For Gleanings
(Newsletter of CT NOFA)

Late Blight: What Can Organic Farmers Do?

Kim Stoner
CT Agricultural Experiment Station

As I write this in late August, the spread of late blight across the Northeast has paused due to a spell of hot, dry weather (our first of the summer!), but the damage has already been extensive, and we may well see more as the first hurricane system of the year brings us new storms. Late blight is a disease of tomatoes and potatoes (although it has also been known to attack related plants such as eggplant and pepper, weeds in the same plant family such as hairy nightshade and bittersweet, and ornamental hybrid petunias).

NOFA responded quickly to the late blight crisis in 2009 in the Northeast with a forum at the Summer Conference with a stellar panel – Abby Seaman of the New York State Integrated Pest Management Program; Ruth Hazzard, who directs the University of Massachusetts Vegetable Program; Michael Glos of Kingbird Farm and who has also participated in research at Cornell University; Paul Stamets, mycologist, author of *Mycelium Running: How Mushrooms Can Save the World*, and founder of Fungi Perfecti, LLC; and Dan Kittredge of the Real Food Campaign. I will present some of the information from that forum, and from other sources such as my own Experiment Station and universities that have studied late blight, particularly the "Vegetable MD Online" website at Cornell (see the website addresses below).

The pathogen that causes late blight is *Phytophthora infestans*, famous for causing the Irish potato famine in the 1840's. *Phytophthora infestans* is classified as a part of the Oomycota, the water molds, which are technically no longer considered fungi. The classification is important because the disease cycle is driven by water, and this summer we had lots of water – 7 weeks of rainy weather.

But it wasn't just the weather that caused this year's crisis. According to news reports (including an article in the *New York Times* on the day of the NOFA forum, now at the website: http://www.nytimes.com/2009/08/09/opinion/09barber.html), the pathogen was spread rapidly by large retailers of tomato transplants, such as Home Depot, Kmart, Lowe's and Walmart, who unintentionally bought infected tomato bedding plants from a grower in the South, and then shipped the infected plants across the Northeast. According to the experts on the panel, the grower eventually took back all of the infected plants, but by then it was too late – the spores from the plants had spread for miles (they can spread 30 miles in favorable conditions), and some infected plants had already been purchased and planted by gardeners. The horse had already left the barn and was rampaging through the countryside.

A major focus of the forum was on planning what to do this winter to prevent overwintering of the pathogen and also planning what to do if the disease strikes again on

a major scale next year. As far as we know right now, there is only one mating type of *Phytophthora infestans* in the Northeast. This is important because it means the pathogen can not produce oospores able to survive away from living tissue. Because tomatoes don't have any living tissue that survives the winter, all that needs to be done to infected tomato plants is cut them down and till them under. Potato tubers are living tissue that can survive the winter in the ground, in cull piles, or in storage, so they are potential sources of the pathogen next year. Here are some steps to take to prevent the late blight pathogen from overwintering on your farm:

Don't save your potato tubers this year for planting next year if you had any late blight on your farm. When you buy seed potatoes for next year, buy certified seed (not just certified organic, but also certified for disease). But also be aware that the "Certified" grade for seed potatoes allows up to 1 percent late blight infection, so also ask your supplier about what testing is done for late blight and other pathogens, whether the potatoes were grown in an area affected by late blight, and whether any late blight was observed in field and harvest inspections.

Cull potatoes should be frozen, crushed, fed to livestock, or buried under at least 2 feet of soil.

Inspect carefully any tubers you store for eating – tubers infected with the late blight pathogen are often invaded by bacteria that cause soft rot, making a smelly mess, but it is also possible for the lesion to be brown and firm, and reddish-brown inside the tuber. These lesions can be a source of pathogen the next year, if you don't get around to eating the potato.

Rotate your crops in the family Solanaceae away from the area where you grew potatoes and tomatoes this year. Watch carefully for any volunteer potatoes or tomatoes (or solanaceous weeds) and destroy them immediately on sight next spring.

And here are some precautions to prevent late blight for next year:

Make sure you grow your potatoes and tomatoes in well-drained soil with good air drainage. Think about ways to let more light and air get to your plants to dry them off more quickly – stake your tomatoes, and increase your spacing within and between rows.

Diversify your crops – both in varieties and timing. Plant some early varieties of potatoes and tomatoes, so that you can still get a crop if late blight strikes late (or at least at its usual time). Some varieties that are being bred for resistance that were mentioned were "Legend" tomato – out of a breeding program in Oregon, where late blight is a much more frequent problem – and "Mountain Magic" and "Plum Regal" tomatoes from a breeding program in North Carolina. These are all quite new, so there may not be much supply of seeds. Some standard potato

varieties are less susceptible to late blight, including "Kennebec" and "Elba," but cannot be relied upon for control.

Have a plan for what to do if late blight strikes in the area. Learn to distinguish it from the other diseases of tomatoes that we see every year (see the photos in the fact sheets from the Connecticut Agricultural Experiment Station and Vegetable MD Online below). Plan how you will dispose of any crops with late blight efficiently to prevent further spread.

Some organic growers were reported to have successfully held off late blight (at least through the time of the forum) using copper sprays preventatively, and there is scientific evidence of efficacy for copper against late blight. There are two copper fungicides which are approved by the Organic Materials Review Institute (OMRI) and registered for use in New England and New York: Champ WG and NuCop 50 WP. Both of these have to be used early – they can prevent spread of the disease, but they cannot cure the plant once disease is present. Extension newsletters from UConn and UMass can give notice of when the pathogen has been found in the region. Ruth Hazzard of UMass emphasized that personal protection equipment is required for application of copper fungicides. Eye protection is the most important, but long-sleeved shirt, long pants, and gloves are also required. Tomato fruit should be washed before eating – copper washes off well.

Ruth Hazzard also addressed the question of whether build-up of copper is a concern in New England soils. Copper rapidly forms complexes in soil and doesn't leach, so copper applied to the field would be expected to remain in the soil. The data Ruth collected from Steve Bodine of the UMass soil testing lab indicates that currently the average level of copper in soil he tests is around 2 parts per million (ppm). Copper is an essential nutrient for plant growth, and deficiency is more common in Northeastern soils than excess. Toxicity to plants comes into play at levels greater than 100 ppm. The soil scientists Ruth consulted estimated that one application of copper product at 2 lb. per acre (1.5 lbs. of active ingredient) would add about 0.5 -1 ppm of copper to the soil. But, when the soil was tested from a field of tomatoes on plastic that had been sprayed at least 6 times, the soil tested at 0.9 ppm – lower than expected. We need to understand more about this, but the risk of getting toxic levels in one season seems to be low. Organic farmers may want to go ahead now and have their soil tested for copper, so that they can factor their current level of copper in the soil into any decision about whether to spray, if needed. And, if they decide to spray, it would be wise to test for copper periodically, so they will know if levels are building up.

Other spray materials that are OMRI- approved and labeled for use against late blight include the brand names: Serenade ASO, Serenade MAX, Sonata, Oxidate, Sporan, and Sporatec. Ruth said that she did not have any information on efficacy of these materials.

Paul Stamets suggested that growers might want to start tomatoes from seed treated with mycorrhizal and endophytic beneficial fungi, such as *Trichoderma.* There are a number of companies that produce such products, including Paul's own company Fungi Perfecti, LLC. Although I have not found research linking specific fungal products to resistance

to late blight, Abby Seaman has done testing showing that the *Trichoderma* product Plant Shield reduced levels of early blight in tomatoes (see website for Abby's article on induced resistance below), and a group of researchers in Alabama have found that certain strains of beneficial bacteria, added to the root zone, increased resistance to late blight (see reference below) and several other tomato diseases.

Dan Kittredge, director of the Real Food Campaign, showed pictures of two farms that he was managing with a focus on soil nutrition, and stated that some symptoms of late blight had appeared on those farms, but the disease had not spread. He uses measurements of refractive index (or Brix), electrical conductivity, and pH of plant sap to determine if the plants are getting the needed nutrients. More information on this approach to soil and crop management can be found at the Real Food Campaign website below.

This was an unusually difficult year for many farmers in Connecticut, due not only to late blight, but also to the long period of cool wet weather, and other challenges such as hailstorms. Farmers have to constantly keep adapting to new challenges of all kinds. Gathering together what we have learned during this difficult year may help us be more prepared the next time the conditions favor this devastating plant disease.

Sources for more information on the Internet:
Fact Sheet from the Connecticut Agricultural Experiment Station:
http://www.ct.gov/caes/lib/caes/documents/publications/fact_sheets/plant_pathology_and_ecology/late_blight_of_tomato_and_potato_in_connecticut_2009_07-24-09.pdf

Fact Sheet from the Vegetable MD On-line at Cornell:
http://vegetablemdonline.ppath.cornell.edu/factsheets/Potato_LateBlt.htm

Organic Alternatives for Late Blight in Potatoes:
http://www.attra.org/attra-pub/lateblight.html

"Induced Resistance: Revving up plant defenses" from the Resource Guide to Organic Insect and Disease Management
http://www.nysaes.cornell.edu/pp/resourceguide/appendix/appendix_d.php

Scientific study on bacteria that promote resistance to late blight in tomato:
http://apsjournals.apsnet.org/doi/abs/10.1094/PHYTO.2002.92.12.1329