Phytophthora blight (*Phytophthora capsici*) is a serious and complicated disease of peppers and cucurbit crops. Under the appropriate environmental conditions, infections can quickly spread and completely destroy a crop in a matter of days. Chemical control options are limited. They often provide only suppression and not full control of this disease.

**The Disease**

Symptoms in peppers include crown rot, foliar blight, fruit rot and stunting. Initially, stem lesions are dark green and water soaked, later becoming dry and purplish-brown. Typically, the part of the plant above the affected area wilts (Figure 1). A brown discoloration of the vascular tissue can be seen if the main stem is cut open. Irregular water-soaked lesions may appear on the leaves, later drying to a tan or bleached colour. The fruit may develop water-soaked patches that shrivel and darken.

A white to greyish mould may appear on the lesion or inside the fruit. Fruit typically shrivel, but remain attached to the plant.

Depending on the type of cucurbit and the time of infection, symptoms include stunting, crown rot and fruit rot. The crown rot phase is the most destructive. Dark-green lesions form on the crown, girdling it and causing the entire plant to turn yellow/brown and die (Figure 2). Fruit infections begin as a large water-soaked lesion. Under humid conditions, a thin layer of white spores develop on the surface of the fruit. These spores resemble a fine dusting of powdered sugar (Figure 3).

**Spread and Survival**

One of the factors that make *P. capsici* so persistent and difficult to control is that the pathogen produces different types of spores, each suited to survival in a different type of environment.

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**Figures 1-3.** Pepper Plant (left), Crown Rot (centre), Fruit Spores (right)
Spread and Survival...continued

- oospores live in plant debris and in infested soil for long periods of time (3-4 years).
- sporangia are formed on infected plant material. They can become airborne, further spreading the infection across the field. In the presence of free-water, sporangia may burst releasing zoospores.
- zoospores live in water and can actively swim through saturated soils towards plant roots. They are also carried in flowing water and remain viable for several days in streams and ponds.

Irrigation Water Studies at Michigan State University

Dr. Mary Hausbeck, Michigan State University, conducted an extensive study on the presence and potential impact of Phytophthora in irrigation water sources.

In this study, they placed cucumbers and pears in floating milk crates. These were placed in various different types of surface water, including: rivers, ditches, naturally fed ponds and ponds fed from a deep well. The fruit baits were left in the water for 3-5 days at which time samples of infected fruit tissue were analyzed in the lab for the presence of P. capsici.

P. capsici was most commonly found at the river and ditch monitoring locations, especially when the sampling location was adjacent to a host crop. However, the pathogen was present even in years when the adjacent crop was not a host crop. It was rarely found in ponds fed by deep wells.

The spores do not appear to overwinter in the water sources. The assumption is the spores enter water courses in the runoff from infected or infested fields. However, the study did not show a clear relationship between significant rain events and the presence of P. capsici in the water source. The study did indicate that irrigation from surface water is a potential source of Phytophthora infection in cucurbit and pepper crops.

Home-grown Testing Efforts

Should Ontario growers conduct similar tests on their own water sources? Not necessarily. In the Michigan study, the presence of P. capsici varied greatly over the sampling periods. Even a high-risk water source may test negative one week and positive the next. Each test really only provides a snapshot in time and not a full picture of the relative risk. By the time the test results have been analyzed, the in-field situation will undoubtedly have changed.

The lab procedure used by Dr. Hausbeck is labor intensive and expensive. It is possible that other methods of testing, such as immunostrips or water sampling, may be less expensive; but these methods have not been thoroughly investigated or proven comparable to the lab results.

The take home message from Dr. Hausbeck’s study was: avoid using surface water to irrigate susceptible crops, especially if there is a history of P. capsici in the area. Deep wells, or irrigation ponds fed by deep wells are the safest option.

The Michigan study did not investigate ponds filled from surface water during spring runoff. If the pond does not receive additional surface water or runoff water during the growing season, it can be assumed that the risk would be low; however there is no research to support this assumption.

Figure 4. Wilted Pepper Plants Caused by Phytophthora Infection
Best Management Practices

- Drainage, drainage, drainage. Phytophthora thrives in wet soil conditions. Do not grow susceptible crops in poorly drained fields. Avoid planting into low-lying areas. Adopt production practices that minimize compaction. These practices include the use of cover crops, dedicated drive rows and rotation with deep-rooted crops. The use of raised beds improves drainage and will help reduce levels of infection.
- Follow a crop rotation away from all host crops for at least 4-years. See the inset below for a list of potential host crops.
- Do not over-irrigate, especially during harvest.
- Remove all plants showing symptoms (and a border of surrounding healthy plants) from the field.
- Clean all equipment and boots to avoid moving the pathogen to uninfected fields.

Phytophthora capsici - Host Crops

While not all of these crops will show obvious signs of infection from P. capsici in the field, they may act as hosts. Avoid growing any of these in rotation with cucurbit and pepper crops.

- Cucurbits – cantaloupe, cucumber, gourd, pumpkin, squash, zucchini, watermelon
- Solanaceae – eggplant, pepper, nightshade, tobacco, tomato
- Legumes – snap beans, lima beans, peas
- Others – beet, radish, turnip, swiss chard, carrot, spinach, onion, velvet leaf

References

- Ontario CropIPM – Phytophthora Blight of Peppers. www.ontario.ca/cropIPM