Keeping Late Blight in Your Rear View Mirror – Planning for 2010 – Commercial Tomato Grower Version

Tom Zitter, Department of Plant Pathology, Cornell University, Ithaca, NY 14853

taz1@cornell.edu

The 2009 season was very challenging for most commercial tomato growers (both conventional and organic) because of weather conditions unsuitable for tomato growth and because of the widespread occurrence of late blight in much of the Northeast US and beyond. Late blight (LB), the fungal-like disease responsible for the Irish Potato Famine, occurred on tomato transplants much earlier in the season (mid-June) compared with all previous recorded occurrences. And environmental conditions in 2009 during June and July, and continuing into August were very conducive for the occurrence and spread of late blight inoculum, since the organism responsible, *Phytophthora infestans*, prefers cool and wet conditions for its reproduction and spread. Thus in 2009, tomato growers were required to make numerous fungicide sprays of the best products available to control LB, and do this on a very tight schedule if they expected to harvest any marketable fruit.

The more frequent occurrence and the presence of more virulent genotypes (isolates) of LB has been a continual progression which began in the 1990's and has continued to the present day. Two different genotypes of LB occurred in New York and in other areas of the Northeast in 2009, and these genotypes fit the category of being more virulent for potato, tomato or both. Genotype US8 is quite specific for potato, has an A2 mating type and is metalaxyl resistant. Is has become nationally predominant since 1995 (locally present 1992-present) and is easily disseminated on infected potato tubers used for seed. Infection of potato with US8 was a concern for potato growers in 2009, especially for acreage located in western NY. The genotype responsible for widespread losses for tomato and some potato fields was a new isolate called US22. US22 is also mating type A2, but is actually metalaxyl sensitive. This genotype, though quite severe on tomato, is not as severe as previously occurring genotypes in the state (US11 [locally present 1994-1998] and US17 [locally present 1996-97], both mating type A1 and metalaxyl resistant). The greatest fear is when both mating types (A1 and A2) occur at the same time in a location, this would lead to sexual recombination, the production of overwintering oospores, and the creation of new genotypes which could break currently identified genetic resistance in tomato and potential resistance for current fungicides. Unfortunately, this fear is being realized, since both mating types have been found in several states in the same year (PA, VA, and FL).

Table 1. Mode of Action (MOA) for fungicides registered (NYS) for tomato foliar diseases; -- no effect; ? = not known; P = Poor; F = Fair; G = Good; E = Excellent; OLF = other labeled formulations or products are available.
[1] Group No. as assigned by FRAC (Fungicide Resistance Action Committee) and used by EPA; DTH = days to harvest for main product.

MOA (esp. for LB)	1^{Group} Fungicide ^{DTH}	LB - foliar	LB - stem	LB new growth	EB control	SLS control
Contact	^{M5}Bravo^{0} or OLF (*chlorothalonil*)	G	P	No	G (tolerance if used repeatedly)	E
	^{M3}Dithane^{5} or OLF (*mancozeb*)	G	P	No	G	G
	^{M3}Maneb ^{5} or OLF (*maneb*) (use till product is exhausted)	G	P	No	G	G
	^{M1}Kocide^{0} or OLF (*fixed copper*)	P-F	P	No	F-G	F
	$^{22+M3}$Gavel^{5} (*zoxamide* + *mancozeb*)	E	P	No	E	G
	^{21}Ranman^{0} + contact $^{0\ or\ 5}$(*cyazofamid* + *chloro* or *mz*)	E	P	No	G (with contact)	G (with contact)
	^{7}Endura^{0} (*boscalid*)	--	--	--	G	G
	^{9}Scala^{1} (*pyrimethanil*)	--	--	--	F-G	--
Trans-laminar	^{27}Curzate^{3} + contact^{3or5} (*cymoxanil* + *chloro*, *mz* or *copper*)	G	F	?	G (with contact)	G (with contact)
	$^{11+27}$Tanos^{3} + contact^{3or5} (*famoxadone* + *cymoxanil* + above)	G	F	?	G	G
	^{40}Forum^{4} + contact^{4or5} (*dimethomorph* + *chloro* or *mz*)	G	F	?	G (with contact)	G (with contact)
	^{40}Revus^{1} (*mandipropamid*)	E	F	?	--	--
	$^{40+3}$Revus Top^{1} (*mandipropamid* + *difenoconazole*)	E	F	?	E	E
	$^{11+M5}$Quadris Opti^{0} or $^{11+3}$Quadris Top^{0} (*azoxystrobin* + *chloro* or *difenoconazole*)	G	F	F	E	E
	^{11}Flint^{3}, ^{11}Cabrio^{0}, ^{11}Reason^{14} + contact ^{varies} (*trifloxystrobin*, *pyraclostrobin*, *fenamidone*)	G	F	F	G (with contact)	G
Systemic	^{28} Previcur Flex^{5} + contact^{5} (*propamocarb*)	G	G	G	G (with contact)	G (with contact)

Many fungicides are labeled for the control of late blight, and some if mixed with a protectant (contact) fungicide, will also provide control of early blight (EB, *Alternaria tomatophila*) and Septoria leaf spot (SLS, *Septoria lycopersici*)(see Table 1). If LB is reported in your area and you are uncertain of the spray coverage you are achieving, then fungicides with translaminar or systemic mode of action (MOA) should be selected over contact fungicides. Note that many fungicide MOAs (different FRAC numbers) exist among products used for LB control, and will be expanding for EB and SLS products in the near future. MOA selection is particularly important when needing to protect both foliage and developing fruit. Apply the sprays preventatively and on a shortened spray schedule. The fungicide available for organic control of LB, EB and SLS is limited to fixed copper; in 2009 with US22 genotype present, organic growers and experiments in our own plots demonstrated that copper was effective when used preventatively and on a shorten schedule for all three diseases. Almost all fungicides are effect for EB control, with this precautionary note. First, repeated use of chlorothalonil as the single choice fungicide is not recommended because the EB fungus (*A. tomatophila*) will develop tolerance by the middle of the season when chlorothalonil is used repeatedly. Thus it is important to rotate products even among contact fungicides. Secondly, isolates of *A. tomatophila* exist in the state that are resistant for strobilurin fungicides, meaning that group 11 fungicides (ie. Quadris, Cabrio, Flint, Reason and others) should never be used alone, but always mixed with a contact fungicide (ie. Quadris Opti).

Genetic resistance for plant pathogens, including late blight, is known and is being incorporated into tomato varieties using conventional plant breeding techniques. The web site http://vegetablemdonline.ppath.cornell.edu/NewsArticles/Tomato_Performance_Late%20Blight_Mar2010.pdf lists the performance of tomato cultivars for late blight, and includes the performance of reds, heirlooms, large cherry and small-fruited types, some with known genes for resistance or tolerance for LB. The most widely known genes for LB resistance are *Ph1*, *Ph2* and *Ph3*. The *Ph3* gene provides the strongest protection since it confers resistance for multiple LB genotypes including last years' US22, unlike *Ph1* or *Ph2* which are very genotype specific, and thus do not provide control of for all known LB genotypes.

Where do we stand for the 2010 growing season? Choosing cultivars with resistance or tolerance is always a good starting point for disease control. For tomato growers in the affected areas (most of the Northeast in 2009), the slate is wiped clean in terms of survival of LB inoculum from last year. The late blight organism is an obligate parasite, meaning it must survive on living tissue. This source of inoculum can be LB-infected potato tubers that were saved or survive in compost piles or appear as volunteers that overwintered in the soil from last year. In the case of potato tubers as a potential source, make sure none survive in compost piles or as volunteers, and if present, dispose of

them properly before you begin preparing the soil this spring. Use clean tubers to establish your new crop in 2010. Tell your neighbors to do the same! The late blight isolate (US22) is not capable of surviving in the soil and is not seedborne in tomato. So growers do not need to rotate away from the planting area they used in 2009 specifically for LB control. However, I suspect most growers also have disease problems with two common fungal diseases, EB and SLS, for which rotation is critical. A few cultivars on the tomato list also have good resistance or tolerance for early blight and should be considered. Starting with disease-free transplants is important. The development of triple resistant tomato varieties (LBR, EBR and SLSR) is currently underway at Cornell, with important field trials for selection of resistance and multiple fruit types set for 2010. Many commercial seed companies are also working with genetic resistance for LB and EB, and these should be available in the near future.

Images of the diseases mentioned in this report can be found at Tomato Diagnostic Key: http://vegetablemdonline.ppath.cornell.edu/DiagnosticKeys/TomKey.html.