



Vegetable Crop Update

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

No. 15– June 17, 2015

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Calendar of Events

July 15 – UW-Hancock ARS Field Day, 12:30PM, 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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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.** NA 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_2015.html

<i>Location</i>	Planting Date	50% Emergence	P-Day Cumulative	Disease Severity Value	Date of DSV Generation	Increase in DSV from 6/12
<i>Antigo</i>	Early 4/25	5/25	111	34	6/16	20
	Mid 5/5	6/1	111	34	6/16	20
	Late 5/15	6/15	13	8	6/16	1 st calc
<i>Grand Marsh</i>	Early 4/5	5/10	245	45	6/16	18
	Mid 4/15	5/15	235	44	6/16	18
	Late 5/1	5/21	201	42	6/16	18
<i>Hancock</i>	Early 4/10	5/15	234	40	6/16	16
	Mid 4/20	5/18	209	37	6/16	16
	Late 5/5	5/25	175	32	6/16	16
<i>Plover</i>	Early 4/15	5/20	236	48	6/16	16
	Mid 4/25	5/22	197	45	6/16	16
	Late 5/10	5/30	134	29	6/16	16

Further details on registered fungicides for WI vegetables can be found in the Univ. of WI Commercial Vegetable Production in WI Guide A3422,

<http://learningstore.uwex.edu/assets/pdfs/A3422.PDF>. Disease indicator/forecast tools provide information based on pathogen ecology to help make management decisions. No tool replaces field scouting and disease observations.

Potato Early Blight Preventive Management: P-Days have not yet reached threshold of 300 in any locations of Wisconsin. Likely this threshold will be met within the next 7 days or so. It is a good time to begin looking more carefully at lower potato canopies for the first signs of early blight (*Alternaria solani*) or brown spot (*Alternaria alternata*).

Late Blight Preventive Management: The DSV 18 threshold has been met/surpassed for early-, mid-, and late-planted/emerged potatoes in the Grand Marsh, Hancock, and Plover potato production areas. The threshold has also been met for early- and mid-planted/emerged potatoes in Antigo. This threshold indicates that environmental conditions have been met to promote late blight disease activity. At 18 DSVs, preventive applications of effective late blight fungicides is recommended. No late blight detections have been made in WI at this time on tomato or potato.

Considerations for fungicide programs to manage late blight: 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. Please see UWEX Veg Crop Updates article on fungicide selections from June 5 at link below.

<http://www.plantpath.wisc.edu/wivegdis/pdf/2015/June%205,%202015.pdf> or a listing of 2015 WI potato late blight fungicides:

<http://www.plantpath.wisc.edu/wivegdis/pdf/2015/Potato%20Late%20Blight%20Fungicides%202015.pdf>

Late blight updates: Nationally, in the past week, there were no new diagnoses of late blight reported to www.usablight.org. So far in 2015, there have been confirmations of late blight (US-23) in FL, CA (US-11), NC (strain not yet determined), and TX (not reported on [usablight.org/strain not yet identified](http://www.usablight.org/strain%20not%20yet%20identified)).

Limited chlorothalonil in 2015: (reprinted from Michigan State University Extension Vegetable Newsletter – authored by Drs. Willie Kirk and Noah Rosenzweig, Dept. of Plant, Soil and Microbial Sciences). Chlorothalonil supply for 2015 is limited. Potato growers, therefore, have a dilemma about what to base their late blight control programs on. There are limited supplies of Bravo-based and Echo-based products available and growers should endeavor to secure supplies. In addition, chlorothalonil is available in mixed products such as [Ariston](#) (chlorothalonil equals 3.83 pounds per gallon plus cymoxanil 0.51 pounds per gallon) with an application rate of 2.0 pints per acre; [Zing!](#) (chlorothalonil equals 4.19 pounds per gallon plus zoxamide 0.71 pounds per gallon) at 24 fluid ounces per acre; and [Elixir](#) (chlorothalonil equals 0.125 pounds per pound plus mancozeb 0.625 pounds per pound) with an application rate of 2.0 pounds per acre. For more information about using Zing! for use against late blight, see “[Zing! registered for use against potato late blight and early blight.](#)”

In 2014, many growers used Elixir fungicide as the base control for potato late blight. Trials conducted at Michigan State University in 2013 indicated Elixir at the lower rate of 1.5 pounds

per acre gave significantly poorer control of late blight than at the 1.8 pounds per acre rate or Bravo WS 6SC applied on a seven-day interval at 1.5 pints per acre (see table). Note that the rate for Elixir has been increased to 2.0 pounds per acre and [Michigan State University Extension](#) does not recommend dropping to lower labeled rates of 1.2 pounds per acre under any circumstances. It is important to keep to the highest labeled rate of Elixir, especially in the blight conducive conditions currently being experienced in Michigan.

Control of foliar late blight with fungicides in 2013 at MSU Clarksville Research Station						
Treatment and rate per acre	Foliar potato late blight (percent)				RAUDPC^b – 37 days after inoculation	
	Aug. 30 – 31 days after inoculation^a		Sept. 5 – 37 days after inoculation			
Elixir 75DF 1.5 pounds (A, B, D, F, H, J, L, N ^c)	7.5	efg ^f	28.8	f-j	3.9	d-i
Elixir 75DF 1.8 pounds (A, B, D, F, H, J, L, N)	3.3	fg	17.5	g-l	2.1	f-i
Bravo WS 6SC 1.5 pints (A, B, D, F, H, J, L, N)	0.5	g	0.8	l	0.2	i
Revus 249FS 5.5 fluid ounces (A, D, H, L); Bravo WS 6SC 1.5 pints (B, F, J, N)	1.0	g	1.3	l	0.4	i
Inoculated check	50.0	a	100.0	a	19.2	a

Data from [2013 Michigan Potato Research Report](#) (page 138) and [2014 Michigan Potato Research Report](#) (page 99).

^a Days after inoculation of *Phytophthora infestans* (US-22, A2 mating type, mefenoxam sensitive) on 31 Jul.

^b RAUDPC, relative area under the disease progress curve calculated from day of appearance of initial symptoms to Sept. 5 (37 days).

^c Incidence of tuber late blight at harvest (150 DAP) and after storage for 28 days at 50°F (178 DAP).

^d Days after planting.

^e Application dates: A= 10 Jul; B= 17 Jul; C= 18 Jul; D= 24 Jul; E= 26 Jul; F= 31 Jul; G= 3 Aug; H= 7 Aug; I= 11 Aug; J= 14 Aug; K= 19 Aug; L= 21 Aug, M= 27 Aug; N= 28.

^f Values followed by the same letter are not significantly different at $p = 0.05$ (Fishers LSD).

Although not tested as a stand-alone product in 2014, another product of note that could be used as a base program over the past few years includes Omega (fluazinam), which is used as the base program in Europe (Shirlan, Syngenta). Although significantly more expensive than Elixir or chlorothalonil products, Omega offers white mold control and can suppress early blight and gray mold.

Mancozeb-based products such as Penncozeb, Manzate and Dithane may also be used as the base products and can be used in combination with translaminar or systemic fungicides. Super Tin (TPTH, UAP) should be reserved for situations where late blight is present in the field. Of the

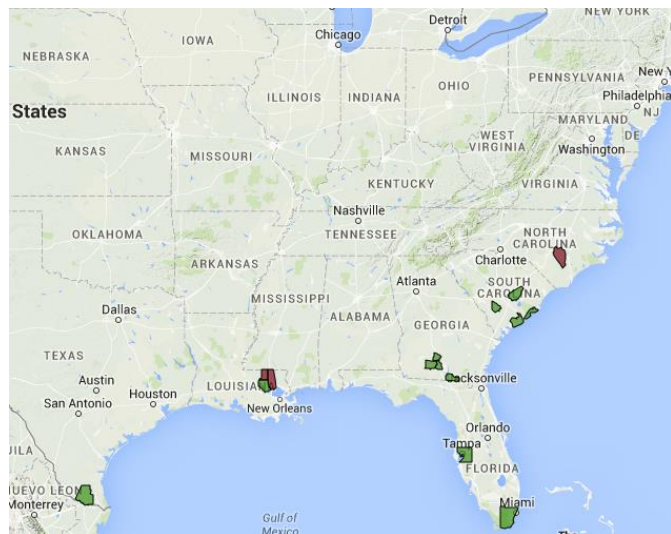
systemic fungicides tested over the past few years, Zampro (ametoctradin plus dimethomorph, BASF), Ranman (cyazofamid, FMC), Revus Top (mandipropamid plus difenoconazole, Syngenta), Tanos (famoxadone plus cymoxanil, DuPont), Curzate (cymoxanil, DuPont), Previcur Flex (propamocarb, Bayer), Gavel (zoxamide plus EBDC, Gowan) and Reason (fenamidone, Bayer) have provided excellent control of potato late blight, but are most effective when applied prior to the onset of late blight and should be mixed with a protectant partner (except Gavel).

Also, 2014 trials and field observations on Ridomil-based products indicated Ridomil applied protectively to crops provided excellent late blight control, as the current predominant genotype of *Phytophthora infestans* (US-23) is Ridomil-sensitive. Trials in 2013 indicated Ridomil-based products applied to blighted foliage did not successfully prevent further disease development. However, 2014 field observations showed when Ridomil-based products were applied to crops where about 0.01 percent of the field was affected and there were low levels of foliar blight in the affected areas (about 1-2 percent of the canopy affected), the products were effective in curtailing further development of the disease.

Full information on rates of most of these products is available on the [Late Blight Risk Monitoring website](#).

Dr. Kirk's work is funded in part by MSU's AgBioResearch. This article was originally published by [Michigan State University Extension](#). For more information, visit <http://www.msue.msu.edu>. To have a digest of information delivered straight to your email inbox, visit <http://bit.ly/MSUENews>. To contact an expert in your area, visit <http://expert.msue.msu.edu>, or call 888-MSUE4MI (888-678-3464).

Cucurbit downy mildew updates: No Wisconsin or Midwestern detects at this time.



Nationally, in the past week, there were two new diagnoses of cucumber downy mildew from North Carolina and Louisiana reported to <http://cdm.ipmPIPE.org/> So far in 2015, there have been confirmations of cucurbit downy mildew in LA, NC, FL, GA, SC, and TX on various cucurbit types including summer and winter squash, watermelon, cucumber, and pumpkin. No forecasted risk of spore movement from these southerly sites to the Upper Midwestern region.

Angular leaf spot can easily be misdiagnosed as downy mildew. Lesions off angular leaf spot are confined between veins, much like downy mildew. Angular leaf spot is caused by a bacterial pathogen and can be common in cucurbit fields when conditions are humid and wet. Downy

mildew is caused by a fungus-like pathogen that will produce profuse sporulation or spore masses on leaf undersides in the yellow lesion areas.

Information on angular leaf spot: <http://learningstore.uwex.edu/assets/pdfs/A3801.PDF>

Information on cucurbit downy mildew: <http://learningstore.uwex.edu/Assets/pdfs/A3978.pdf>



Photo courtesy: On left) Walt Stevenson, Prof. Emeritus UWEX; On right) Gerald Holmes, Cal Poly – Strawberry Sustainability Research and Education Center.

Basil downy mildew updates: No reports from WI at this time – nor from other Upper Midwestern states. Often we have had a report or two from greenhouses or plant retail centers by this time, but none have occurred. Basil downy mildew caused by the fungus-like pathogen *Peronospora belbahrii* has become more prevalent in the Great Lakes region and throughout the U.S. over the past 8 years. Since about 2007, basil downy mildew has made headlines as a new North American culinary herb disease – with confirmed reports in FL, NC, PA, NJ, NY, MA, NC, KS, MO, and WI (for the first time in 2010). Other European and South American nations are also dealing with this destructive plant pathogen. In 2014, nearly 40 states reported basil downy mildew from within the continental U.S. The basil downy mildew pathogen can be transmitted on seed, infected plant parts, and on the wind. This particular downy mildew can affect both ornamental and basil varieties grown as herbs. It is suspected that basil downy mildew has moved geographically on contaminated seed or leaves. The spores of basil downy mildew are produced on leaf underside prolifically and can be aurally dispersed long distances. Symptoms begin as non-descript pale yellow leaves which mimic nitrogen deficiency, but typically progress to well defined yellow, angular lesions on leaf surfaces (Figure 1). As disease develops, the pathogen’s dark gray to black spores can be seen on leaf undersides.

Management includes planting uninfested or ‘clean’ basil seed, selecting resistant or tolerant varieties, using adequate plant spacing to promote dry plant canopies, and applying fungicides when environmental conditions favor disease. Currently there are no effective seed treatments for basil downy mildew and hot water seed treatments negatively impact seed quality. Ongoing research in steam treatment of basil seeds may result in a viable, effective approach. Sweet or Italian basil varieties are more susceptible than other basil types. See Table 1 for further listings

of basil varieties with tolerance to downy mildew. Minimizing leaf wetness and humidity will aid in management as the pathogen is favored by moist conditions. There are a limited number of fungicides with registration for use, and few with meaningful efficacy in either organic or conventional systems. While not a preferred approach for most growers, applying fungicides frequently and starting before first symptoms may be necessary to control downy mildew effectively. Few fungicides are currently labeled for this new disease and fewer offer meaningful control. Actinovate AG and OxiDate are OMRI-listed fungicide labeled for use on herbs and for suppressing foliar diseases including downy mildew. OxiDate is labeled for use outdoors and in greenhouses and can offer some knock down of spores on infected plants – but the treatment does not provide lasting protection. The Actinovate label does not have a statement prohibiting use in greenhouses. There are now several phosphorous acid fungicides, Confine, OxiPhos, Phostrol, Phosphite, ProPhyt, Rampart, FungiPhite, and K-Phite, which include herb downy mildew on the current label. These fungicides were effective in fungicide efficacy experiments with applications started before or after initial symptoms were found. Greenhouse use is not prohibited. Quadris, Equation, and Satori are labeled for use on basil but not specifically for downy mildew; they have the same active ingredient - azoxystrobin, which has been shown to be effective for this downy mildew (greenhouse use not permitted). Ridomil Gold SL is another fungicide with registration on basil, but not specifically for downy mildew, and not for greenhouse use – however – it is highly effective in controlling downy mildew. Other fungicides which are very effective and have relatively new basil downy mildew registrations include: Ranman (cyazofamid) (greenhouse use permitted) and Revus (mandipropamid) (greenhouse use is not prohibited).

To determine when to initiate a fungicide program, or when to harvest early to avoid losses, growers should routinely scout for disease, and should stay informed of disease reports within the region to determine when downy mildew is occurring. The cucurbit downy mildew forecasting web site (<http://cdm.ipmpipe.org>) might be useful for predicting when conditions are favorable for basil downy mildew since both pathogens likely have similar requirements for successful wind dispersal and infection. Basil crops should be disked under or otherwise destroyed as soon as possible after last harvest, or when abandoned because of disease, to eliminate this source of inoculum.



Figure 1. Basil downy mildew symptoms and signs. **A.** Topside of leaf (note yellowing or chlorosis and brown, dead lesions). **B.** Underside of leaf (note patches of gray-purple fuzzy pathogen sporulation). **C.** Portion of whole plant infected with downy mildew (note yellowing and curling of lower leaves, along with brown lesions).

Basil varieties susceptible to downy mildew	
Aroma 2	Italian Large Leaf
Genovese	Magical Michael
Genoveser Martina	Mariden
Nufar	Opal Purple Variegated
Queenette	Poppy Joe's
Superbo	Napoletano
Basil varieties tolerant to downy mildew	
Eleonora	Thai Magic
Amethyst Imp	Mrs. Burns Lemon
Red Rubin	Red Leaf
Sweet Adin	Lemon
Lemon Standard	Lemon Mrs. Burns
Lemona	Lime
Basil varieties resistant to downy mildew	
Spice	Blue Spice
Blue Spice Fil	

Table 1. Resistance responses of basil varieties to downy mildew (Wyenandt, C.A, et al. 2010)

Onion downy mildew – be prepared: Onion downy mildew can be very problematic in onion fields. This foliar disease is caused by a fungus-like pathogen called *Peronospora destructor*. Infection is favored by temperatures less than 72°F and high humidity and leaf wetness. The pathogen can overwinter in volunteer onion, culls, and wild Allium weed species if the pathogen was present in your location in previous years. Symptoms include pale or white elongated patches on leaves that start off small and can elongate and produce a purple-gray sporulation which appears “downy.” Leaves can bend over and eventually die due to severe downy mildew infection. Please refer to pictures below. This disease can impact bulb size, quality, and storability. Management recommendations include practicing a 3+ year rotation to non-hosts such as small grains and corn, eliminating culls and volunteers, avoiding dense planting, avoiding excess N and overhead irrigation, and orienting rows parallel to prevailing wind to avoid prolonged leaf wetness. Additionally, there are fungicides that can be effective for the management of onion downy mildew. Effective fungicides for Downy mildew control include azoxystrobin (Quadris, Amistar), pyraclostrobin (Cabrio), pyraclostrobin & boscalid (Pristine), cymoxanil + famoxadone (Tanos), dimethomorph (Forum), mandipropamid (Revus), fenamidone (Reason), azoxystrobin + propiconazole (Quilt Excel), fluazinam (Omega), mefenoxam (Ridomil Gold), phosetyl-aluminum (Aliette), fenamidone (Reason), mancozeb (Dithane, Manzate) and copper hydroxide (Kocide, Champ). Newer registrations with activity against downy mildew include Zampro (ametoctradin+dimethomorph) and Zing! (chlorothalonil+zoxamide). Although labeled for onion downy mildew, coppers and chlorothalonil are not very effective for disease control, and coppers can be phytotoxic to onions. Please see the 2015 Wisconsin Vegetable Production Guide A3422 for further details on application rates and specifications. If you suspect you have Downy mildew in your onions,

please get a sample and contact your county agent, our disease diagnostic clinic, or myself for confirmation.



For further information on any fungicides that may be mentioned in this newsletter, please see the 2015 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>

