# Tomato / Pepper / Eggplant

## **Moderator:** Trevor Meachum

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|---|---|
| 9:00 am | Invasive Insects: Should Vegetable Growers be Concerned? (OH 2B, 0.5 hrs)<br>• Dr. Mike Reinke, Michigan State University Extension |
| 9:30 am | PACA: Perishable Agricultural Commodities Act<br>• Elizabeth Rumley, The National Agricultural Law Center |
| 10:00 am | Pepper Diseases and Their Control (OH 2B, 0.5 hrs)<br>• Sally Miller, Ohio State University |
| 10:30 am | Pepper Production and Fertility<br>• Dr. Timothy Coolong, University of Georgia |

**Pepper Diseases and Their Control**

Great Lakes Expo 2019
Sally A. Miller
Department of Plant Pathology
The Ohio State University, Wooster, OH 44691
miller.769@osu.edu; @OhioVeggieDoc;
Ohio Veggie Disease News u.osu.edu/miller.769

Peppers are subject to a number of bacterial, oomycete, fungal and viral diseases in the Midwest. Recent wet springs and frequent summer thunderstorms in many growing areas have contributed to a high incidence of these diseases.

The most common and important bacterial disease of peppers in the Midwest is bacterial spot (*Xanthomonas euvesicatoria*), although syringae leaf spot (*Pseudomonas syringae* pv*. syringae*) and bacterial canker (*Clavibacter michiganensis* subsp*. michiganensis*) can occur. Bacterial spot is favored by warm, rainy weather, causes lesions on foliage and fruit and defoliation (Figure 1). Syringae leaf spot is favored by cool, wet weather and is often mistaken for bacterial spot but rarely causes as much damage. Fruit spots are not known to occur. Bacterial canker is caused by the same pathogen that causes canker in tomatoes, but the disease is not systemic in peppers and is relatively rare in occurrence. All of these diseases are seedborne, so management has to start before seeds are planted in the greenhouse. Once these diseases become established in the field, it is not possible to control them under conditions that are favorable for the disease, the most critical of which is an overabundance of moisture. Bacterial soft rot (*Pectobacterium carotovorum* subsp*. carotovorum*) is not seedborne but can cause serious damage.

A B C D E

Figure 1. Peppers with symptoms of bacterial spot (A and B), syringae leaf spot (C), and bacterial canker (D and E).

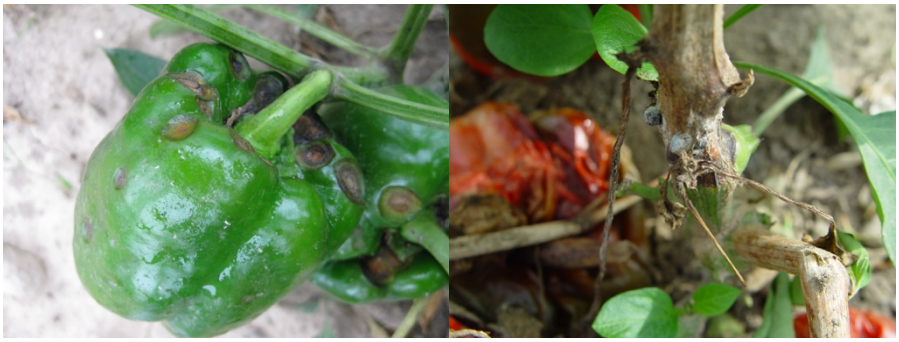
There are two common diseases of peppers caused by oomycetes: Pythium root rot (*Pythium* spp.) and Phytophthora blight (*Phytophthora capsici*) (Figure 2). Pythium root rot is a soilborne disease that is most common when peppers are transplanted into very wet soil followed by high stress conditions such as high or low temperatures. The roots and sometime crown/lower stem are affected resulting in plants that are stunted and may die. Phytophthora blight is the more common of the two diseases and is also soilborne. *Phytophthora* thrives under conditions of high moisture and high temperature. Like *Pythium*, it produces motile spores (zoospores) that are attracted to plants then form a structure that allows them to infect, and aggressively attack any type of plant tissue. Zoospores are produced in structures called sporangia and can be splashed

onto leaves, stems and fruits during rain events and overhead irrigation. Phytophthora blight is often seen first in low spots or other poorly drained areas of production fields, but the disease also occurs on well-drained, even sandy soils if the environmental conditions are right.

A B C

Figure 2. Pepper roots with symptoms of Pythium root rot (A); Pepper plant (center) with Phytophthora blight (B); and pepper leaf with Phytophthora blight lesions (C).

There are a number of diseases of peppers caused by fungal pathogens, but most are not a particular problem in the Midwest. The most troublesome pepper disease caused by a fungus in this region is anthracnose (*Colletotrichum acutatum*), an aggressive seedborne disease that mainly affects the fruit (Figure 3). White mold (*Sclerotinia sclerotiorum*) and grey mold (*Botrytis cinerea*) may occur in peppers grown in high humidity environments such as high tunnels or open fields during cool wet or humid weather. Wilt diseases caused by *Fusarium* and *Verticillium* are not common in peppers in this region.



A B

Figure 3. Anthracnose on pepper fruit (A); white mold on pepper stem (B).

Finally, peppers are susceptible to a number of viruses but fortunately in this growing region they are not particularly common and outbreaks can be prevented. The Tobamoviruses including Tobacco mosaic virus (TMV), Tomato mosaic virus (ToMV) and Pepper mild mottle virus (PMMV) are mechanically transmitted and can be seedborne. Cucumber mosaic virus (CMV) is primarily transmitted by aphids and the Tospoviruses, primarily Tomato spotted wilt virus (TSWV) are transmitted by thrips.

Managing pepper diseases effectively requires a multiple-step, integrated approach.

*1. Use Clean Seed*

The first step in prevention of seedborne bacterial, viral and fungal diseases is to exclude pathogens from the crop. Obtaining clean seeds should be a first priority. If seeds are purchased, they should be obtained from a reputable producer with a good track record for selling high quality seed. Ideally, the producer will have tested a sample of the seeds for the presence or absence of pathogens. If they have been tested and the results are negative, there is a relatively low risk that pathogens may be present. If they have not been tested, seeds should be treated to kill any pathogens on the surface. If seeds are saved from the previous year's crop or obtained from a source with an unknown track record, they should *always* be treated. The Clorox seed sanitizing protocol is effective for all of these pathogens (https://u.osu.edu/vegetablediseasefacts/management/chlorine-seed-treatment/).

*2. Choose a Resistant Variety*

A number of varieties of bell and other pepper types resistant to the common races of the bacterial leaf spot pathogen are available. A few pepper varieties are resistant to the root rot phase of Phytophthora blight. In general, these varieties are susceptible to the crown rot phase, which affects foliage and fruits. Varieties with moderate to good resistance to Phytophthora blight include Paladin, Aristotle, Declaration, Intruder, Vanguard (bell); Hechicero (jalapeño); and Sequioa (ancho). Research is now being conducted to determine if susceptible pepper varieties grafted onto Phytophthora-resistant rootstocks fare better against this disease than non-grafted plants. Many pepper varieties have resistance to TMV and ToMV and these should be selected if possible. Since these pathogens are capable not only of rapid reproduction but also rapid change and adaptation, resistant varieties should never be the sole means of disease management, no matter how tempting it may be to rely on this management strategy alone.

*3. Use Pathogen-Free Transplants*

The greenhouse environment in which seedlings are produced, if not managed properly, is highly conducive to diseases. The following practices will reduce the threat of diseases: 1) use of new or sanitized plug trays or flats and pathogen-free mixes, 2) sanitizing equipment, installing solid flooring and raising trays from the floor, 3) limiting movement of personnel and equipment between greenhouses, 4) cleaning benches and greenhouse structures thoroughly after the crop; and 5) prohibiting exotic or experimental pepper or tomato varieties, or plants from saved seed, in the same greenhouse with commercial seedlings unless all seeds are sanitized. Pepper seedlings should never be produced in the same greenhouse as ornamental plants, which may be a source of Tospoviruses and the thrips that transmit them. Plants should scouted regularly for thrips and other vectors, and treated with appropriate insecticides if needed. Relative humidity should be low, air circulation should be high and plants should be watered only enough to ensure growth and minimize the risk of drought stress. Surface water (from ponds, lakes, rivers, etc.) or re-circulated water should never be used to irrigate seedlings unless it has been treated (e.g. ozone, chlorine) and is tested regularly. Farmers who purchase transplants from others should ask about their management practices, and visit them during transplant production, if possible.

*4. Choose the Best Site and Rotate*

Crop rotation is an important strategy that not only reduces disease problems but also affects weed, insect and nutrient management. Crop rotation should be done among crop families; peppers, tomatoes, eggplants, and potatoes are solanaceous plants. Plants in the same crop family often share the same or related pathogens, and thus should never be used as rotational crops with each other. For bacterial leaf spot management, a relatively short rotation of two years out of solanaceous crops is adequate. However, longer rotations are needed for other bacterial, oomycete and fungal diseases. *Phytophthora* produces structures called oospores that can survive for a number of years in the soil. Plan to rotate out of peppers, cucurbits or green beans for 4-5 years if Phytophthora blight has been a problem. Site factors that minimize opportunities for disease development include good drainage and good aeration.

*5. Use Appropriate Cultural Practices*

There are a number of cultural practices that can help to improve overall plant health and also reduce disease development. Our research has shown that increasing the organic matter content of soil not only improves crop growth and yield, but may also reduce some diseases. Organic amendments such as high-quality compost and manures should be considered if available within a practical distance from the farm. Organic amendments are best applied in the fall or early spring to allow leaching of excess salts and destruction of pathogens. Care should be taken with any fertilizer program to avoid excessive nitrogen, which can increase plant susceptibility to soft rot and other diseases. Irrigation should be carefully controlled to minimize the time that plants are wet and surface water sources should be avoided. Raised beds should be used to help manage Pythium root rot and Phytophthora blight. Finally, *Phytophthora* and other soilborne pathogens can be moved from an infested field to a clean one on soil clinging to boots, equipment, etc. Power washing to remove soil is a good first step, followed by rinsing with a sanitizer. Allowing cull piles containing discarded peppers or cucurbits is not a good practice– plant material needs to be disposed of, preferably by burying, far from fields and surface waters.

*6. Use Crop Protectants as Needed*

Bactericides are usually ineffective in stopping established bacterial diseases under favorable environmental conditions. Copper bactericides are not recommended in the field for bacterial disease management due to the high incidence of copper resistance in the bacterial pathogens. If the other steps in the integrated disease management program have been followed, however, the need for bactericides is significantly reduced. Insecticides may be required to control European corn borer and other insects that damage pepper fruits, leading to bacterial soft rot. There are a number of fungicides labeled for use on peppers to manage Phytophthora blight. The newest product, Orondis, has very good efficacy against this disease. It is available as a pre-mix with either Revus (Orondis Ultra), Ridomil (Orondis Gold) or Bravo (Orondis Opti). To manage anthracnose, fungicides must be applied as soon as fruits begin to set, and continued on a weekly schedule as fruits develop. Several studies have shown the best results with Aprovia Top, Quadris, Quadris Top, Cabrio or Priaxor alternated with chlorothalanil or mancozeb. Some labels may recommend a spreader-sticker. Fungicides labeled for use against diseases of fruiting vegetables are listed in the Midwest Vegetable Production Guide for Commercial Growers.