



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 has been confirmed in potatoes in two Wisconsin counties today, July 31, 2012.

Today, Dr. Brian Hudelson of the UW-Madison Plant Disease Diagnostic Clinic confirmed the presence of *Phytophthora infestans*, causal agent of late blight, on potato foliage from Barron County. I, too, confirmed late blight on potato foliage today from Adams County. Barron County is in northwestern WI. Adams County is in central WI. Lesions appear to be 3-7 days old given their size (diameter of a quarter at the largest) and sporulation status. Affected fields in both counties are showing lesions on upper leaves of plants. Sporulation appears to be very light on plants from Adams County. My laboratory is currently working to determine the genotype (also referred to as race or clonal lineage) from both counties. Genotype characterization will help us associate the late blight with mefenoxam resistance and can aid in possibly tracking potential sources.

To date, most of the late blight identified in the U.S. has US-23. This lineage is a dynamo at producing sporangia. In a recent study in my lab, it produced more sporangia per area of infected tomato leaf than US-22 or US-24. The table below provides further information on US-23 in comparison to the other lineages that have been present in Wisconsin over the past 3 years.

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

Preventative fungicide sprays are critical at this time for all potatoes in Wisconsin. The geographical pattern of detects and presentation of lesions on upper leaves indicates that there has likely been aerial movement of the late blight pathogen over northwestern and central Wisconsin in the past week. Our disease forecasting tool (updated table below) indicates that all potato growing locations but for late planting potatoes in the Hancock area have exceeded the threshold for preventative sprays. To aid in your fungicide selections, I've included tables of information at the end of this newsletter supplement.

If you have any questions on symptoms, control, or fungicide resistance, please contact your county agent, crop consultant, the diagnostic clinic, or myself at UW-Plant Pathology. For further information on any fungicides that may be mentioned in this newsletter, please see the 2012 Commercial Vegetable Production in Wisconsin Guide A3422. An online pdf can be found at the link below or a hard copy can be ordered through the UWEX Learning Store. <http://learningstore.uwex.edu/assets/pdfs/A3422.PDF>

Intensified scouting of potato fields is critical. The best place to scout for potato late blight is in field corners and areas of fields that are sheltered by tree lines, or are often inaccessible to aerial pesticide application. If late blight is found, infected sections of the field should be killed with a defoliant such as Reglone. Healthy-appearing potatoes surrounding the infected area should also be killed to try to isolate and destroy any potential late blight-infected plants. The field should then be treated with fungicides that are effective in managing late blight. Such products are listed in the table below. Now that late blight is on potatoes in WI it is critical that all plantings be protected with effective fungicides. Some fields may already be receiving vine-kill applications. It may be of value to consider vine-killing early to limit foliar infections which may increase risk of tuber infections. 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 fungus that remain on the foliage also die. This practice will prevent infection of tubers during harvest and development of late blight in storage.

If late blight is identified in your potatoes at harvest or beyond, do not make cull piles. Such piles are a significant source of spores and centers of large piles may not be subject to 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.

For conventional potato and tomato operations, it is advisable to go to a 5 day spray program with effective chemistries. For potatoes, we have Tanos, Reason, Curzate, Revus Top, Gavel, Ranman, Forum, Presidio, Previcur Flex and Omega. These are all specific late blight products. All should be tank mixed with a protectant such as chlorothalonil, mancozeb or metiram (potato). The strobilurins will work but at high rates and this may not be cost effective. For tomatoes, we have Curzate, Tanos, Ranman, Forum, Presidio, Reason, Revus Top, Previcur Flex and Gavel. A complete table of fungicides for potato late blight accompanies this newsletter. More information specific to tomato will come later this week. See tables below for further detail.

For organic operations, coppers are the only materials consistently effective for late blight control. Coppers can only slow the epidemic and will not stop the progress of late blight. My program has been evaluating organic-approved fungicides for late blight control on detached leaves in the laboratory. Our results indicate high variability in control with materials such as EF400 and Mycostat. Materials offering little to no control included Oxidate, Serenade, and Regalia. In our test, we inoculated leaves with the pathogen and then applied the fungicide.

Some fungicides have antispore activity, such as Oxidate, which may be helpful in a field setting in addition to copper, but did not limit progress of the pathogen when applied prior to sporulation. For a severely infected tomato or potato field, crop destruction may be the only option to limit further spread. Please check with your certifying agency for fungicides permitted for late blight control.

Compilation of fungicides registered for potato late blight control in Wisconsin

A.J. Gevens, UW-Plant Pathology, July 31, 2012 (this list omits fungicides labeled for seed or in-furrow use only)

Trade Name (rate/A)	Active Ingredient(s)	PHI	REI	FRAC #	Comments
<u>Agri Tin, Super Tin 4L, Super Tin 80WP</u> (4-6 fl oz)	triphenyltin hydroxide	7 days	48 hours	30	Restricted use pesticide. 3 fl oz rate can be used if material is tank-mixed with another fungicide.
<u>Alude</u> (1.25 qt in 90 gal water)	mono and dipotassium salts of phosphorous acid	0 days	4 hours	33	Foliar application
<u>Fosphite, Rampart</u> (1-4 qt in at least 20 gal water/A)	potassium phosphite	0 days	4 hours	33	Foliar post-emergence spray and post harvest spray for control in storage.
<u>Fungi-Phite</u> (Foliar: 2 qt/A Seed trt: 15% volume to volume-2 ton in 1 gal solution)	potassium phosphite	0 days	4 hours	33	Seed piece spray and foliar post-emergence spray. Tank-mix with another effective fungicide is recommended and use high label rate for late blight control.
<u>Badge SC</u> (1-3 pt at 7-10 day interval)	copper hydroxide, copper oxychloride	0 days	24 hours	M1	Protectant activity only.
<u>Bravo Ultrex</u> (.7 then .9 to 1.36 lb) <u>Bravo WeatherStik</u> (.75 then 1-1.5 pt) <u>Bravo Zn</u> (1 1/8 then 1 1/5 to 2 1/4 pt)	chlorothalonil	7 days	12 hours	M5	WI has a 24c Special Label for long season potatoes extending max a.i. from 11.25 lb to 16 lb a.i./acre (expires Dec 31, 2012).
<u>Cabrio Plus</u> (2.9 lb)	pyraclostrobin+metiram	3 days	24 hours	11+M3	17.4 lb/acre maximum per season. Do not apply more than 2 sequential applications.
<u>Equus 720 SST, Initiate 720, Chlorothalonil 720 SC</u> (.75 then 1-1.5 pt) <u>Equus 500 Zn, Initiate Zn</u> (1.125 then 1.5-2.25 pt)	chlorothalonil	7 days	12 hours	M5	11.25 lb a.i./acre maximum.

<u>Equus DF</u> (.7 then .9 to 1.36 lb)					
<u>Echo 90DF</u> (5/8 then 7/8 to 1 ¼ lb)					
<u>Echo 720</u> (.75 then 1-1.5 pt) <u>Echo Zn</u> (1 pt to 2.125 pt)	chlorothalonil	7 days	12 hours	M5	WI has a 24c Special Label for long season potatoes extending max a.i. from 11.25 lb to 16 lb a.i./acre (expires Dec 31, 2014).
<u>Champ WG</u> (1 to 1.5 lb 3 to 4 lb in severe areas) <u>Champ Formula 2 Flowable</u> (2/3 to 2 2/3 pt) <u>Champ DP Dry Prill</u> (2/3 to 1 lb 2 to 2 2/3 lb when disease is severe) <u>Kentan DF</u> (1-2.5 lb 4 lb when severe)	copper hydroxide	0 days	24 hours	M1	Use high label rates for foliar late blight protection.
<u>Kocide 2000, Kocide 3000</u> (.73- 3 lb .5-1.75 lb) <u>Nu-Cop 3L</u> (2/3 to 2 pt 2 to 4 pt if severe) <u>Nu-Cop 50DF</u> (1-1.5 lb 3-4 lb if severe)	copper hydroxide	0 days	24 hours	M1	Use high label rates for foliar late blight protection.
<u>C-O-C-S WDG</u> (1.5- 4 lb)	copper oxychloride, basic copper sulfate	0 days	24 hours	M1	Use high label rates for foliar late blight protection.
<u>Curzate 60DF</u> (3.2 oz foliar)	cymoxanil	14 days	12 hours	27	Locally-systemic fungicide. Must be tank-mixed with a protectant fungicide. Rainfast within 2 hours.
<u>Dithane F45 Rainshield</u> (.4 to 1.6 qt Seed trt: 1 qt per 50 gal water) <u>Dithane M45</u> (.5 to 2 lb Seed treatment: 1.25 lb per 50 gal water) <u>Dithane DF</u> (1 -2 lb Seed treatment 1.25 lb per 50 gal water)	mancozeb	24 hours	3 days	M3	Max rate per acre/season is 11.2 lb a.i. Plant as soon as possible after seed treatment.

<u>Evito 480SC</u> (3.8 fl oz)	fluoxastrobin	7 days	12 hours	11	Follow label for resistance management.
<u>Forum</u> (Foliar and tuber control: 6 oz)	dimethomorph	4 days	12 hours	40	May be tank-mixed with another effective fungicide for enhanced management. An adjuvant may enhance management. Can be applied after vine kill.
<u>Gavel 75DF</u> (1.5 to 2 lb)	zoxamide+mancozeb	3 days	48 hours	22+M3	Do not make >6 applications/crop. Contact fungicide.
<u>Gem 500SC</u> (3.8 fl oz)	trifloxystrobin	7 days	12 hours	11	Follow label for resistance management.
<u>Headline</u> (6 to 12 fl oz)	pyraclostrobin	3 days	12 hours	11	Follow label for resistance management.
<u>ManKocide</u> (1.5 to 2 then 4-5 lb)	mancozeb+copper hydroxide	3 days	24 hours	M3+M1	Not labeled as a seed trt for potatoes.
<u>Omega 500F</u> (5.5 fl oz)	fluazinam	14 days	48 hours	29	REI is 4 days for high exposure activities. New special local need label 24c in April 2011.
<u>Omega Top MP</u> (5.5 fl oz) – individual label for Omega sold in co-pack with Top MP (difenoconazole)	fluazinam	14 days	48 hours	29	Can be applied aerially. REI is 4 days for high exposure activities.
<u>Oxidate</u> (40 to 120 fl oz to 100 gal water, 30-100 gal solution per acre)	hydrogen dioxide	0 days	1 hour	NC	Foliar spray for late blight. Frequent applications (5-day intervals) can limit sporulation.
Penncozeb 80WP, Penncozeb 75DF (.5 to 2 lb) Penncozeb 4FL, Manzate flowable (.4 to 1.6 qt) <u>Manzate Pro-Stick</u> (1 to 2 lb, seed trt: 1.25 lb/50 gal water)	mancozeb	3 days	24 hours	M3	Do not exceed 11.2 lb a.i./acre/year.
<u>Phostrol</u> (2.5 to 10 pt) (Post harvest trt: 1 gal/ton in .5 gal water)	mono- and di-basic sodium, potassium, and ammonium phosphites	0 days	4 hours	33	Can be applied as a foliar for late blight, pink rot, and Pythium leak. Can be applied post-harvest for storage disease control.
<u>Polyram 80DF</u> (1.5 to 2 lb in 15 gal water/acre minimum)	metiram	3 days	24 hours	M3	Metiram is an EBDC, like mancozeb (M3). Total amount of a.i. per year/acre must include all EBDCs.
<u>Presidio</u> (4 fl oz)	fluopicolide	7 days	12 hours	43	Tank-mix with another fungicide with a different mode of action. Apply 20-50 gal of spray mixture by ground and no less than 5 gal by air.

<u>Previcur Flex</u> (.7 to 1.2 pt)	propamocarb hydrochloride	14 days	12 hours	F	Apply in a tank-mix with protectant. Can be applied as a broadcast or banded application over the row, post-emergence.
<u>Quadris</u> (6 to 15.5 fl oz)	azoxystrobin	14 days	4 hours	11	Alternate away from Group 11 fungicides to manage resistance.
<u>Quadris Opti</u> (1.6 pt)	azoxystrobin+chloro thalonil	14 days	12 hours	11+M5	Alternate away from Group 11 fungicides to manage resistance.
<u>Ranman</u> (1.4 to 2.75 fl oz)	cyazofamid	7 days	12 hours	21	Follow label for resistance management.
<u>Reason</u> (5.5 to 8.2 fl oz)	fenamidone	14 days	12 hours	11	Follow label for resistance management.
<u>Revus</u> (5.5 to 8 fl oz)	mandipropamid	14 days	4 hours	40	Addition of an adjuvant is recommended.
<u>Revus Top</u> (5.5 to 7 fl oz)	mandipropamid+dif enoconazole	14 days	12 hours	40+3	Addition of an adjuvant is recommended.
<u>Tanos</u> (8 to 10 oz)	cymoxanil + famoxadone	14 days	12 hours	27+11	Must be tank-mixed with an effective protectant fungicide.
<u>Ridomil Gold SL</u> (1 to 2 pt)	mefenoxam	14 days	48 hours	4	Do not apply beyond the at-planting stage.
<u>Ridomil Gold Bravo SC</u> (2.5 pt)	mefenoxam+chlorot halonil	14 days	48 hours	4+M5	Follow label for resistance management.
<u>Ridomil Gold Copper</u> (2 lb/A)	mefenoxam+copper hydroxide	14 days	48 hours	4+M1	Tank-mix with an effective protectant.
<u>Ridomil Gold MZ WG</u> (2.5 lb/A)	mefenoxam+manco zeb	3 days	48 hours	4+M3	Follow label for resistance management.

Comparison of Late Blight Fungicides (highest rates registered)

Provided by Dr. Steve Johnson, University of Maine Cooperative Extension

Product	Effectiveness				Mode of action			Rainfastness	Mobility in the plant	FRAC #	REI	PHI
	Leaf blight	New growth	Stem blight	Tuber blight	Protectant	Curative	Anti-sporulant					
Bravo etc	G	No	P	No	G	No	No	G	contact	M5	12 hrs	7 days
Curzate + Dithane etc	G	?	F	No	G	E	P	G	translaminar + contact	27 + M3	24 hrs	14 days
Dithane etc	G	No	P	No	G	No	No	F	contact	M3	24 hrs	3 days
Forum + Dithane	G	?	F	F	G	P	G	G	translaminar + contact	40 + M3	24 hrs	4 days
Gavel	E	No	P	F	E	No	No	G	contact + contact	22	48 hrs	3 days
Kocide etc	P	No	P	No	F	No	No	P	contact	M1	24 hrs	0 days
Omega	E	No	P	G	E	No	No	G	contact	29	48 hrs	14 days
Previcur Flex + Dithane etc	G	G	G	No	G	G	G	E	systemic + contact	28 + M3	24 hrs	14 days
Ranman	E	No	P	E	E	No	No	E	contact	21	12 hrs	7 days
Tanos	G	?	F	No	G	E	P	G	translaminar + contact	11	12 hrs	14 days
Revus Top	E	?	F	G	E	P	F	E	translaminar + contact	40 + 3	12 hrs	14 days
Tin	E	No	E	E	G	No	E	F	contact	M1	48 hrs	7 days

No=No effect; P=Poor; F=Fair; G=Good; E=Excellent; ?=Unknown.

DSVs and Late Blight: All potato plantings in Wisconsin, with the exception of late planted potatoes in the Hancock area, have exceeded the threshold with 20-33 DSVs. An accumulated DSV of 18 indicates time to initiate fungicide applications for late blight control. While this season has generally been hot and dry, isolated storms have been dropping precipitation across several WI regions creating conditions favorable for disease. And, irrigation provides the moisture necessary for pathogen progress. This is a tool to aid in preventative fungicide decision-making. **Since we know late blight is in Central WI, it is critical that potato fields be treated for late blight at this time.**

Current P-Day (Early Blight) and Severity Value (Late Blight) Accumulations

Location	Planted	50% Emergence	P-Day Cumulative	DSV Cumulative	Calculation Date
Antigo Area	Early 5/1	5/30	428	33	7/30
	Mid 5/10	6/6	391	33	7/30
	Late 6/1	6/16	324	33	7/30
Grand Marsh Area	Early 4/3	5/8	567	28	7/30
	Mid 4/15	5/16	521	28	7/30
	Late 4/30	NA	465	27	7/30
Hancock Area	Early 4/1	5/1	630	20	7/30
	Mid 4/15	5/10	573	14	7/30
	Late 5/1	5/17	529	14	7/30
Plover Area	Early 4/3	5/17	572	28	7/30
	Mid 4/19	5/18	507	28	7/30
	Late 5/1	5/27	444	24	7/30