Vegetable Crop Update

A newsletter for commercial potato and vegetable growers prepared by the University of Wisconsin-Madison vegetable research and extension specialists

UW Extension

No. 26 – October 18, 2012

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Calendar of Events

October 24&25, 2012 – Hancock ARS-Storage Research Facility, Potato Variety Harvest Expo, 8AM-4:30PM, Hancock, Wisconsin

January 20-22, 2013 – Wisconsin Fresh Market Fruit and Vegetable Conference, The Wilderness, Wisconsin Dells, Wisconsin

February 5-7, 2013- UWEX & WPVGA Grower Education Conference, Holiday Inn , Stevens Point, Wisconsin

Vegetable Disease Update – Amanda J. Gevens, Assistant Professor & Extension Vegetable Plant Pathologist, UW-Madison, Dept. of Plant Pathology, 608-890-3072 (office), Email: gevens@wisc.edu.

Vegetable Pathology Webpage: http://www.plantpath.wisc.edu/wivegdis/

Late blight summary for 2012: The generally hot, dry weather of Wisconsin in the 2012 production season made for a year of good foliar disease control in potato and vegetable crops. In potato, but for minor incidences of early rhizoctonia and blackleg, and some later early blight, the season seemed destined to make its way through to harvest without account of late blight. However, mid-July brought isolated, and in some parts of the state, intense rain storms, adding the critical third angle to the disease triangle (recall the other two: disease-susceptible plants and pathogen). The manner in which the pathogen was introduced in 2012 is not well understood, but we know that sources can include infected potato seed or tomato transplants, infected potato volunteers, or aerial movement of inoculum from sites of disease. By 18 July, potatoes in Antigo and Plover areas had reached or exceeded late blight disease thresholds (DSVs of ≥18) and preventative fungicides for control were initiated. By 31 July, the first case of late blight was confirmed in state, with several counties to follow in the months of August and September.

In 2012 across the U.S., late blight challenged both tomato and potato crops in over a dozen states along the eastern seaboard, the Midwestern states, and in isolated cases along the west coast. Predominating the epidemics was late blight clonal lineage US-23, a lineage only recently identified and characterized by the allozyme banding pattern at the glucose phosphate isomerase (Gpi) locus of 100/100, is of the A1 mating type, and has some sensitivity to mefenoxam. In our UW-Plant Pathology Laboratory, US-23 isolates have shown to be prolific producers of sporangia (airborne spores), and have a cooler optimum growth temperature than other recent strains, US-22 or US-24.

Late blight is a potentially destructive disease of potatoes and tomatoes caused by the fungal-like organism, *Phytophthora infestans*. This pathogen is referred to as a 'water mold' since it thrives under wet conditions. Symptoms include leaf lesions beginning as pale green or olive green areas that quickly enlarge to become brown-black, water-soaked, and oily in appearance. Lesions on leaves can also produce pathogen sporulation which looks like white-gray fuzzy growth. Stems can also exhibit dark brown to black lesions with sporulation. Tuber infections are dark brown to purple in color and internal tissues are often reddish brown in color and firm to corky in texture. The time from first infection to lesion development and sporulation can be as fast as 7 days, depending upon the weather.

In Wisconsin, late blight has been reported in each of recent years since 2009, after having an approximately 7 year period (2002-2009) without detection. We know that the predominant clonal lineage (a.k.a. strain or genotype) of *Phytophthora infestans* that we had in WI this season was US-23 and can be aggressive on tomato and potato. Based on the biology of the pathogen, we know that this A1 mating type late blight strain cannot produce persistent overwintering spores in the soil without pairing with a strain of the opposite (A2) mating type. However, the pathogen can overwinter on infected plant material that is kept alive through the winter. Such plant materials can include late blight infected tomato plants kept warm in a compost pile and late blight infected potato tubers that remain in the soil after harvest or are stored in a warm place. Although the late blight pathogen has the potential to infect other plants in the Solanaceae family (tomato, potato, pepper, eggplant, nightshade weeds), we have seen late blight on just tomatoes and potatoes in fields in recent years.

Over the past 4 years, late blight isolates were collected from potato and tomato from across the state. A lab technique known as allozymes genotyping revealed 3 banding patterns which profiled US-22, US-23, and US-24. In our phenotype testing, all isolates of US-22 were sensitive to mefenoxam, while isolates of US-23 and US-24 showed partial insensitivity. US-22 isolates were of the A2 mating type, and US-23 and US-24 isolates were of the A1 mating type. Isolates of opposite mating types were geographically separated in the state in 2010. We have only identified single mating types (A1) in WI in the past 2 years, reducing the potential risk for recombination and production of soil persistent oospores. Summary of isolates is below.

Clonal lineage	**Mating type**	**Optimum growth temp**	**Host comments**	**Years found in WI**	**Resistance to mefenoxam**
US-22	A2	24ºC	Tomato and potato, poor pathogen on pepper, eggplant, tomatillo	2009, 2010	Sensitive
US-23	**A1**	**18ºC**	**Tomato and potato**	**2010, 2011, 2012**	**Intermediately resistant**
US-24	A1	20ºC	potato	2010, 2011	Intermediately resistant (great variability among isolates)

The late blight in WI in 2009 was part of a nationwide epidemic likely initiated by tomato transplants, thus one clonal lineage, US-22, predominated. In 2010, the sources of late blight are unknown, but US-22 may have overwintered on plant material protected under the early heavy snowfall. US-24 was found only on potato in central WI, and US-23 was found only on tomato, primarily in areas of WI with concentrated suburban tomato gardens. In 2011, WI had an early (7 July) and isolated detection of late blight on tomato in Waukesha Co. caused by US-23. Late blight did not again reappear until confirmed on 26 and 27 August in Waushara and Adams Cos. (US-23 and US-24). The 2012 late blight occurrences in Wisconsin advanced from the northwestern part of the state, moving eastward. Later season, reports came from central and southern counties, but with limited economic impact on direct market and home garden tomatoes. All 2012 isolates were US-23 (detailed in table below).

County	Crop	Date of Detection	Clonal Lineage of the Late Blight Pathogen
Barron	Potato/Tomato	31 July 2012	US-23
Adams	Potato/Tomato	31 July 2012	US-23
Portage	Potato/Tomato	2 August 2012	US-23
Oneida	Potato	4 August 2012	US-23
Waushara	Potato/Tomato	20 August 2012	US-23
Marathon	Potato/Tomato	22 August 2012	US-23
Rusk	Tomato	23 August 2012	US-23
Sheboygan	Tomato	24 August 2012	US-23
Sauk	Tomato	10 September 2012	US-23
Eau Claire	Tomato	14 September 2012	US-23

Late blight pathogen populations in the U.S. have and continue to experience major genetic changes or evolution. The end result is the production of pathogen isolates with unique genotypes and epidemiological characteristics. As such, continued investigation of this pathogen is necessary to maintain best management strategies in susceptible crops.

With the late season presence of the late blight pathogen in WI, it has been critical that growers remained on alert and continued late blight control efforts from field to storage. Recommendations for late-season potato late blight disease management should include the following:

1) Continue to scout fields regularly. Scouting should be concentrated in low-lying areas, near the center of center-pivot irrigation structures, and in areas that are shaded and protected from wind. Any areas where it is difficult to apply fungicides should be carefully scouted.
2) Avoid excess irrigation and nitrogen. If foliage is infected with late blight, spores can be washed down through the soil and infect tubers. Green vines can continue to be infected and produce spores even at harvest. Additionally, green and vigorous vines are hard to kill and skin may not be well-set at digging resulting in higher risk of post-harvest infection by late blight and other diseases.
3) Allow 2-3 weeks between complete vine kill and harvest. Fungicide applications should be continued until vines are dead. When foliage dies, spores of the late blight pathogen that

remain on the foliage also die. This practice will prevent infection of tubers during harvest and development of late blight in storage.

4) Do not produce cull piles of late blight infected tubers. Such piles are a significant source of spores and centers of large piles may not experience freezing/killing winter temperatures which serve to kill tuber tissue and the pathogen. Culls should be spread on fields not intended for potato production the following year in time that they will freeze completely and be destroyed during the winter. Potato culls can also be destroyed in some other way such as chopping, burial, burning or feeding to livestock.

5) Keep tubers dry in storage. Air temperature and humidity should be managed so as to avoid producing condensation on tubers. Condensation can promote spore production of the late blight pathogen in storage. Application of fungicidal materials on tubers entering storage can limit tuber rot progress and spread. Avoid or limit long term storage of tubers from fields in which late blight was detected.

The decision to make fungicide applications to potato tubers post-harvest is not trivial. The addition of water to the pile, even in small volumes necessary for effectively carrying fungicides, may create an environmental favorable to disease under certain conditions. Typically, post-harvest fungicides are applied in ≤0.5 gal water/ton (2000 lb) of potatoes. At this spray volume, an evenly emitted liquid will leave tubers appearing slightly dampened. If tubers appear slick or shiny with wetness, the spray volume is likely greater than 0.5 gal/ton or the emitter may not be properly functioning.

Under some circumstances, for instance when tubers come out of the field in excellent condition and field history includes little to no disease concern, additional tuber dampness may be unacceptable and seen as a bin risk that outweighs any fungicidal benefit. In other circumstances, tubers may come out looking rough or with harvest damage, and field history includes pink rot or late blight. A scenario such as this may benefit from a post-harvest fungicide and resulting dampness should be mitigated by appropriate ventilation and temperature control.

Wisconsin fungicide recommendations for late blight can be found in the University of Wisconsin Extension Publication entitled "Commercial Vegetable Production in Wisconsin," publication number A3422 (http://learningstore.uwex.edu/Commercial-Vegetable-Production-in-Wisconsin2012-P540.aspx) and additional information is provided in weekly newsletters during the growing season (provided and archived at the vegetable pathology website: http://www.plantpath.wisc.edu/wivegdis/).

Current P-Day (Early Blight) and Severity Value (Late Blight) Accumulations. ***Thresholds for both diseases have been met. Final season accumulations are provided in the table below.*** **May thanks to** ***Vaughan James for his efforts in this reporting throughout the production season.***

Location	Planted	50% Emergence	P-Day Cumulative	DSV Cumulative	Calculation Date
Antigo Area	Early 5/1	5/30	730	56	9/11
	Mid 5/10	6/6	693	56	9/11

	Late 6/1	6/16	626	56	9/11
Grand Marsh Area	Early 4/3	5/8	866	62	9/11
	Mid 4/15	5/16	820	62	9/11
	Late 4/30	NA	764	61	9/11
Hancock Area	Early 4/1	5/1	955	39	9/11
	Mid 4/15	5/10	898	33	9/11
	Late 5/1	5/17	854	33	9/11
Plover Area	Early 4/3	5/17	865	57	9/11
	Mid 4/19	5/18	800	57	9/11
	Late 5/1	5/27	737	53	9/11

Potato common scab: by A.J. Gevens and B.J. Webster, Graduate Research Assistant in Plant Pathology: In our research trials and in commercial production, common scab was generally limited in the 2012 production year. However, several samples of what looked like pitted scab were submitted for diagnosis late season and were identified as insect or grub damage. How can you tell the difference between symptoms?

When young potato tubers become infected by the common scab pathogen at tuber initiation stage, the resultant infection can be create three distinct lesion types as tubers mature throughout the growing season: russeted or superficial lesions, raised corky patches that are erumpent, and pitted scab that produces gouges that vary from shallow to deep pits. All lesion types are putatively caused by *Streptomyces scabies*, but may vary depending on virulence factors of pathogen strains, environment, infection timing, and/or level of host resistance. As tubers age beyond the initiation phase, they undergo changes in peridermal structure that thicken the cells to form a protective barrier. Phellem thickness and number of cell layers increases in response to infection by *S. scabies*. Potato cultivars with a thicker periderm tend to be more resistant to CS based on a more rapid production of lignin in response to a pathogen, compared to cultivars that have a lower suberin content in the phellem.

Common scab lesions are rough in appearance and often corky in texture. Often multiple lesion types are present on a single tuber (Fig 1A). Potato pitted scab is depicted below in Fig1B. Insect damage results in a smoother appearing pit on the tuber, often with elongated tunneling evident in picture below in Fig 1C. Field samples with insect boring damage had few pits on an individual tuber; typically common scab has multiple pits per individual tuber.

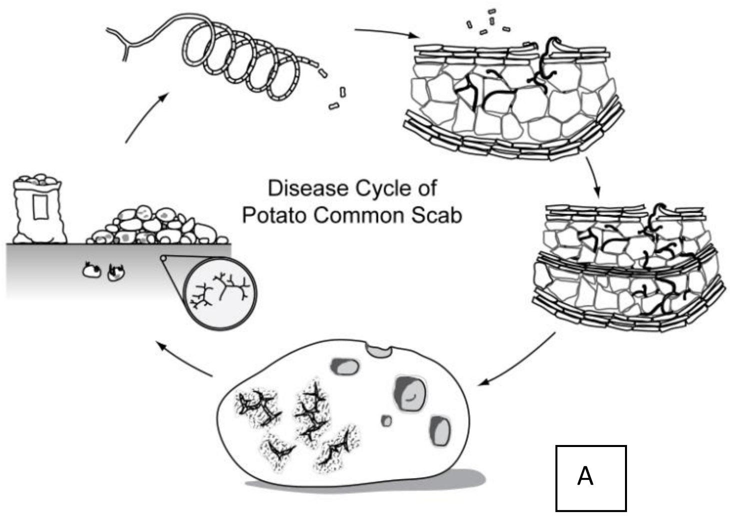

Figure 1. Potato common scab vs. insect damage. A. Disease cycle of potato common scab. B. Pitted common scab on potato tuber. Photo by Gevens, UW-Plant Pathology. C. Grub damage on potato tubers. Photo by Karl Ritchie, Walther Farms, Michigan (from MSUE Newsletter)

Potato black and silver scurfs: Both scurfs were noted, particularly on round whites and red potatoes, this harvest season and are caused by soilborne fungal pathogens (Fig. 2). Both diseases can worsen as the period of time between vine kill and harvest is extended. Black scurf is a disease caused by *Rhizoctonia solani*. The distinctive black sclerotia or fungal masses that adhere to tuber periderm develop very late season, typically after vine kill. The fungal masses typically cannot be removed with the standard brush and wash systems of packing houses. As such, this condition can render potatoes unsaleable. Control measures include harvesting when tubers are mature, limiting soil moisture late season, planting of disease free seed, and at plant or seed treatments with effective fungicides. Silver scurf is a disease caused by *Helminthosporium solani*. Conidia (spores) are soil borne and cause brown-gray lesions on the potato surface. On red cultivars, lesions may look pale brown to white or ‘bleached.’ These lesions are primarily cosmetic. Symptoms develop under moist conditions and often are not observed until the tubers have been stored for a period of time. However, on reds, symptoms may have been obvious right at harvest. Control can be achieved by planting clean seed, harvesting the tubers when mature, and storing tubers under cool conditions without excessive moisture. Silver scurf symptoms can progress in storage if conditions favor the disease. From our storage trial work, it appears that tubers with high severity of silver scurf desiccate rapidly in storage as the pathogen creates microscopic wounds in the periderm.

Figure 2. Potato scurfs. A. Black scurf caused by *Rhizoctonia solani*. B. Silver scurf caused by *Helminthosporium solani*.

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Potato Variety Harvest Expo

The SpudPro Committee is looking for your feedback on varieties that may be selected for potato breeding advancement. Visit the Hancock Agricultural Research Station anytime from 8am to 4:30pm on Oct 24 & 25, 2012 to cast your vote for the new reds, processing russet, fresh russet and chipping potatoes that you would like to see selected for advancement in the SpudPro breeding program. The expo will include material harvested from the Wisconsin Potato Variety and SpudPro Trials, selections from the Wisconsin Breeding Program team and other specialty and heirloom potato varieties.