UW PEST MANAGEMENT Fast Facts

University of Wisconsin-Madison, Nutrient and Pest Management Program (NPM) and Integrated Pest Management Program (IPM)

WEED RESISTANCE

DOCUMENTED WEED RESISTANCE IN WI – 2019

Group	Herbicide Site of Action	Weed species	Year (1st case)
1	**ACCase** inhibitors	Giant foxtail	1991
		Large crabgrass	1992
2	**ALS** inhibitors	Kochia	1995
		Eastern black nightshade	1999
		Giant foxtail	1999
		Green foxtail	1999
		Waterhemp ‡	1999
		Giant ragweed	2013
		Common ragweed	2013
		Palmer amaranth*	2014
5	**PS II** inhibitors	Common lambsquarters	1979
		Smooth pigweed	1985
		Kochia	1987
		Velvetleaf	1990
		Palmer amaranth*	2019
9	**EPSP**	Giant ragweed	2011
		Horseweed	2013
		Palmer amaranth*	2013
		Waterhemp ‡	2013
		Common ragweed	2018
14	**PPO** inhibitors	Waterhemp ‡	2016
27	**HPPD** inhibitors	Palmer amaranth*	2014

* indicates multiple resistance to ALS, EPSP and HPPD inhibitors
‡ indicates multiple resistance to ALS, EPSP and PPO inhibitors

AVOID HERBICIDE RESISTANCE IN WEEDS

- ✓ **Always start with a clean field.** Use burndown treatments or tillage in combination with preemergence and postemergence herbicides.
- ✓ **Rotate herbicides and use the recommended rate.** Mix and rotate multiple herbicide sites of action with overlapping weed spectrums. Use the full recommended rate, correct spray height and application timing for the hardest to control weed.
- ✓ **Rotate crops.** Use diverse crop rotations; three or four crops in rotation provide more resistance protection than two. Where possible, use crops with different life cycles.
- ✓ **Use mechanical weed control methods.** Rotary hoe and/or cultivate to complement herbicide treatments where appropriate.
- ✓ **Scout regularly for weeds.** Know your weeds! Respond quickly when herbicide resistance is suspected and control escaping weeds as needed. *Do not allow them to produce seed.* Pay attention to field borders and headlands.
- ✓ **Practice prevention.** Do not move weed seed around. Clean all farm equipment prior to moving from fields/farms with resistant weeds to other fields/farms.

SIGNS OF HERBICIDE RESISTANT WEEDS

- ✓ Weed species is labeled for control, and application was made at correct weed height.
- ✓ There were no herbicide application errors.
- ✓ Environment was favorable for good herbicide performance.
- ✓ Only one species escaped control.
- ✓ Weed is healthy while neighboring weeds of the same species have died.
- ✓ Respraying did not control the weed.
- ✓ Weed was not controlled in the same patch in the past and the patch is getting larger.
- ✓ Weed was not controlled by different herbicides with the same site of action in the past.
- ✓ The same site of action has been used frequently.

Adjuvant rate conversions

Adjuvant rate	Amount/ 100 gallons	Spray volume (GPA) 20	15	10
		Adjuvant rate per acre		
2%	2 gallons	3.2 pints (51.2 ounces)	2.4 pints (38.4 ounces)	1.6 pints (25.6 ounces)
1%	1 gallon	1.6 pints (25.6 ounces)	1.2 pints (19.2 ounces)	0.8 pint (12.8 ounces)
0.5%	2 quarts	0.8 pint (12.8 ounces)	0.6 pint (9.6 ounces)	0.4 pint (6.4 ounces)
0.25%	1 quart	0.4 pint (6.4 ounces)	0.3 pint (4.8 ounces)	0.2 pint (3.2 ounces)
0.125%	1 pint	0.2 pint (3.2 ounces)	0.15 pint (2.4 ounces)	0.1 pint (1.6 ounces)

Field sprayer calibration equations

$$\text{Speed (mph)} = \frac{\text{Distance (in feet)} \times 60}{\text{Time (in seconds)} \times 88} \qquad \text{GPA} = \frac{5{,}940 \times \text{GPM (per nozzle)}}{\text{mph} \times W^*}$$

*W stands for nozzle spacing for broadcast application or spray width for single nozzle or band applications.

Conversions

- Celsius = (Faranheit - 32) x .55
- 1 tablespoon = 0.5 fluid oz
- 2 tablespoons = 1.0 fluid oz
- 32 fluid ounces = 1 quart
- 128 fluid ounces = 1 gallon
- 1 pound/acre = 1.12 kilogram/hectare
- 1 square mile = 640 acres
- 1 acre = 43,560 square feet
- 1 mile = 5,280 feet
- 1 mile/hour = 88 feet/minute

INSECT PEST TREATMENT THRESHOLDS

FIELD CORN TREATMENT THRESHOLDS

Armyworm	One or more armyworms on 75% of the plants or 2 armyworms on 25% of the plants. Average armyworm length must be ≤ 1 inch to merit treatment.
Black cutworm	2–5% of plants damaged and larvae are ≤ 6th instar. Use the head capsule gauge below to determine instar.
Corn leaf aphid	50% or more of the plants have > 50 aphids per plant. Plants are in the late-whorl to early tassel stages.
Corn rootworm beetle	For pollination protection: Treat before 70% silking if silks are clipped to within ½ inch of husk. For root protection: Following corn, treat when counts average 0.75 beetles per plant during the egg laying period of mid-Aug. to early Sept. of the previous year. Following soybean, treat corn if yellow sticky trap catches average more than 1.5 Western corn rootworm beetles/trap/day during the egg laying period of Aug. to early Sept.
European corn borer (ECB)	ECB has two generations per year in most of Wisconsin. Peak spring moth flights occur at 630 GDD. Peak summer moth flights occur at 1700 GDD. Use the worksheets in UWEX publication A3646 *Pest Management in Wisconsin Field Crops* to determine if treatment for ECB is justified.
Japanese beetle	Treat if corn is pollinating and there are >3 beetles/ear and silks being clipped within ½ inch of ear tip.
Two-spotted spider mite	Control may be necessary when 15–20% of the leaf area is covered with colonies and moderate damage is noted and hot, dry conditions are expected to continue. The greatest benefit of miticides normally occurs prior to dent stage. Thorough corn leaf coverage is necessary for control.
Western bean cutworm (WBC)	Scout 20 consecutive corn plants at 5 locations in a field to obtain a representative field sample. Treat if 5% of sampled plants have egg masses and/or small larvae.

No established thresholds for seed corn maggot, white grubs, wireworms, hop vine borer or slugs.

ALFALFA TREATMENT THRESHOLDS

Avoid insecticide applications within 7 days of cutting

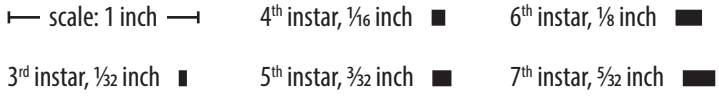
Alfalfa blotch leafminer	30–40% of leaflets showing pinhole feeding.
Alfalfa plant bug Tarnished plant bug	3 per sweep on 3 inch or shorter alfalfa. 5 per sweep on alfalfa taller than 5 inches.
Alfalfa weevil	1st cutting: 40% or more of stems showing feeding and prior to one week of harvest. 2nd cutting: 50% or more of stems showing feeding.
Meadow spittlebug	1 nymph per stem.
Pea aphid	Minimum of 100 aphids per sweep.
Potato leafhopper	0.2/sweep on 3 inch alfalfa. 0.5/sweep on 6 inch alfalfa. 1/sweep on 8–11 inch alfalfa. 2/sweep on alfalfa taller than 12 inches.

SMALL GRAINS TREATMENT THRESHOLDS

Armyworm	3 armyworms per sq. foot.
Bird-cherry aphid Oat aphid English grain aphid Corn leaf aphid	Delay planting until September 15th. Seedlings: 30 aphids per stem. Boot to heading: 50 aphids per stem.
Cereal leaf beetle Wireworm	1 larvae per flag leaf.
Greenbug	Seedlings: 20 aphids per stem. Boot to heading: 30 aphids per stem.
Grasshopper	Treat if grasshoppers average 20 per sq. yard on field edges or 8 per sq. yard for a field average. For most effective control, apply when grasshoppers are small.

HEAD CAPSULE GUAGE for black cutworm

To determine the instar stage of larvae, hold the head between thumb and forefinger, and place on the closest corresponding ruler.



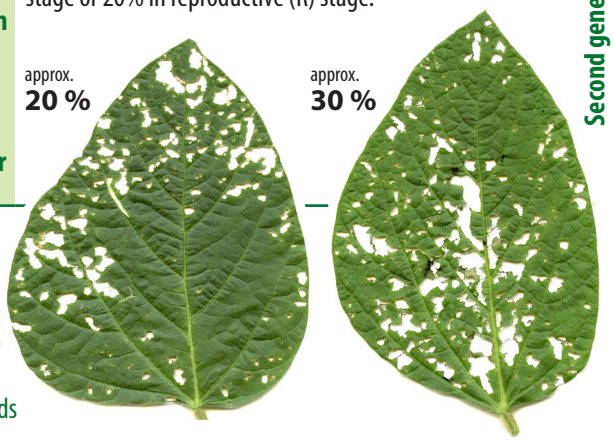
Stalk borer thresholds based on corn price and expected yield

Thresholds based on $13.00/acre control costs and 80% control with insecticides. (Adapted from Erin Hodgson, Iowa State University.)

	$3/bu				$4/bu				$5/bu				$6/bu			
	--- Expected yield bu/a ---				--- Expected yield bu/a ---				--- Expected yield bu/a ---				--- Expected yield bu/a ---			
leaf stage	**150**	**175**	**200**	**225**	**150**	**175**	**200**	**225**	**150**	**175**	**200**	**225**	**150**	**175**	**200**	**225**
1	5.8	4.9	4.3	3.8	4.3	3.7	3.2	2.9	3.5	3.0	2.6	2.3	3.0	2.5	2.2	1.9
2	7.1	6.0	5.3	4.7	5.3	4.5	4.0	3.5	4.2	3.6	3.2	2.8	3.5	3.0	2.7	2.4
3	9.3	8.0	7.0	6.2	7.0	6.0	5.3	4.7	5.6	4.8	4.2	3.7	4.7	4.0	3.5	3.1
4	9.9	8.5	7.4	6.6	7.4	6.4	5.6	5.0	5.9	5.1	4.5	4.0	5.0	4.3	3.7	3.3
5	11.3	9.7	8.5	7.6	8.5	7.3	6.4	5.7	6.8	5.8	5.1	4.5	5.7	4.9	4.3	3.8
6	19.8	17.0	14.9	13.2	14.9	12.8	11.2	9.9	11.9	10.2	8.9	7.9	9.9	8.5	7.4	6.6
7	54.7	46.9	41.1	36.5	41.1	35.2	30.8	27.4	32.8	28.2	24.6	21.9	27.4	23.5	20.5	18.2

SOYBEAN TREATMENT THRESHOLDS

Soybean aphid	Avoid treating soybean aphid when they first appear. Scout fields weekly to find rate of population increase. Count number of aphids on 20–30 plants per field. Check upper leaves and stems where aphids congregate. Continue scouting through the R5 pod stage. Treat when approximately 80% of the field has reached an average of 250 aphids per plant and the population is actively increasing. This threshold applies to R1–R5. Treating after R6 has not been shown to increase yield.
Green stinkbug	Treat when adults and/or nymphs reach 1 per foot of row during pod fill. If "narrow rows", threshold is 40/100 sweeps.
Two-spotted spider mite	Treatment may be warranted if: Mites are present between bloom (R1) and pod fill (R5). 15% or more leaf area on plants are discolored and stippled with leavings yellowing. Live mites are present. Hot, dry weather is expected to continue.
Potato leafhopper	2 per plant with ≤ 3 trifoliate leaves. R1-R2: 6 per plant on flowering soybean. R4: 13 per plant on soybean at full pod.
Seed corn maggot	No established thresholds. Monitor degree days to avoid peak flight periods (360 DD, 1080 DD, base 39º F).
Grasshopper Green cloverworm Japanese beetle Wooly bear caterpillar Thistle caterpillar	Treat when defoliation reaches 30% in vegetative (V) stage or 20% in reproductive (R) stage.



Defoliation thresholds should be based on leaves sampled from the entire plant, not just the upper leaves. Also, keep in mind that estimating leaf damage in the field is a subjective observation, not an exact measurement; just getting it in the 'ballpark' is acceptable.

Additional pest management resources

UW Wisconsin Crop Manager: https://ipcm.wisc.edu/wcm/

UW Corn Agronomy: http://corn.agronomy.wisc.edu

UW Field Crop Disease: http://badgercropdoc.com

UW Insect Diagnostics: http://labs.russell.wisc.edu/insectlab/

UW Plant Disease Diagnostics: https://pddc.wisc.edu

UW Soybean Research: https://coolbean.info

UW Weed Science: http://www.wiscweeds.info

DACTP Wisconsin Pest Bulletin: http://datcpservices.wisconsin.gov/pb/index.jsp

Bean leaf beetle thresholds based on soybean price and control cost

Overwintering adults (per soybean plant)

	VC growth stage			V1 growth stage			V2 growth stage		
Control	**$6**	**$8**	**$10**	**$6**	**$8**	**$10**	**$6**	**$8**	**$10**
$5/bu	2.4	3.2	4.0	3.7	5.0	6.2	5.9	7.8	9.8
$6/bu	2.0	2.7	3.4	3.1	4.1	5.2	4.9	6.5	8.1
$7/bu	1.6	2.2	2.8	2.5	3.2	4.2	3.9	5.2	6.4
$8/bu	1.2	1.7	2.2	1.9	2.3	3.2	2.9	3.9	4.7
$9/bu	0.8	1.2	1.6	1.3	1.4	1.2	1.9	2.6	3.0
$10/bu	0.4	0.7	1.0	0.7	0.5	0.2	0.9	1.3	1.3

First generation adults (per 20 sweeps)

Control	**$7**	**$8**	**$10**	**$12**	**$15**
$5/bu	23.0	26.2	32.6	39.0	48.6
$6/bu	19.3	22.0	27.3	32.6	40.6
$8/bu	14.6	16.6	20.3	24.6	30.6
$10/bu	11.8	13.4	16.6	19.8	24.6
$13/bu	9.2	10.5	12.9	15.4	19.1

Second generation adults (per 20 sweeps)

Control	**$10**	**$11**	**$12**	**$13**	**$14**	**$15**	**$16**	**$17**
$7/bu	4.45	4.89	5.34	5.78	6.22	6.67	7.11	7.56
$8/bu	3.89	4.28	4.67	5.06	5.45	5.84	6.22	6.61
$9/bu	3.46	3.8	4.15	4.50	4.84	5.19	5.53	5.88
$10/bu	3.11	3.42	3.73	4.05	4.36	4.67	4.98	5.29
$11/bu	2.83	3.11	3.40	3.68	3.96	4.24	4.53	4.81
$12/bu	2.59	2.85	3.11	3.37	3.63	3.89	4.15	4.41
$13/bu	2.39	2.63	2.87	3.11	3.35	3.59	3.83	4.07
$14/bu	2.22	2.45	2.67	2.89	3.11	3.33	3.56	3.78

Source: Dr. Erin W. Hodgson, Extension Entomologist, Iowa State University

SOYBEAN CYST NEMATODE (SCN)

How to collect soil samples for testing

1. Use a soil probe or narrow-bladed trowel or shovel. Take cores close to plants at a depth of 8–10 inches. Discard the upper 2 inches of soil, especially if it is dry. Be sure to include plant roots.

2. Submit one sample for a 10-acre field or for a suspected area within the field. Sample from plants in the margins of suspected area, not from their centers. Collect in a zigzag pattern across the field. Collect from areas of similar soil texture and cropping history. If different crops were grown or there is markedly different soils within a field, sample separately.

3. Take soil and roots from 12–20 plants and mix into one sample (1–2 pints of soil). Place in a sturdy plastic bag (or soil sample bag), fasten the open end securely and label accurately with an indelible marker. Keep the samples out of the sun and don't let them dry out.

4. Mail as soon as possible (early in the week to avoid delays in transit). Mail to the Plant Disease Diagnostic Clinic,1630 Linden Drive, University of Wisconsin, Madison, WI 53706. Consult with your county extension agent about private laboratories that conduct SCN analyses.

FUNGICIDE MANAGEMENT

GUIDELINES FOR FUNGICIDE RESISTANCE MANAGEMENT

- ✓ **Choose hybrids/varieties adapted** for your region; resist the temptation to "push" relative maturity or maturity group for your region.
- ✓ **Plant disease-resistant** hybrids/varieties whenever possible.
- ✓ **Maintain** proper soil fertility.
- ✓ **Avoid sites** with a history of high disease pressure.
- ✓ **Utilize** a crop rotation that fits your area and field history.
- ✓ **Scout** fields on a regular basis, noting incidence and severity of diseases. Use this information to develop a field history for future disease management decisions.
- ✓ **Tank mix** high-risk fungicides with fungicides that have different modes of action, are active against the targeted disease(s), and have similar lengths of residual activity.
- ✓ **Do not use** reduced rates of fungicides.
- ✓ **Alternate** or tank mix fungicides with different modes of action when multiple applications are required.
- ✓ **Apply fungicides preventively** or early in the disease cycle and when a disease threat is warranted.
- ✓ **Avoid curative** fungicide applications, especially with high-risk fungicides.
- ✓ **Monitor weather conditions in-season;** warm dry weather does not promote disease development. You might be able to avoid having to make a fungicide application altogether in some years.
- ✓ **For more information,** consult University of Wisconsin Extension publication: A3878, *Fungicide resistance management in corn, soybean, and wheat in Wisconsin*.

NPM
April 2020

This publication is available from the Nutrient and Pest Management (NPM) Program.
For copies, contact us:
email (npm@hort.wisc.edu);
phone (608) 265-2660 or visit our website (ipcm.wisc.edu)

College of Agricultural & Life Sciences
UNIVERSITY OF WISCONSIN–MADISON

FUNGICIDE APPLICATION TIMING FOR CORN, SOYBEAN AND WHEAT

Below are some general guidelines for preferred timing of fungicide application, targeted pathogens and tools to help you make the decision to spray fungicide or not. For more information, consult University of Wisconsin Extension publication, A3646 *Pest Management in Wisconsin Field Crops*.

FIELD CORN

- ✓ **The best time to apply fungicide for foliar disease control in Wisconsin corn is during VT–R1 growth stages.**
- ✓ Use past history of disease, scouting information and weather forecasts to make the decision to spray or not.
- ✓ For diseases such as gray leaf spot and northern corn leaf blight, scout the lower canopy prior to the VT growth stage. If symptoms of these diseases are present on the lower leaves on 50% or more plants, there is a history of these diseases in the field, and weather is warm, wet/humid, then a fungicide might be warranted to protect the upper leaves.
- ✓ Other factors to consider are the susceptibility of the hybrid being grown, the presence of previous crop corn residue and supplemental irrigation.

VT: The last branch of the tassel is completely extended; silks have not emerged from the ear sheaths. **R1:** The silks are visible outside the husks.

SOYBEAN

- ✓ **Fungicides should be applied between the R1– R4 growth stages based primarily on the risk for white mold and foliar disease such as frogeye leaf spot.**
- ✓ Use past field history to gauge the risk of white mold and foliar disease.
- ✓ Use the Sporecaster smartphone app to make the decision to apply fungicides for targeting white mold.
- ✓ Scout during bloom (R1–R3) to make a decision to apply fungicide for foliar disease control. Make the decision to spray for foliar diseases if symptoms are present and weather is warm, wet/humid.

R1: One open flower anywhere on the main stem. **R2:** An open flower at one of the two uppermost nodes on the main stem with a fully developed leaf. **R3:** 3/16 inch long pod at one of the four uppermost nodes on the main stem with a fully developed leaf. **R4:** 3/4 inch long pod at one of the four uppermost nodes on the main stem with a fully developed leaf.

THE LABEL IS THE LAW

Always read and follow the pesticide label.

Pay close attention to the maximum number of sprays allowed per season, recommended application rates and application timing for both target pest and plant growth stage.

WHEAT

- ✓ **In Wisconsin, fungicide applications prior to Feekes 8 are generally not economically viable.**
- ✓ **Scout at the Feekes 8 growth stage** to gauge foliar disease pressure, especially from stripe rust. If active disease is present, a fungicide might be warranted at this time, especially if weather is forecasted to be wet.
- ✓ Plan to apply a fungicide at the **Feekes 10.5.1** growth stage or up to 5 days after the start of this growth stage to protect wheat against Fusarium head blight.

Feekes 8: Flag leaf is visible but still rolled up; it must be protected from disease or insect damage to ensure the plant's full yield potential. **Feekes 10.5.1:** Flowering begins; starting slightly above the middle portion of the head and continuing towards the top.