Vegetable Crop Update

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

Division of Extension
University of Wisconsin-Madison

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Calendar of Events

July 16, 2020 – UW Hancock Ag Research Station Field Day CANCELLED
December 1-3, 2020 – Midwest Food Producers Association Annual Convention/Processing Crops Conference, Kalahari, Wisconsin Dells, WI
February 2-4, 2021 – UW-Madison Div. of Extension & WPVGA Grower Education Conference, Holiday Inn, Stevens Point, WI

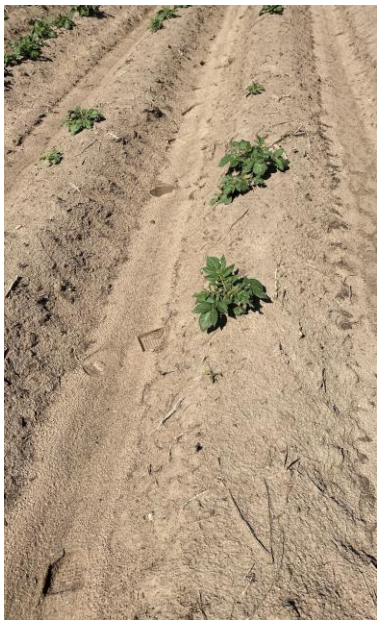
Yi Wang, Assistant Professor & Extension Potato and Vegetable Production Specialist, UW-Madison, Dept. of Horticulture, 608-265-4781, Email: wang52@wisc.edu.

This week on June 1st we collected the emergence data of several varieties. The seeds were planted between April 30 and May 4.

Market Class	Variety	Planting Date	Emergence
Russets	Caribou Russet	5/4	45%
	GoldRush	4/30	40% - 90%
	Plover Russet	4/30	80%
	Reveille Russet	5/4	50%
	Russet Burbank	5/1	85%
	Silverton	4/30	85%
Yellows	Agata	5/4	70%
	Colomba	5/4	40%
	Malou	5/4	25%
	Soraya	5/4	10% - 65%
Reds	Dark Red Norland	5/4	100%
	Red Praire	5/4	50%
Chippers	Hodag	5/1	20%
	Snowden	5/1	50%

Obviously, some were faster than others. The tallest plants were about 5 in tall, such as Plover Russet, Russet Burbank, Silverton, and Dark Red Norland (Figure on left).

The slower growing varieties were highly variable, including Gold Rush, Hodag, and Soraya (Figure on right). We dug up some seed pieces and saw that some were rotten, and others were just beginning to sprout. There was no clear reason for the variation, since all seed were cut pieces that had been suberized at 55F and 95% humidity for 2 weeks prior to planting. Conversations with commercial growers indicated similar issues on certain varieties.



Jed Colquhoun, UW-Madison, Department of Horticulture, colquhoun@wisc.edu
Do you have injured Russet Burbanks?: We've received a few reports of Russet Burbank injury in the past week, and would like to learn more about the situation in order to provide the best support to the industry and avoid such situations as much as possible in the future. However, it can be very challenging to identify causal agents when such situations are so sporadic and uncommon. Our past experience suggests that it's most productive to get as much information as possible from across affected fields in order to identify common themes across production systems, such as herbicide programs and previous crops.

We can use modern communications to "crowdsource" this information with just a few minutes of our collective time. So, if you have Russet Burbank potatoes showing poor emergence or malformed growth and are willing to share your production information with us, please simply text a few pictures of the symptoms to 608-852-4513. Please include your name in the text. I'll follow up with a few questions based on the symptoms in the pictures. Thanks and stay safe!

Amanda Gevens, Dept. Chair, Associate Professor & Extension Specialist, UW-Madison Plant Pathology, gevens@wisc.edu, Cell: 608-575-3029. https://vegpath.plantpath.wisc.edu/

Current P-Day (Early Blight) and Disease Severity Value (Late Blight) Accumulations (Many thanks to Ben Bradford, UW-Madison Entomology; Stephen Jordan, UW-Madison Plant Pathology). 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 indicates threshold has been met/surpassed. TBD indicates that data is To Be Determined as time progresses. Weather data used in these calculations comes from weather stations that are placed in potato fields in each of the four locations. Data are available in graphical and raw data formats for each weather station at: https://vegpath.plantpath.wisc.edu/dsv/

Location	*Planting Date*		50% Emergence Date	Disease Severity Values 6/6/20	Potato Physiological Days 6/6/20
Grand Marsh	Early	Apr 17	May 18	8	139
	Mid	Apr 25	May 26	5	83.9
	Late	May 6	June 1	2	43.3
Hancock	Early	Apr 8	May 18	6	146
	Mid	Apr 20	May 25	4	94.6
	Late	May 4	May 30	1	57
Plover	Early	Apr 10	May 23	7	111
	Mid	Apr 20	May 30	1	56.5
	Late	May 5	June 1	1	44.3
Antigo Station set up at airport 5/29	Early	May 14	June 5	0	15.69
	Mid	May 24	TBD	TBD	TBD
	Late	Jun 1	TBD	TBD	TBD

Hop Downy Mildew Identification and Control in Wisconsin: The UW Plant Disease Diagnostic Clinic received its first digital case of what looked to be downy mildew. Be on alert for other downy mildews. It is not uncommon to see downy mildew on various crops at this time of year – note that downy mildews have specific host ranges, so even if you see downy mildew on your basil, it is not the same as the downy mildew on hop or wild grape. The pathogens are unique to each crop, but similar weather favors their onset and development.

Downy mildew caused by *Pseudoperonospora humili*, is a common disease on hop in Wisconsin. Once established in a hop yard, the disease can be persistent, overwintering in the below-ground plant parts. Earliest symptoms include downcurling of often brittle leaves, pale green-yellow foliage, and presence of dark gray-purple pathogen sporulation on leaf undersides. Early management of hop downy mildew is critical for limiting inoculum for the rest of the production season. While the pathogen will not likely be eradicated from the yard, sound management enables a healthy production season with less inoculum for late season when cones are forming. Further, reducing disease and inoculum in this season, limits the amount of pathogen that will remain with your hop plants for future years. Cool, wet weather is most favorable for downy mildew and may require weekly applications of fungicides for disease management. Hot, dry weather provides great conditions for limiting disease – often enabling 10-14 day fungicide application intervals for disease management. For further information on use of fungicides in management of hop downy mildew, please see the "Hops" section of the A3422 Commercial Vegetable Production Guide for Wisconsin. This pathogen is likely systemic in many hop yards, meaning that the pathogen is inside the rhizomes and can 'awaken' when spikes emerge in the spring. As such, fungicides are important for early season control of this pathogen so as to limit the amount of initial inoculum that can become available to the developing crop as the season progresses.


The start of a preventative fungicide program for downy mildew should begin at spike emergence. When to follow up with fungicide sprays for downy mildew: This will vary depending upon the weather. There is a disease risk index utilized by some Pacific northwestern hop growers that has not yet been validated for WI. The premise is that the more rainfall and relative humidity present under moderate temperatures (46-86°F) the greater the disease pressure. Under high pressure times, fungicides should be applied on a 5-7 day spray program. When rainfall is reduced, relative humidity is low and we experience either temps cooler than 46 or higher than 86°F, disease pressure is low and fungicides should be applied on a 10-14 day program.

A good fungicide for use in a 14-day calendar program is fosetyl aluminum or Aliette/Linebacker. Phostrol also provides similar extended control as it upregulates resistance in the plant. Use of an 'Aliette' type product alternated with a tank mix of copper hydroxide plus cymoxanil (Curzate) creates a sound program. Western states also alternate with copper hydroxide (ie: Kocide) and trifloxystrobin (Flint) in control of powdery mildew.

Several growers are using mefenoxam (ie: Ridomil Gold SL) for early season downy mildew control. This is a very good choice for early season control – and early season control leads to more robust full season control. While some locations have downy mildew with resistance to this fungicide (meaning it will not work to control disease); a recently tested Dane County hop yard had downy mildew that was very sensitive to Ridomil – making this fungicide an outstanding option for early season, preventive control. This fungicide can move upward into new tissues as well as downward into the below ground plant parts in managing downy mildew. Please carefully follow the label. For Ridomil Gold SL, specifically, the label rate is 0.50 pt/acre (equivalent to 0.25 lb. of active ingredient per acre). Note that you can only apply up to 0.25 lb of active ingredient per acre as a soil drench, per year of this fungicide. As a foliar spray, you can apply up to 0.5 lb of active ingredient per acre (ie: 2 full rate foliar applications). Foliar applications must be tank-mixed with a copper fungicide. There is a 45 day preharvest interval with Ridomil Gold SL. I included an excerpt of the label, below.

GROUP 4 FUNCTICIDE PULL HERE TO OPEN

RidomilGold® SL

syngenta.

Hops	Downy Mildew (*Pseudoperonospora humuli*)	0.50 pt/A (0.25)	**Soil drench:** Apply in water or liquid fertilizer to the soil over the crowns after pruning but before training. Apply early when shoots are 6 inches or less. **Foliar spray:** At the first sign of a secondary infection (primary infection persists after the soil drench and/or there is evidence of foliar infection), apply in combination with copper fungicides. Apply by ground with a minimum of 50 gal of water per acre.

Specific Use Restrictions:
1. Do not apply foliar sprays of Ridomil Gold SL without a copper fungicide registered for hops.
2. Do not apply within 45 days of harvest (45-day PHI).
3. Do not exceed the equivalent of 0.25 lb ai/A per crop of soil-applied and 0.5 lb ai/A per crop of foliar-applied mefenoxam-containing products.

Below, I have outlined a general foliar fungicide program by calendar for Wisconsin hop yards with additional notes in the right-hand column. If you raise other crops and have familiarity with common

base protectant fungicides, remember that **you cannot use captan, chlorothalonil, or mancozeb on hops.** These fungicides do not have EPA Section 2 or any other special labeling to permit their use on this crop. The only base protectant, broad spectrum fungicide for hops is copper (or copper containing formulations such as Kocide). Follow the label for appropriate fungicide usage as resistance management guidelines may limit total amount of product per acre and per season, and/or total number of applications per season. The label will also tell you of the REI (re-entry intervals) and PHI (pre-harvest intervals) requirements.

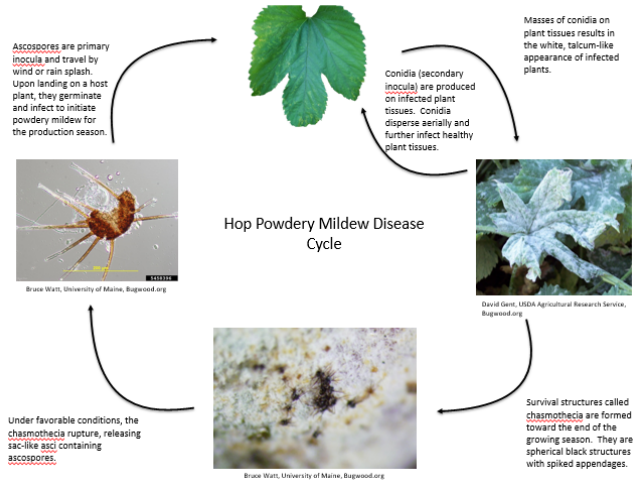
Time of application	**Fungicide selection** **Active ingredient (trade name examples)**	**Comments**
Spray 1: Spike emergence (or GDD 111.3, 6.5°C or 43°F base, Feb 1 start) *For southern WI this often falls within the first week of May*	Fosetyl aluminum (Aliette, Linebacker) Salts of phosphorous acids (Phostrol)	The Aliette program is used in the Pacific northwest with good results. Fosetyl aluminum products cannot be tank mixed with coppers. Phostrol has similar activity as Aliette. Be careful with spray volume and rate – as concentrated Phostrol can potentially be phytotoxic.
Spray 2: 2 weeks after Spray 1 *Roughly May 15*	Cymoxanil (Curzate) Copper hydroxide (Kocide) Dimethomorph (Forum) Cyazofamid (Ranman) Pyraclostrobin + Boscalid (Pristine) Famoxadone + Cymoxanil (Tanos) Mandipropamid (Revus) Ametoctradin + Dimethomorph (Zampro) Mefenoxam (Ridomil Gold SL)	The Curzate + Kocide tank-mix program is used in the Pacific northwest with good results. Curzate and Kocide are good downy mildew fungicides across multiple vegetable crops. Pre-mixes that have good downy mildew and powdery mildew control are: Pristine and Tanos. Price point and availability of products in this list may influence selection. All listed have performed well on downy mildews of various crops. Resistance to Ridomil may exist in downy mildew of WI. Contact UWEX for testing to determine resistance level in your hop yard. Ridomil must be tank-mixed with copper for foliar applications.
Spray 3: 2 weeks after Spray 2 *Roughly May 30*	Fosetyl aluminum (Aliette, Linebacker) Salts of phosphorous acids (Phostrol)	The Aliette program is used in the Pacific northwest with good results. Fosetyl aluminum products cannot be tank mixed with coppers. Phostrol has similar activity as Aliette. Be careful with spray volume and rate – as concentrated Phostrol can potentially be phytotoxic.
Spray 4: 2 weeks after Spray 3 *Roughly June 15*	Cymoxanil (Curzate) Copper hydroxide (Kocide) Dimethomorph (Forum) Cyazofamid (Ranman) Pyraclostrobin + Boscalid (Pristine) Famoxadone + Cymoxanil (Tanos) Mandipropamid (Revus) Ametoctradin + Dimethomorph	The Curzate + Kocide tank-mix program is used in the Pacific northwest with good results. Curzate and Kocide are good downy mildew fungicides across multiple vegetable crops. Pre-mixes that have good downy mildew and powdery mildew control are: Pristine and Tanos. Price point and availability of products in this list may influence selection. All listed have performed well on downy mildews of various crops.

	(Zampro) Mefenoxam (Ridomil Gold SL)	Resistance to Ridomil may exist in downy mildew of WI. Contact UWEX for testing to determine resistance level in your hop yard.
Spray 5: 2 weeks after Spray 4 *Roughly June 30*	<u>Fosetyl aluminum (Aliette, Linebacker)</u> Salts of phosphorous acids (Phostrol)	The Aliette program is used in the Pacific northwest with good results. Fosetyl aluminum products cannot be tank mixed with coppers. Phostrol has similar activity as Aliette. Be careful with spray volume and rate – as concentrated Phostrol can potentially be phytotoxic.
Spray 6: 2 weeks after Spray 5 *Roughly July 15*	*For Powdery and Downy mildew control:* <u>Pyraclostrobin + Boscalid (Pristine)</u> Famoxadone + Cymoxanil (Tanos) *For Powdery mildew control:* Trifloxystrobin (Flint) Tebuconazole (Tebuzol, Orius, Toledo, Monsoon, ONSET, Tebustar) Myclobutanil (Rally, formerly Nova) Quinoxyfen (Quintec) Triflumizole (Procure) Neem oil *For Downy mildew control:* Cymoxanil (Curzate) Dimethomorph (Forum) Cyazofamid (Ranman) Mandipropamid (Revus) Ametoctradin + Dimethomorph (Zampro) Mefenoxam (Ridomil Gold SL)	Powdery mildew (PM), if present, may be problematic at this time of the year. We often see PM on cucurbits and other crops at this time (earlier in hot years). Pristine and Tanos are good pre-mix selections for both PM and Downy mildew. Products with individual disease activity can be tank-mixed. If you have primarily or just a PM problem, good selections include: Flint, Tebustar, Rally, Quintec, Procure. Neem oil and other horticultural oils are good choices for PM control on organic hops. If you have primarily or just a Downy mildew problem, good selections include: Curzate, Forum, Ranman, Revus, or Ridomil Gold SL. As you start to use a reduced risk, single site fungicide multiple times over the production season, keep in mind that some fungicide labels restrict total # of applications per season (ie: Forum, do not apply more than 3X per season).
Spray 7: 2 weeks after Spray 6 *Roughly July 30*	<u>Fosetyl aluminum (Aliette, Linebacker)</u> Salts of phosphorous acids (Phostrol)	See comments above for Spray 5.
Spray 8: 2 weeks after Spray 7 If needed – follow alternation pattern as needed based on status of disease in crop.	<u>Spray 6 program and comments</u>	Pay careful attention to Pre-harvest intervals at this time of the season as you near cone maturity.

Hop Powdery Mildew Background (Dr. Michelle Marks, formerly of UW-Madison Plant Pathology & Soil Science and Amanda Gevens): Wisconsin hop growers should be keeping an eye out for hop powdery mildew, a fungal disease of hops that until recently has been relatively sporadic within WI, with formal diagnosis and reporting in 2016. This disease is a significant issue in the Pacific Northwest and is becoming more prevalent in other hop growing regions of the country as the hop industry expands. Increasing numbers of growers here in Wisconsin are reporting powdery mildew infections in their hop yards, and may wish to consider incorporating fungicides that protect against this disease into their chemical management rotations.

Hop powdery mildew is caused by the fungal pathogen *Podosphaera macularis*. As will be discussed in detail later in this article, the pathogen is capable of overwintering as asexual mycelia in dormant hop buds or in sexually-produced survival structures called chasmothecia. The pathogen resumes growth again in the spring, releasing spores that can to on to infect healthy plant tissue. Disease is favored by moderate temperatures (64-70°F) and cloudy, humid weather.

Symptoms include powdery, white colonies that start small and usually expand over time. Colonies are typically more numerous on the leaf surface, and may be discrete or cover larger surface areas. Chlorosis, or yellowing of plant tissue, may be seen surrounding powdery mildew lesions. Leaves may also develop blister-like symptoms. Hop cones are particularly susceptible to infection. If infected early in their development, cones may abort or become necrotic, distorted, and deformed. Later infections will exhibit the classic fluffy white fungal growth. Hop plants themselves can generally withstand heavy infections and it is these cone infections that lead to yield losses and decreased marketability.



Hop powdery mildew disease cycle created by Dr. Michelle Marks, UW-Madison Plant Pathology & Soil Science. Symptoms can include yellowing and death of foliage. Signs include the white, talcum-like pathogen sporulation, diagnostic of powdery mildew. There are many powdery mildew pathogens and all are favored by similar weather. Hop powdery mildew pathogen has a limited host range of cultivated and wild hops.

Status of hop powdery mildew control in WI: (Amanda Gevens, UW-Madison Plant Pathology) We have observed an increase in incidence and severity of hop powdery mildew over the past few years. In response, growers are incorporating fungicides with specific activity against powdery mildew in prevention of the disease. While their disease names are similar, the pathogens causing powdery mildew and downy mildew are substantially different. Powdery mildew is caused by a true fungus and downy mildew is caused by an oomycete or water mold pathogen. The fungicides relied upon for downy mildew control have little to no activity against the true fungal pathogen that causes powdery mildew. The listing of fungicides for hop powdery mildew is available in the "Hop" Chapter of our 2020 A3422 Commercial Vegetable Production Guide for Wisconsin. **Our UW-Madison Plant Pathology Plant Disease Diagnostic Clinic offers a suite of hop disease tests. The PDDC website is: https://pddc.wisc.edu/**

We are very interested in suspect or certain hop powdery mildew findings to better understand geographic incidence in our region. Please contact me at gevens@wisc.edu with information. Pictures of symptoms are helpful. Thank you!