# 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. 579*
*March 20, 2014*

## *IN THIS ISSUE*



### Be on the Lookout for Tobacco Mosaic Virus (TMV) on Tomatoes and Peppers

- (*Gail Ruhl*, **ruhlg@purdue.edu**, *765-494-4641*) - (Adapted from an article by John Damicone, Extension Plant Pathologist, OK State University)

The current outbreak of tobacco mosaic virus (TMV) on certain cutting propagated petunias is also a concern for vegetable crops since TMV has an extremely wide host range that includes vegetables as well as many bedding plants species in addition to petunias. Viruses are most often transmitted from plant to plant by insects such as aphids, leafhoppers and whiteflies and are short-lived outside of a plant or insect vector. TMV, however, is an exception to this 'rule-of-thumb'. TMV 'particles' are extremely stable and can survive for extended periods on the surfaces of propagating tools such as knives and shears as well as contaminants on pots, benches, hoses, dead plant debris, and soil. Human activity within a greenhouse or field can spread TMV from plant to plant. For this reason, TMV can be easily spread in greenhouses where plants are frequently handled by personnel or touched by equipment. As a result, greenhouse operations and retailers handling both bedding plants and vegetable transplants might unknowingly transmit TMV from infected bedding plants, such as petunia, to susceptible vegetable transplants, such as peppers and tomatoes.

Symptoms on tomato and peppers are variable depending on environmental conditions and the age at which the plant is infected. Generally, symptoms on leaves include mosaic and mottling (light and dark green patches of color) and distortion (see Figure 1 and Figure 2). Due to the systemic nature of virus diseases, symptoms are often most noticeable on young leaves near the growing point (see Figure 3). Plants infected at a young age may exhibit stunting and reduced fruit production. TMV also causes a mottling and distortion of leaves on petunias and other bedding plants (see Figure 4 and Figure 5).


Figure 1. TMV symptoms on tomato.


Figure 2. TMV symptoms on pepper.

Figure 3. TMV symptoms on young tomato leaves. (*Photo by PPDL*)

Figure 4. TMV mosaic-like symptoms on petunia. (*Photo by PPDL*)

Figure 5. TMV mottle-like symptoms on petunia. (*Photo by PPDL*)

Managing the spread of TMV in the greenhouse relies on sanitation, minimizing physical contact with plant foliage, and resistant varieties (as indicated by a 'T' or 'TMV' in the variety description). Symptomatic plants should be carefully rogued out, placed in a plastic bag (do not throw directly into a cart) and removed from the greenhouse. Wash hands with soap and water and sterilize tools in 10% bleach to prevent virus spread. The Purdue Plant and Pest Diagnostic Lab (PPDL) can quickly test for TMV and several other common viruses (INSV, TSWV, CMV) with serological assays. Submission of the entire, symptomatic plant is preferred, as described on our web page: (**www.ppdl.purdue.edu/PPDL/physical.html#greenhouse**), however, you may also collect symptomatic leaves and shoots from suspect plants, fold them into newspaper, enclose in a 'zipper' lock bag and ship in a crush-proof container to the lab. A complete listing of our services and testing fees are located at: **www.ppdl.purdue.edu/PPDL/samples.html.** If you have specific questions pertaining to TMV and vegetable production please contact Dan Egel, Extension Vegetable Pathology Specialist at **egel@purdue.edu**; 812-886-0198.

**Calibration of Hand Sprayers** - (*Dan Egel, **egel@purdue.edu**, 812-886-0198*) - In the last issue, I discussed the relative advantages and disadvantages of different types of pesticide sprayers that are powered by humans. That is, a hand sprayer is any sprayer that depends on humans to move the sprayer from plant to plant. This is in contrast to pesticide sprayers that are moved along a field by a tractor.

In a tractor borne sprayer, it is possible to set a constant speed and pressure. This fact facilitates calibration. In the space below, I would like to discuss one method whereby it might be possible to calibrate a hand sprayer.

As stated in my last article, make sure that the product is labeled for the host and disease(s) that are of concern. If the area to be sprayed is a greenhouse, make sure the product can legally be applied to a greenhouse (or high tunnel). In this example, the fungicide to be applied has a label that requires 1 lb/acre of tomatoes.

In our example, we will be applying the fungicide in a greenhouse. The greenhouse is 30 ft. x 90 ft. The total number of square feet in the greenhouse is 2700. 2700 sq. ft. per greenhouse divided by 43560 sq. ft. per acre = 0.062 acres/greenhouse. That is, our greenhouse is 0.062 acres. Since we know our product is applied at a rate of 1 lb/acre, then we know that we must apply 0.062 lbs. of product to our greenhouse. To make it a bit easier, we will use ounces. If a pound equals 16 oz., 0.062 lbs of product equals very close to 1 oz.

But how much water is needed to apply 1 oz. of our fungicide to the greenhouse tomatoes? Remember that the greenhouse is 0.062 acres. We need to know how much water will be needed to cover 0.062 acres of green-

house tomatoes.

To determine how much water to apply to our greenhouse of tomatoes, apply water to a portion of the greenhouse and then calculate how much water it will take to apply a spray to the entire greenhouse.

In this greenhouse example, there are 6 rows of tomatoes each 90 feet long on 5 foot centers. If we apply water to one row of tomatoes, we will be able to determine how much water to apply to the entire greenhouse. We place 5 gallons of water in our backpack sprayer and apply it to our tomatoes as if we were actually applying fungicide. Use a slow and steady motion. Carefully apply water to each plant. Avoid stopping in the middle of the row, and have the person who will do the applications be the same person to conduct this sprayer calibration.

After we have applied water to one row, we will measure the contents of the sprayer. We find out that we have 4.5 gallons left in the sprayer. That means that we applied 0.5 gallon to one row. Since there are 6 rows, 3 gallons of water will be needed to cover the entire greenhouse.

Place the amount of product calculated above for the greenhouse, 1 oz. of fungicide, in 3 gallons of water.

There are other ways to calibrate a hand sprayer. For example, if you know accurately how much time it takes to apply fungicide to one row of tomatoes (or to the entire greenhouse), one could measure how much water the sprayer puts out in a minute and thus calculate the total amount of water.

Perhaps the most important factor is consistency. Follow a steady motion across all the plants. Use a constant pressure. Nozzle wear will affect calibration, as will new nozzles. Recalibrate the sprayer if someone else will do the spraying.

If you have questions or concerns, please let me know. Or visit this article on the VeggieDiseases Blog **agpurdue.edu/arp/swpap/VeggieDiseasesBlog/default.aspx** and share your comment online.

**Tips for Submitting Greenhouse Samples to the Purdue Plant and Pest Diagnostic Lab (PPDL)** - (*Gail Ruhl, **ruhlg@purdue.edu**, 765-494-4641*) - Samples in plug trays, as well as unrooted and rooted cuttings, and plants in pots require extra care when they are packaged for submittal to a diagnostic lab. Before you mail the next sample, please take a few minutes to review these suggestions for packaging and submitting samples. This will help preserve the integrity of the sample during shipment and increase the likelihood of a more accurate diagnosis.

**Plugs - keep them in the tray.** If possible, do not remove the plugs from the plug tray. Submitting either an entire tray or cutting off a section of the tray helps keep the soil off the foliage where most symptoms are observed (see Figure 6). Secondary decay often occurs when soil is allowed to come in contact with the foliage, interfering with accurate diagnosis. When possible, submit at least 5-10 cells with plugs. This provides the diagnostician with ample material for microscopic observation, culturing, and virus testing if necessary.

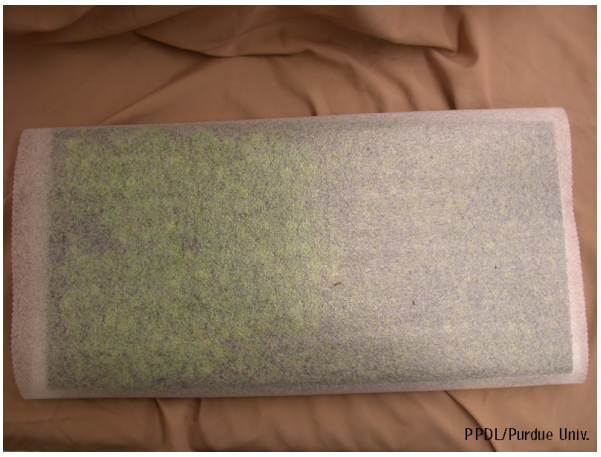


Figure 6. Plug flat wrapped and ready for shipment to diagnostic lab.

**Cuttings - separate foliage from media with a plastic bag.** The primary concern is to keep the growing media separate from the foliage to prevent contamination and rotting. Put the cuttings into a plastic bag, and seal the bag with a twist tie (see Figure 7) at the soil line. Do **not** seal the foliage in a plastic bag. Next, wrap the sample in newspaper to prevent additional drying out of foliage before it is received. Newspaper is one of the best packing materials for plant samples.


Figure 7. Media and roots on left are properly secured for shipment.

**Potted material - pack around the plant.** Take into consideration that the mail carrier will not necessarily keep these packages right side up even when those directions are written on the outside of the box. Place plastic wrap, clear packing tape or paper (see Figure 8) over the pot surface, or put the pot in a bag and seal it with a twist tie around the base of the plant. Fill any extra space in the shipping box with newspaper, styrofoam peanuts, or another space filling packing material (see Figure 9) to prevent jostling of sample during shipment.

Figure 8. Tape keeps soil in the pot during shipment.

Figure 9. Use styrofoam, packing peanuts, or crumpled newspaper inside a crush proof box to protect the sample during shipment.

**Shipping - watch the weekend.** Do not mail or ship samples on Friday, as we are not here to receive them over the weekend. Samples can be sent via US mail, UPS, FedEx, etc. We encourage you to send samples with priority or express delivery so we receive them in the best condition possible to provide you with the most accurate diagnosis.

**If you are delivering the sample to our building...** We welcome delivery of samples in person! There are two short-term metered parking spaces on the west end of our LSPS building (see Figure 10). Samples may be dropped off from 8 A.M. to 5 P.M. in room LSPS 101 in the two-story brick building (Life Sciences Plant and Soils) located in-between Lily Hall of Life Sciences and the Life Science Greenhouses. A completed submission form must accompany all samples. Sample submission forms can be downloaded from our website (**www.ppdl.purdue.edu**) and filled out ahead of time or are available at the drop off point.


Figure 10. Short-term metered parking spaces on the west end of the LSPS building at Purdue are reserved for PPDL customers. (*Photo by PPDL*)

**Resources from USDA** - (*Liz Maynard, **emaynard@purdue.edu**, 219-531-4200*) - A recent press release from USDA announced resources for small and mid-sized farmers. Of special interest to vegetable farmers are changes in the Farm Storage and Facility Loan program that will make those loans easier for small-scale producers to get. These loans can be used for "cold storage and related equipment like wash and pack stations." Read the full press release here **content.govdelivery.com/accounts/USDAOC/bulletins/aa0c7d**. Contact your local FSA office to learn about the Farm Storage and Facility loan program as well as the ongoing microloan program, and visit with NRCS to learn about cost-sharing for high tunnels and other conservation programs.

**Research Project on Sanitizer Treatment for Cantaloupes** - (*Liz Maynard, **emaynard@purdue.edu**, 219-531-4200*) - The Purdue College of Agriculture AgSEED grant program has funded a two-year project to improve cantaloupe food safety. The main goal of the project is to determine whether a high voltage atmospheric cold plasma (ACP) process could be used to sanitize the surface of cantaloupe. The process was developed at Purdue by Professor Kevin Keener and associates in the

Department of Food Science. It is known to reduce bacteria and fungi on other food such as bagged or packaged apples, tomatoes, salads, etc. The project will also support food safety education for Indiana growers. In addition to project lead Kevin Keener, the project team includes Bruce Applegate, professor of food science, Jean Jensen, research scientist, and Liz Maynard, Extension specialist.

**Research Project on Using Forest Industry Residuals as Soil Amendments** - *(Lori Hoagland, **lhoaglan@purdue.edu**, 765-494-1426, Dan Egel and Tim Filley)* - The Purdue College of Agriculture AgSEED grant program has funded a project to look into using by-products from the forest industry as soil amendments for biocontrol of Fusarium wilt and Phytophthora blight in vegetable crops. Biocontrol involves reduction of pathogens through the activities of one or more soil microorganisms via competition for resources, production of antimicrobial compounds, parasitism, and/or induction of enhanced defensive capacity in plants. Amending soil with lignin-rich organic substrates is one alternative that has potential to help mediate these pathogens by supporting beneficial microbes with biocontrol activity. Indiana has a robust forest industry with many lignin-rich residual products left over after processing that previously ended up in landfills. We will determine whether these residuals can be used to modify soil microbial communities to suppress Fusarium wilt and Phytophthora blight, and effectively sequester soil carbon in Indiana vegetable crop production systems.

**Research Briefs: Watermelon Flowering and Cuke Breeding** - (*Liz Maynard, **emaynard@purdue.edu**, 219-531-4200*) - Research Briefs will be an occasional feature highlighting recently published research from around the country and world that is relevant to Indiana vegetable production. Comments welcome!

Georgia researchers are looking at genetics of watermelon to understand what controls flowering time. With seedless watermelon production, coordinated flowering between the fruiting variety and the pollenizer is important so that pollen is present when the fruiting flowers are open. The researchers expect that their work will lead to speedier development of new watermelon varieties, particularly under varying environmental conditions. *McGregor, CE et al. 2014. Flowering Time in Watermelon Is Associated with a Major Quantitative Trait Locus on Chromosome 3. JASHS January 2014 vol. 139 no. 1 48-53.*

New York researchers are breeding cucumbers with new genetics for resistance to downy mildew. In a recent trial, one breeding line showed excellent resistance and produced fruit until frost with no protection from fungicide applications. This work should lead to varieties with improved resistance to downy mildew. *Holdsworth, W. L. et al. 2014. Development of Downy Mildew-resistant Cucumbers for Late-season Production in the Northeastern United States. HortScience January 2014 vol. 49 no. 1 10-17.*

## Upcoming Events

**Good Agricultural Practices A to Z.** Workshops will run from 9 A.M. to 3:30 P.M. at most locations, with an afternoon-evening program planned at LaGrange.

- March 25: Southern Indiana Purdue Agricultural Center, 11371 E. Purdue Farm Road, Dubois. Contact: Kenneth Eck, **kjeck@purdue.edu**, 812-482-1782.
- March 27: Clearspring Produce Auction, 2050 S. 300 W, LaGrange. Contact: Steve Engleking, **sengleking@purdue.edu**, 260-499-6334.
- March 28: Wakarusa Produce Auction, 65460 County Road 9, Goshen. Contact: Jeff Burbrink, **jburbrink@purdue.edu**, 574-533-0554.
- April 4: Wabash Valley Fairgrounds, 3901 U.S 41 S, Terre Haute. Contact: Jim Luzar, **luzar@purdue.edu**, 812-462-3371.
- April 10: Wayne County Produce Auction, 8025 Carlos Road, Williamsburg. Contact: Jonathan Ferris, **ferrisj@purdue.edu**, 765-973-9281.

**Don't Forget to Renew Your Subscription** If you are receiving a paper copy of the *Hotline*, this is the last issue you will receive unless you have paid the $15 subscription fee. On-line subscriptions are free. Also, if you join the Indiana Vegetable Growers Association (IVGA) you will automatically receive the *Hotline*. The IVGA membership form was in the last issue of the *Hotline* and is also available at **ivga.org**. Please call the Southwest Purdue Agiculture Program at 812-886-0198 if you have any questions about your subscription.