Vegetable Crops Hotline

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

Liz Maynard, Editor
600 Vale Park Road
Valparaiso, IN 46383
(219) 531-4200
emaynard@purdue.edu

vegcropshotline.org

No. 603
August 6, 2015

IN THIS ISSUE

Botrytis Gray Mold of Tomato - (*Dan Egel, egel@purdue.edu, 812-886-0198*) - Gray mold of tomato is one of the more common diseases of greenhouse-produced tomatoes. Although it is often a minor problem, if left unchecked, gray mold can cause yield loss.

Gray mold, or more properly, Botrytis gray mold, often causes a light gray or brown necrotic lesion on leaves (see Figure 1). The lesions on leaves are sometimes wedge shaped on the margin of the leaf. Stem lesions are a similar color and may encircle the stem, causing the death of the upper portion of the stem. Occasionally, gray mold may cause the rot of tomato fruit. Whether on leaves, stems or fruit, the gray fungal sporulation is often easily seen, thus the name. Although not common, when fungal spores land on wet tomato fruit, the spores may germinate, causing a symptom known as a ghost spot (see Figure 2).

Figure 1. Leaf lesions of Botrytis gray mold are often a light gray or brown color and the sporulation of the causal fungus can be seen on the leaf margin. (*Photo by Dan Egel*)

Figure 2. Although less common than leaf or stem lesions, ghost spots may also be caused by gray mold. (*Photo by Dan Egel*)

Botrytis gray mold can cause disease on many different host plants, enabling the fungus to easily survive and disperse between tomato crops. Host crops include flowers such as geraniums as well as other vegetables such as green beans. The disease is favored by relatively cool temperatures and high humidity which explains why the disease is often observed in greenhouses.

Any cultural practice that lessens humidity such as pruning, will lessen the severity of gray mold. Since gray mold favors older plant tissue, pruning old leaves should reduce susceptible plant tissue. As a general rule, indeterminate tomatoes should be left with no more than eighteen to twenty fully mature leaves after pruning. Determinant (staked) tomatoes are often pruned until the first flower cluster, improving airflow and encouraging larger fruit. Another practice that may reduce airflow is spacing plants too close together.

Practicing crop rotation may reduce the amount of the gray mold fungus that survives in a greenhouse. If crop rotation is not possible, remove as much of the crop as possible far away from production when the season is complete. Clean and sanitize the greenhouse between tomato crops. Use of a ground covering between rows of tomatoes may help to reduce the amount of crop residue that becomes incorporated in the soil.

Several fungicides that may help to manage gray

mold are listed in the *Midwest Vegetable Production Guide*. Products that should be effective against gray mold and are allowed for greenhouse/high tunnel use in Indiana include: Botran®, Fontelis®, Scala® and Switch®. Products that contain the active ingredient mancozeb may be less effective than those listed above, but these products may be less expensive and are readily available. Organic producers should look for products that contain formulations of copper.

The article was original published on the **veggiediseaseblog.org** on July 23, 2015.

Late Blight in LaGrange County- (*Dan Egel, egel@purdue.edu, 821-886-0198*) - Late blight has been reported on potatoes and tomatoes in LaGrange County. Potato and tomato growers in northern Indiana should follow the management recommendations listed below and in the *Midwest Vegetable Production Guide for Commercial Growers 2015* (*ID-56*).

Late blight thrives under cool, wet conditions. The disease can easily spread from plant to plant. Under ideal conditions, the disease can spread rapidly, causing symptoms on all above ground plant parts (see Figure 3). The lesions may be green to brown and under moist conditions may be ringed with white fungal growth. Affected tomato fruit may have large brown lesions.

The fungus-like organism that causes late blight does not usually overwinter in Indiana. Therefore, the disease must be blown or brought into Indiana.

All strains of the fungus-like organism that affect tomato will cause disease on potato. However, not all potato strains will affect tomatoes. It is best for tomato and potato growers in Northeast Indiana to take precautions against late blight.

Off-season recommendations for late blight include destroying cull piles and disking under affected crops. This time of year, however, the only option left to growers is the application of specialized fungicides. The *Midwest Vegetable Production Guide for Commercial Growers 2015* (*ID-56*) has specific products listed. Many of the products that are effective against late blight are not effective against more common diseases such as early blight or Septoria leaf blight. Organic growers should apply a copper product.

Regular readers of the *Hotline* will remember a very similar article about late blight in LaGrange County a year ago. Potato and tomato growers in this area should be prepared for similar outbreaks in the future.

More information about late blight is included in this bulletin **https://www.extension.purdue.edu/extmedia/BP/BP-80-W.pdf**. For a hard copy of this bulletin or for questions or comments, contact Dan Egel.

Figure 3. Late blight can cause brown necrotic lesions on tomato leaves that may be surrounded by growth of the causal fungus under moist conditions (*Photo: Tom Creswell*).

Downy Mildew Update - (*Dan Egel, egel@purdue.edu, 812-886-0198*) - On July 22, I announced that downy mildew had been observed on watermelon in Knox County in southwestern Indiana. This article **https://ag.purdue.edu/arp/swpap/VeggieDiseasesBlog/Lists/Posts/Post.aspx?ID=48** describes the outbreak and management options. Below, I will discuss the whereabouts of additional downy mildew outbreaks on cucurbits.

Downy mildew has now been reported on cucumber in Knox and La Porte County Indiana. Downy mildew has been observed on pumpkins in Mason County in central Illinois. In addition, several counties in Kentucky and Michigan have reported downy mildew, primarily on cucumbers. A photo of downy mildew on pumpkin is shown here for reference (see Figure 4).

You may follow the development of downy mildew of cucurbits on this website **http://cdm.ipmpipe.org/**.

Figure 4. Downy mildew causes bright chlorotic lesions on pumpkin leaves that are limited by veins. Lesions eventually become necrotic. (*Photo by Dan Egel*).

Mid-Season Nitrogen Management in Pumpkins - (*Nathan Johanning, njohann@illinois.edu, 618-687-1727*) - Pumpkins are off to good start and vines are starting to run, which means it is time to think about making a sidedress application of nitrogen. Typically, I recommend split nitrogen application half preplant and half sidedress. This is especially beneficial given all of our rain this season. If you relied on preplant N alone, with all of the rain, you may very well have lost almost all of your nitrogen with plants just now starting to set fruit. In my personal scenario, on light colored forest soils (common in So. IL and IN, 1.5-2.5 % organic matter) and given no-till with cereal grain residue I generally shoot for around 100-110 lbs actual N per year (this would be decreased with more fertile, high organic matter soils) with about 50 lbs of that at sidedress. In a tilled field, you could decrease this recommendation to around 80 lbs actual N/A per year. This difference can be attributed to a couple of factors. Tilling helps to oxidize organic matter, therefore, releasing some extra N from the soil. Also, the presence of a high carbon:nitrogen ratio residue (such as wheat or cereal rye) can temporarily tie up some nitrogen as it breaks down; this is also dependent quantity of residue present. Hence, the recommendation for slightly higher N levels to compensate under a no-till/cereal grain residue system.

My preferred nitrogen source for sidedress is calcium nitrate (15.5-0-0). It has a low risk of nitrogen loss when surface applied and I also feel the added calcium is beneficial for plant growth and good fruit development. Also, ammonium nitrate (34-0-0) is a good option with a higher N content than calcium nitrate and low risk of N loss with surface applications; however, ammonium nitrate is becoming increasingly more difficult to find at local retailers. Urea (46-0-0) is also another option but if you are not incorporating (with tillage or water/rain) you can have very significant nitrogen loss due to volatilization especially if you do not have incorporation within 5-7 days. If you want to surface apply urea, look in to getting a product such as Agrotain® (a urease inhibitor) applied to the urea. This will stabilize the urea and significantly reduce volatilization. The down side is typically you would have purchase fertilizer in bulk rather than bagged to get this but it is an option to consider depending on what is available in your area.

Sunburn on Vegetables - (*Dan Egel, egel@purdue.edu, 812-886-0198, Shubin K. Saha, shubin.saha@uky.edu, 859-257-3374 and Liz Maynard, emaynard@purdue.edu, 219-531-4200*) - Loss of foliage due to poor growing conditions or disease can cause fruit to be exposed to the sun. Hot temperatures and direct sunlight can lead to areas of the fruit that appear bleached or sunburned. Sunburned fruit may not be marketable.

To reduce the probability of sunburned fruit, every effort should be made to maintain foliage throughout the season. Early wet weather encouraged foliar disease and recent hot, dry weather may have restricted foliar development. Orienting vegetable plantings to minimize damage from the prevailing winds and providing windbreaks such as strips of rye or wheat may help to reduce sunburn.

Several products are available that are labeled for use as a preventive for sunburn. These products may be broken into two groups: kaolin (clay) based products and calcium carbonated based products.

Kaolin based products include Surround®. Some Surround® products are labeled for use as sunburn protection, while others are not. For example, the label for Surround WP® includes language about reducing sunburn damage, whereas Surround CF® lacks such language. These products are designed to place a layer of the clay product on the surface of the fruit. The clay will reflect the sunlight, thus reducing the sunlight that reaches the fruit. Kaolin based products should be applied in sufficient spray volume to obtain 'near-drip coverage'. Growers should be prepared to wash off the kaolin product if necessary prior to sale.

Products with the active ingredient calcium carbonate represent the other major category of sunburn protectant. Products include Purshade® and Sombrero®. These products are also designed to reflect sunlight away from the surface of the fruit. Read the label to make sure it is labeled for sunburn protection. The label for Purshade® specifies NOT to apply to runoff. As with kaolin products, the grower should be prepared to wash the product off the fruit surface.

Since both the kaolin and calcium carbonate based products work by reflecting sunlight away from the fruit surface, there is some concern that these products may reduce sunlight that reaches the leaves and therefore the photosynthesis that drives plant growth. However, a study of the use of kaolin in apples found that the reduction of sunlight to leaves may be compensated for by the reflection of sunlight into the interior of the canopy. The benefit of these products for managing sunburn may out-weigh any reduced photosynthesis. However, growers must balance the possible benefits and risks of using any of these products.

A study in Michigan looked at the use of kaolin to reduce shoulder check in fresh-market tomatoes, a disorder described as a surface roughness that appears on the shoulder area of the fruit. The use of a kaolin product actually increased the amount of shoulder check found in tomatoes.

Vegetable growers should avoid using products to manage sunburn unless the label specifically states such a use on the label. For example, anti-transpirant products (e.g., Vapor Gard®) do not list on the label anything

about reducing sunburn on vegetable crops.

Some pesticides may aggravate sunburn problems. For example, products with the active ingredient chlorothalonil (e.g., Bravo®, Echo®, Equus®) have a warning that applying the product to mature watermelon fruit may result in sunburn to the upper surface. In general, it is best not to apply any pesticides during the heat of the day.

Sunburn or sunscald damage of vegetables can be a problem, especially in years with as much sun and heat as we have witnessed this season. Avoiding sunburn on vegetables involves maintaining good foliage cover and the judicious use of the right product if necessary.

Figure 5. Vegetables such as this watermelon may become sunburned if lack of foliage cover exposes the fruit to excess sun and heat. *(Photo by Dan Egel)*

Soil Solarization - (*Dan Egel, **egel@purdue.edu**, 812-886-0198, Shubin K. Saha, **shubin.saha@uky.edu**, 859-257-3374)* - Tomato growers who utilize high tunnels to reach early markets often find that there are few economic alternatives to tomato. Therefore, many growers grow tomatoes after tomatoes instead of rotating to a different crop. The repeated cropping of tomato in the same area can lead to disease problems such as Fusarium crown rot and white mold (timber rot).

Soil solarization takes advantage of solar radiation to heat the soil to temperatures that are lethal to many fungal pathogens, nematodes, and weed seeds. In Indiana, soil solarization is not always practical for field use since the period where soil solarization would be useful, summer, is also the period where most growers must produce crops. The use of soil solarization in high tunnels, however, may be more practical since these crops are produced earlier than field crops. Additionally there is chance for greater heating of the soil if the high tunnel vents are all closed which is another advantage compared to the solarizing in an open field. As an example, determinant tomatoes in high tunnels in Indiana may be grown from the third week of March through July. A second flush of tomatoes may occur in August, but by this time the price of tomatoes may make the continued production of tomatoes into August impractical. Further, at this point in the season, most growers are dealing with significant foliar diseases like leaf mold and insect pests that reduce the growth, size, and yield of tomatoes. In such a case, the high tunnel could instead be used for soil solarization as outlined below.

Soil preparation - all plant material should be removed from the soil to be solarized. The soil should be well tilled and leveled as if preparing for planting or bed formation. If beds are to be solarized, the beds should be formed and the plastic applied rather than forming the beds after solarization. However, using this method, extra caution must be taken when recovering with black plastic mulch as you do not want to contaminate solarized with non-solarized soil from the row middles.

Irrigation - Adequately moistened soils will conduct the radiant heat of the sun and is required for the treatment to be effective. It is best to wet the soil to at least 12 inches. Place the plastic on the soil after the soil is irrigated.

Plastic tarp - the best way to trap the radiant energy of the sun is to use clear plastic (see Figure 6). In general, the thinner the plastic, the better. 1 to 2 mil plastic should work well. Some growers that have effectively solarized high tunnel soils simply utilized the old plastic covering from the existing high tunnel which is usually 6 mil. However, some growers may want to use a plastic treated with a UV inhibitor so the plastic doesn't breakdown too soon. The plastic should be placed snug against the soil.

Temperature - soil solarization is most likely to be successful if the soil temperature in the top 6 inches reaches 110 to 125 degrees F. Bury at least one soil thermometer so that the temperature of the soil may be monitored without too much disturbance to the tarp. Higher temperatures will be achieved if the high tunnel is closed up, but growers should check to be sure that the high temperatures will not damage any greenhouse equipment or structure. This could include fertilizer injectors, greenhouse controllers, and plastic electrical conduit.

Time - most soil solarizations for open field will require 4 to 6 weeks to be successful. The higher the temperatures achieved, the less time is required. There could be potential to reduce the time to 2-4 weeks given the warmer conditions in a high tunnels.

Soil solarization is just one tool to use against soil borne diseases of tomato in high tunnels. It will still be necessary to practice sanitation and keep the area around the high tunnel free of weeds and debris. In some cases, resistant varieties may be used against tomato diseases.

Saha et al, 2007. EFFECT OF SOLARIZATION AND COWPEA COVER CROP ON PLANT-PARASITIC NEMATODES, PEPPER YIELDS, AND WEEDS NEMATROPICA Vol. 37, No. 1, 2007

Figure 6. Whether clear plastic is used to solarize a raised bed as shown here or a flat field plot, it is essential that the plastic be snug against the well tilled, irrigated soil. (*Photo by Shubin K. Saha*)

Spider Mites - (*Rick Foster, **fosterre@purdue.edu**, 765-494-9572*) - We have received a number of reports of outbreaks of spider mites, primarily in watermelons (see Figure 7) and in high tunnels. The problems in high tunnels are not unexpected because one of the primary causes of mortality in mite populations is rainfall washing them off the plants and, of course, that is lacking completely in high tunnels. With all the rain we have had, it's a little surprising that we are seeing problems in watermelons, but the older I get, the less I'm surprised by how infrequently arthropods behave the way we expect them to.

In both scenarios, we don't really have treatment thresholds for mites. Generally speaking, if populations are increasing, they need to be controlled. Once the decision to treat has been made, that's where things get very different. In watermelons, we have a variety of pesticide choices. See page 115 of the *Midwest Vegetable Production Guide (ID56)* for the list of options. Most of these miticides will provide good to excellent control of spider mites.

In high tunnels, the choice of a pesticide is a little more complicated. First, you need to find the products available for use on your crop. If, for example, tomatoes is the crop of concern, you can find 5 options to choose from on page 135 of *ID56*, Acramite®, Agri-Mek®, Oberon®, Portal®, and wettable sulfur. However, since you are growing in a high tunnel (defined as a greenhouse by the Office of the Indiana State Chemist), some of those options are not available to you, namely Oberon® and Portal®. So, you need to choose from the other three options. Sulfur is much less effective than the other two choices and is primarily for organic growers. If you are a conventional grower, your choices would come down to Acramite® and Agri-Mek®, both of which will work well.

Figure 7. Spider mite damage on watermelon may be recognized by the chlorotic pattern that occurs between the veins. (*Photo by Dan Egel*)

Corn Earworm - (*Rick Foster, **fosterre@purdue.edu**, 765-494-9572*) - Pheromone trap catches for corn earworms continue to be very low. Again, this is a time when growers can save a lot of money and time by monitoring their pheromone traps and not spraying. I harvested untreated sweet corn on Friday, July 31, and had over 98% clean ears and the few that were damaged had very few kernels feed upon and in 400 ears, we found not a single earworm. On the other hand, moth flights are likely to pick up any time between now and about August 20, based on 28 years that I have been monitoring their flights in Indiana. Regularly checking your moth catches will help you to know when the moths have arrived and when you need to increase your management activities. The treatment threshold now is 10 moths per night, because of the maturity level of field corn nearby.

Fall Armyworm - (*Rick Foster, **fosterre@purdue.edu**, 765-494-9572*) - Fall armyworms have completed their annual trek from the Gulf Coast to the Midwest. Fall armyworm larvae will feed on all aboveground parts of the sweet corn plant (see Figure 8), during all stages of growth. The damage to the foliage is much more severe than with European corn borer. Larvae will feed from within the whorl of the plant until the tassel starts to emerge, at which time they will move to other plant parts, including the ear. Larvae will enter the ear either through the tip, similar to corn earworm, or they may come through the husk into the side of the ear. The best time to control fall armyworms is during the late whorl stage, before they tassel emerges and they start to move. Pyrethroid insecticides such as Warrior®, Brigade®, Mustang Max® and Hero® will provide excellent control.

Most growers will want to save their more expensive Coragen® or Radiant® treatments for earworm control after silking begins (when moth catches increase).

Figure 8. Fall armyworm damaged corn whorl unrolled. (*Photo by John Obermeyer*)

Green Stink Bug - (*Rick Foster, fosterre@purdue.edu, 765-494-9572*) - I have seen more green stink bugs this year than at any time in my career. I have no logical explanation for their abundance. It was thought that as the invasive brown marmorated stink bug became established, it might outcompete the native stink bugs such as the green stink bug, causing numbers to decrease. However, this year, brown marmorated stink bugs have been relatively uncommon, and green stink bugs seem to be everywhere. Stink bugs feed with their sucking mouthparts and are likely to feed on a wide variety of vegetable crops, including cabbage, sweet corn (see Figure 9), cucumber, bean of all types, okra, mustard, peas, peppers, and tomato. Check *ID56* for your particular crop for insecticide recommendations.

Figure 9. Stink bug damage to ear of corn. (*Photo by John Obermeyer*)

Goodbye Endosulfan - (*Rick Foster, fosterre@purdue.edu, 765-494-9572*) - Growers should remember as of July 31, 2015, it is illegal to use endosulfan on any crop other than pineapple or strawberry. By July 31, 2016, all use of this product will be cancelled. Endosulfan in an organochlorine insecticide, the same class as DDT, and was first produced in the US in 1954. It has been a very effective insecticide for over 60 years, but is quite toxic to humans, so it has outlived its usefulness. Fortunately, we have a variety of newer, safer products available today.

Upcoming Events

Pinney Purdue Vegetable Field Day and Sweet Corn Sampler. Thursday, August 13, 2015. 4:00 p.m. - 8:00 p.m. CDT. Pinney Purdue Ag Center, 11402 S. County Line Rd., Wanatah, IN. Plot tours include soil health management and disease suppressive soils, tomatoes and peppers in high tunnels, and sweet corn varieties. Private Applicator Recertification (PARP) Credit available. To register, visit **http://tinyurl.com/no6tosr** or contact Lori Jolly-Brown, **ljollybr@purdue.edu**, or 765-494-1296.

Beginning Farmer Tours. Free farm tours and networking events sponsored by Purdue Extension and Local Growers Guild. For more information and to register contact the Purdue Extension Education Store at **www.edustore.purdue.edu** or 888-EXT-INFO.

- September 8: Growing Places Indy, Indianapolis, IN. Lunch, networking session, tour. Urban produce farm with raised beds, u-pick, and greenhouses.
- September 14: Morning Harvest, Palmyra and Hardinsburg, IN. Breakfast, networking session, lunch and tour. Developing local markets for produce, including marketing to institutions such as hospitals and schools, hydroponic lettuce, herbs, strawberries, and more.
- October 11: Wayne-Egenolf Farm, Spencer, IN. Lunch, networking session, tour. Grassfed beef, pastured pork, and eggs.
- November 7: Perkins Good Earth Farm, DeMotte, IN. Breakfast, networking session, lunch, tour. Soil health, cover crops, vegetable and high tunnel production.

Indiana Pesticide Clean Sweep. To dispose of pesticides, first, complete the Pesticide Clean Sweep Planning Form to the best of your ability **www.oisc.purdue.edu/pesticide/clean_sweep.html**. Mail, fax or e-mail the completed form to Kevin Neal at OISC, 175 S. University, W. Lafayette, IN 47907-2063, 765-494-4331, or **nealk@purdue.edu** no later than Monday, July 30, 2015.

- August 18: Miami County Fairgrounds, Peru, IN
- August 19: Elkhart County Fairgrounds, Goshen, IN
- August 20: Randolph County Fairgrounds, Winchester, IN
- August 26: Decatur County Fairgrounds, Greensburg, IN
- August 27: Hendricks County Fairgrounds, Danville, IN