Vegetable Crop Update

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

No. 11 – June 3, 2016

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Calendar of Events

July 14, 2016 – UW-Rhinelander Agricultural Research Station Field Day
July 21, 2016 – UWEX Langlade County –Antigo Research Station Field Day
July 28, 2016 – UW-Hancock Agricultural Research Station Field Day
February 7-9, 2017 – UWEX/WPVGA Grower Ed. Conf., Stevens Point, WI

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

National Late Blight Updates (www.usablight.org). This past week there were two confirmations of late blight in the US. On Jun 1st, Washington (Walla Walla Co.) reported late blight on potato (type not yet confirmed). On Jun 2nd, Virginia reported late blight on potato (type not yet confirmed). Earlier reports have come from MD (tomato US-23), CA (potato, types US-8 and US-11), and FL (potato and tomato US-23). **US-11** can infect both tomato and potato, is of the A1 mating type, and is resistant to Ridomil. **US-8** can infect both potato and tomato, but favors potato, is of the A2 mating type and is also resistant to Ridomil. **US-23** is a genotype that can be controlled with mefenoxam/metalaxyl fungicides (ie: Ridomil Gold SL) and can infect both tomato and potato. It should be noted, however, that some US-23 isolates can be intermediately or fully resistant to mefenoxam. As such, ongoing tests/screens should be conducted to best prescribe appropriate treatment responses.

Cucurbit Downy Mildew Updates (http://cdm.ipmpipe.org/). In the past week there were two states reporting new confirmations of cucurbit downy mildew: FL and NC. Previous confirmations were made in FL, GA, and TX.

Current P-Day (Early Blight) and Severity Value (Late Blight) Accumulations (R.V. James, UW-Plant Pathology/R.V. James Designs): A P-Day value of ≥ 300 indicates the threshold for early blight risk and triggers preventative fungicide application. A DSV of ≥ 18 indicates the threshold for late blight risk and triggers preventative fungicide application. Red text in table below indicates threshold has been met/surpassed. "-" indicates that information is not available. Blitecast and P-Day values for actual potato field weather from Grand Marsh, Hancock, Plover, and Antigo will soon be posted at the UW Veg Path website at the tab "P-Days and Severity Values."
http://www.plantpath.wisc.edu/wivegdis/contents_pages/weather_%20list_2016.html

Location	Planting Date	50% Emergence	P-Day Cumulative	Disease Severity Value	Date of DSV Generation	Increase in DSV from 5/28
Antigo	Early 5/1	6/2	**9**	**0**	6/3	-
	Mid 5/18	-	**-**	**-**	-	-
	Late 6/3	-	**-**	**-**	-	-
Grand Marsh	Early 4/15	5/22	**-***	**-***	**-***	-
	Mid 5/1	5/27	**-***	**-***	**-***	-
	Late 5/15	-	**-**	**-**	-	-
Hancock	Early 4/18	5/24	**89**	**17**	6/3	0
	Mid 5/3	5/29	**48**	**4**	6/3	-
	Late 5/20	-	**-**	**-**	-	-
Plover	Early 4/20	5/25	**80**	**18**	6/3	0
	Mid 5/5	5/30	**37**	**3**	6/3	-
	Late 5/20	-	**-**	**-**	-	-

Summary: From our initial report of **DSV** accumulations on 5/28, conditions were less ideal for late blight promotion around the state. As such, the DSVs still stand at 18 (threshold) for early planted potatoes in Plover and 17 for early planted potatoes in Hancock. Earliest planted potatoes in Antigo and mid-planted potatoes in Hancock and Plover have accumulated 0-4 DSVs over the last few days. *We worked on our Grand Marsh station and are awaiting a new battery which will enable us to generate hourly data and disease risk values by late next week.
P-Day values are very low, but accumulating with warm days and ranged from 9-89 across the state based on dates of 50% emergence and local weather.

Fungicide Considerations for Late Blight Control in Wisconsin Potatoes: There is not one recommended fungicide program for all late blight susceptible potato fields in Wisconsin. Fungicide selections may vary based on type of inoculum introduction, proximity to infected fields, crop stage, late blight strain, and other diseases that may be in need of management. This article provides general guidance to assist in development of your fungicide program.

Under high late blight pressure, fungicide programs with Revus Top, Forum, Curzate 60DF, Ranman, Tanos, Gavel, Previcur Flex, Zampro, Zing!, Orondis Ultra A, or Omega should be used. Mefenoxam containing fungicides such as Ridomil Gold SL can also be highly effective in controlling late blight caused by the pathogen strain US-23 (recent isolates have been showing some resistance and therefore it is important to keep submitting samples for testing). This strain was identified in all WI cases in 2015. The US-8 and US-11 strains have also been identified this season on the west coast of the U.S. Note that Ridomil will not work to control the US-8 strain. Zampro and Zing! are newly registered late blight fungicides offering a novel mode of action in a pre-mix (Zampro) and a pre-mix of established fungicides (Zing!) for effective late blight control. Brief comments on each of these fungicides are listed below.

Revus Top contains mandipropamid (Group 40) for late blight and difenoconazole (Group 3) for early blight; excellent protectant on leaf blight; rainfast; translaminar and contact activity.

Forum contains dimethomorph (Group 40) for late blight; can be applied after vine kill; good protectant on leaf blight; good antisporulant; rainfast; translaminar activity.

Curzate 60DF contains cymoxanil (Group 27) for late blight; locally systemic; excellent curative activity; good protectant on leaf blight; rainfast in 2 hours.

Ranman contains cyazofamid (Group 21) for late blight; excellent protectant for leaf and tuber blight; rainfast; contact activity.

Tanos contains cymoxanil (Group 27) for late blight and famoxadone (Group 11) for early blight; excellent curative activity; good protectant on leaf blight; rainfast; translaminar and contact activity.

Gavel (zoxamide, Group 22+mancozeb, Group M3) is best used as a protectant and has been reported to reduce tuber blight; excellent protectant on leaf blight; rainfast; contact activity.

Zing! (zoxamide, Group 22+chlorothalonil, Group M5) is best used as a protectant and is excellent in protecting against leaf blight; rainfast; contact activity. This is Gavel's zoxamide, which is very effective against late blight, with chlorothalonil base protectant rather than the EBDC.

Previcur Flex contains propamocarb hydrochloride (Group 28); good protectant on leaf, new growth, and stem blight; good curative and antisporulant activity; excellent rainfast activity; systemic and contact activity.

Omega is a broad spectrum fungicide (fluazinam, Group 29) and especially effective at controlling the tuber phase of late blight (with added benefit of white mold control); excellent protectant on leaf blight; good protection against tuber blight; rainfast; contact activity. Has special label for powdery scab in WI as of 2011.

Ridomil Gold SL contain mefenoxam (Group 4); excellent systemic movement in plant; curative activity; excellent control of stem, leaf, and tuber late blight; rainfast; can only be effective if you are controlling a sensitive strain such as US-23, US-22.

Zampro contains ametoctradin (Group 45) and dimethomorph (Group 40) both with activity on late blight; good preventative disease control; systemic and protective activity.

Orondis Ultra contains oxathiapiprolin (Group U15) a brand new mode of action with outstanding activity against late blight and water mold pathogens, in general; systemic with antisporulant activity; Orondis multi-packs are around for 2016 with pre-mixes available in 2017, as I understand – Orondis Ultra is oxathiapiprolin plus mandipropamid,

however, growers will need to refer to Orondis Ultra A (oxathiapiprolin) and Orondis Ultra B (mandipropamid) labels. See labels for all details.

In Wisconsin, the QoI inhibitors Headline (pyraclostrobin, Group 11), Quadris (azoxystrobin, 11), and Reason (fenamidone, 11) have offered good late blight control at high label rates under moderate late blight pressure and should be used in a manner which mitigates pathogen resistance development - in tank-mix with protectant fungicides such as mancozeb or chlorothalonil-based products and do not apply in consecutive applications.

Headline (or the QoI component of Priaxor), Quadris, Reason, Revus Top, and Tanos, also provide good control of early blight in most potato fields in Wisconsin. There are fields/areas where the early blight pathogen population may have some resistance to the QoI fungicide group (11), but generally, this group of fungicides is still effective.

Phosphorous acid formulations such as Crop-phite, Fosphite, Phostrol, Prophyt, and Rampart can increase tuber protection to late blight and pink rot. However, rates must be high and multiple applications must be made for significant tuber protection initiating at dime-size tuber and following up with 2 more applications made 14-days apart. This group doesn't provide great foliar control of late blight, but tuber protection with this approach is very strong.

Mancozeb used as a tank-mix partner in the final fungicide applications can provide some additional tuber late blight production. Research conducted in Washington and published in 2006 by Porter, Cummings, and Johnson indicated that soil application of mancozeb greatly reduced the incidence of tuber blight when compared to other fungicides. Additionally, in our early blight fungicide trial work at the Hancock Research Station we have often seen yield increases when we use mancozeb as the base protectant tank-mix partner in our final 2 applications.

In years when weather conditions do not favor severe late blight, programs based on chlorothalonil formulations and EBDCs can be adequate to reduce risk of late blight. The addition of TPTH 80WP to any of the protectant programs can enhance disease control particularly towards the end of the growing season. Our current weather conditions, while warm can promote disease development due to periods of rainfall, high humidity, and moderate overnight temperatures.

Timing and frequency of fungicide applications are critical elements in an effective disease control program. Five to seven-day applications are needed to protect the crop under conditions of rapid growth and high disease pressure. Now that DSVs have reached 18 (or nearing) in several parts of the state, protectant programs should be maintained until the end of the growing season as appropriate during disease risk periods.

If late blight is detected in a field, 'hot spots' should be destroyed to limit disease development and production of inoculum. A conservative approach to reducing spread from a hot spot includes destruction of 30 rows on either side of the newest lesions at the border of the late blight locus and 100 feet along the row (either side) are killed with Reglone or with Gramoxone (generic). Although harsh, trials at MSU have shown that the latent period between infection and

symptom development is about seven days and although not visible, plants within this area are already infected. Fields with very few lesions across a broad acreage, must be intensively managed and consideration for early vine kill and harvest should be made to reduce overall risk.

Listing of 2065 WI potato late blight fungicides is inset below in this newsletter and is also available as a separate attachment in the newsletter email and will be online shortly. I will send a link to this fungicide list as soon as it's posted.

For further information on common diseases, insect and weed pest information, please consider the 2016 A3422 Commercial Vegetable Production in Wisconsin guide is available for purchase ($10) through the University of Wisconsin Extension Learning Store website:
http://learningstore.uwex.edu/Commercial-Vegetable-Production-in-Wisconsin2016-P540.aspx

A pdf of the document can be downloaded for free at the following direct link:
http://learningstore.uwex.edu/Assets/pdfs/A3422.pdf

Potato Late Blight Fungicides Registered for WI, 2016.

In-furrow and seed treatment registrations are omitted. This is not a comprehensive list. Most fungicides listed are for use in conventional production systems. List compiled 2 June 2016.

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Trade Name (rate/A)	Active Ingredient(s)	PHI	REI	FRAC #	Comments
Agri Tin, Super Tin 4L, Super Tin 80WP (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.
Alude (1.25 qt in 90 gal water) Confine Extra (3-5 qt in 20 gal water/acre)	mono and dipotassium salts of phosphorous acid	0 days	4 hours	33	Foliar application
Ariston (2.0 pt)	chlorothalonil+ cymoxanil	14 day	12 hours	M5+27	Newly registered fungicide. Additional chlorothalonil may be tank-mixed with this formulation to enhance % active ingredient applied, but be sure to include the Ariston component in overall season total. Cymoxanil is same active ingredient in Curzate.
Elixir (1.2-2.0 lb)	mancozeb+ chlorothalonil	7 days	24 hours	M3+ M5	Newly registered fungicide for potato only. Use higher rate as vines increase in size.
Fosphite, Rampart (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.
Fungi-Phite (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.
Badge SC (1-3 pt at 7-10 day interval)	copper hydroxide, copper oxychloride	0 days	24 hours	M1	Protectant activity only.
Bravo Ultrex (.7 then .9 to 1.36 lb) Bravo WeatherStik, Echo 720, Equus 720 SST, Initiate 720, Chlorothalonil 720 SC, Chloronil 720 (.75 then 1-1.5 pt) Bravo Zn, Equus 500 Zn (1 1/8 then 1 1/5 to 2 ¼ pt)	chlorothalonil	7 days	12 hours	M5	11.25 lb a.i./acre maximum on standard label. However, WI has a special 24(c) registration for long season potatoes extending the max a.i. from 11.25 to 16 lb a.i./acre with Bravo (Syngenta) and Echo (Sipcam Advan) formulations.

Potato Late Blight Fungicides Registered for WI, 2016.

Trade Name (rate/A)	Active Ingredient(s)	PHI	REI	FRAC #	Comments
Echo Zn (1 to 2.125 pt) Equus DF (.7 then .9 to 1.36 lb) Echo 90DF (5/8 then 7/8 to 1.25 lb)	chlorothalonil	7 days	12 hours	M5	11.25 lb a.i./acre maximum on standard label. However, WI has a special 24(c) registration for long season potatoes extending the max a.i. from 11.25 to 16 lb a.i./acre with Bravo (Syngenta) and Echo (Sipcam Advan) formulations.
Cabrio Plus (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.
Champ WG (1 to 1.5 lb 3 to 4 lb in severe areas) Champ Formula 2 Flowable (2/3 to 2 2/3 pt) Champ DP Dry Prill (2/3 to 1 lb 2 to 2 2/3 lb when disease is severe)	copper hydroxide	0 days	24 hours	M1	Use high label rates for foliar late blight protection.
Kentan DF (1-2.5 lb 4 lb when severe) Kocide 2000, Kocide 3000 (.73-3 lb .5-1.75 lb) Nu-Cop 3L (2/3 to 2 pt 2 to 4 pt if severe) Nu-Cop 50DF (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.
C-O-C-S WDG (1.5- 4 lb) Cuprofix-Ultra 40 Disperss (0.75-3.0 lb)	copper oxychloride, basic copper sulfate	0 days	24 hours	M1	Use high label rates for foliar late blight protection.
Mastercop (0.5-1.5 pt)	copper sulfate pentahydrate	0 days	24 hours	M1	Use high label rates for foliar late blight protection.

Potato Late Blight Fungicides Registered for WI, 2016.

Trade Name (rate/A)	Active Ingredient(s)	PHI	REI	FRAC #	Comments
Cueva (2 gal in 50-100 gal water/acre)	copper octanoate	0 days	24 hours	M1	Use high label rates for foliar late blight protection.
Curzate 60DF (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.
Dithane F45 Rainshield (.4 to 1.6 qt) Dithane M45 (.5 to 2 lb) Koverall, Roper DF Rainshield (1-2.0 lb)	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.
Evito 480SC, Aftershock (3.8 fl oz)	fluoxastrobin	7 days	12 hours	11	Follow label for resistance management.
Forum (Foliar and tuber control: 6 oz)	dimethomorph	4 days	12 hours	40	May be tank-mixed with another effective fungicide for enhanced management – but not required by label. Addition of an adjuvant may enhance management. Can be applied after vine kill.
Gavel 75DF (1.5 to 2 lb)	zoxamide+ mancozeb	3 days	48 hours	22+M3	Do not make >6 applications/crop. Contact fungicide.
Gem 500SC (3.8 fl oz)	trifloxystrobin	7 days	12 hours	11	Follow label for resistance management.
Headline (6 to 12 fl oz)	pyraclostrobin	3 days	12 hours	11	Follow label for resistance management.
ManKocide (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.
Omega 500F (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.
Omega Top MP (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.
Orondis Ultra A (1.4-4.8 fl oz)	oxathiapiprolin	5 days	4 hours	U15	Do not exceed 27.2 fl oz/acre/season.
Oxidate (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.

Potato Late Blight Fungicides Registered for WI, 2016.

Trade Name (rate/A)	Active Ingredient(s)	PHI	REI	FRAC #	Comments
Penncozeb 80WP, Penncozeb 75DF (.5 to 2 lb) Penncozeb 4FL, Manzate flowable (.4 to 1.6 qt) Manzate Pro-Stick (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.
Phostrol (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.
Polyram 80DF (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.
Previcur Flex (.7 to 1.2 pt)	propamocarb hydrochloride	14 days	12 hours	F	Apply in a tank-mix with effective protectant. Can be applied as a broadcast or banded application over the row, post-emergence.
Priaxor (4-8 fl oz)	fluxapyroxad+ pyraclostrobin	7 days	12 hours	7+11	Cannot apply more than 3 applications/season. Follow label for resistance management. Xemium and Headline pre-mix.
Quadris, Satori (6 to 15.5 fl oz)	azoxystrobin	14 days	4 hours	11	Alternate away from Group 11 fungicides to manage resistance.
Quadris Opti (1.6 pt)	azoxystrobin+ chlorothalonil	14 days	12 hours	11+M5	Alternate away from Group 11 fungicides to manage resistance.
Ranman (1.4 to 2.75 fl oz)	cyazofamid	7 days	12 hours	21	Follow label for resistance management.
Reason (5.5 to 8.2 fl oz)	fenamidone	14 days	12 hours	11	Follow label for resistance management.
Revus Top (5.5 to 7 fl oz)	mandipropamid+ difenoconazole	14 days	12 hours	40+3	Addition of an adjuvant is recommended.
Tanos (8 to 10 oz)	cymoxanil + famoxadone	14 days	12 hours	27+11	Must be tank-mixed with an effective protectant fungicide.
Ridomil Gold SL (1 to 2 pt)	mefenoxam	14 days	48 hours	4	Do not apply beyond the at-planting stage.
Ridomil Gold Bravo SC (2.5 pt)	mefenoxam+ chlorothalonil	14 days	48 hours	4+M5	Follow label for resistance management.
Ridomil Gold Copper (2 lb)	mefenoxam+ copper hydroxide	14 days	48 hours	4+M1	Tank-mix with an effective protectant.

Potato Late Blight Fungicides Registered for WI, 2016.

Trade Name (rate/A)	Active Ingredient(s)	PHI	REI	FRAC #	Comments
Ridomil Gold MZ WG (2.5 lb)	mefenoxam+ mancozeb	3 days	48 hours	4+M3	Follow label for resistance management.
Zampro (11-14 fl oz)	ametoctradin+ dimethomorph	4 days	12 hours	45+40	Do not make more than 2 sequential applications. Follow label for resistance management. Ametoctradin is new a.i.; dimethomorph is Forum (formerly Acrobat).
Zing! (32-34 fl oz)	zoxamide+ chlorothalonil	7 days	12 hours	22+M5	Do not make more than 2 sequential applications before alternating with another fungicide of a different mode of action. Do not make >8 applications or apply >1.52 lb of zoxamide and 8.88 lb of chlorothalonil per season per acre.