CROPS HOTLINE

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



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Two Diseases of Spaghetti Squash

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

The photo here (Figure 1) shows a spaghetti squash with many lesions on the fruit. At first glance, it may seem to be several lesions of different sizes. However, if one looks closely, there are actually two different diseases on the fruit.

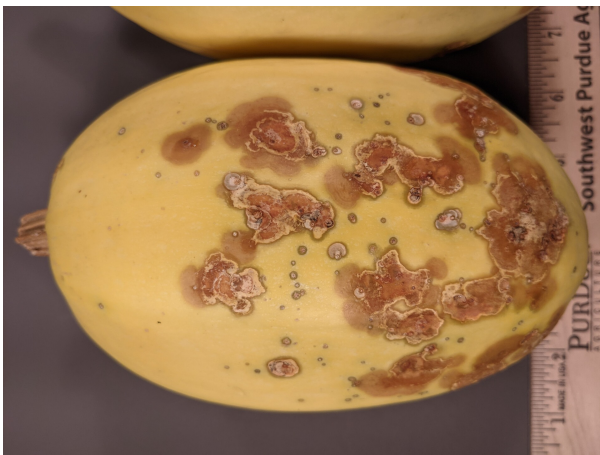


Figure 1. This spaghetti squash has lesions of both black rot and bacterial spot.

The larger, brown, irregular water-soaked areas are black rot, caused by the same pathogen that causes gummy stem blight. The smaller, round, slightly depressed lesions are bacterial spot. Unfortunately, the biology and management of these diseases are

quite different.

Black rot is caused by a fungus that may survive in crop residue or on seed or transplants. In addition to causing lesions on fruit, the same pathogen can cause economically important lesions on foliage as well (the disease is known as gummy stem blight on foliage and black rot on fruit). Gummy stem blight is an important pathogen of cantaloupe and watermelon. Black rot and gummy stem blight can be managed with crop rotation and fall tillage. Manage black rot with a combination of contact fungicides such as chlorothalonil and mancozeb products and systemic fungicides such as Luna Experience®, Miravis Prime®, tebuconazole products and several premixes.

Bacterial spot of cucurbits (not caused by the same pathogen as causes bacterial spot of tomato) may also survive in crop residue or seed or transplants. However, the lesions on leaves are not economically important. This disease is important on squash and pumpkin, but less so on other cucurbits. Crop rotation and fall tillage are important management considerations. Products with copper as an active ingredient such as copper hydroxide and copper sulfate will help to lessen disease severity. Tank mix copper products with mancozeb products and start applications when fruit are at about softball stage.

Another important aspect of disease management is proper diagnosis. The sample shown here might be difficult to diagnose without sending it to a plant diagnostic lab such as the [Purdue Plant and Pest Diagnostic Laboratory](#).

Lookout for Tomato Pinworm: a Rare but Very Hungry Caterpillar that can Devastate Tomatoes

(Elizabeth Long, eylong@purdue.edu, (765) 796-1918)

Over the last few years, we've heard of 2 or 3 unusual cases of high tunnel tomato producers losing entire crops of their tomatoes, with plants suddenly looking brown and covered in leaf mines/tunnels (Figure 1). After collecting specimens, we've confirmed the very hungry and tiny culprit is the caterpillar of the tomato pinworm (*Keiferia lycopersicella*). The adult stage of this insect is a tiny (~1/4-inch long), drab-colored moth that can be easy to miss, and the caterpillars can be devastating to your crop if they are not detected and managed early.



Figure 1. Symptoms of tomatoes with severe tomato pinworm infestation.

What is the biology and life cycle of the pest? This insect is typically found in Mexico, California, and Texas, where temperatures are warmer year round; however, tomato pinworm is increasingly reported from greenhouses in colder regions, including Delaware, Missouri, Pennsylvania, and Virginia. There is also evidence that tomato fields that are near greenhouses may also become infested. Fortunately for us, this insect does not survive the winter in colder regions like ours because it does not diapause (period of suspended development when insects are inactive), so it relies on a food source year round to sustain development and survival.

The tomato pinworm attacks plants in the Solanaceae (nightshade family); preferring tomato, but some varieties of eggplant and potato may be attacked as well. There are also several weedy plants in the nightshade family that are suitable hosts for the tomato pinworm, including Carolina horsenettle, a common invasive weed in Indiana. This insect can complete its life cycle in as little as 28 days and as many as 67 days. As with many insects, development occurs more rapidly in warmer temperatures than cooler temperatures. The eggs are quite small and laid alone or in groups of three, so they are challenging to spot. Young caterpillars are also small and feed within leaves, creating blotch-like leaf mines (Figure 2). Older caterpillars are easily visible to the naked eye and tie or fold leaves to feed inside (Figure 3). Mature caterpillars drop to the ground and pupate in a loose case of soil particles they build around themselves. The tiny adult moths emerge 2-4 weeks later. There may be as many as 8 generations of this pest each year and importantly generations overlap with each other, leading to infestations growing and reaching damaging levels quickly.

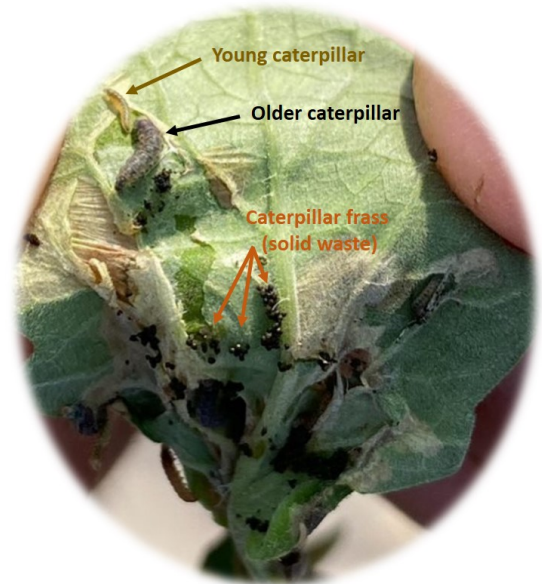


Figure 2. Signs and symptoms of tomato pinworm damage on tomato leaves. Note presence of blotch-like leaf mines, caterpillar frass (poo), and both young and old caterpillars on the same leaf (designated by arrows).



Figure 3. A tomato leaf with edges that have been folded/tied by mature tomato pinworm caterpillars.

What are the symptoms of damage? Small, blotch-like mines on the leaves (caused by the youngest, smallest caterpillars) and leaves that are tied with silk or folded over (caused by older, larger caterpillars). Mature caterpillars may also enter stems or fruits, leaving behind "pin-sized" holes in the latter (Figure 4). Feeding injury to the stems and fruits can lead to secondary infection by plant pathogens, leading to fruit rot and even plant death. Needless to say, this insect is an important one to be on the lookout for!



Figure 4. A tomato with characteristic “pin-sized” holes and frass (poo) caused by tomato pinworm feeding.

What are critical management steps?

- **Sanitation is key!!** Tomato pinworm infestations are often the result of accidental movement of the pest via shipments of infested fruit, seedlings, crates, or picking containers. Although this insect is not known to survive the winter in field-grown tomatoes in our region, protected environments may extend the activity of this insect.
- **For producers growing in greenhouses or high tunnels, it is extremely important to inspect transplants for eggs, caterpillars, or signs of leaf mining as soon as they are received.** Continue inspecting transplants throughout the season as they are received, and be vigilant about removing and destroying plant debris that accumulates during and after each tomato crop. Carrying out these critical management steps will help eliminate any life stages (eggs, young caterpillars, or pupae on the soil surface) that may survive unnoticed to infest the next crop.
- **Insecticides are effective against this pest; however, they are most effective against the smaller, youngest caterpillars, so it is critical to scout and detect early (and regularly!) to detect infestations before they gain a foothold.** Please take care to read insecticide labels carefully to ensure that any insecticide you plan to apply is labelled for use in greenhouse and high tunnel settings. Systemic products that circulate throughout plant tissues, such as coragen (active ingredient: chlorantraniliprole) are most likely to be effective against tomato pinworm caterpillars, because they spend most of their time in protected locations: young larvae feed within leaf mines and older larvae feed within tied or folded leaves. It will be difficult to reach and manage caterpillars feeding in these locations with contact insecticides. Refer to the [Midwest Vegetable Production Guide for Commercial Growers](#), or contact your local university extension specialist for information about

current, crop-specific insect pest management recommendations.

- **If you are concerned about an insect that you suspect is tomato pinworm, please contact the [Purdue Plant and Pest Diagnostic Laboratory](#) and submit a picture or sample of the insect and affected plant parts!** They will work with specialists to confirm the identity of the insect!

We hope you’ve had a successful growing season and look forward to sharing important insect pest/activity updates with you next year!

Warmer Temperatures Expected Over Next Several Months

(Beth Hall, hall556@purdue.edu)

The last several weeks have certainly been warmer than normal. Figure 1 illustrates just how warm with some parts of Indiana almost 7°F above normal over the past 30 days. That is quite incredible, however not many records were broken over this period. Climate outlooks for the next several weeks are indicating that above-normal temperatures are likely to continue. How will this impact the timing of the first hard freeze? Figure 2 shows the median date of the first hard freeze based upon data from 1981 through 2010. For Indiana, the end of October is when the first hard freeze typically has occurred. However, the last 10 years have been indicating an increasing warming trend. Combine that with the climate outlooks favoring continued warmer-than-normal temperatures, this year’s first hard freeze is likely to be later than normal.

Average Temperature (°F): Departure from 1991-2020 Normals
September 21, 2021 to October 20, 2021

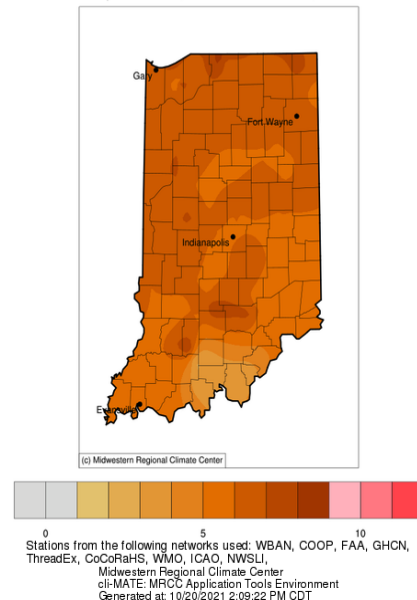


Figure 1. Difference in the maximum temperature and the 1991-2020 normals for September 21, 2021 through October 20, 2021.

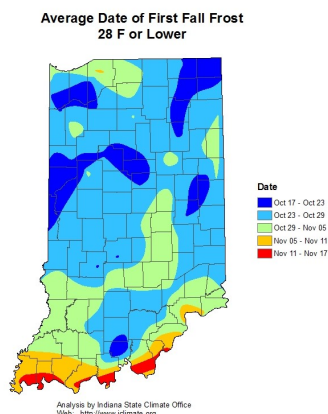


Figure 2. Average date of the first hard freeze (28°F or less) based upon data from 1981-2010.

Precipitation has been wetter than normal lately with periodic rain events passing through providing enough moisture to minimize any concerns for drought. In fact, the US Drought Monitor released on 14 October 2021 shows Indiana completely free of any drought or even abnormally dry conditions! Will this continue and are we possibly facing more issues around flooding? Some parts of Indiana have received an abundance of precipitation over the last 30 days which has likely caused localized flooding and some challenging harvesting conditions (Figure 3). Unfortunately, the shorter-term outlooks for the rest of October are favoring above-normal to normal precipitation amounts with too much uncertainty on how precipitation amounts will be relative to normal over the next several months.

Accumulated Precipitation (in): Percent of 1991-2020 Normals
September 21, 2021 to October 20, 2021

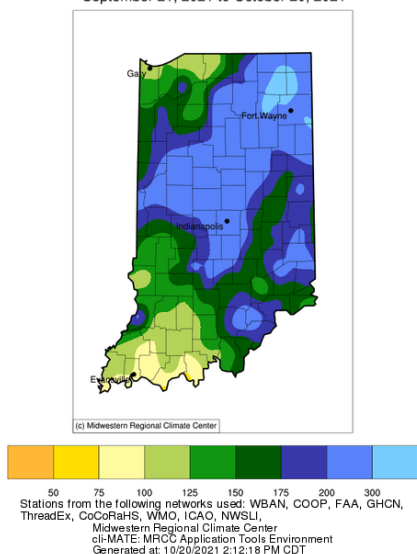


Figure 3. Accumulated precipitation from September 21st through October 20th, 2021 represented as the percent of the 1991-2020 mean. A percent of mean around 100 would indicate near-normal values.

The latest El Nino – Southern Oscillation (ENSO) report from the

national Climate Diagnostics Center is now indicating an 87% likelihood that a La Niña will develop by December. While correlations between La Niña events and winter climate in the Midwest are low, there are some indications that the early part of the winter (December into early January) tends to start off mild with warmer temperatures and near-normal precipitation — falling mostly as rain rather than snow. The latter half of winter in Indiana tends to be a bit harsher with colder-than-normal temperatures and precipitation more likely to fall as snow. With climate trends favoring warmer seasons, will this pattern hold for this upcoming winter? We will just have to wait and see.

The growing season is wrapping up with harvests either underway or finished. With the warmer temperatures in September, the latest modified growing degree-day maps (Figure 4) are indicating above normal values compared to average (Figure 5).

Growing Degree Day (50 F / 86 F) Accumulation

April 1 - October 19, 2021

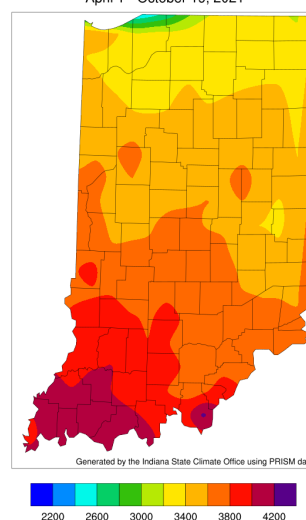


Figure 4. Modified growing degree day accumulations from April 1 to October 19, 2021.

Growing Degree Day (50 F / 86 F) Departure From Average

April 1 - October 19, 2021

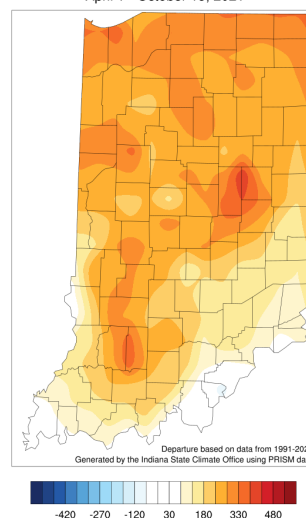


Figure 5. Modified growing degree day departures from the 1991-2020 averages from April 1 to October 19, 2021.

Southwest Indiana Melon and Vegetable Growers Winter Meeting

(Wenjing Guan, guan40@purdue.edu, (812) 886-0198)

Date: November 18, 2021, 5:00 pm (EST)

Location: 4207 Purdue Rd, Vincennes, IN 47591. Purdue Extension Food Safety Training Hub, in the newly constructed Vincennes University Agricultural Center, located on highway 41 adjacent to Southwest Purdue Agriculture Center.

The Southwest Indiana Melon and Vegetable Growers Winter Meeting will be back in person in 2021! Note the new location of the meeting this year.

This event is a great opportunity to receive the most recent information on the performance of watermelon and melon cultivars and have a casual discussion of the past growing season. As usual, the meeting will start at 5:00 pm. We will discuss the current season and solicit topics for the upcoming Southwest Indiana Melon and Vegetable Growers Annual Meeting. At 6:00 pm, dinner will be served. Following the meal, Dr. Wenjing Guan will present the results of the 2021 watermelon and melon variety trials.

We will follow Purdue Extension events guidelines and CDC recommendations for the event. Mask is required inside the building, and it has to be worn when not actively eating.

Any grower interested in becoming a member is invited to attend the meeting. Membership dues are \$15 per year and can be paid at this meeting.

Please RSVP by Nov. 1, 2021 by e-mailing Barb Joyner at joynerb@purdue.edu or call the SWPAC office at (812) 886-0198 or Knox County Extension office at (812) 882-3509. Please list any non-members that will be attending with you so that we will have a more accurate dinner count.

A Survey to Assess Awareness of a Soil-borne Pathogen, Root-knot Nematode, among Vegetable Farmers in the Temperate Region

(Wenjing Guan, guan40@purdue.edu, (812) 886-0198)

Root-knot nematodes cause damage on a wide range of vegetable crops. They are widely prevalent throughout regions where summers are long and winters are mild. However, root-knot nematodes are not confined to tropic and subtropic environments. Northern root-knot nematode is capable of surviving harsh winters in the northern U.S.; the disease is troublesome in greenhouses everywhere, and climate change may potentially change root-knot nematode species and distribution.

We are asking vegetable farmers' and agricultural professionals' to take this short [survey](https://purdue.ca1.qualtrics.com/jfe/form/SV_73bKsHblfzLZQdU) https://purdue.ca1.qualtrics.com/jfe/form/SV_73bKsHblfzLZQdU. The purpose of the survey is to assess awareness about the pathogen among vegetable farmers in our region and understand research and extension needs in controlling this pest. The survey

will take no more than 5 minutes. Thank you very much for your attention.

The project is funded by United States Department of Agriculture National Institute of Food and Agriculture grant no. 2021-51181-35904.

Collaboration between Purdue University and Michigan State University to Improve Irrigation Management in Indiana Watermelon Production

(Wenjing Guan, guan40@purdue.edu, (812) 886-0198)

Supported by Indiana Vegetable Growers Association and Illiana Watermelon Association, a collaborative project between Purdue University and Michigan State University that aims to help watermelon farmers improve irrigation management was recently funded by Indiana State Department of Agriculture, Specialty Crop Block Grant. In this project, the team will conduct the scientific experiment at the Southwest Purdue Agricultural Center to test currently used irrigation management tools, and their effects in influencing watermelon yield and quality. The purpose of the trials is to develop irrigation guidelines for watermelon production in our region. The team also plans to monitor soil moisture levels in watermelon fields across the region using an real-time irrigation management technology (LOCOMOS, Low-Cost Sensor Monitoring System) developed by Dr. Younsuk Dong from the Department of Biosystems and Agricultural Engineering at the Michigan State University. The purpose of the effort is to help watermelon farmers better understand how precipitation and their current irrigation management practices affect soil moisture.

If you grow watermelons and are interested in participating in this project, please contact Wenjing Guan at guan40@purdue.edu.

Background about this project:

Indiana is one of the major watermelon production states in the U.S. With close to 7,000 acres of watermelons grown in Indiana, approximately half of the acreage is under supplemental irrigation through either drip irrigation or overhead irrigation. Watermelon is regarded as a relatively drought-tolerant crop. The extensive root systems are known to take up water in deep soils. Therefore, in most years, reasonable yields are achieved without supplemental irrigation. However, problems that are likely associated with water-deficient stress are often observed. In 2021, we visited watermelon fields with large percentages of misshapen fruit, and blossom end rot (Figure 1). Farmers face detrimental yield losses under such circumstances. In less severe cases, fruits are marketable, but they are in smaller sizes and yield was lower. On the other hand, over-irrigation is a concern, especially in drip-irrigated fields. We observed late-season vine decline in 2021 season, which is a problem suspected to be related to over-irrigation. Over-irrigation also leads to fertilizer leaching that causes economic loss and environmental pollution.

Supplemental irrigation is valuable insurance in a dry year. But to fully justify the added cost of using supplemental irrigation, yield increases in most of the years must be achieved with proper irrigation management.



Figure 1. Blossom-end rot on watermelon.

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Produce Safety Alliance Grower Training Interest Survey

(Scott Monroe, jmonroe@purdue.edu, (812) 888-7401), (Amanda J Deering, adeering@purdue.edu) & (Tari Gary)

The Safe Produce IN team is planning Produce Safety Alliance (PSA) Grower Training courses for winter 2022. This training is for fruit and vegetable growers and others interested in learning about produce safety, the Food Safety Modernization Act (FSMA) Produce Safety Rule, Good Agricultural Practices (GAPs), and co-management of natural resources and food safety. This training is a requirement for those growers who are covered by the Produce Safety Rule.

We are currently trying to determine where PSA trainings will be offered this year and are trying to select our locations based on grower demand. If you are interested in attending a PSA Grower Training in 2022, please complete this online survey (<https://arcg.is/1u8Oen0>) by November 15, 2021.

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