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Late Blight: *Phytophthora infestans*

Introduction

New York gardeners are sometimes surprised by a quick and apparently spontaneous blighting and death of their potato and tomato plants during wet weather. Tubers harvested from such plants often rot in storage. Tomatoes often rot on the plant. These disappointing losses are the result of late blight, a disease caused by the fungus *Phytophthora infestans*. Late blight affects the foliage, fruits, and tubers of potato and tomato; hairy nightshade can also be affected. These plants are all members of the *Solanaceae* or "Nightshade" family.

Late blight was responsible for the Irish potato famine in the 1850's. Millions of people in Ireland starved or were forced to emigrate when entire potato crops rotted in the field or in storage because of infection by *P. infestans.*

Symptoms and Signs

The characteristic foliar symptoms on any susceptible plant are irregular to circular lesions. Initially, in wet weather, the lesions may appear water-soaked; in dry weather, the centers tend to dry out. The dark center is often surrounded by yellow, chlorotic tissue or brown, collapsed tissue. These spots often occur at the tips or edges of leaves (**Fig. 1**).

If moist weather persists, the leaf spots enlarge rapidly to blight larger areas of the foliage. Dark brown discoloration of leaf stalks and stems is also commonly encountered. The symptoms frequently develop first on lower leaves but can develop at any

Figure 1: Lesions on the foliage of the potato (provided by **Dr. William B. Fry, Cornell University)**

level in the canopy. The symptoms are usually most dramatic inside the canopy. During humid weather, a white fuzz or mildew-like growth appears on the leaves (upper or under sides) and on stems. This indicates that the fungus is producing spores.

Infected potato tubers are discolored by a reddish-brown, granular rot (**Fig. 2**). The rot can be superficial or penetrate more deeply into the tubers (an inch or more). Tubers must be cut open to observe this symptom. The rot continues to develop after the tubers are harvested. Further decay of the tubers is often hastened by secondary fungi and bacteria. The soft rot bacteria often turn tubers into a foul smelling liquid.

Tubers become infected when spores of the fungus wash down through the soil and come into contact with the fleshy organs. Tubers are not infected via their connection to plants with blighted foliage. Affected tomatoes develop a firm, dark, greasy-

looking lesion. Fluffy, white fungal growth often develops on the fruit under humid conditions. Affected fruit often rots as secondary bacteria and fungi enter.

Figure 2: Infected potato tubers (provided by **Dr. William B. Fry, Cornell University)**

Disease Cycle

Until recently, only one form of the fungus (with one mating type or one "sex") existed in the United States. The fungal growth and spores produced by this form could only survive in living tissues. Infected potato tubers used for seed, infected tubers left in cull piles, and unharvested, infected tubers left in the ground were the sources of inoculum, or spores, for the disease from one growing season to another.

This situation, however, is changing. Beginning in the late 1980s additional forms of the fungus arrived in the United States. Some strains of this new form are especially pathogenic to tomatoes. Some are also resistant to metalaxyl, the systemic fungicide traditionally used to manage late blight. These new forms also contain representatives of both mating types (or "sexes") of the fungus. The presence of the second mating type should allow the fungus to sexually reproduce and form spores (oospores) that are better able to survive adverse conditions. Oospores should be able to survive in the soil during the cold winter months, not just in tubers. This will further complicate management of the disease. **As there has not yet been any evidence found to indicate that there are two mating types present in New York State, treatment of soil to manage blight is <u>not</u> recommended at this time.**

The development of the disease is favored by daytime temperatures of 21-27°C (70-80°F) and nighttime temperatures of 10-16°C (50-60°F). The presence of free moisture (such as dew, rain or fog) on the foliage also favors the disease. Free moisture is a prerequisite for spore germination and infection and thus is essential for disease development. As the foliage becomes further blighted, more spores are produced and spread of the disease to adjacent plants becomes more likely. Potatoes and tomatoes go through essentially the same infection process. As the season progresses, potato tubers can become infected as spores from the blighted foliage are washed down through the soil and contact developing tubers.

Management Strategies

Late blight is currently a threat to home gardeners as well as commercial farmers. The disease is capable of wiping out entire tomato and potato gardens or commercial fields within a week if the conditions are wet. Farmers who grow tomatoes and potatoes are at serious risk of losing their entire income for the season. Thus it is important for everyone who grows tomatoes and potatoes to be able to identify late blight and know how to control it.

1) Seed and Transplants

The most effective strategy for managing late blight is to avoid sources of inoculum (spores). Do not save potato seed from year to year. Use health-certified potato seed. Many states that produce potato seed have seed certification programs to ensure that the seed meets certain standards for disease levels. Using certified seed also reduces the carry over of a number of potato viruses. Certified seed, however, is NOT A GUARANTEE that late blight or other diseases will not be present. Examine your seed carefully before you plant, and plant only sound, blemish-free tubers. Examine tubers for late blight symptoms by cutting them open with a knife. Immediately sterilize or thoroughly wash the knife if late blight symptoms are found.

Destroy any rejected seed tubers that you do not plant (bury them deeply in an area away from the garden, burn them, or discard them in a plastic bag in the trash). Make sure any tubers put into compost piles are completely decomposed. Pull up and destroy

potato plants that come up from tubers left in the garden last season. Also, only plant healthy-looking tomato transplants. Fortunately, the late blight fungus is not known to infect tomato seed.

2) Resistant Varieties

There are several potato varieties that show resistance to late blight. These varieties will slow down, but do not prevent, the development of the disease. Elba is currently the most resistant potato variety available. Potato varieties with moderate levels of resistance include: Kennebec, Sebago, Allegany, and Rosa. Unfortunately no late blight resistant tomato varieties are available.

3) Scouting and Sanitation

During the growing season, check your garden for symptoms of late blight regularly- at least weekly. Scout more often during periods of wet weather. If you find any late blight, begin fungicide applications if you haven't done so already, or intensify your fungicide applications by increasing application frequency or rate. Be sure to keep within the guidelines on the pesticide label, however. See section 5 for more information on fungicides.

If late blight becomes severe, remove diseased plants by digging them up. Destroy these plants immediately by one of the following: burying them deeply in an area away from the garden, burning them, or by bagging them in a plastic bag and discarding the bag. These steps will help avoid production of a larger number of spores. Harvest all potato tubers in the garden. If late blight occurs when the tubers have already 'sized up', harvest the crop as soon as possible to avoid post-harvest tuber rot. Again, destroy diseased foliage and stems.

4) Modifying Growing Conditions

It is best to avoid wetting the leaves of your garden plants when you water; soak the ground around the plants instead of spraying the plants with water. If this is not possible, water your garden mid-day so that the foliage dries off quickly. Eliminate weeds around the garden so as to maximize air circulation around the plants. These practices will generally help reduce the incidence of many foliage diseases. Additionally for potatoes, hill up the soil around the plants to provide a more substantial barrier against tuber infection from spores washing down through the soil.

5) Fungicides

Tomatoes and potatoes are susceptible to late blight at any time during the growing season. If the growing season is wet, late blight occurrence is very likely in New York State. Fungicides may be necessary to protect your plants from infection.

The only fungicides now effective against late blight and available to home gardeners are protectant materials. These products protect foliage from infection but they cannot cure plants once they are infected. Continuous fungicide coverage is necessary to protect plants from infection.

Protectant fungicides are available to manage the disease in the home garden in New York State. When disease first appears, begin treatment with chlorothalonil (see list below) or a registered copper product. Additional pesticides that may be used later in rotation include Heritage or products containing the active ingredients *Bacillus subtilis,* (for suppression). See the label directions for specific information on application rates and frequency of application. The brand names mentioned above are examples of specific products available. Other brands may also be available. This information is supplied with the understanding that no discrimination is intended and no endorsement by Cornell Cooperative Extension is implied.

Some of the products listed above may be legal for use only on tomatoes, some only on potatoes, and some are legal for use on both. Check the pesticide label for specific directions and follow them exactly. Pesticide labels are considered legal documents; if you do not follow the label directions you are breaking the law.

Additional products may be available for commercial use. Commercial applicators should refer to the appropriate commercial pest management guidelines, or contact their local Cooperative Extension Office

for more information on currently registered products. The *Cornell Integrated Crop & Pest Management Guidelines for Commercial Vegetable Production* is currently available on-line. See: http://www.nysaes.cornell.edu/recommends/.

Some **chlorothalonil** products registered in NYS for "home garden" use for Late Blight and/or Early Blight on potato and tomato, and for Septoria Leaf Spot on tomato are listed below. Note: Additional products may be available. Early Blight and Septoria Leaf Spot are other common diseases we often see on plants during the growing season in NYS.

Bonide Fung-onil Multi-purpose Fungicide: EPA Reg # 4-410,
Bonide Fung-onil Multi-purpose Fungicide Concentrate: EPA Reg # 60063-9-4,
Fruit Tree, Vegetable & Ornamental Fungicide: EPA Reg # 60063-9-54705,
Garden Disease Control Concentrate - Ortho Group: EPA Reg # 239-2522,
Gardentech Daconil Fungicide Concentrate: EPA Reg # 67572-82-71004, or
Gardentech Daconil Fungicide RTU: EPA Reg # 67572-2-71004

Learn more about Late Blight:

"Managing Late Blight in Organically Produced Tomato"
2010: Keeping Late Blight in Your Rear View Mirror – Commercial Potato Growers
2010: Keeping Late Blight in Your Rear View Mirror – Commercial Tomato Growers
http://vegetablemdonline.ppath.cornell.edu/NewsArticles/LateBlightJune09.html
Vegetable Crops, Late Blight of Potatoes and Tomatoes

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READ THE LABEL BEFORE APPLYING ANY PESTICIDE! Changes in pesticide regulations occur constantly. All pesticides distributed, sold, and/or applied in New York State must be registered with the New York State Department of Environmental Conservation (DEC). Questions concerning the legality and/or registration status for pesticide use in New York State should be directed to the appropriate Cornell Cooperative Extension Specialist or your regional DEC office.

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