Vegetable Crop Update

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

No. 7 – May 8, 2015

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Calendar of Events

July 15 – UW-Hancock ARS Field Day, 1:00PM, Hancock, WI
July 17 – Rhinelander State Farm Field Day, Lelah Starks Elite Found. Seed Farm, Rhinelander, WI
August 20 – UWEX Langlade County Airport Field Day, Antigo, WI
August 25-27 – Wisconsin Farm Technology Days, Statz Bros., Inc. Farm, Sun Prairie, WI

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Late blight updates: The Wisconsin Administrative Code (ATCP 21.15(2)) requires potato cull piles to be fed, disked in or otherwise removed by **May 20**, to prevent late blight. Nationally, in the past week, there were no new late blight diagnoses reported at www.usablight.org. So far in 2015, there have been confirmation of potato and tomato late blight (US-23) in FL and tomato late blight in CA (US-11). Additionally, there were a few potato fields in Frio County Texas that have had late blight. To date, the strain has not yet been identified.

Strategizing potato early blight control in 2015: Despite its similar name, early blight routinely affects Wisconsin potatoes in each production year without the drama and urgency of late blight. While there are sound reasons for the emergent and significant response to late blight, the measured preventative approach to early blight control annually assures maintenance of healthy plant canopy, yield, and quality. Early blight, caused by the fungus *Alternaria solani*, is a debris-borne pathogen, meaning it overwinters in infected potato tubers and plant parts remaining in fields after harvest. In the spring, spores (conidia) are produced on infected plant debris and dispersed by wind and rain splash and infect first fully expanded leaves near the soil. Generally, first foliar lesions are observed in early July and are characterized as dark brown to black and circular with distinctive target patterning within the lesion. Often, lesions are constrained by leaf veins giving the appearance of an angular edge. By late summer, early blight can be prevalent on senescing tissue and plants stressed from low nitrogen and from other pest pressures. Infected plants and tubers then harbor the pathogen for the following cropping season. Foliar symptoms are most common in Wisconsin, with tuber symptoms occurring infrequently, particularly when the foliar phase of the disease is well managed. Potato cultivars differ in susceptibility, but none are completely resistant to early blight. Very early maturing cultivars are often most susceptible; as such it's a good practice to avoid planting early and late cultivars in the same or adjacent fields. Early maturing infected plants may serve as an inoculum source for the late planting. Nitrogen management aids in control.

Currently, there are good fungicide options available for potato early blight control, but careful product selection and timing is essential to achieve control and maintain efficacy of site-specific fungicides. It is critical that fungicide modes of action are alternated to follow resistance management recommendations. Tank mixes of site-specific fungicides with broad-spectrum protectants such as chlorothalonil or mancozeb aid in resistance management as well as provide broader protection against a range of foliar pathogens. Good coverage, particularly on lower canopy and oldest leaves will enhance early season control – leading to overall reduction in in-field disease pressure throughout the season. The best timing for initial application of fungicides on early blight-susceptible potato varieties is just prior to row closure, for enhanced lower canopy coverage, or when P-Day (or potato physiological day) accumulation reaches 300. P-Day of 300 timing correlates with initial increase in early blight spore concentration. Effective conventional fungicides currently registered for early blight control include Bravo (or Equus, Echo, etc.), Curzate, Dithane (or Manzate, Penncozeb, etc.), Endura, Evito, Gem, Headline, Luna Tranquility, Priaxor, Quadris, Quash, Reason, Revus Top, Scala, Super Tin, Tanos, Top, and Vertisan. Further details on registered fungicides for Wisconsin potatoes can be found in the University of Wisconsin Commercial Vegetable Production in Wisconsin Guide A3422, UWEX Veg Guide 2015.

Presence of brown spot in Wisconsin: Brown spot, caused by another Alternaria species (*A. alternata*), is a foliar and tuber disease, very similar to early blight. In Europe, the symptoms caused by the 2 diseases are so hard to discern, that both are considered to be causal agents of an early blight 'complex.' Brown spot lesions, like early blight, are dark brown to black, with target patterning, but tend to be smaller and darker in color. Brown spot typically appears first in the mid-canopy compared to early blight which is seen first on oldest, lower canopy leaves. The tuber phase of brown spot is called black pit, and like early blight, requires wounding for infection.The conditions that favor disease development is similar for both diseases. While *A. alternata* has been identified in Wisconsin potato fields, its role in our early blight 'complex' and timing of its activity during the potato production season is unclear. We have identified A. alternata on potato foliage in multiple Wisconsin fields over the last few years. We do not know how pronounced the brown spot pathogen is in early blight epdemics. In some cases, brown spot occurrence may be interpreted as loss of early blight control or fungicide resistance in the early blight pathogen population. The brown spot pathogen (*A. alternata*) can become resistant to azoxystrobin much more readily and completely when compared to the early blight pathogen (*A. solani*) due to differences in genetic mutations. We plan to continue our survey and fungicide resistance work on both early blight and brown spot to better understand the role of both pathogens in the early blight complex and the incidence of fungicide resistance in both species in Wisconsin.

Azoxystrobin resistance in Wisconsin early blight?: The introduction of strobilurins, or QoI (quinone outside inhibitor) fungicides such as kresoxim methyl (Sovran), azoxystrobin (Quadris), pyraclostrobin (Headline), trifloxystrobin (Gem), famoxadone (component of Tanos), and fenamidone (Reason), offered a fungicide group with a broad spectrum of disease activity, reduced environmental impact, and reduced toxicity to mammals compared with other conventional materials for control of early blight on potato. Azoxystrobin and kresoxim-methyl were released commercially in the U.S. in the late 1990's and by 2001-2003, approximately 80%

of the total Wisconsin potato acreage was treated with QoI fungicides (avg of 3 applications per year) alternated with chlorothalonil or mancozeb.
Resistance to the QoI or strobilurin fungicides develops through mutations in the cytochrome b gene at 3 possible sites. The mutation of a particular pathogen isolate affects the type of resistance it will express. Isolates carrying a mutation at site G143A express high (complete) resistance. Isolates with mutations at sites F129L or G137R express moderate (partial) resistance. In a study by Emeritus Professor Walt Stevenson, *A. solani* (early blight fungus) isolates with partial resistance to azoxystrobin (mutation at F129L) were detected in Wisconsin during 2001 from fungicide field experiments. In 2002 and 2003, a statewide monitoring of *A. solani* from commercial potato fields in Wisconsin resulted in further finding of isolates with partial resistance (again mutation at F129L). To date, all potato *A. alternata* azoxystrobin-resistant isolates from Europe, have carried the mutation at site G143A. In the U.S., *A. alternata* from non-potato hosts has also carried the G143A azoxystrobin resistance mutation. To the best of our knowledge, U.S. potato *A. alternata* isolates have not yet been tested.
We have been characterizing the azoxystrobin resistance of isolates of *A. solani* and *A. alternata* from Wisconsin potato fields and some of our results are shared in the tables below.

Numbers of *A. alternata* isolates (causing brown spot) tested with sampling locations and ratio of fungicide resistance isolates.

Locations	F129L (partial resistance)	G143A (complete resistance)	Wildtype	Total	Ratio of fungicide resistance isolates
Plover	0	10	0	10	100%
Hancock	0	2	8	10	20%
Grand Marsh	0	10	0	10	100%
Total	0	22	8	30	73%

Numbers of *A. solani* isolates (causing early blight) tested with sampling location and ratio of fungicide resistance isolates.

Locations	F129L (partial resistance)			G143A (complete resistance)	Wildtype	Total	Ratio of fungicide resistance isolates
	TTG	CTC	TTA				
Plover	1	0	8	0	1	10	90%
Hancock	0	0	10	0	0	10	100%
Grand Marsh	0	1	6	0	0	7	100%
Total	1	1	24	0	1	27	96%

New fungicide chemistries for potato early blight control: Luna Tranquility (Bayer CropScience), a pre-mix of fluopyram and pyrimethanil, is currently registered for use on potato in the U.S. Fluopyram is a new fungicide in the carboxamide or FRAC Group 7 category and pyrimethanil is in the anilino pyrimidine (AP) or FRAC Group 9 category. In our trials at the Hancock Agricultural Research Station in WI, we had excellent results with programs including Luna Tranquility in 2010 for control of early blight control. The Luna Tranquility label includes suppressive activity for potato on white mold, black dot, and Rhizoctonia. Quash (Valent USA Corp), metconazole, received a supplemental label for use on potato in the U.S. Metconazole is a Demethylation inhibitor (DMI) or in the FRAC Group 3 category. In our Hancock trial, we had

similar early blight control with Quash and Luna Tranquility in 2011. The Quash label includes activity on white mold, black dot, and Rhizoctonia. Quadris pre-mixes (Syngenta Crop Protection), Quadris Top (azoxystrobin+difenoconazole) and Quadris Opti (azoxystrobin+chlorothalonil) are now registered and have activity on early blight and black dot on potato. Both contain azoxystrobin a Quinone outside inhibitor (QoI) or in the FRAC Group 11 category. Early blight control performance was similar with Quadris Top, Quash, and Luna Tranquility in 2011. Vertisan (DuPont Crop Protection), penthiopyrad, recently received registration on potato. Penthiopyrad is a new fungicide in the carboxamide or FRAC Group 7 category. In our Hancock trial, we had similar early blight control with Quash, Luna Tranquility, Quadris Top, and Vertisan in 2011. Most recently registered is BASF's new fungicide, Priaxor (Xemium, a group 7 carboxamide+pyraclostrobin a QoI strobilurin). This fungicide has performed well in our Hancock potato early blight trials and has activity against black dot, Rhizoctonia, and white mold. With the registration of new fungicides for potato early blight, we have additional tools with which to appropriately and effectively alternate modes of action for both enhanced disease control and management of fungicide resistance. Keep in mind that several of the new fungicides contain a carboxamide (Group 7). Endura (boscalid) is also a carboxamide and is currently widely used in Wisconsin for early blight control.

Vegetable Insect Update – Russell L. Groves, Associate Professor and Applied Insect Ecologist, UW-Madison, Department of Entomology, 608-262-3229 (office), (608) 698-2434 (cell), or e-mail: groves@entomology.wisc.edu.

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Aster Leafhoppers – Localized increases in the numbers of Aster leafhopper (ALH) were detected in portions of southern Wisconsin. Samples taken earlier this week by Pest Pros Inc., a Division of Allied Cooperative, Adams, WI, obtained 8 adult ALH/100 sweeps at a select location in southern Wisconsin. Infectivity levels of the Aster Yellows phytoplasma (AYp) within these insects were not determined, but these numbers could be potentially problematic if infectivity levels were estimated at, or above 3%. These infected adults do pose an early season risk for newly emerged and highly susceptible crops such as lettuce, celery, susceptible carrot varieties, where the Aster Yellows Index (AYI) values are not greater than 25. Migrant leafhoppers could continue to arrive in the state over the next 2-3 weeks with southerly winds that precede cold fronts moving westerly across the Midwest and into the Lake States.

Seed Maggots - The emergence and flights of the first generation of seed corn maggot flies is still underway at several locations in central Wisconsin and is approaching several sites in northern Wisconsin (**Fig. 1**). Recall that this insect has a base temperature of 39^{o}F and the emergence of adult fly populations are expected at accumulated degree days of 360, 1,080 and 1,800 degree days. In central Wisconsin, several locations have just exceeded this value. Adult flies will become very active at this time and begin to lay eggs at the base of susceptible (young) plants, where larvae tunnel into underground portions.

Similarly, the first of three generations of onion maggots will occur when degree day totals of 680 degree days (spring), 1950 degree days (summer), and 3230 degree days (fall) respectively, have been reached using a slightly different base temperature of 40^{o}F. The first generation peak of egg-laying adults is now present in southwestern portions of the state. As onions mature, they are less susceptible to onion maggot infestation unless they are damaged by cultivation

equipment. Soil applications of Lorsban can be used to control onion maggot in dry bulb onions and the new Farmore DI 400 and 500 seed treatment formulations are available to minimize damage. The preventative soil insecticide applications are recommended for the control of the first generation larvae if you have previously documented damage from the previous year's crop which exceeds 5 to 10%.

Colorado potato beetle – Few overwintering Colorado potato beetle (CPB) adults continue to emerge in southern Wisconsin at the Arlington Agricultural Experiment Station. In the next few weeks, as early planted potato is being hilled, beetles will start to colonize emerging plants and begin to deposit eggs. .

Imported cabbageworm – Adult moths of the imported cabbageworm have emerged from overwintered pupae and are present in much of southern Wisconsin. These early populations may attempt to enter open hoop or greenhouses and can easily find transplant cole crops. Care should be taken to limit and exclude early season oviposition from these invading adults. Upon emergence, the adult butterfly has wings which are white in color with black at the tips of the forewings (**Fig. 2**). The front wings are also marked with black dots: two in the central area of each forewing in the female, and one in case of males. The body of the butterfly is covered with dense hair, which is colored white in females, but darker in males. The adult typically lives about three weeks and is now feeding on many brassica, or cruciferous weeds in ditchbanks and non-cropped areas. The adult is most active during the daylight hours, often moving from the flowering weeds to transplant cole crops where they will oviposit.

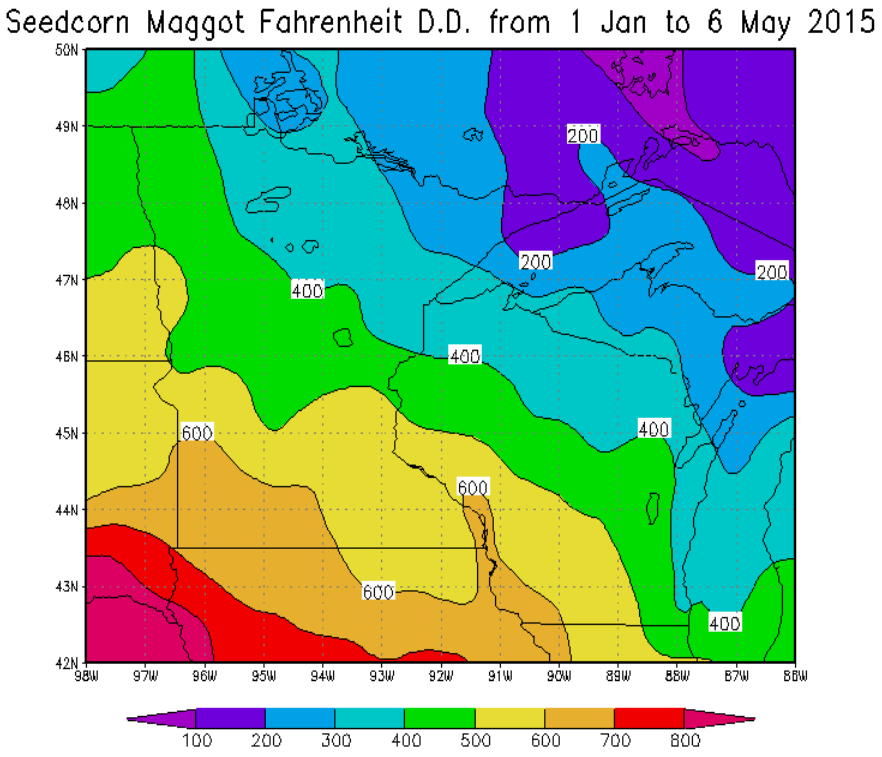

Figure 1. Degree day accumulations from 1 Jan to 6 May 2015 over the state of Wisconsin using a base temperature of 39°F (http://agwx.soils.wisc.edu/uwex_agwx/thermal_models/scm).

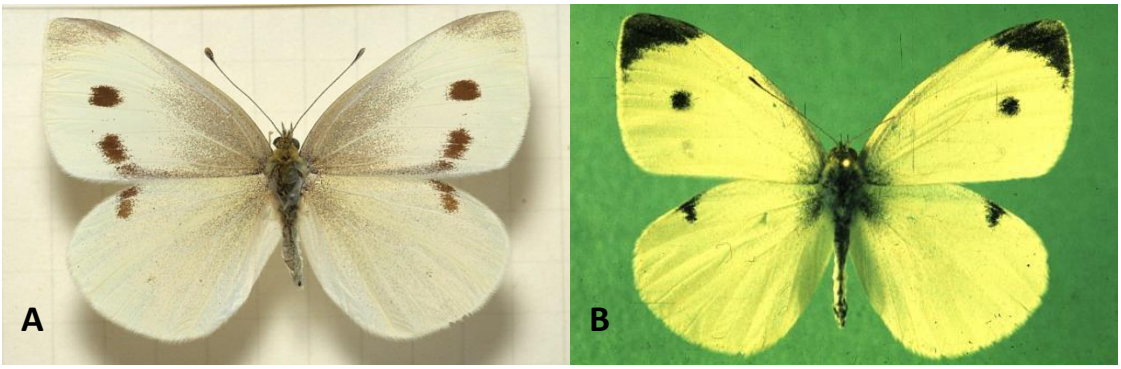

Figure 2. Adult imported cabbageworm moth female (A) and male (B). (http://www.vegedge.umn.edu/vegpest/colecrop/cabbworm.htm).