VEGETABLE CROPS HOTLINE

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

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In This Issue

Tomato Transplant Diseases

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

Many Indiana growers may have tomato transplants growing in a greenhouse for field or greenhouse/high tunnel production. The three most likely diseases are bacterial spot, bacterial speck and bacterial canker. This article describes symptoms for these diseases and some management options. While these bacterial diseases thrive in transplant production where plants are often overhead watered, these diseases are not common on tomatoes grown to maturity in greenhouses or high tunnels. This is because, for the most part, tomatoes grown to maturity in a greenhouse or high tunnel do not have the necessary leaf wetness required for these diseases. Bacterial canker is occasionally observed in greenhouse/high tunnel situations since this disease may become established in transplants and becomes systemic in plants. Once bacterial canker is systemic in the plant, it 'spreads' within each plant even if it does not spread from plant to plant.

Bacterial speck and spot – The symptoms produced by these two diseases are not easy to distinguish. This is particularly true for symptoms on transplants. Bacterial speck tends to produce dark brown to black round lesions. These lesions may be found throughout the leaf, but are easiest to see on leaf bottoms. Bacterial speck lesions are often surrounded by a yellow halo (chlorosis). Lesions of bacterial spot may be more brown than black and are less likely to be surrounded by a chlorotic halo, although leaves with numerous lesions may have a general chlorosis. Lesions of bacterial spot may have a shot hole appearance with the center of the lesion having fallen out. Part of the reason that bacterial spot symptoms are so diverse is that this disease is be caused by two different species of bacteria as confirmed by a survey of bacterial spot strains in Indiana funded in 2016 by a Specialty Crop Block Grant through the Indiana State Department of Agriculture (ISDA).

These lesions of bacterial speck of tomato were observed on a transplant for sale to homeowners at a retail outlet. Tomato transplants should be inspected for disease symptoms during production or at delivery.

Bacterial Canker – Symptoms on transplants can be easy to miss. Affected transplants may have what appears to be necrotic lesions along leaf margins. Older plants may become wilted or show internal stem discoloration.

Transplants that are watered overhead in a greenhouse are a near perfect environment for all of these diseases. These pathogens need overhead water for disease initiation and spread. The proximity of the transplants to each other allows easy plant-to-plant spread.

As much as possible, growers should use tomato seed tested for these bacterial diseases. Hot water or chlorine treatment of seed should also lessen the chance of seed transmission of these bacterial diseases. Such treatments may be applied by the grower or the seed company. If conducted by the grower, the *Midwest Vegetable Production Guide for Commercial Growers* 2017 (ID-56) has a section on seed treatments.

Conditions that favor these diseases in transplant greenhouses include prolonged leaf wetness and high relative humidity. Therefore, anything that can be done to lessen the time leaves remain wet or to reduce humidity will help to reduce these diseases. Leaf wetness can be lessened, for example, by avoiding overhead irrigation in the evening when the leaves are likely to remain moist all night. Reduce relative humidity by venting the greenhouse or high tunnel in the evening if possible.

Products that may be used to manage tomato bacterial diseases in a high tunnel or greenhouse include those with the active ingredient copper. Appropriate products may contain copper

hydroxide, copper sulfate, copper oxychloride or copper soaps. Unfortunately, many strains of the bacterial spot pathogen are insensitive or resistant to copper products. That is, these pathogens may not respond to the levels of copper usually applied for bacterial diseases. Evidence of copper insensitivity of bacterial spot was observed in the survey mentioned above. Products containing mancozeb (e.g., Dithane®, Manzate®, Penncozeb®) may help to increase the amount of copper available on the leaf to combat bacterial diseases. Note that mancozeb products are fungicides and used alone will have little effect on bacterial diseases. Always check the label to make sure that these products are labeled for greenhouse use. Some copper formulations may be used in certified organic production.

Products that have the active ingredient streptomycin (streptomycin sulfate) may also be used to manage these bacterial diseases in the greenhouse or high tunnel. These products may not be used on field produced tomatoes or tomatoes grown past seedling stage. In our survey of strains of the bacteria that cause bacterial spot of tomato, we found that some strains are resistant/insensitive to streptomycin. However, streptomycin resistance is not as prevalent as copper resistance. Thus, it makes sense to treat the tomato transplants at least once with a streptomycin product. Products with streptomycin sulfate as an active ingredient include: Agri-mycin®, Firewall® and Harbour®.

Oxidate® is another product that can be effective against bacterial diseases and is labeled for greenhouse use. Normally, I am cautious about recommending the use of Oxidate® in the field. Oxidate®, which has the active ingredient hydrogen dioxide, disinfects the plant tissue with which it comes into contact. However, there is little or no residue on the leaf once Oxidate® dries. Therefore, Oxidate® may be less useful than, say, a copper product. Used in the greenhouse, however, Oxidate® may be helpful. When used on a small area, Oxidate® may be applied carefully and thoroughly. In addition, Oxidate® may be applied frequently on a relatively small area, partially making up for the lack of residue for this product. Oxidate® effectiveness will not be influenced by whether the pathogen is copper resistant or not. Oxidate® may be used in some organic certifications.

Serenade Opti® is another product which may be used to manage bacterial diseases in a greenhouse/high tunnel situation (Serenade Max® is an older name for this product). The active ingredient for this product is *Bacillis subtilis* strain QST 731. Although the active ingredient is a bacterium, it is not necessary that the bacterium be living. Rather, the active ingredient is a product of the bacterium that is present in Serenade Opti®. This means that the product can be mixed with copper. If used in alternation or tank mixed with some of the other products mentioned here, Serenade Opti® should be able to lessen the symptoms of tomato bacterial diseases. Serenade Opti's® effectiveness will not be influenced by whether the pathogen is copper resistant or not. Serenade Opti® may be used in some organic certifications.

Another product that will not be influenced by whether the pathogen is copper resistant or not is AgriPhage®. This product is a microbe that parasitizes and ultimately kills the pathogens described here. If applied shortly after first symptoms are produced, AgriPhage® can slow the spread of these diseases and symptom development. AgriPhage® is very specific in which strain of pathogen is attacked. One must work closely with the manufacturer, Omnilytics, to obtain product that will be most likely to work in one's region. AgriPhage® should not be tank mixed or contaminated with copper products. Similarly, Oxidate® will react adversely with AgriPhage®. AgriPhage® is recognized by the National Organic Program (NOP) but not by the Organic Materials Review institute (OMRI).

Many other products are labeled for use in managing bacterial diseases of tomato transplants. However, it is not always clear how effective these products are for disease control. I hope to be able to trial many of these products for efficacy over the next few years.

Seed and Root Maggots

(Rick Foster, fosterre@purdue.edu, (765) 494-9572)

Three species of seed and root maggots attack vegetables in Indiana. The seedcorn maggot feeds on seeds and seedlings of sweet corn, cucurbits, lima and snap beans, peas, and other crops. Cabbage maggots can cause serious damage to transplants of cabbage, broccoli, cauliflower, and Brussels sprouts and make the fleshy roots of radishes, turnips, and rutabagas unmarketable. Onion maggots are pests of seedling onions, developing bulbs and onions intended for storage.

Seedcorn maggot flies (Figure 1) emerge in April and May and lay eggs preferentially in areas with decaying organic matter. Fields that are heavily manured or planted to a cover crop are more likely to have seedcorn maggot injury. Maggots burrow into the seed and feed within, often destroying the germ. The seeds fail to germinate and plants do not emerge from the soil, leaving gaps in the stand. When infested seeds germinate, the seedlings are weak and may die. Maggots also will feed within the stems of transplants.

Figure 1. Seedcorn maggot on corn kernel

Any condition that delays germination may increase damage from this pest. Damage can be reduced by planting into a well-prepared seedbed, sufficiently late to get rapid germination. The slower the rate of growth, the greater the likelihood of seedcorn maggot injury. For any type of early season transplant, soil temperatures should reach at least 70° F or more for 4-5 days in a row to avoid maggot injury. Anything that raises soil temperature (black or clear plastic mulch) will increase soil warming and decrease the possibility of seedcorn maggot injury. Once damage is observed, the only management strategy available is the decision to replant or not. If you decide to replant, be sure to use treated seed. When resetting transplants be sure to wait 5 days from the first evidence of wilted plants before you reset. Unfortunately, we don't have any insecticides that can be applied at planting time that will provide good control of seedcorn maggots. Admire Pro and Platinum, which both provide several weeks of excellent systemic control of striped cucumber beetles when applied at planting, are not labeled for seedcorn maggots and the control is marginal at best. Capture LFR is labeled for control of wireworms, grubs, and other soil insects on cucurbits but not for seedcorn maggots. I have one year of data with Capture that showed fairly promising results, but more data are needed.

Cabbage maggot injury is also favored by cool, wet conditions. The flies, slightly smaller than a housefly, emerge in late April or early May and lay white eggs at the base of newly set plants. Larvae from this first generation tunnel in the roots of small plants, causing the plants to appear sickly, off color or stunted, and may cause them to die. Early cabbage and turnips are particularly vulnerable to damage. Control of first generation maggots can be achieved using soil insecticides such as Capture LFR, Lorsban or diazinon at planting or transplanting. Lorsban had been scheduled for cancellation, but it appears that decision has been reversed. For short season crops such as radishes and turnips, long-residual insecticides cannot be used. Cabbage maggots usually do not affect later planted crucifers.

Figure 2. Onion maggots on garlic

Onion maggot (Figure 2) flies emerge throughout May and lay eggs at the base of onion plants. The maggots attack the underground portions of the onion plants and cause plants to wilt and die. Seeded onions are more susceptible than transplanted onions. Do not overseed to compensate for losses to onion maggots. The flies do not space their eggs evenly, so you may end up with smaller bulbs because the plant spacing is too close. The second-generation flies emerge during July and the third generation emerges during late August and early September. Each generation will damage onions.

Removing cull onions after harvest and planting as far as possible from fields planted to onion the previous year can reduce damage. Soil drenches of Lorsban® (dry bulb only) or diazinon at planting will effectively control first generation maggots and provide some control of the second generation. As the onions begin to mature, they become physically resistant to attack from onion maggots, unless they have been injured in some way. Be careful during field operations not to damage the growing plants in any way. A nick in an onion bulb allows the maggots to enter and begin feeding. Also, the flies are attracted to damaged onions to lay eggs. Reducing the amount of physical damage to the onions at harvest as much as possible will also reduce the amount of injury from the third generation. Do not apply foliar sprays to kill flies before they lay eggs.

Pheromones and Pheromone Traps

(Rick Foster, fosterre@purdue.edu, (765) 494-9572)

One way insects communicate with individuals of the same species is with pheromones. Pheromones are volatile chemicals released by an insect that usually can be detected only by individuals of the same species. There are a number of different types of pheromones, but the most common type is the sex pheromone. Usually the females will emit a tiny amount of a chemical that attracts the male to her and increases the likelihood of mating. Because the chemical is volatile, air currents carry it. The male detects the pheromone in the air with receptors on his antennae. He then flies upwind to find the source of the pheromone, a prospective mate. The chemical compositions of pheromones for a number of pest species have been identified and synthetic copies can be produced in the laboratory. Synthetic pheromones can be used in conjunction with traps to catch male insects.

Listed below are some, but certainly not all, of the suppliers of pheromones and traps.

Alpha Scents, Inc. 1089 Williamette Fals Drive, West Linn, OR 97068. 503-342-8611; www.alphascents.com

Gempler's; P. O. Box 270; 100 Countryside Dr.; Belleville, WI 53508; 800-382-8473; www.gemplers.com

Great Lakes IPM; 10220 Church Rd., NE; Vestaburg, MI 48891; 517-268-5693; www.greatlakesipm.com

Insects Limited Inc.; 16950 Westfield Park Rd.; Westfield IN 46074-9374; 317-896-9300; www.insectslimited.com

Pacific Biocontrol Corporation; 620 E. Bird Lane, Litchfield Park, AZ 85340; 623-935-0512 or 800-999-8805; www.pacificbiocontrol.com

Scentry Biologicals Inc.; 610 Central Ave.: Billings MT 59102; 800-735-5323; www.scentry.com

Trece Incorporated; P. O. Box 129. Adair, OK 74330; 866-785-1313; www.trece.com

You can buy most pheromone traps from these suppliers, but for corn earworm/tomato fruitworm, I recommend that you use the wire mesh trap which is available from:

Kevin Poppe's Service

25738 N. 3200 East

Lexington, IL 61753

(309) 365-3651

mailto:kdpoppe99@hotmail.com

The wire traps catch more moths and last longer than the nylon traps.

To get the most from your pheromone traps, they must be used properly:

- Place the traps and the pheromones out before you would normally expect the insect pest to be active. That way you can monitor the adult activity, which will warn you that damage from the larvae may be coming soon. Corn earworm pheromone traps should go out about June 1.
- Be careful how you store pheromones. Ideally, they should be frozen until ready for use. At the very least, they should be refrigerated. If you keep them on the dashboard of your truck, they won't work well when you place them in the trap.
- When handling pheromone lures, do not touch them with your hands. Use a pair of forceps or wear latex gloves. This is especially important when you are using pheromones for more than one pest. Contamination of a lure with another pheromone will likely reduce the effectiveness.
- Lures usually should be changed every 3-4 weeks, although this will vary for individual lures.
- Check traps regularly, at least weekly. Daily would be better.

Indiana Grown

(Heather Tallman, HTallman@isda.IN.gov)

Indiana Grown is an initiative through the Indiana State Department of agriculture that supports products made by Hoosiers for Hoosiers. If you grow, raise, package or produce a product in Indiana then Indiana Grown is right for you. As a member, you will have access to the Indiana Grown logo, promotional and marketing support, a community to share ideas and successes, increased product and brand awareness and introductions to retailers, partners and restaurants.

Our goal is to help consumers more easily identify these products by using in-store signage, a sticker on the packaging or the digital Indiana Grown Logo. Members choose how the logo can work for their particular branding needs. Some choose to adhere our logo stickers to their product to help identify them as an Indiana Grown member, some will use our digital logo on their website and some will hang a sign at their farm stands. How the Indiana Grown branding can work for the member is up to the individual member.

Since 2015, we have worked hard to gain partnership with many of the retail outlets in Indiana that sell food or beverages. We want the Indiana consumer to more easily find locally made and grown food at their neighborhood grocery store. Indiana Grown products can be found in a variety of locations such as grocery stores, convenience stores, restaurants, farmers markets and many more.

When you buy Indiana Grown products, you are keeping dollars and food close to home and supporting fellow Hoosiers. You are supporting job creation and building sustainable communities, while preserving Indiana's agricultural heritage!

My role with Indiana Grown is to find new members across a variety of backgrounds and to help grow our existing members. From sampling events to wholesale buyers to helping members tell their stories of Indiana agriculture- we offer quite a bit to the Indiana agricultural business owner. Best of all- membership to Indiana Grown is free. There is no cost to join.

For more information about Indiana Grown please visit IndianaGrown.Org. You can also find our member products on our website as well using the search function. Please let me know if you would like more information or to schedule a visit, you can reach me at HTallman@ISDA.IN.GOV, or 317-697-5863 or contact Suzi Spahr at SSpahr@ISDA.IN.GOV.

Sad News

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

It is with the deepest sorrow that we inform our readers of the deaths of Tom Roney of Tuttle Orchards in Greenfield, John Hilger of Hilger Family Farm in Fort Wayne and Abner Horrall of Melon Acres in Oaktown. They were all great leaders of the vegetable industry in Indiana. They will be greatly missed.

Upcoming Events

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

Indiana Farm Market Association (IFMA) Spring Tour Day

The spring tour day will be held on May 2, 2017 in the Fort Wayne area. This is open to anyone with a farm retail store, farm market, or agritourism farm. It's a great time for sharing ideas and gather new ones. This is a driving tour, map and directions will be provided.

The tour begins at...
10:00 *Cook's Bison Ranch* cooksbisonranch.com. It is located in Wolcottville, Indiana.
Lunch at *Sandra D's Italian Garden in Auburn, Indiana.*
12:00-2:00 The owner/chief, Bentley Dillinger will also give a brief talk on his business and his relationship to local farmers. The menu will be specially selected, and it will include their famous dessert, tiramasu. Note: they are listed as Sandra Ds Garden Cafe for Google Maps.

The afternoon will conclude with a tour of *Sechler's Pickles*. Tour at 3:00 p.m. There is a requirement of no open-toed shoes, no sandals and no dangle jewelry.
Cost is $25 for the day and includes all tours and food for the entire day.

RSVP to chuckandtami@sweetcorncharlie.com. Please RSVP by Tuesday, April 25th, 2017 if you are able to attend or have any questions.

Southwest Purdue Agricultural Center Field Day

The field day will be held on June 29, 2017. More information is coming up soon.

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