



Vegetable Crop Update

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

No. 21 – July 29, 2016

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Calendar of Events

September 11, 2016 – UW-West Madison ARS Organic Vegetable Field Day
January 22-24, 2017 – WI Fresh Fruit & Vegetable Growers Conf. WI Dells
February 7-9, 2017 – UWEX/WPVGGA Grower Ed. Conf., Stevens Point, WI
March 1, 2017 – UWEX Processing Vegetable Crops Meeting, Hancock, WI

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

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 are now posted at the UW Veg Path website at the tab “P-Days and Severity Values.” http://www.plantpath.wisc.edu/wivegdis/contents_pages/pday_sevval_2016.html

Location	Planting Date	50% Emergence	P-Day Cumulative	Disease Severity Value	Date of DSV Generation	Increase in DSV from 7/22
Antigo	Early 5/1	6/2	446	74	7/29	14
	Mid 5/18	6/7	412	64	7/29	14
	Late 6/3	6/21	309	49	7/29	14
Grand Marsh	Early 4/15	5/22	531	94	7/29	21
	Mid 5/1	5/27	494	88	7/29	21
	Late 5/15	6/3	435	77	7/29	21
Hancock	Early 4/18	5/24	498	89	7/29	20
	Mid 5/3	5/29	458	76	7/29	20
	Late 5/20	6/5	401	67	7/22	20
Plover	Early 4/20	5/25	484	100	7/29	24
	Mid 5/5	5/30	442	85	7/29	24
	Late 5/20	6/6	385	76	7/29	24

Summary: Disease Severity Values (DSVs) and Late Blight Blitecast: We now have all potatoes in WI at 50% emergence or greater and are generating forecast values for all potatoes. All growing areas have reached threshold for late blight management. Generally, conditions

were very favorable for late blight in this past week with 7 day accumulations of 14-24 Disease Severity Values. Recall the maximum number of DSVs that one day can accumulate is 4. Where thresholds of 18 DSVs have been met, routine, protection of susceptible tomato and potato crops is recommended.

The stormy and cloudy weather that we've experienced here in WI has provided favorable conditions for late blight and other diseases. In addition to moving spores, storms provide some crop damage and moisture which can be great promoters of many diseases. Consider tightening up your fungicide application calendar in this week following the storms.

Wisconsin commercial conventional fungicides for late blight control can be found at:

Potato: <http://www.plantpath.wisc.edu/wivegdis/pdf/2016/updated%20Potato%20Late%20Blight%20Fungicides%202016%20MOA.pdf>

Tomato: listing included at the end of this newsletter

P-Days indicating early blight risk are now at or above threshold for all potatoes in Wisconsin. Lesions are being observed in the lower and middle canopies of potato crops in central and southern WI. We have not noted much brown spot in potatoes, so far, this year. Based on my early blight observations from our trials at the UW Hancock Ag Research Station, early blight is poised to become more problematic in this upcoming week. I saw small lesions in mid-canopies than in previous weeks which will likely progress and bear more spores for further spread

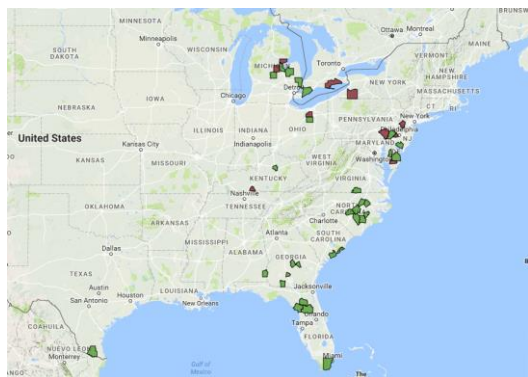
Late Blight Diagnostic Updates (www.usablight.org). The questionable “late blight” that was reported earlier this week is NOT late blight caused by *Phytophthora infestans*. No late blight has been detected in WI as of 7/29/16, as far as I am aware. There was 1 new report of late blight on potato from St. Joseph's County Michigan (south central) on 7/25/16. It is likely that the pathogen that caused symptoms similar to late blight was *Phytophthora nicotianae*; further tests will confirm. The symptoms that were suspicious as late blight are shown below.



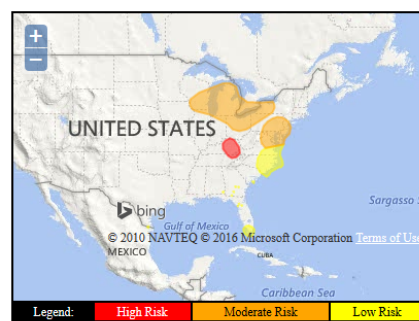
Earlier season's reports have come from AR, MD, CA, FL, MI, SC, VA, and WA. However, Western Manitoba, Canada (north of North Dakota) confirmed late blight in their potato production region last weekend. The closest detection to WI so far has been in south central MI (US-23) on potato. US-23 has predominated cases of this disease in the US so far this year. West coast has had US-8 and US-11 as well. Disease has been confirmed on both potato and tomato. Careful monitoring for and management of volunteers and solanaceous weeds is critical – along with preventive management of the main potato crop with use of effective fungicides.

If you are suspect late blight, please submit for free diagnostic testing through the UWEX Plant Disease Diagnostic Clinic or through my laboratory directly. Dr. Brian Hudelson in the clinic offers rather quick late blight confirmations. My program can do this, similarly, for commercial producers. Further my lab will genotype the pathogen in order to better prescribe best management strategies.

Cucurbit Downy Mildew Updates (<http://cdm.ipmpipe.org/>). In the past week there were 8 states reporting new confirmations of cucurbit downy mildew: KY, MD, MI, NJ, NY, OH, ON (Canada), and PA. Previous confirmations were made in AL, DE, FL, GA, KY, MD, MI, NC, NJ, OH, PA, SC, TX, VA, and Ontario, Canada. The closest finds to WI at this time are in central MI and northeastern/central OH. There was some risk of movement of the pathogen to the southeastern Wisconsin production region late this week (figure below from <http://cdm.ipmpipe.org/current-forecast>). Growers in this area of the state should be on watch for earliest symptoms of downy mildew for rapid response with effective fungicides (link below to treatment information.
<http://www.plantpath.wisc.edu/wivegdis/pdf/2016/July%2013,%202016.pdf>



Risk prediction map for Day 2: Thursday, July 28

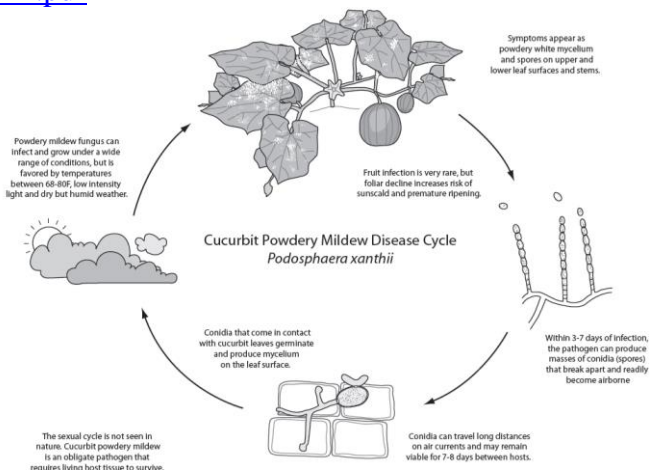


HIGH Risk for cucurbits in eastern KY. Moderate Risk in northern VA, MD, DE, NJ, eastern / south-central / northwest PA, western NY, southern ON, northern OH, northeast IN, all of lower MI, far northern IL, and southern WI. Low risk for cucurbits in east-central and eastern NC, and southeast VA. Minimal Risk to cucurbits elsewhere.

Forecaster: TK at NCSU for the Cucurbit ipmPIPE - 2016

Cucurbit powdery mildew: It's that time of year again when powdery mildew is beginning to develop on more mature, lower leaves of cucurbit plants in southern and central Wisconsin. Symptoms/signs include white, talcum-like pathogen sporulation on all leaf surfaces and petioles (picture below with disease cycle). Early management of powdery mildew can greatly enhance your overall control, especially for long season cucurbit types such as pumpkins and winter squashes. Management not only leads to healthier foliage and better quality pumpkins, but also leads to stronger and healthier stems for enhanced marketability and shelf life post-harvest. I have included data from a recent fungicide evaluation trial that S.A. Jordan and I ran at the UW Hancock Ag Research Station (below). Our approach was to make applications every 14 days with some common fungicides. We learned that 14 day intervals were insufficient for best control; Rally (myclobutanil) is not working optimally in the region any longer due to resistance (confirmed by Dr. Meg McGrath of Cornell Univ.); and that Quintec (quinoxifen) fungicide was a very effective fungicide for limiting powdery mildew. We are continuing our studies in 2016 with weekly applications at the Hancock station. Many other fungicides are registered for use on cucurbit powdery mildew and are included in the A3422 Commercial Vegetable Production Guide for Wisconsin:

<http://learningstore.uwex.edu/Assets/pdfs/A3422.pdf>



Evaluation of fungicides for control of pumpkin powdery mildew – Hancock, 2014.

A trial was established on 1 Jun at the Hancock Agricultural Research Station in Hancock, WI to evaluate the efficacy of fungicides for control of powdery mildew on pumpkin. ‘Sorcerer’ pumpkin was direct seeded into black plastic mulch. Each treatment plot consisted of 10 plants spaced 2 ft apart (within row) and a 5 ft spacing between rows. Treatments were replicated four times and arranged in a randomized complete block design. Insecticide, herbicide, and fertility applications were made according to standard production practices for the region. Natural precipitation provided 13.5 in. of water during the growing season. Supplemental irrigation was provided with overhead irrigation totaling 15.9 in. The first fungicide application was initiated when powdery mildew was first detected in the plots on 23 Jul. Two additional applications were made at 2-week intervals on 6 and 20 Aug. Plots were treated with fungicides using a CO₂ backpack sprayer equipped with four TeeJet 8002VS nozzles spaced 19-in. apart and calibrated to deliver 35 gal/A at a boom pressure of 35 psi. Powdery mildew severity was visually assessed on 25 Jul, 5 and 18 Aug, and 2 Sep using the Horsfall-Barratt rating scale (0-11 rating with 0 = no disease, 11 = 100% disease severity). The Area Under the Disease Progress Curve (AUDPC) was determined by trapezoidal integration and then converted into Relative AUDPC (RAUDPC), i.e. percentage of the maximum possible AUDPC for the whole period of the experiment. Plots were harvested for yield and graded for handle quality (% of fruit with peduncles that could support the weight of the fruit) on 24 Sep.

While onset of powdery mildew was late in the growing season, disease pressure rapidly increased with nearly complete defoliation of the untreated control plots by the final rating date. All fungicide treatments provided significantly greater disease reduction than the non-treated control. Quintec alternated with Microthiol Disperss provided the best control of powdery mildew, the best handle rating, and was the highest yielding, numerically, among treatments. Treatments containing Bravo WeatherStik, JMS Stylet Oil, and Microthiol Disperss had significantly less disease than the non-treated control, Kocide 3000, and Rally. The poor performance of Rally was not expected. Anecdotal reporting from area growers of Rally losing efficacy to control powdery mildew indicates that there may be wide-spread resistance to myclobutinil in Wisconsin. There were no significant differences among treatments for plot yield. No phytotoxicity was observed.

Treatment and rate/A	Application Timing ^z	Plot Yield (lb)	Handle Rating (%) ^y	RAUDPC ^x
Untreated Control	1-3	172.5	40.6ab	0.51g
JMS Stylet Oil 5.0 qt/100 gal water	1-3	151.3	42.3ab	0.36c-e
Microthiol Disperss 80DF 4.0 lb	1-3	160.4	53.8ab	0.30b
Rally 40WSP 5.0 oz	1-3	163.7	46.2ab	0.44f
Bravo WeatherStik 720SC 2.0 pt	1-3	163.4	51.1ab	0.30b
Bravo WeatherStik 720SC 2.0 pt	1,3	151.7	40.4ab	0.31bc
Bravo WeatherStik 720SC 2.0 pt	1,3			
Quadris 2.08SC 15.5 fl oz	2	169.7	61.0b	0.33bc
Quintec 2.08SC 6.0 fl oz	1,3			
Microthiol Disperss 80DF 4.0 lb	2	203.2	90.1c	0.22a
Kocide 3000 DF 0.75 lb	1-3	195.0	36.4a	0.39ef
Kocide 3000 DF 0.75 lb	1,3			
Microthiol Disperss 80DF 4.0 lb	2	186.3	39.5a	0.38d-f

^zFungicide application dates: 1=23 July, 2 = 6 August, 3= 20 August.

^yColumn numbers followed by the same letter are not significantly different at $P=0.05$ as determined by Fisher's Least Significant Difference (LSD) test.

^xRAUDPC= Relative Area Under the Disease Progress Curve.

Tomato Late Blight Fungicides Registered for WI, 2016.

This is not a comprehensive list. Most fungicides listed are for use in conventional production systems.

List updates July 25, 2016.

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Trade Name (rate/A)	Active Ingredient(s)	PHI	REI	FRAC #	Activity of fungicide	Comments
<u>Ariston</u> (1.9-3.0 pt)	chlorothalonil+ cymoxanil	3 day	12 hours	M5+27	protectant + locally systemic	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 which is a good curative fungicide for late blight.
<u>Fosphite, Rampart</u> (1-3 qt in 20 - 100 gal water/A)	potassium phosphite	0 days	4 hours	33	upregulates resistance/ disease protection in plant	Foliar post-emergence spray. Do not apply at less than 3 day intervals. Water dilution of rate is dependent upon specific product label.
<u>Badge SC</u> (0.75- 1.8 pt/acre)	copper hydroxide, copper oxychloride	0 days	24 hours	M1	protectant	Protectant activity only.
<u>Bravo Ultrex</u> 1.3- 2.6 lb) <u>Bravo</u> <u>WeatherStik,</u> <u>Equus 720 SST,</u> <u>Initiate 720,</u> <u>Chloronil 720</u> (1.375 – 2.75 pt) <u>Echo 720</u> (1.375-3.0 pt) <u>Bravo Zn, Echo Zn,</u> <u>Equus 500 Zn</u> (2.0-4.0 pt) <u>Equus DF</u> (1.3 – 2.6 lb) <u>Echo 90DF</u> (1.125 - 2.5 lb)	chlorothalonil	0 days	12 hours	M5	protectant	Foliage protection rates are typically lower than fruit protection rates. See specific product labels for rate ranges. Do not apply more than 15.1 lb of active ingredient per acre per year. Minimum retreatment interval is 7 days.
<u>Cabrio EG</u> (8.0 – 16.0 oz)	pyraclostrobin	0 days	12 hours	11		Make no more than 1.2 lb of active ingredient per acre per year. Make no more than 2 sequential applications on tomato before alternating to a different mode of action fungicide.

Trade Name (rate/A)	Active Ingredient(s)	PHI	REI	FRAC #	Activity of Fungicide	Comments
<u>Champ WG</u> (1.06 lb) <u>Champ Formula 2</u> <u>Flowable (1.33 pt)</u> <u>Champ DP Dry</u> <u>Prill (1.33 – 2.0 lb)</u> <u>Kentan DF</u> (1.32 lb) <u>Kocide 2000</u> (1.5-3.0 lb) <u>Kocide 3000</u> (0.75-1.75 lb) <u>Nu-Cop 3L</u> (1.33-4.0 pt) <u>Nu-Cop 50DF</u> (1.0-3.2 lb, rates depend upon processing/fresh market)	copper hydroxide	0 days	24 hours	M1	protectant	Use high label rates for foliar late blight protection. Minimal interval between treatments is 3 days.
<u>C-O-C-S WDG</u> (1.0 lb) <u>Cuprofix-Ultra 40</u> <u>Disperss</u> (0.75-3.0 lb)	copper oxychloride, basic copper sulfate	0 days	24 hours	M1	protectant	Use high label rates for foliar late blight protection.
<u>Mastercop</u> (0.5-3.0 pt)	copper sulfate pentahydrate	0 days	24 hours	M1	protectant	Use high label rates for foliar late blight protection.
<u>Cueva</u> (2 gal in 50-100 gal water/acre)	copper octanoate	0 days	24 hours	M1	protectant	Use high label rates for foliar late blight protection.
<u>Curzate 60DF</u> (3.2-5.0 oz)	cymoxanil	3 days	12 hours	27	locally systemic	Locally-systemic fungicide. Must be tank-mixed with a protectant fungicide. Rainfast within 2 hours. Excellent curative activity.

Trade Name (rate/A)	Active Ingredient(s)	PHI	REI	FRAC #	Activity of fungicide	Comments
<u>Dithane F45</u> <u>Rainshield</u> (1.2-2.4 qt) <u>Dithane M45</u> (1.5-3.0 lb) <u>Koverall, Roper DF</u> <u>Rainshield,</u> <u>Manzate ProStick</u> (0.75-1.5 lb) <u>Penncozeb 80WP,</u> <u>Penncozeb 75DF</u> (0.75 to 3.0 lb) <u>ManKocide</u> (1.0-3.0 lb)	mancozeb mancozeb + copper hydroxide	5 days 5 days	24 hours 24 hours	M3 M3	Protectant protectant	Max rate per acre/season is 16.8 lb a.i. (east of Mississippi River). Latron surfactant addition will improve performance of Dithane F45.
<u>Evito 480SC,</u> <u>Aftershock</u> (5.7 fl oz)	fluoxastrobin	3 days	12 hours	11	locally systemic	Follow label for resistance management. Make no more than 4 applications per season. Do not apply to fruiting veg in the greenhouse.
<u>Flint</u> (4.0 oz) <u>Gem 500SC</u> (3.8 fl oz)	trifloxystrobin	3 days	12 hours	11	locally systemic	Do not make more than 5 applications per acre per season. Do not apply more than 16 oz per acre per season. Tank mix and alternate with broad spectrum base protectants to mitigate resistance development.
<u>Forum</u> (6 fl oz)	dimethomorph	4 days	12 hours	40	systemic	May be tank-mixed with another effective fungicide for enhanced management. Addition of an adjuvant may enhance management. Do not make more than 5 applications per acre per season. Do not exceed 30 fl oz per acre per season. Good antisporeulant.
<u>Gavel 75DF</u> (1.5 to 2 lb)	zoxamide+ mancozeb	5 days	48 hours	22+M3	protectant	Do not make >8 applications/crop. Contact fungicide. Excellent in limiting leaf blight.
<u>Orondis</u> <u>(Ultra/Opti)</u> (2.0-4.8 fl oz)	oxathiapiprolin	0 days	4 hours	U15	Systemic, trans-laminar movement	Do not exceed 19.2 fl oz/acre/season. Orondis Ultra – co-pack includes mandipropamid; Orondis Opti – co-pack includes chlorothalonil.
<u>Presidio</u> (3.0-4.0 fl oz)	fluopicolide	2 days	12 hours	43	locally systemic + translaminar	Must be tank mixed with another effective fungicide with a different mode of action for resistance management.
<u>Previcur Flex</u> (.7 to 1.5 pt)	propamocarb hydrochloride	5 days	12 hours	28	systemic antisporeulant	Apply in a tank-mix with effective protectant. Excellent at killing spores if used on a field with new and sporulating late blight lesions. Good curative activity.

Trade Name (rate/A)	Active Ingredient(s)	PHI	REI	FRAC #	Activity of fungicide	Comments
<u>Priaxor</u> (8.0 fl oz)	fluxapyroxad+ pyraclostrobin	0 day	12 hours	7+11	protectant + locally systemic	Cannot apply more than 3 applications/season. Follow label for resistance management. Do not mix with other pesticides, nutrients, additives, or adjuvants. Xemium and Headline pre-mix.
<u>Quadris, Satori</u> (6.2 fl oz)	azoxystrobin	0 day	4 hours	11	locally systemic	Alternate away from Group 11 fungicides to manage resistance. Do not apply more than 37 fl oz per acre per season.
<u>Quadris Opti</u> (1.6 pt)	azoxystrobin+ chlorothalonil	0 day	12 hours	11+M5	locally systemic + protectant	Alternate away from Group 11 fungicides to manage resistance.
<u>Ranman</u> (2.1 to 2.75 fl oz)	cyazofamid	0 days	12 hours	21	protectant	Follow label for resistance management. Do not apply more than 16.5 fl oz per acre per year.
<u>Reason 500SC</u> (5.5 to 8.2 fl oz)	fenamidone	14 days	12 hours	11	locally systemic	Follow label for resistance management. Make no more than 1 application before alternating to a different effective fungicide of a different mode of action.
<u>Revus Top</u> (5.5 to 7 fl oz)	mandipropami d+difenoconaz ole	1 day	12 hours	40+3	locally systemic + contact	Addition of an adjuvant is recommended. Do not apply more than 28 fl oz per acre per season.
<u>Ridomil Gold SL</u> (1.0 pt)	mefenoxam	14 days	48 hours	4	systemic	Do not apply beyond the at-planting stage. Excellent two-way systemic activity when pathogen strain is sensitive (ie: US-23).
<u>Ridomil Gold Bravo SC</u> (2.5 pt)	mefenoxam+ chlorothalonil	14 days	48 hours	4+M5	systemic + protectant	Follow label for resistance management. Excellent two-way systemic activity when pathogen strain is sensitive (ie: US-23).
<u>Ridomil Gold Copper</u> (varies)	mefenoxam+ copper hydroxide	14 days	48 hours	4+M1	systemic + protectant	Excellent two-way systemic activity when pathogen strain is sensitive (ie: US-23). Rates vary for fresh market and processing vegetables.
<u>Ridomil Gold MZ WG</u> (2.5 lb)	mefenoxam+ mancozeb	5 days	48 hours	4+M3	systemic + protectant	Follow label for resistance management. Excellent two-way systemic disease management if late blight strain is sensitive (ie: US-23)
<u>Tanos</u> (8.0 oz)	cymoxanil + famoxadone	3 days	12 hours	27+11	locally systemic + contact	Must be tank-mixed with an effective protectant fungicide. Good protectant for limiting leaf blight. Excellent curative.
<u>Zampro</u> (14.0 fl oz)	ametoctradin+ dimethomorph	4 days	12 hours	45+40	systemic + protectant	Do not make >2 sequential applications. Follow label for resistance management. Ametoctradin is new a.i.; dimethomorph is Forum (formerly Acrobat). Highly effective late blight treatment in several states in research trials (high rate gave significantly better control). Has curative activity.

Trade Name (rate/A)	Active Ingredient(s)	PHI	REI	FRAC #	Activity of fungicide	Comments
<u>Zing!</u> (36.0 fl oz)	zoxamide+ chlorothalonil	5 days	12 hours	22+M5	protectant	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 >1.6 lb of zoxamide and 9.44 lb of chlorothalonil per season per acre. Excellent protectant with good rainfastness. No curative activity or antispurulant.