NC STATE UNIVERSITY DEPARTMENT OF PLANT PATHOLOGY

Late blight of Tomato

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Pathogen

Late blight of tomato is caused by the fungus-like organism *Phytophthora infestans.* The pathogen is best known for causing the devastating Irish potato famine of the 1840's, which killed over a million people, and caused another million to leave the country.

Host crops and plants

Besides tomatoes, *P. infestans* can only infect a few other closely related plants including potato, petunia and related solanaceous weeds such as hairy nightshade.

Host parts affected

All above-ground portions of the plant.

Symptoms of late blight

The first symptoms of late blight on tomato leaves are irregularly shaped, water-soaked lesions, often with a lighter halo or ring around them (Figure 1); these lesions are typically found on the younger, more succulent leaves in the top portion of the plant canopy. During high humidity, white cottony growth may be visible on underside of the leaf (Figure 2). Spots are visible on both sides of the leaves. As the disease progresses, lesions enlarge causing leaves to brown, shrivel and die (Figure 3). Late blight can also attack tomato fruit in all stages of development. Rotted fruit are typically firm with greasy spots that eventually become leathery and chocolate brown in color (Figure 4); these spots can enlarge to the point of encompassing the entire fruit.

Figure 1. The first symptoms of late blight on tomato leaves are irregularly shaped, water-soaked lesions, often with a lighter halo or ring around them.

Figure 2. During humid conditions, white cottony growth of *P. infestans* may be visible on the underside of affected leaves.

Figure 3. *P. infestans* can cause leaves to turn brown, shrivel & die.

Figure 4. Infected fruit are typically firm with spots that eventually become leathery and chocolate brown in color.

Favorable environmental conditions

The pathogen is favored by cool, wet weather; clouds protect the spores from exposure to UV radiation by the sun, and wet conditions allow the spores to infect when they land on leaves. Nights in the 50's/60's and days in the 80's accompanied by rain, fog or heavy dew are ideal for late blight infection. Under these conditions, lesions may appear on leaves within 3-5 days of infection, followed by white

cottony growth soon thereafter (Figure 2). This white cottony growth is a sign of rampant spore production. Although spores may also be produced on tomato fruit, they are more commonly produced on leaves. Spores can spread readily by irrigation, equipment, wind and rain and can be blown into neighboring fields within 5-10 miles or more, thus beginning another cycle of disease.

Disease management

Without proper preventative measures and under the right weather conditions, diseases like late blight can completely defoliate and destroy a crop within two to three weeks. Due to moderate temperatures, frequent rainfall, and heavy morning dew during the growing season, late blight on tomatoes, caused by *Phytophthora infestans*, can be severe in the mountains of North Carolina, as well as in late plantings in the piedmont. Despite intensive efforts for over 150 years to control *P. infestans*, it remains one of the world's most costly plant pathogens, concerning either direct loss and/or in the need for intensive use of costly fungicides. The recent spread of aggressive, fungicide-resistant strains of this pathogen on tomatoes in NC has further aggravated the problem, making the pathogen much harder to control.

Host resistance

Plant resistance is a recently new component in late blight management for commercial production of fresh market tomatoes. New varieties resistant to some strains of *P. infestans* have recently been developed at the Mountain Horticultural Research and Extension Center in Mills River, NC by tomato breeders Randy Gardner and Dilip Panthee. A plum tomato variety named 'Plum Regal', as well as a new campari-type called 'Mountain Magic' and the large-fruited variety 'Mountain Merit' have resistance to some strains of late blight, as well as the variety 'Defiant' from Johnny's seed company.

Chemical: products for commercial conventional growers

The application of fungicides plays a significant role in the control of late blight; however mefenoxam resistant strains of the pathogen have been identified throughout the southeast. Fungicides containing mefenoxam (trade name Ridomil) are recommended only when weather favors disease development and should only be applied one time as a first application (one pint Ridomil Gold SL per acre). Mefenoxam resistance in *Phytophthora infestans* can often be found after only one application, so successive applications of Ridomil are usually less or ineffective. Resistance development to this active ingredient can occur rapidly; use of this chemistry after the pathogen has been in the area for a few weeks is not recommended.

Commercial growers in western NC should apply protectant products as soon as possible, as controlling late blight preventatively is better than after infection. **Before** late blight infection occurs, chlorothalonil products (Bravo, Equus) work best and have a 0-day PHI. If you are using a generic formulation of chlorothalonil, make sure the product contains a sticker within it, or tank-mix one in. **After** infection occurs, mefenoxam in the drip as a single application is the most effective chemistry. In addition, several other chemistries such as cyazofamid (Ranman; 0-day PHI), mandipropamid (one of the chemistries in Revus Top; 1-day PHI), fluopicolide (Presidio; 2-day PHI), and propamocarb (Previcur flex; 5-day PHI) work well against this pathogen. Check the NCSU tomato spray program web site for help on spray schedules and rates:
http://www.ces.ncsu.edu/fletcher/programs/plantpath/
Table 3-53 of the 2013 SE Vegetable Crop Handbook provides efficacy ratings against this disease; it can be found at:
http://www.thegrower.com/south-east-vegetable-guide/

Organic growers have less chemical options that are effective; the only OMRI labeled active ingredients that have decent efficacy against late blight are fixed copper formulations.

Chemical: products for home gardeners

Products containing the active ingredients copper or chlorothalonil (the trade name of one product with chlorothalonil is known as 'Daconil') are the BEST and only effective products available to home gardeners. Ready-to-use formulations of products containing either of these active ingredients are commonly sold at box stores like Home Depot or Lowes. In addition, home gardeners should grow varieties with resistance if they are worried about late blight in future years because most chemicals available to the home gardener are marginal at best in curbing late blight once it appears. Once plants are infected in a home garden, there is little that can be done to protect them besides weekly fungicide sprays. Since the disease can infect tomato fruit as well, once your plants show signs of late blight, your best option is to harvest all of the fruit, even if they are green, and learn how to make fried green tomatoes.