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. 7 – June 30, 2024

In This Issue:

- Updates in potato and vegetable production research
- Potato and vegetable disease forecasting updates – thresholds met for preventative applications of fungicides for early blight and late blight in some WI locations
- Cucurbit downy mildew
- Diamondback moth, Potato leafhopper, Japanese beetle, Asiatic garden beetle descriptions and management

Calendar of Events:

July 11, 2024 – UW Agricultural Research Station Potato Field Day, Hancock, WI
July 18, 2024 – UW Langlade County Extension & WI Seed Potato Certification Program – Ag Research Station Field Day, Antigo, WI
July 31, 2024 – UW-Madison Rhinelander Agricultural Research Station Potato Breeding Farm Field Day, Rhinelander, WI (contact Becky Eddy)
December 3-5, 2024 – Midwest Food Producers Assoc. Processing Crops Conference, Kalahari Convention Center
January 13-14, 2025 – Wisconsin Agribusiness Classic, Alliant Energy Center, Madison, WI
February 4-6, 2025 – UW-Madison Div. of Extension & WPVGA Grower Education Conference & Industry Show, Stevens Point, WI

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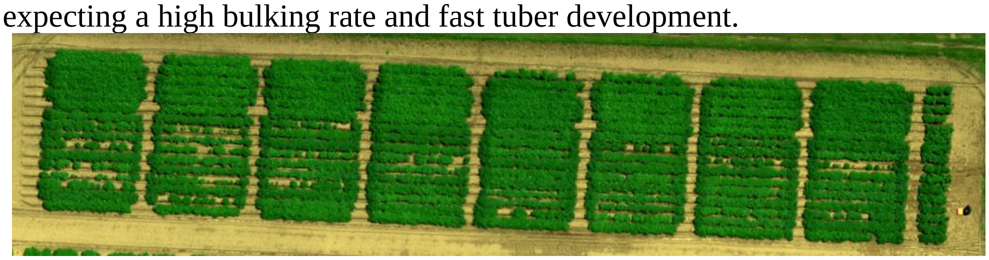
This week most of our potato varieties in the nitrogen trial have shown canopy closure (except for those that showed poor emergence rate and scattered canopy establishment). When digging a couple of Russet Burbank plants, we saw quarter-sized tubers. With the good temperatures and some rainfall in the next week, we are expecting a high bulking rate and fast tuber development.



This summer besides the aerial images collected by the drone, we implemented another precision agriculture technique – the robotic field scout that can capture live videos. This robot is helping us take a closer look at the plants from a different angle so that we can inspect our crops for any signs of stresses, pest pressures or defects real-time. One charging of the battery can last about six hours, and it can walk in the field with varied speed depending on the setup.

The drone-based aerial images collect reflectance values that can indicate the health/vigor/development of the canopy, but all images are 2D. With the robot, we have 3D videos of the plants, and we can use data fusion techniques to lump all information together to inform us of the nutrient status or any early disease potential of the plants. I published this YouTube video to show what we can see from the camera when the robotic dog inspects the snap bean and cucumber fields: https://www.youtube.com/watch?v=uqYKRLytE5k&t=4s

We are having trouble walking the dog in potato fields with closed canopies (the level of plant and soil disturbance is not minimal), so we are making modifications and will try it next week. We also plan to walk the dog on silt loam soil that is harder and might show less soil disturbance after the dog walks by (the weight of the dog is about 100 lbs with sensors, cables and battery).

Something interesting to share is that we took a 3D image of one Silverton tuber using the camera on the dog, and then we successfully printed a duplicate of that tuber using a 3D printer! The material of the duplicate is PLA so the color is not optimal, but we can certainly paint it to look like a russet!

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Current P-Day (Early Blight) and Disease Severity Value (Late Blight) Accumulations will be posted at our website and available in the weekly newsletters. Thanks to Ben Bradford, UW-Madison Entomology for supporting this effort and providing a summary reference table: https://agweather.cals.wisc.edu/thermal-models/potato. 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. Data from the modeling source: https://agweather.cals.wisc.edu/vdifn are used to generate these risk values in the table below. I've estimated early, mid-, and late planting dates by region based on communications with stakeholders. These are intended to help in determining optimum times for preventative fungicide applications to limit early and late blight in Wisconsin.

	Planting Date		50% Emergence Date	Disease Severity Values (DSVs) *through 6/29/2024*	Potato Physiological Days (P-Days) *through 6/29/2024*
Spring Green	**Early**	Apr 3	May 9	**21**	**411**
	Mid	Apr 17	May 12	**21**	**394**
	Late	May 10	May 25	16	293
Arlington	**Early**	Apr 5	May 10	11	**404**
	Mid	Apr 20	May 15	11	**373**
	Late	May 12	May 25	9	294
Grand Marsh	**Early**	Apr 5	May 10	**21**	**390**
	Mid	Apr 20	May 15	**21**	**361**
	Late	May 12	May 25	14	288
Hancock	**Early**	Apr 10	May 17	**24**	**343**
	Mid	Apr 22	May 21	**22**	**313**
	Late	May 14	June 2	17	233
Plover	**Early**	Apr 14	May 18	**21**	**339**
	Mid	Apr 24	May 22	17	**307**
	Late	May 19	June 7	13	191
Antigo	**Early**	May 1	May 24	14	267
	Mid	May 15	June 1	15	226
	Late	June 1	June 15	10	128
Rhinelander	**Early**	May 7	May 25	8	259
	Mid	May 18	June 8	7	164
	Late	June 2	June 16	7	116

Late blight of potato/tomato. The usablight.org website (https://usablight.org/map/) indicates no reports of late blight from the US so far in 2024. The site is not comprehensive. Outside of this site, I'm aware of just the few Florida late blight samples from potato that were processed in my program with the confirmed genotype of US-23. This genotype/clonal lineage is generally still responsive to phenylamide fungicides meaning that Ridomil and Metastar fungicides (mefenoxam and metalaxyl) can still effectively control late blight caused by these strain types.

We accumulated just 0-3 Blitecast Disease Severity Values over the past week in WI. **In the earlier plantings of potato in the Plover areas and southward, we have reached the threshold for the recommendation of foliar fungicides for preventing late blight.** I updated a listing of fungicides for WI potato late blight management for 2024 which can be found at the link below. Base protectants such as chlorothalonil and mancozeb offer broad-spectrum control of fungal and oomycete (water mold – like late blight) pathogens. https://vegpath.plantpath.wisc.edu/wp-content/uploads/sites/210/2022/07/2024-Potato-Late-Blight-Fungicides.pdf

Early blight of potato. Plover and southward, areas of production have reached the threshold for the application of foliar fungicides to limit early blight. P-Day values will continue to amass (up to ~10 per day) and develop conditions optimum for early blight disease caused by *Alternaria solani*. Earliest inoculum typically comes from within a field and from nearby fields. Once established, early blight continues to create new infections due to its polycyclic nature – meaning spores create foliar

infection and the resulting lesion on the plant can then produce new spores for ongoing new infections in the field and beyond. We suspect that we've seen *A. solani* conidia in our air samplers already, but as of early this past week, we haven't yet seen lower canopy early blight lesions in our 'Russet Burbank' research plots at the UW Hancock Agricultural Research Station (planted first week of May). Early season management of early blight in potato can mitigate the disease for the rest of the season.
https://vegpath.plantpath.wisc.edu/diseases/potato-early-blight/

Fungicides can provide good control of early blight in vegetables when applied early on in infection. Multiple applications of fungicide are often necessary to sustain disease management to time of harvest due to the typically high abundance of inoculum and susceptibility of most common cultivars. For Wisconsin-specific fungicide information, refer to the Commercial Vegetable Production in Wisconsin (A3422), a guide available through the UW Extension Learning Store website which is annually updated. Or, for home garden fungicide recommendations, see Home Vegetable Garden Fungicides (D0062), a fact sheet available through the UW Plant Disease Diagnostic Clinic website. Always follow label directions carefully.

For custom values, please explore the UW Vegetable Disease and Insect Forecasting Network tool for P-Days and DSVs across the state (https://agweather.cals.wisc.edu/vdifn). This tool utilizes NOAA weather data. 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. 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 2024 Commercial Veg. Production in WI Extension Document A3422:
https://learningstore.extension.wisc.edu/products/commercial-vegetable-production-in-wisconsin

Cucurbit Downy Mildew: During this past week, downy mildew spores (all Clade 2 – cucumber strain type) were found in air sampling traps in four counties of Michigan (Bay, Muskegon, Monroe and Saginaw). No field disease confirmations were made. This suggests potential dispersal of cucurbit downy mildew pathogen in Michigan. Over the past week there were no new reports of the disease in the US. Previously in this growing season, the disease was confirmed in: NJ, NC and SC. No findings of cucurbit downy mildew in our Wisconsin-based sentinel plots or commercial fields.

No new US counties with reports of cucurbit downy mildew during the past 7 days. Green counties indicate a former report of the disease greater than 7 days ago. From: https://cdm.ipmpipe.org/

Management information can be sourced here: https://vegpath.plantpath.wisc.edu/2022/07/03/update-10-july-3-2022/

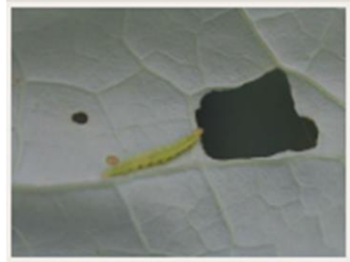
Vegetable Insect Update – Russell L. Groves, Professor and Department Chairperson, UW-Madison, Department of Entomology, 608-262-3229 (office), (608) 698-2434 (cell), e-mail: rgroves@wisc.edu

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

Diamondback moth. (https://vegento.russell.wisc.edu/pests/caterpillar-pests-of-cole-crops/). Continue to scout fields weekly now and throughout the remainder of the season for early season damage. Check plants carefully, even if no feeding damage is apparent and look for eggs that will hatch into small caterpillars in several days. Examine the lower leaves of the plant for the larvae of Diamondback moth (DBM), and especially look for the characteristic 'window-paning' damage. Caterpillars cause varying amounts of damage depending on the plant's maturity, and the stage of their development. Early stages of DBM infestation can be very minor and occur on the undersurface of the leaves.

Caterpillars of DBM are steadily increasing at both the Arlington and Hancock Agricultural Research Stations. They have completed their first full generation as we are observing the woven pupae on the undersurface of leaves now. While scouting, you will often observe the feeding damage associated with larval DBM feeding and immediately adjacent will be the pupa within a silken cocoon.

Diamondback moth



Diamondback moth caterpillar
Photo source

Diamondback moth adult
Photo: David McClenaghan

Keep a record of which stage of development is present and the percentage of plants infested. This information will be useful for monitoring whether the population is increasing or decreasing. Diamondback moth eggs are tiny, flat, circular and cream-colored, laid singly or in small clusters on the leaves. The larvae are small (up to 3/8 inches long at maturity) pointed at both ends and range in color from green to yellow. The diamondback larvae are commonly found on the leaf surface and will wiggle back and forth when disturbed, often falling from the plant. Adults are small grayish-brown, night-flying moths with a 1-inch wingspan. Diamond-shaped markings on the wings are evident when the wings are folded over the back at rest. Behavioral differences between the caterpillars can aid in their identification. The cabbageworm will usually remain motionless when disturbed, whereas DBM will wiggle its body around.

Treatment thresholds are well established and based on the percent of infestation by any lepidopteran species. Economic thresholds (ETs) vary based on the stage of crop development. Cabbage, broccoli and cauliflower in the seedbed are particularly susceptible to damage. Therefore, control measures are warranted when 10% of the plants are affected. Between transplant and cupping, the ET is raised to 30%, from the time plants begin to cup until early heading, if more than 20% of plants are infested, treatment is warranted. From early heading until harvest, the threshold again drops to 10% to protect market quality of the produce. Use pest-specific insecticides in early to mid-season when diamondback moths and cabbageworms are prevalent. Spinosans are another reduced-risk insecticide option. Spinosans are biologically based materials that are quite selectively active on caterpillar pests but are safe to beneficials. Many chemical insecticides are also effective in controlling caterpillar pests of cole crops.

Potato leafhopper – (https://vegento.russell.wisc.edu/pests/aphids/). Pay careful attention to the presence of immature (nymphal) potato leafhoppers (PLH) in susceptible crops!! Hops, succulent bean, potato and eggplants can be especially damaged. The first signs of leafhopper feeding are the leaf veins turning pale and the leaf curling. Continued feeding results in a characteristic triangular yellowing or browning of the leaf tip known as "hopperburn." As symptoms develop, lesions spread backward and inward from the margin, eventually destroying

the entire leaf. Plants become stunted and yellow leaves curl upward. More damage is attributed to the nymphs than the adults. Leafhopper damage may take weeks before symptoms begin to show and it is typically older leaves that display the "hopperburn" symptomology. Yield loss generally occurs before symptoms are readily seen. Though plants may show little evidence of hopperburn, yield losses can be substantial.

Japanese beetles. (https://vegento.russell.wisc.edu/pests/japanese-beetle/) - Japanese beetles have only one generation per year. In mid-June or around 1000 growing degree day units, adults begin emerging from the soil. We have already observed an early emergence of adult Japanese beetles across much of southern Wisconsin, but the bulk of the adult emergence is just underway.

Immediately thereafter, females mate with males and begin laying eggs. Adult beetles are most active in the afternoon in full-sun. Females leave ornamental plants where they feed and mate, and burrow two to four inches into the soil (under the turf and in mulched areas) in a suitable area to lay their eggs. Eggs hatch in about two weeks, after which grubs begin feeding on the roots of turfgrass and ornamental plants.

Japanese beetle (*Popillia japonica*)
Photo: Bruce Marlin

Mid-summer rainfall and adequate soil moisture are needed to prevent eggs and newly-hatched grubs from drying out. Adult females instinctively lay their eggs in areas with higher soil moisture content to ensure survival of their offspring. Older grubs are more drought-tolerant and will move deeper into the soil if conditions become dry. Grubs can also withstand elevated levels of soil moisture, so excessive rainfall or irrigation will not affect them.

As soil temperatures cool in the fall, and the first meaningful frost occurs, grubs begin to move deeper into the soil. Grubs overwinter in the soil about two to six inches below the surface, although some may be a deep as 20 inches. They become inactive when soil temperatures fall below 50°F. In the spring, when soil temperatures reach 50°F, the grubs begin to move up into the root-zone to resume feeding for about three to five weeks. Thereafter, the grubs stop feeding and begin creating an earthen cell where they pupate (i.e., transform) into adults.

Both the adults and grubs of Japanese beetles cause damage. Thus, controlling one life stage will not preclude potential problems with the other. Control options for each life stage are presented below.

Physical removal and trapping of adults: Removing beetles by hand, or trapping, may provide adequate protection for small plantings when beetle numbers are low. However, Japanese beetle adults can migrate from other areas, and the presence of beetles on or near a plant will attract more beetles. Consequently, use of Japanese beetle traps often attracts more beetles, and results in subsequent damage to plants.

Chemical control of adults: Several insecticides are labeled for use against adult Japanese beetles. Always follow label directions. Treat foliage and flowers thoroughly. For optimal control, apply in the afternoon when beetles are most active.

Cultural control of grubs: Because Japanese beetle eggs and young grubs have difficulty surviving in dry soil conditions, withholding irrigation during peak adult beetle flight may help to reduce grub populations. However, adequate soil moisture in late-August and September can help damaged turf recover from grub damage.

Biological control of grubs: Although there are a few biological control products that allegedly control Japanese beetle grubs, the performance of these products has been inconsistent. Biological control products include milky spore disease, insect-parasitic nematodes, and fungal pathogens such as *Beauveria bassiana* and *Metarhizium*.

Chemical control of grubs: Nearly all soil insecticides provide adequate control of Japanese beetle grubs. However, not all control products perform equally. The traditional approach has been to apply short-residual products after eggs have hatched, but before grubs cause visible damage. This approach is termed "curative" control. The optimal timing for curative treatments is early to mid-August. Carbaryl (Sevin), clothianidin (Arena) and trichlorfon are three active ingredients that all provide meaningful curative control. Preventative insecticides are another effective management option that is typically preferred over curative insecticides due to greater level of control and a larger application window of time, May to July, due to their longer residual activity. Preventative insecticides are best applied prior to egg lay, typically early July. Preventative products contain the active ingredients imidacloprid, chlorantraniliprole, clothianidin and thiamethoxam.

Asiatic garden beetle – (https://entomology.wisc.edu/2023/07/31/asiatic-garden-beetle-a-new-pest-to-have-on-your-radar/). There is a new insect pest to have on your radar in Wisconsin—the Asiatic garden beetle (AGB) (*Maladera formosae*). This species can feed on and damage a wide range of plants including vegetable crops, field crops, fruit crops, turfgrass, and ornamental flowers, trees, and shrubs in nursery and landscape settings.

The non-native AGB is originally from parts of eastern Asia and was first detected in the US in 1921. It can now be found across much of the eastern US. Over the last two decades, AGB has become more common in the Midwest with crop damage being reported in Indiana and southern Michigan in soybean, mint and potatoes. It is also established in parts of northern Illinois. Asiatic garden beetles were first collected in Wisconsin in July 2021 in a residential yard in Dane County (Middleton). Small numbers of adults continue to be spotted at that site, although no feeding or plant damage has been observed to date. In late July 2023, beetles were collected from a home garden in eastern Green Lake County; this is also the first confirmed report of plant damage in the state.

The AGB has a single generation each year, and adults have primarily been spotted in July in Wisconsin, although some specimens have been collected as late as September. Adults are nocturnal and feed almost exclusively after dark. If disturbed, they tend to tumble to the ground and hide. Adult AGBs are capable fliers and can come to lights in large numbers; blacklight traps can be a useful monitoring tool. In addition, adult flight activity is strongly associated with warm nighttime temperatures (70+˚ F). After mating, adult females lay eggs in soil. Reports from nearby states indicate that larvae may be more common in sandy soil compared to loamy areas.

Both the larvae and adults can feed on a wide range of plants. Adult AGBs tend to pack less of a punch than Japanese beetles but can chew irregular notches out of leaves. The larvae can be a considerable issue in potato fields when they normally feed on roots until vine-killing. After vine killing, roots will die, and the grubs will switch to other below-ground structures (tubers) to feed causing considerable damage. An abundance of AGB grubs resulting in below-ground wounds can serve as a potential entry point for pathogens that can cause storage rots.

Asiatic garden beetles belong to the same family as Japanese beetles and the larvae (white grubs) resemble this species. Larvae have pale, C-shaped bodies with three pairs of jointed legs and a brownish-orange head capsule and chewing mouthparts. They have a pale, bulbous structure at the base of their mouthparts which aids in diagnosis (no other white grubs in the Midwest have that feature). Adults AGBs are approximately 3/8 inch long, brownish, and resemble small May/June beetles; their elytra (wing covers) are also slightly iridescent.

Photo: P. Liesch, UW-