

LATE BLIGHT IN PENNSYLVANIA

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Late blight, caused by the pathogen *Phytophthora infestans*, was a disease once considered sporadic, but is now an annual concern for tomato and potato growers in Pennsylvania as well as the mid-Atlantic and Northeast regions. On tomato, symptoms can develop on leaves, stems, branches and fruit at any growth stage. On leaves, pale green to brown lesions will develop on the upper leaf surface and have pale green or water soaked margins. The lesions may enlarge rapidly until entire leaflets are killed. Under conditions of high relative humidity, grayish white sporulation will develop on the lower leaf surface opposite to the lesions. Stem lesions are chocolate brown in color and can girdle causing them to break. Greasy-brown lesions can develop on both immature and mature fruit and the fruit typically remain firm unless infected by secondary soft-rotting organisms. Disease development and spread is favored by temperatures between 65 and 70°F with high relative humidity (RH) near 100%. Survival of the spores is greatly reduced when the RH is below 95%; at 80% RH they can survive only five hours. Once the spores have landed on the plant, a film of water must be present to initiate infection. Infection can occur in a matter of hours under ideal conditions and visible symptoms are evident in the field after 5 to 7 days.

Since the pandemic in 2009 when late blight was distributed via infected transplants destined for home gardens on a widespread scale, late blight was been confirmed as early as 17 May in 2010 in tomato greenhouse transplants and as late as 12 July in 2012 in a commercial tomato field. Aside from 2009 when late blight became widely established in home gardens before moving into commercial production, late blight over the past five years has originated in commercial fields and then later in the season as the population of the pathogen built-up it moved into home gardens. In two of the past five years, it is suspected that either volunteer potatoes, cull potatoes or infected potato seed were the source of the first confirmed outbreak. The past several years, the majority of the samples were genotyped from PA were



the US-23 clonal lineage which has also been dominant in both the mid-Atlantic and Northeast regions. In 2014, approx. 90% of the 108 samples submitted for genotyping were US-23. US23 is characterized as the A1 mating type and is aggressive on both tomato and potato; however it produces many more spores on tomato. US-23 is also characterized as sensitive to the systemic fungicide mefenoxam which was again effectively used in several potato fields early in the season to manage the disease outbreak. Knowledge of the pathogen population structure is an important component of an integrated disease management program and helps growers make informed in-season disease management decisions.

Until recently, late blight management has focused on the frequent use of fungicides, especially under favorable conditions however, as more cultivars are released with resistance to late blight, **host resistance** becomes an important and more feasible component of an IPM program. To-date, three major late blight resistance genes (*Ph-1*, *Ph-2* and *Ph-3*) have been identified in the red-fruited tomato wild species *Solanum pimpinellifolium* and transferred through conventional breeding into the cultivated tomato (*S. lycopersicum*). Unfortunately, the pathogen population is constantly adapting has already overcome *Ph-1*, rendering it no longer effective. More recently, *Ph-2* and *Ph-3* have been introgressed into a few commercial cultivars in both the heterozygous and homozygous state (e.g. Mountain Magic, Mountain Merit, Plum Regal and Defiant). Currently, commercially available cultivars that contain both *Ph-2* and *Ph-3* (e.g. Mountain Merit and Mountain Magic) are considered most effective against the current genotypes of late blight. Dr. Majid Foolad, tomato breeder at Penn State has been working to identify new late blight resistance genes (e.g. *Ph-5*) in the wild species *S. pimpinellifolium*. The goal is to combine multiple resistance genes to increase the strength and durability of resistance. Molecular markers and marker-assisted selection (MAS) technology is used to facilitate this process. In addition, planting only certified potato seed and visibly healthy transplants as well as diversifying plantings to include some resistant or less susceptible cultivars will help ensure some crop in the event of a late blight outbreak. Selecting less susceptible cultivars with host resistance can also reduce your reliance on fungicides and provide more flexibility in the timing of application, especially when you are delayed getting into the field to spray.

Fungicides can also be used to effectively manage late blight however they are most effective when applied either preventatively when late blight has been confirmed nearby or when the very first symptoms are observed in the field. This means that having a good scouting program is essential and knowing if and where there are nearby late blight outbreaks. The latest information on confirmed outbreaks at the county level can be found on the USAblight.org website. When you click on a county on the map, information about all the samples including host crop and pathogen genotype (if the sample was submitted) submitted from that county are presented. You can also sign-up for email or text alerts notifying you when late blight is confirmed with a pre-determined radius from your location. You can also check your local extension team website for information on late blight and in PA, I have a 1-800-PENN-IPM hotline that I update voice messages on a weekly basis. A list of recommended fungicides can be found in the Cornell Integrated Crop and Pest Management Guidelines for Commercial Vegetable Production (<http://veg-guidelines.cce.cornell.edu/>); The Cornell Store at (800) 624-4080. Fungicides applications can also be timed based on weather driven models such as Blitecast or the Cornell Decision Support System that utilized Blitecast as one component of a more comprehensive

system. Another presentation by Ian Small will focus the utility of these fungicide timing programs.

Managing late blight with organically approved fungicides is more challenging. Since most OMRI-approved fungicides are protectants application of these products before symptoms are observed is really important. Copper-based products are still the most effective tool but they can be tank mixed with other OMRI-approved products such as Actinovate, EF-400 and Zonix. Whether using conventional or organic fungicides, it is important to have effective fungicides available and on-hand and know how to apply them appropriately to maximize their efficacy. Under favorable conditions, late blight can devastate a crop in as few as 5 to 7 days if left unmanaged.

Cultural practices such as maximizing row spacing, trellising, and drip irrigation to improve air circulation and promote leaf drying will reduce potential losses from late blight but creating less favorable conditions for the pathogen. Managing weeds especially solanaceous weeds like nightshade and volunteer tomato and potato plants that could be sources of late blight. Roguing out symptomatic plants or hot spots in the field when symptoms are first observed will reduce potential spread of the pathogen. Roguing in the middle of a warm sunny day will minimize the chances of dislodged spores spreading and infecting the crop.

Management of late blight requires an integrated approach that is initiated prior to late blight developing in the field. This starts by preventing the introduction of late blight through planting certified potato seed and visibly healthy tomato transplants. Selecting less susceptible cultivars with host resistance can reduce your reliance on fungicides and provide more flexibility in the timing of application, especially when you are delayed getting into the field to spray. Once detected in the region, continue to scout your crop carefully and, at the very least, initiate a protectant fungicide program depending on the forecasted weather conditions. Be sure to have products available and on-hand and know how to apply them appropriately to maximize their efficacy. Under favorable conditions, late blight can devastate a field in as few as 5 to 7 days if left unmanaged.

Please contact your local Extension office if you suspect late blight on either tomatoes or potatoes. We would like to continue to collect as many samples as possible during the upcoming 2014 season. Understanding more about the pathogen population structure, not just in New York and Pennsylvania but across the U.S., helps us develop better tools to manage this disease more cost-effectively.

Portions of the research reported here were supported by the Agriculture and Food Research Initiative Competitive Grants Program 2011-68004-30104 from the USDA National Institute of Food and Agriculture, the Pest Management Alternatives Program 2011-34381-30770 and the Pennsylvania Vegetable Marketing and Research Program/PA Vegetable Growers Association.