Vegetable Crop Update

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

Extension
UNIVERSITY OF WISCONSIN-MADISON

No. 10 – July 3, 2022

In This Issue:

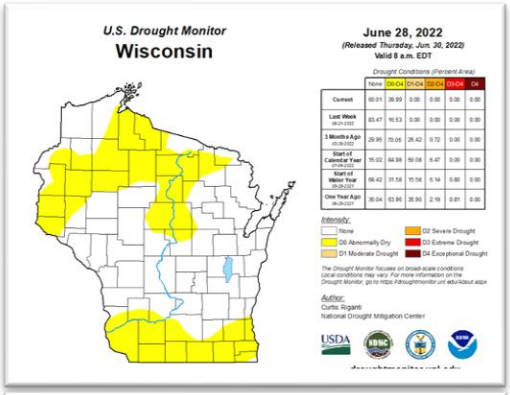
Calendar of Events:

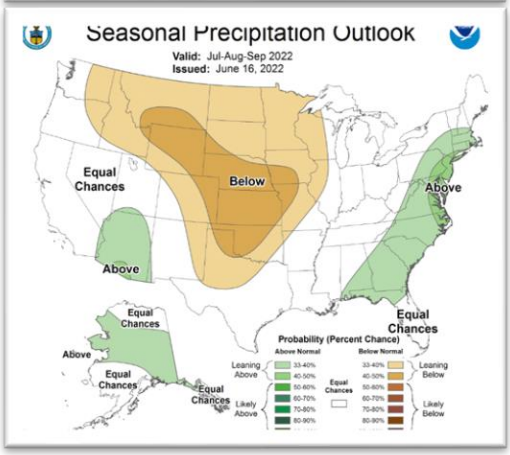
July 7, 2022 – UW-Hancock Ag Research Station Field Day (start at 1PM ending with a meal at HARS)
July 8, 2022 – UW-Extension Langlade Co. Airport Ag Research Station Field Day
July 28, 2022 – UW-Rhinelander Field Day
November 29-December 1, 2022 – Midwest Food Producers Assoc. Processing Crops Conference, Kalahari Convention Center
February 7-9, 2023 – UW-Madison Div. of Extension & WPVGA Grower Education Conference & Industry Show, Stevens Point, WI

Vegetable Insect Update – Russell L. Groves, Professor and Department Chair, UW-Madison, Department of Entomology, (608) 698-2434 (mobile), e-mail rgroves@wisc.edu

Vegetable Entomology Webpage: https://vegento.russell.wisc.edu/

Onion thrips – (https://vegento.russell.wisc.edu/pests/onion-thrips/). Onion thrips (*Thrips tabaci*) are an important annual pest of onion. They may attack nearly all garden crops, but serious damage is generally limited to onions, cabbage, cucumber, and tomatoes (hoop/hot house). Adult onion thrips are about 1/12" long, thin, and pale yellow to brown in color. Their wings have no veins and are fringed with long hairs. Immature thrips (e.g. nymphs) somewhat resemble adults except they are smaller and are often yellow in color.





https://www.weather.gov/mkx/Drought

Mass immigration of adult thrips to onion fields can occur any time throughout the summer but is likely coincident with harvest of infested legume and grain fields that are nearby. Second cutting alfalfa is also a significant risk factor for the movement of adult onion thrips. Throughout portions of Wisconsin, 'abnormally dry' conditions are developing in portions of the state, and these conditions also favor the development and survival of onion thrips populations. Forecast rain in the coming week across southern Wisconsin may slow this development. Continue scouting susceptible crops, however, to determine whether established thresholds have been met or exceeded. Management thresholds are most often based upon numbers of immature (nymphs) per leaf, and are not

based upon levels of visual damage. Recall that feeding damage causes whitish blotches and dry, yellow areas on leaves, decreased pollen set, and, under heavy infestations, brown leaf tips and distorted or undersized bulbs. Both adults and larvae can cause silvery streaking on leaves, which becomes dry and yellow.

Since thrips prefer tight spaces, cabbage varieties with extremely dense heads are most susceptible to damage. Thrips are often found several layers deep within developing cabbage heads. Heavy thrips buildup may cause the cabbage head to become distorted. Red onions are particularly susceptible, while Spanish onions tend to be somewhat resistant. Insecticide active ingredients that are part of management guidelines for onion thrips include spirotetramat (Movento), abamectin (Agri-Mek), spinetoram (Radiant), cyantraniliprole (Exirel, Minecto Pro), methomyl (Lannate) and lambda-cyhalothrin (Warrior). Many of these active ingredients are also available as generics and pre-mixes, so be cautious when developing your annual program of control and do not use similar modes of action (MoA) over successive generations. It is often recommended to use the same active ingredient as a series of two, successive applications (spaced 7-10 days apart) followed by a switch to a new MoA.

Squash bugs – (**https://vegento.russell.wisc.edu/pests/squash-bug/**). Squash bugs are an emerging problem at this point in the summer in parts of southern and central Wisconsin. In recent years, these insects have become more prevalent, causing damage to vine crops in commercial fields and home gardens alike. The key to management is early detection. Squash bugs feed on all vine crops, but pumpkins and squash are the preferred hosts with gourds and melons favored next.

Nymphs and adults feed on plant juices and release toxins into leaves. Feeding causes wilting, and leaves become dry and brown or black along the edges. This wilting may appear like bacterial wilt, but bacterial wilt is spread by the cucumber beetle. Early symptoms of infestation include yellow spotting on the leaves. Later in the season, adults will also feed on fruit, which can cease development and begin to rot. Young plants are more susceptible to severe damage.

Squash bug (Anasa tristis)
Photo: Jeffrey Hahn, Univ. of Minnesota

Squash bug nymphs
Photo: 'Pollinator' on Wikipedia

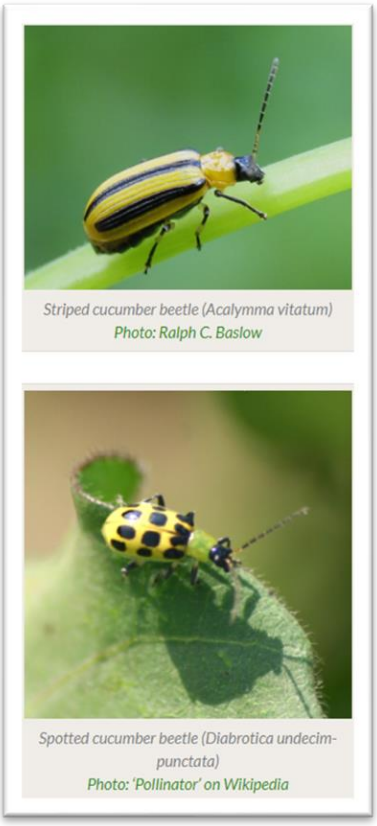
Squash bug eggs
Photo: 'Pollinator' on Wikipedia

Adults are about ½ -3/4-inch long, brownish-black, flat, shield-shaped bugs. They are sometimes mistaken for stink bugs. Adults congregate and emit a strong odor when crushed. Immature squash bugs initially have red heads and legs with whitish-green bodies, but later have black heads and legs with gray bodies. Eggs are 1/16-inch, reddish orange to brown-colored and are laid in clusters on the undersides of leaves along the center vein

Unmated adults overwinter in Wisconsin in protected areas. Eggs are laid in late June and early July when cucurbit vines begin to develop. Eggs hatch in about 10 days. The nymphal stage lasts 4-6 weeks. Nymphs undergo 5 molts before reaching maturity. Adults appear in late July and early August. There is one generation per year. The female lays eggs over an extended period, and all life stages may appear at once on the plant.

Destroy crop residues in the fall to reduce the number of overwintering adults. Crop rotation will also reduce the incidence of infestation. Trellised plants are less susceptible to squash bug infestations. Young nymphs are the most susceptible to control practices, while adults are more difficult to control. In smaller plantings, adults can be congregated by placing boards on the ground near the plants as a hiding place. The squash bugs will aggregate at night under the boards, which can then be destroyed each morning.

Striped cucumber beetle – (**https://vegento.russell.wisc.edu/pests/cucumber-beetles/**). Striped and spotted cucumber beetles continue to cause significant damage in vine crops, but the striped beetle is more prevalent in Wisconsin. Feeding from larvae and adults causes direct damage to roots, leaves, flowers, and fruits. Adults can also vector fusarium wilt and the bacteria, *Erwinia tracheiphila*. Cucumbers and melons are particularly susceptible to bacterial wilt, and damage from this can be severe**.**



Striped cucumber beetle (Acalymma vitatum)
Photo: Ralph C. Baslow

Spotted cucumber beetle (Diabrotica undecim-punctata)
Photo: 'Pollinator' on Wikipedia

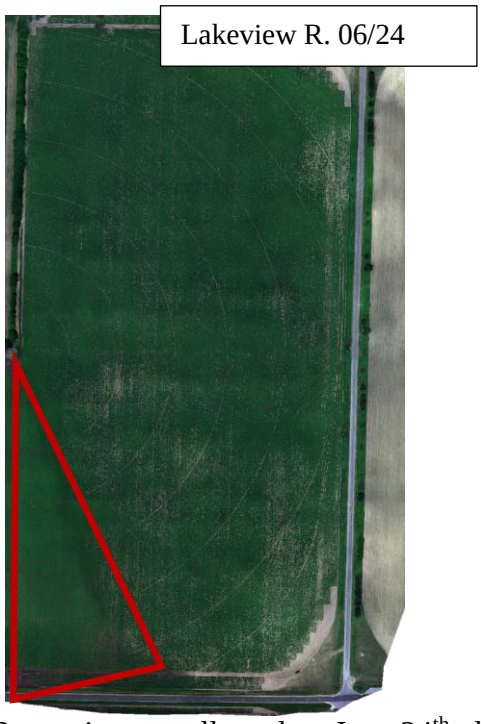
Only the striped cucumber beetle overwinters in Wisconsin. Significant numbers emerged in mid- to late May and began infesting cucurbits. The beetles are attracted to the chemical cucurbitactin produced by the plants. The small white larvae feed on plant roots for 2-3 weeks before pupating in the soil. Spotted beetles migrate to northern locations in early to mid-July. This late arrival generally seldom makes them a serious problem. There is one generation of striped and spotted beetles per year.

Cucumber varieties differ in their attractiveness to beetles. The varieties "Liberty" and "Wisconsin SMR58" are tolerant of cucumber beetle damage. In cantaloupe, "Makdimon" and "Rocky Sweet" are less attractive to beetles. Less bitter cultivars are less attractive to cucumber beetles

Several chemical insecticides are available when beetles exceed thresholds. However, chemical control will be limited if beetle populations are already high. Systemic neonicotinoid insecticides should be used with caution. Contact insecticides (including botanicals) should be applied to seedlings before transplanting and continued on a regular basis to keep numbers low. Cucumber leaves are sensitive and can be burned by chemical sprays. Spraying in the afternoon or evening is preferable to avoid killing beneficial insects and pollinators.

Yi Wang, Assistant Professor & Extension Potato and Vegetable Production Specialist, UW-Madison, Dept. of Horticulture, 608-265-4781, Email: wang52@wisc.edu.

With no extreme weather conditions, so far the plants have been doing well. Growers in the Central Sands have done a couple of fertigations to feed nutrients to the rapidly growing plants, which have achieved 100% canopy closure and flowering. Below I am showing some aerial images displaying the fast expansion of plant canopies within one week.



It needs to be pointed out that for the Lakeview Russet image collected on June 24th, there is a blurry patch at the lower left corner (highlighted by a red triangle in figure above right). This was caused by drifted water during an irrigation event.

For other vegetable crops in our research plots, kidney beans planted on June 1st are in their V3-V4 stage, and snap beans planted on the same day are in their V2-V3 stage. We plan to apply the second fertigation to the beans next week prior to blooming.

Hancock C west well

Hancock K well

This week I used the nitrate test strips that I showed in my last week's newsletter to rapidly test the general nitrate-N level in the wells that irrigate our research plots at Hancock. It is very obvious that nitrate-N in the K well is higher than 20 ppm, and that in the C west well is lower than 10 ppm. Again I would recommend that our growers try those test strips on their fields to know their general nitrate-N level in the water.

Last, something fun to share. This year I worked with an undergraduate (Ms. Melina Nguyen) to participate in the Flow project at UW-Madison. This project paired undergraduate student artists with water professionals from across the state of Wisconsin to create art inspired by water. From the breakdown of pesticides in Wisconsin's lakes to a book educating children about the smallmouth bass, this year's Flow Project is featured by the amazing work being done on behalf of the waterways in and around Wisconsin. Below is the artwork that Melina created about my research on water and vegetable crops.

Amanda Gevens, Chair, Professor & Extension Vegetable Pathologist, UW-Madison, Dept. of Plant Pathology, 608-575-3029, Email: gevens@wisc.edu, Lab website: https://vegpath.plantpath.wisc.edu/

Current P-Day (Early Blight) and Disease Severity Value (Late Blight) Accumulations. Thanks to Ben Bradford, UW-Madison Entomology; Stephen Jordan, UW-Madison Plant Pathology; and our grower collaborator weather station hosts for supporting this disease management effort again in 2022. A Potato Physiological Day or P-Day value of ≥300 indicates the threshold for early blight risk and triggers preventative fungicide application. A Disease Severity Value or DSV of ≥18 indicates the threshold for late blight risk and triggers preventative fungicide application. Red text in table indicates threshold has been met or surpassed. TBD indicates that data are To Be Determined as time progresses. Weather data used in these calculations will come from weather stations that are placed in potato fields in each of the four locations, once available. Data from an alternative modeling source: https://agweather.cals.wisc.edu/vdifn will be used to supplement as needed for missing data points. Data are available in graphical and raw formats for each weather station at: https://vegpath.plantpath.wisc.edu/dsv/.

Location	Planting Date		50% Emergence Date	Disease Severity Values (DSVs) 7/2/2022	Potato Physiological Days (P-Days) 7/2/2022
Grand Marsh	**Early**	Apr 5	May 10	15	**394**
	Mid	Apr 20	May 15	15	**354**
	Late	May 12	May 25	15	296
Hancock	**Early**	Apr 7	May 12	14	**353**
	Mid	Apr 22	May 17	14	**325**
	Late	May 14	May 26	12	274
Plover	**Early**	Apr 7	May 15	**28**	**334**
	Mid	Apr 24	May 20	**28**	**300**
	Late	May 18	May 27	**27**	265
Antigo	**Early**	May 1	Jun 3	4	217
	Mid	May 15	June 15	0	143
	Late	June 10	June 24	0	73

In addition to the potato field weather stations, we have the UW Vegetable Disease and Insect Forecasting Network tool to explore P-Days and DSVs across the state (https://agweather.cals.wisc.edu/vdifn). This tool utilizes NOAA weather data (stations are not situated within potato fields). In using this tool, be sure to enter your model selections and parameters, then hit the blue submit button at the bottom of the parameter boxes.

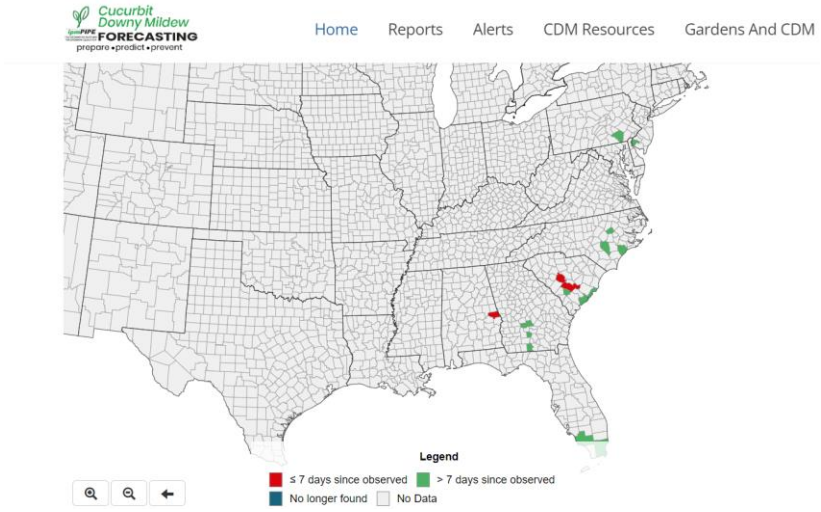
We have reached thresholds for preventative fungicide treatment in potatoes to manage early blight in Grand Marsh (early and mid-plantings, with late plantings likely to reach threshold within the next day). Hancock and Plover locations' early and mid-plantings are also exceeding threshold and should be treated to limit early blight. No threshold for early blight management has been met in the Antigo area. In scouting for early blight in lower potato plant canopies earlier this past week, I couldn't find lesions.

The canopies in our potato plantings at UW Hancock ARS have been quite dry due to unusually higher winds in the region. I've been surprised to see this drying condition this year as it substantially influences moisture and associated disease risk in plant canopies. While P-Days take into account heat and crop status, DSVs also consider moisture. This is why our DSVs have been quite low this year despite where we are on the calendar and in crop development.

Once thresholds are met for risk of early blight and/or late blight, fungicides are recommended for optimum disease control. Fungicide details can be found in the 2022 Commercial Vegetable Production in Wisconsin Guide, Extension Document A3422, linked here: https://learningstore.extension.wisc.edu/products/commercial-vegetable-production-in-wisconsin

According to usablight.org there have not been recent diagnoses of late blight in tomato or potato crops in the US. For this year, there were just 2 reports entered back in March in southern Florida (US-23 clonal lineage/strain type).

Cucurbit Downy Mildew:



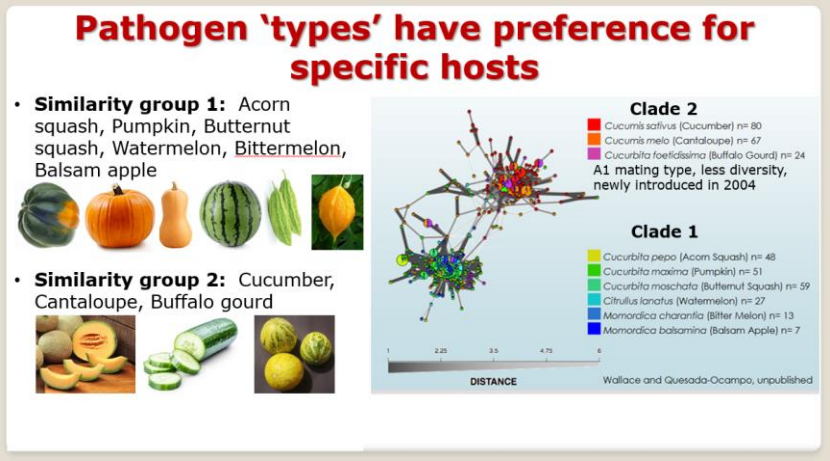
https://cdm.ipmpipe.org/

Current map of reports of cucurbit downy mildew in the continental US (Jul 2, 2022).

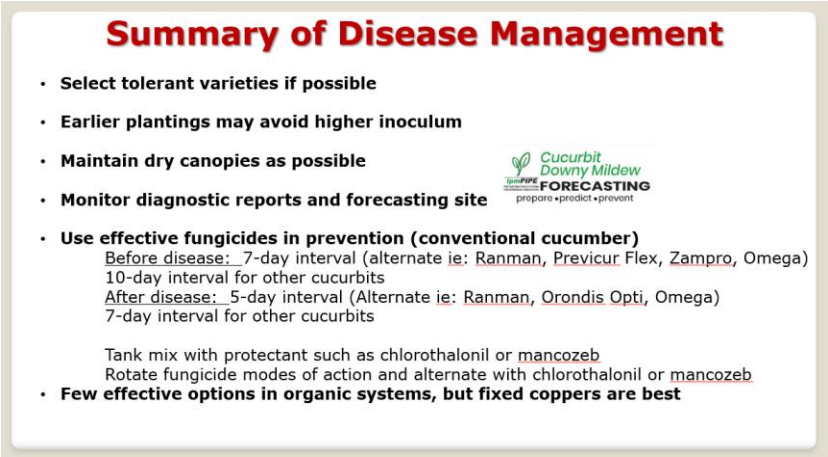
During this past week, cucurbit downy mildew was confirmed in Butternut squash, cucumber and watermelon in Alabama and South Carolina. Previously, in this growing season, the disease was confirmed in Florida, Georgia, South Carolina, North Carolina, Pennsylvania, and New Jersey. No findings of cucurbit downy mildew in our Wisconsin-based sentinel plots in Dane County.

Dr. Mary Hausbeck's Plant Pathology Laboratory at Michigan State University routinely reports spore trapping information for multiple locations in Michigan. In mid-June there were a few days with indication of presence of *Pseudoperonospora cubensis* or cucurbit downy mildew pathogen spores, but, to date, no cases of downy mildew in cucurbit plantings in the state of Michigan.

As a reminder, the pathogen is now known to have two 'strains' for clade types. The type (Clade 2) which infects cucumber, can als infect melon. Due to fungicide resistance within the downy mildew pathogen population, especially in Clade 2, selection of fungicides is important.



Management of cucurbit downy mildew requires preventative fungicide applications as commercial cultivars are generally susceptible to current strains (Clades) of the pathogen.



Because of the unique attributes of the new clades, I have summarized unique preventative fungicide programs based on crop groupings. These recommendations are summarizations of work done by many outstanding research and extension professionals including: Drs. Mary Hausbeck at Michigan State Univ., Sally Miller at Ohio State Univ., and Lina Quesada Ocampo at North Carolina State Univ.

Fungicide Programs for Cucumber (Clade 2) DM

If program is initiated **before** disease onset: adhere to a **7-day** interval.
If program is initiated **after** disease onset: adhere to a **5-day** interval.

Recommendations based on multiple years of field research by Hausbeck, Michigan State Univ. & Quesada Ocampo at NCSU

SE U.S. and MI (2014) have noted resistance in the downy mildew pathogen to several fungicides

Bold indicates best in MI

Use of highest labeled rate of products is recommended	
Previcur Flex 6SC (2 day PHI), GH	propamocarb hydrochloride 28
Elumin SC (2 day PHI)	ethaboxam 22
Ranman 3.6SC (0 day PHI)	cyazofamid 21
Gavel 75WG (5 day PHI), GH	mancozeb M3 + zoxamide 22
Orondis Opti (0 day PHI)	oxathiapiprolin 49/chlorothalonil M5
Orondis Ultra (0 day PHI)	oxathiapiprolin 49/mandipropamid 40
Omega 500F (7 day PHI)	fluazinam 29
Zampro 4.4SC (day PHI)	ametoctradin 45/dimethomorph 40
Zing! SC (0 day PHI)	zoxamide 22 + chlorothalonil M05
Alternate products and mix each with either: Dithane (mancozeb) 3 lb 5 day PHI, M3, GH; or Bravo (chlorothalonil) 2 pt 0 day PHI, M5	

Fungicide Programs for Pumpkin (Clade 1) DM

If program is initiated **before** disease onset: adhere to a **10-day** interval.
If program is initiated **after** disease onset: adhere to a **7-day** interval.

Recommendations based on multiple years of field research by Hausbeck, Michigan State Univ. & Quesada Ocampo at NCSU

SE U.S. and MI (2014) have noted resistance in the downy mildew pathogen to several fungicides

Bold indicates best in MI

Use of highest labeled rate of products is recommended	
Previcur Flex 6SC (2 day PHI), GH	propamocarb hydrochloride 28
Elumin SC (2 day PHI)	ethaboxam 22
Ranman 3.6SC (0 day PHI)	cyazofamid 21
Gavel 75WG (5 day PHI), GH	mancozeb M3 + zoxamide 22
Presidio 4FL (2 day PHI)	fluopicolide 43
Tanos 50WG (3 day PHI)	famoxadone 11 + cymoxanil 27
Zampro 4.4SC (0 day PHI)	ametoctradin 45 + dimethomorph 40
Orondis Opti (0 day PHI)	oxathiapiprolin 49/chlorothalonil M5
Orondis Ultra (0 day PHI)	oxathiapiprolin 49/mandipropamid 40
Omega 500F (7 day PHI)	fluazinam 29
Zing! SC (0 day PHI)	zoxamide 22 + chlorothalonil M05
Alternate products and mix each with either: Dithane (mancozeb) 3 lb 5 day PHI, M3, GH; or Bravo (chlorothalonil) 2 pt 0 day PHI, M5	

Potato Late Blight Fungicides Registered for WI, 2022.

In-furrow and seed treatment registrations are omitted. Not a comprehensive list. Most fungicides listed are for use in conventional systems. Where generic fungicide trade names are listed, there may be numerous. Compiled 3 July 2022.

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Trade Name (rate/A)	Active Ingredient(s)	PHI	REI	FRAC #	Activity of Fungicide	Comments
Agri Tin, Super Tin 4L, Super Tin 80WP (4-6 fl oz)	triphenyltin hydroxide	7 days	48 hours	30	Protectant; kills spores on contact	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) K-Phite 7LP (1-3 qt in 10 gal water/acre)	mono and dipotassium salts of phosphorous acid	0 days	4 hours	33	Upregulates resistance/disease protection in plant	Foliar application. Use higher rate when disease pressure is severe. Do not apply at less than 3 day intervals. Do not apply to plants that are dormant or that are heat or moisture stressed.
Ariston (2 pt)	chlorothalonil + cymoxanil	14 day	12 hours	M5+27	Protectant and locally systemic	Additional chlorothalonil may be tank-mixed with this formulation to enhance % active ingredient applied (be sure to include the Ariston component in overall season total). Cymoxanil is Curzate.
Elixir (1.2-2.0 lb)	mancozeb+ chlorothalonil	7 days	24 hours	M3+ M5	Protectant	Use higher rate as vines increase in size.
Fosphite, Rampart (1-4 qt)	potassium phosphite	0 days	4 hours	33	Upregulates resistance/disease protection in plant	Foliar post-emergence spray and post harvest spray for control in storage. Apply in at least 20 gal water/acre.
Fungi-Phite (Foliar: 2 qt/A Seed trt: 15% vol to vol-2 ton in 1 gal solution) Helena Prophyt (4 pt/acre)	potassium phosphite	0 days	4 hours	33	Upregulates resistance/disease protection in plant	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)	copper hydroxide, copper oxychloride	0 days	24 hours	M1	Protectant	Protectant activity only. Apply at 7 to 10 day interval.
Bravo Ultrex (.7 then .9 to 1.36 lb) Bravo WeatherStik, Echo 720, Equus 720 SST, Initiate 720, Chlorothalonil 720 SC, Chloronil 720, Praiz (.75 then 1-1.5 pt) Bravo Zn, Equus 500 Zn, Initiate Zn (1 1/8 then 1.5 to 2.25 pt)	chlorothalonil	7 days	12 hours	M5	Protectant	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, 2022.

Trade Name (rate/A)	Active Ingredient(s)	PHI	REI	FRAC #	Activity of Fungicide	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	Protectant	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+M 3	Locally systemic and protectant	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) 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) Previsto (1-3 qt)	copper hydroxide	0 days	24 hours	M1	Protectant	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	Protectant	Use high label rates for foliar late blight protection.
Mastercop (0.5-1.5 pt)	copper sulfate pentahydrate	0 days	24 hours	M1	Protectant	Use high label rates for foliar late blight protection.

Potato Late Blight Fungicides Registered for WI, 2022.

Trade Name (rate/A)	Active Ingredient(s)	PHI	REI	FRAC #	Activity of Fungicide	Comments
Cueva (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.
Curzate 60DF (3.2 oz foliar)	cymoxanil	14 days	12 hours	27	Locally systemic	Locally-systemic fungicide. Must be tank-mixed with a protectant fungicide. Rainfast within 2 hours. Cymbol.
Dithane F45 Rainshield (.4 to 1.6 qt) Dithane M45 (.5 to 2 lb) Koverall, Roper DF Rainshield, Fortuna 75WDG (1-2.0 lb)	mancozeb	24 hours	3 days	M3	Protectant	Max rate per acre/season is 11.2 lb a.i. Begin use at lower rate and increase as vines increase in size.
Evito 480SC, Aftershock (3.8 fl oz)	fluoxastrobin	7 days	12 hours	11	Locally systemic	Follow label for resistance management.
Forum (Foliar and tuber control: 6 oz)	dimethomorph	4 days	12 hours	40	Systemic	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+M 3	Protectant	Do not make >6 applications/crop. Contact fungicide.
Gem 500SC (3.8 fl oz)	trifloxystrobin	7 days	12 hours	11	Locally systemic	Follow label for resistance management.
Headline (6 to 12 fl oz)	pyraclostrobin	3 days	12 hours	11	Locally systemic	Follow label for resistance management.
ManKocide (1.5 to 2 then 4-5 lb)	mancozeb+ copper hydroxide	3 days	24 hours	M3+ M1	Protectant	Not labeled as a seed trt for potatoes.
Omega 500F (5.5 fl oz)	fluazinam	14 days	48 hours	29	Protectant	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	Protectant and locally systemic	Can be applied aerially. REI is 4 days for high exposure activities.

Potato Late Blight Fungicides Registered for WI, 2022.

Trade Name (rate/A)	Active Ingredient(s)	PHI	REI	FRAC #	Activity of Fungicide	Comments
Orondis Ultra (5.5-8.0 fl oz)	oxathiapiprolin + mandipropamid	14 days	4 hours	U15 + 40	Translaminar or systemic within leaf and xylem mobile; rainfast within 30 minutes	Max single application rate is 8.0 fl oz/A. Max annual rate is 32.0 fl oz/A/year. Do not apply >0.125 lb ai/year of oxathiapiprolin. Do not apply >0.522 lb ai/year of mandipropamid. Make no more than 2 sequential applications before rotating to a different mode of action. Do not follow soil applications of oxathiapiprolin with foliar applications of Orondis Ultra.
Orondis Opti (1.75-2.50 pt)	oxathiapiprolin + chlorothalonil	7 days	12 hours	U15 + M5	Translaminar or systemic within leaf and xylem mobile; rainfast within 30 minutes	Max single application rate is 2.5 pt/A. Max application annual rate is 10 pt/A/year. Do not apply >0.125 lb ai/A/year of oxathiapiprolin. Do not apply >11.25 lb ai/A/year of chlorothalonil.
Oxidate (40 to 120 fl oz to 100 gal water, 30-100 gal/acre	hydrogen dioxide	0 days	1 hour	NC	Kills spores on contact and no residual protectant activity after treatment	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) Manzate Pro-Stick (1 to 2 lb, seed trt: 1.25 lb/50 gal water)	mancozeb	3 days	24 hours	M3	Protectant	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	Upregulates resistance or plant defense	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	Protectant	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	Systemic antisporulant	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	Protectant and locally systemic	Cannot apply more than 3 applications/season. Follow label for resistance management. Xemium and Headline pre-mix.

Potato Late Blight Fungicides Registered for WI, 2022.

Trade Name (rate/A)	Active Ingredient(s)	PHI	REI	FRAC #	Activity of Fungicide	Comments
Quadris, Satori, Willowood Azoxy 2SC, Aframe, Equation SC (6 to 15.5 fl oz) Trevo, Azoxystrar, Azoxyzone (6-20 fl oz)	azoxystrobin	14 days	4 hours	11	Locally systemic	Alternate away from Group 11 fungicides to manage resistance.
Quadris Opti (1.6 pt)	azoxystrobin+ chlorothalonil	14 days	12 hours	11+ M5	Locally systemic and protectant	Alternate away from Group 11 fungicides to manage resistance.
Ranman (1.4 to 2.75 fl oz)	cyazofamid	7 days	12 hours	21	Protectant	Follow label for resistance management.
Reason (5.5 to 8.2 fl oz)	fenamidone	14 days	12 hours	11	Locally systemic	Follow label for resistance management.
Revus Top (5.5 to 7 fl oz)	mandipropamid+difenoconazole	14 days	12 hours	40+3	Locally systemic and contact	Addition of an adjuvant is recommended.
Tanos (8 to 10 oz)	cymoxanil + famoxadone	14 days	12 hours	27+11	Locally systemic and contact	Must be tank-mixed with an effective protectant fungicide. Good protectant for limiting leaf blight. Excellent curative.
Ridomil Gold SL (1 to 2 pt)	mefenoxam	14 days	48 hours	4	Systemic	Do not apply beyond the at-planting stage.
Ridomil Gold Bravo SC (2.5 pt)	mefenoxam+ chlorothalonil	14 days	48 hours	4+M5	Systemic and protectant	Follow label for resistance management.
Ridomil Gold Copper (2 lb)	mefenoxam+ copper hydroxide	14 days	48 hours	4+M1	Systemic and protectant	Tank-mix with an effective protectant.
Ridomil Gold MZ WG (2.5 lb)	mefenoxam+ mancozeb	3 days	48 hours	4+M3	Systemic and protectant	Follow label for resistance management.
Zampro (11-14 fl oz)	ametoctradin+ dimethomorph	4 days	12 hours	45+40	Systemic and protectant	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	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 >1.52 lb of zoxamide and 8.88 lb of chlorothalonil per season per acre.