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Considerations for Fall 2021: Weed Seed Management and Cover Crop Establishment

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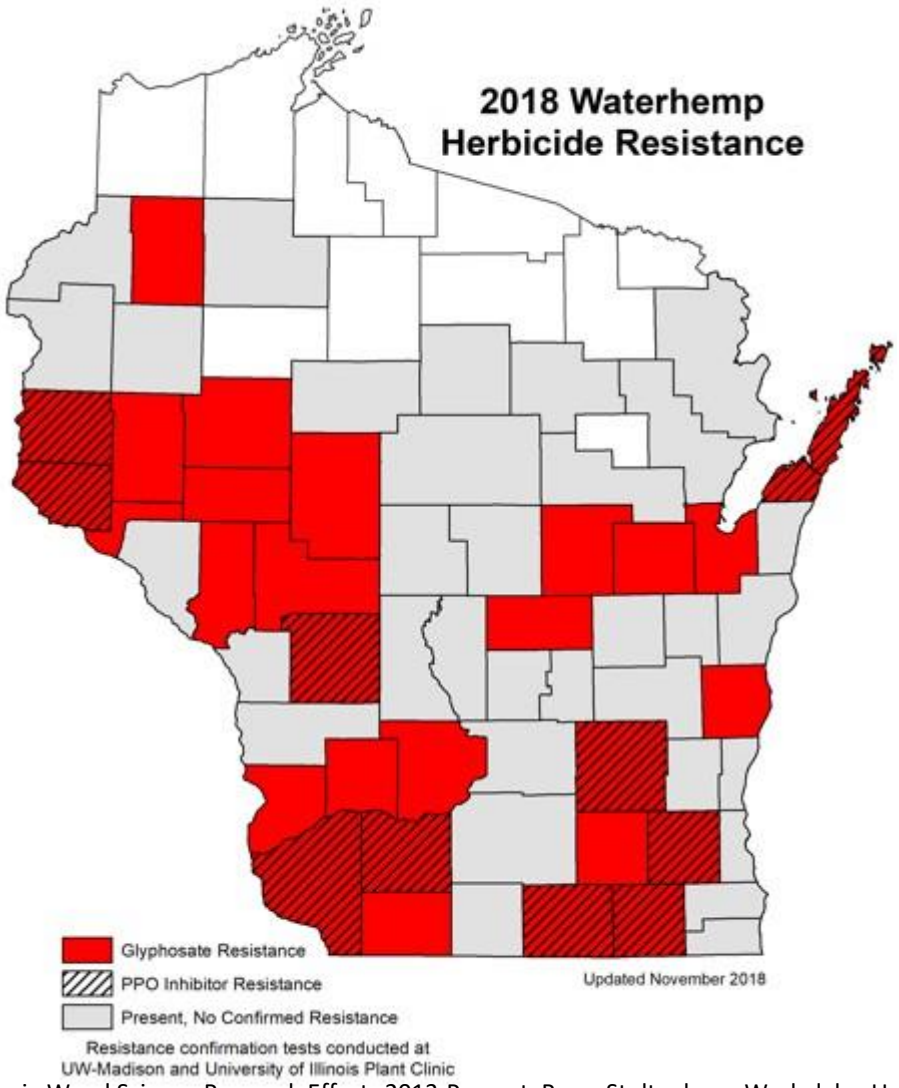
Why Fall Weed Seed Management Matters



Source: Wisconsin Weed Science Research Efforts 2013-Present; Renz, Stoltenberg, Werle labs; University of Wisconsin-Madison; Illinois Plant Clinic Dataset

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Fall Weed Seed Management- Seed Retention

WEED SEED PRODUCTION & RETENTION IN SOYBEAN

TABLE 1

		Seed Production per plant		Seed Retention % at harvest	
		2013	2014	2013	2014
Palmer amaranth	Arkansas	50,022 ± 8,209	33,195 ± 5,775	99.98 ± 0.00	99.85 ± 0.05
	Illinois	26,038 ± 3,753	-	99.95 ± 0.03	-
	Nebraska	36,978 ± 5,399	58,004 ± 9,434	98.89 ± 0.23	99.93 ± 0.02
	Missouri	13,384 ± 27,363	60,221 ± 21,991	99.98 ± 0.00	99.67 ± 0.20
	Tennessee	22,833 ± 4,914	-	99.96 ± 0.01	-
Waterhemp	Illinois	25,649 ± 5,800	11,833 ± 2,277	99.98 ± 0.01	94.98 ± 0.94
	Nebraska	60,228 ± 8,348	82,811 ± 15,051	99.99 ± 0.00	99.63 ± 0.10
	Missouri	19,727 ± 2,493	23,787 ± 4,200	100.00 ± 0.00	99.84 ± 0.04
	Wisconsin	17,459 ± 2,625	38,221 ± 7,956	99.96 ± 0.00	98.80 ± 0.30

Adapted from: Schwartz, L., Norsworthy, J., Young, B., Bradley, K., Kruger, G., Davis, V., Steckel, L., Walsh, M. (2016). Tall Waterhemp (*Amaranthus tuberculatus*) and Palmer amaranth (*Amaranthus palmeri*) Seed Production and Retention at Soybean Maturity. Weed Technology, 30(1), 284-290. doi:10.1614/WT-D-15-00130.1

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Fall Weed Seed Management- Seed Retention

TABLE 2	Total Seed Captured per plant	% Seed Shattered before crop harvest	% Seed Shattered during harvest delay	% Retained on plant after simulated harvest
Redroot pigweed	149,427 ± 27,267	7.2 ± 1.1	7.7 ± 0.9	85.1 ± 17.5
Common ragweed	2,204 ± 382	7.2 ± 1.2	14.1 ± 2.4	78.7 ± 15.3
Common lambsquarters	62,091 ± 11,332	4.3 ± 0.7	40.6 ± 8.1	55.2 ± 12.0
Common cocklebur	1,325 ± 155	14.4 ± 3.5	48.2 ± 8.2	38.9 ± 5.5
Giant foxtail	26,334 ± 2,124	26.3 ± 3.6	24.0 ± 2.8	49.8 ± 5.2
Large crabgrass	84,721 ± 11,637	46.3 ± 6.9	13.7 ± 1.9	40.0 ± 7.7

Adapted from: Haring S. (2017) Harvest Weed Seed Control: An Integrated Weed Management Strategy for Organic and Conventional Production System. M.S. Thesis. Blacksburg, VA: Virginia Tech. 64 p

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Waterhemp Seed

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Waterhemp Seed Dispersal: Combines

Photo Credit: Dr. Mark Loux, Weed Scientist,
The Ohio State University

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Combine Weed Seed Dispersal

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Combine Cleaning

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Where Weed Seeds Hide

Combine Cleaning Video!

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Where Undesired Seeds May Hide

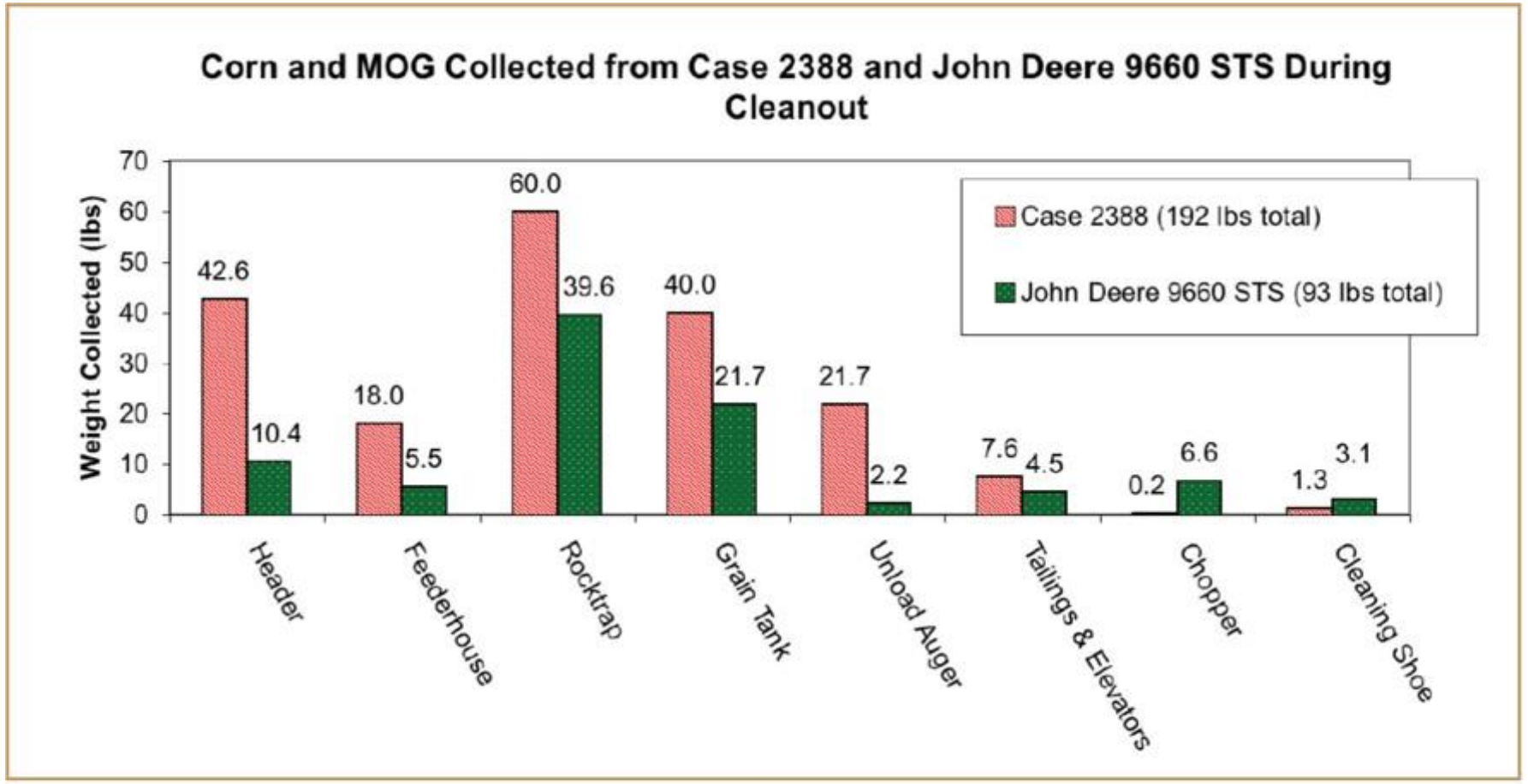

Figure 1. *Material collected inside combines during cleaning.*

John Deere data courtesy of: Hanna, H.M., Quick, G.R., and Jarboe, D.H. 2004. Combine Cleanout for Identity Preserved Grains. Proceedings of the 2004 International Quality Grains Conference, Indianapolis, Indiana. July 19-22, 2004

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So Your Going To Clean Your Combine Between Fields?

Read, Follow, and Understand all safety instructions for the combine and cleaning equipment!

Use proper Personal Protective Equipment!


Photo: Mimi Broeske

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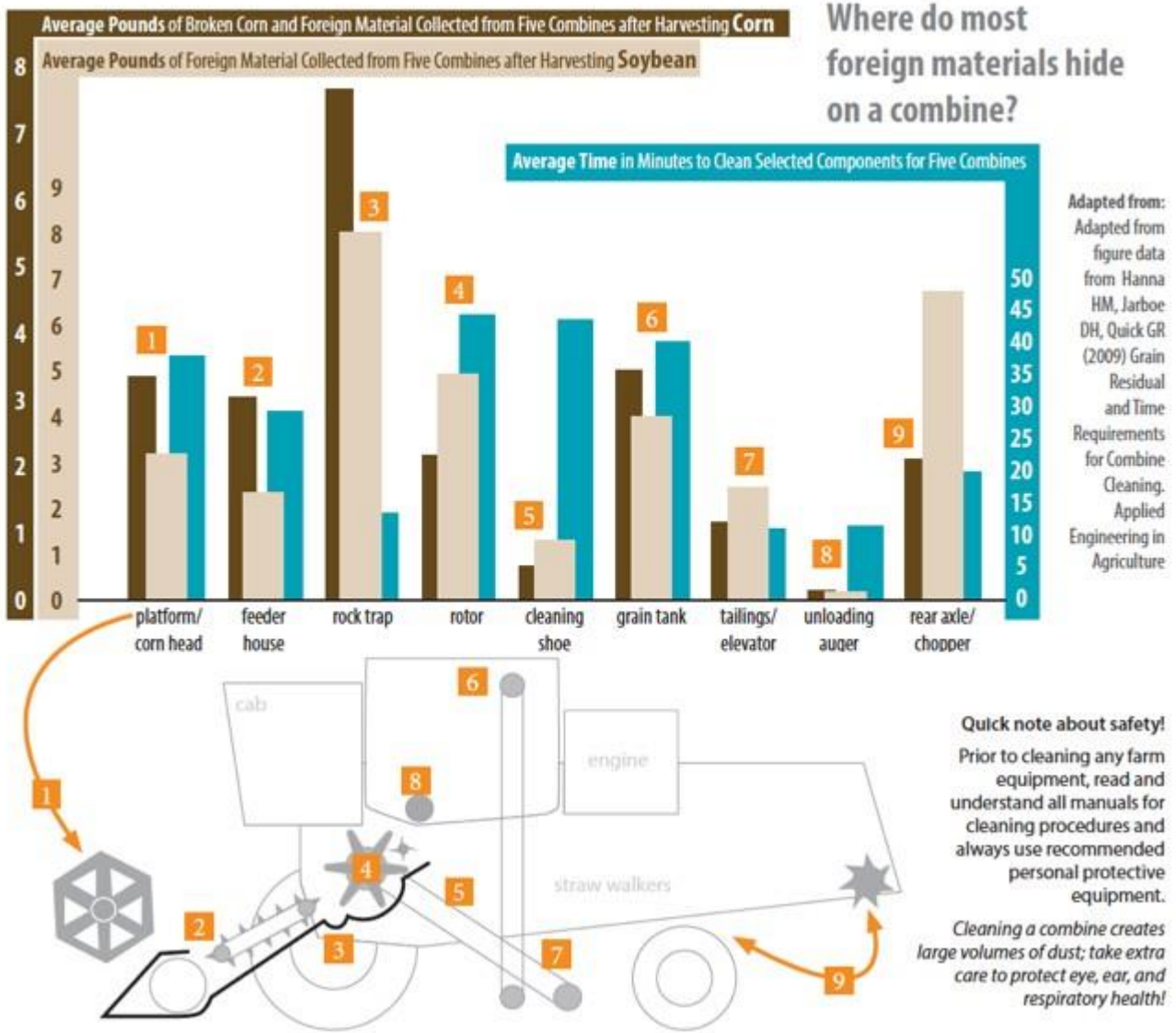
Where to Focus Cleaning Time



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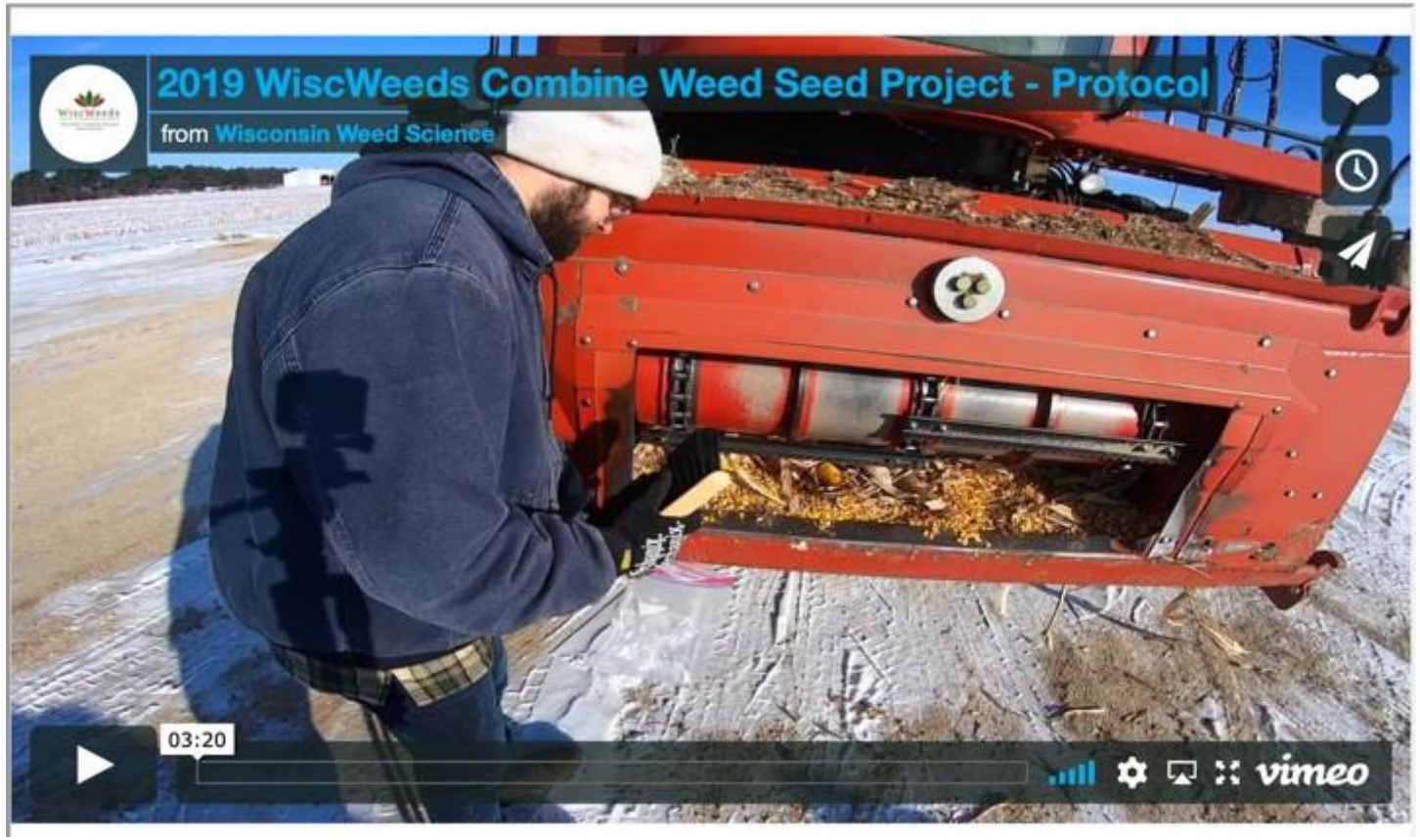
Weed Seed Movement Through Combines: 2020 Study

Nick Arneson: Outreach Specialist UW-Madison Cropping Systems Weed Science Program
Dr. Rodrigo Werle: UW-Madison Extension Cropping Systems Weed Scientist

Thank you to everyone who helped collect samples for this project!



Cropping Systems Weed Science
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Weed Seed Movement Through Combines: 2020 Study

- **97% of combine samples received (n=31) contained viable weed seed**
- **Most frequently observed weeds (% of samples present) were: grass (~68%), pigweed (~55%), and common lambsquarters (~55%).**
- **Combine head samples contained the most weed species with ~49% of the total weeds emerged (Feeder house, ~30%; Rock trap, ~19%; Rotor, ~2%)**

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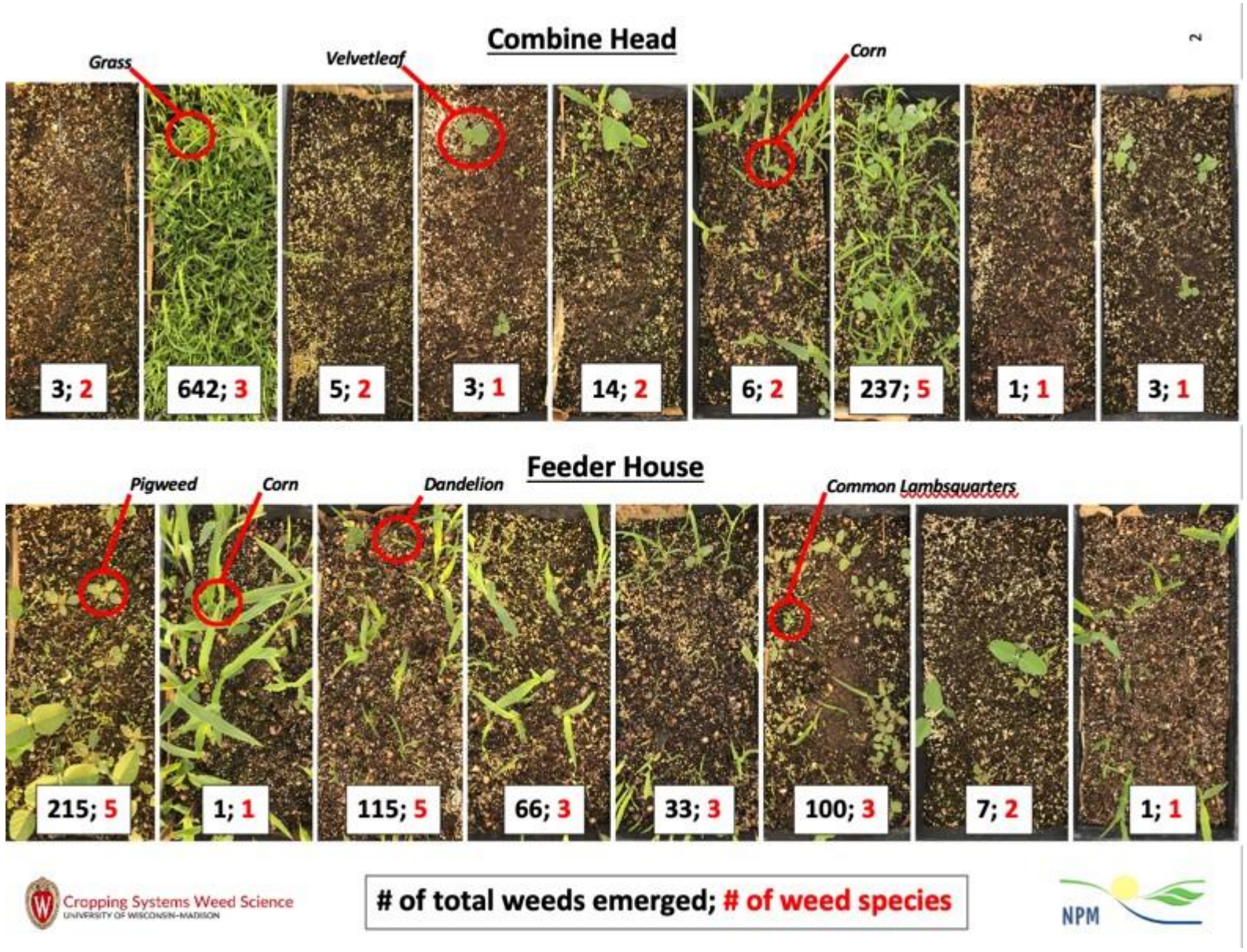
Arneson, N.J., D.H. Smith, R. Werle (*2020*) Weed Seed Movement Through Combines: 2020 Case Study. WI Cropping Systems Weed Science Research Brief (in-review)

Weed Seed Movement Through Combines: 2020 Study



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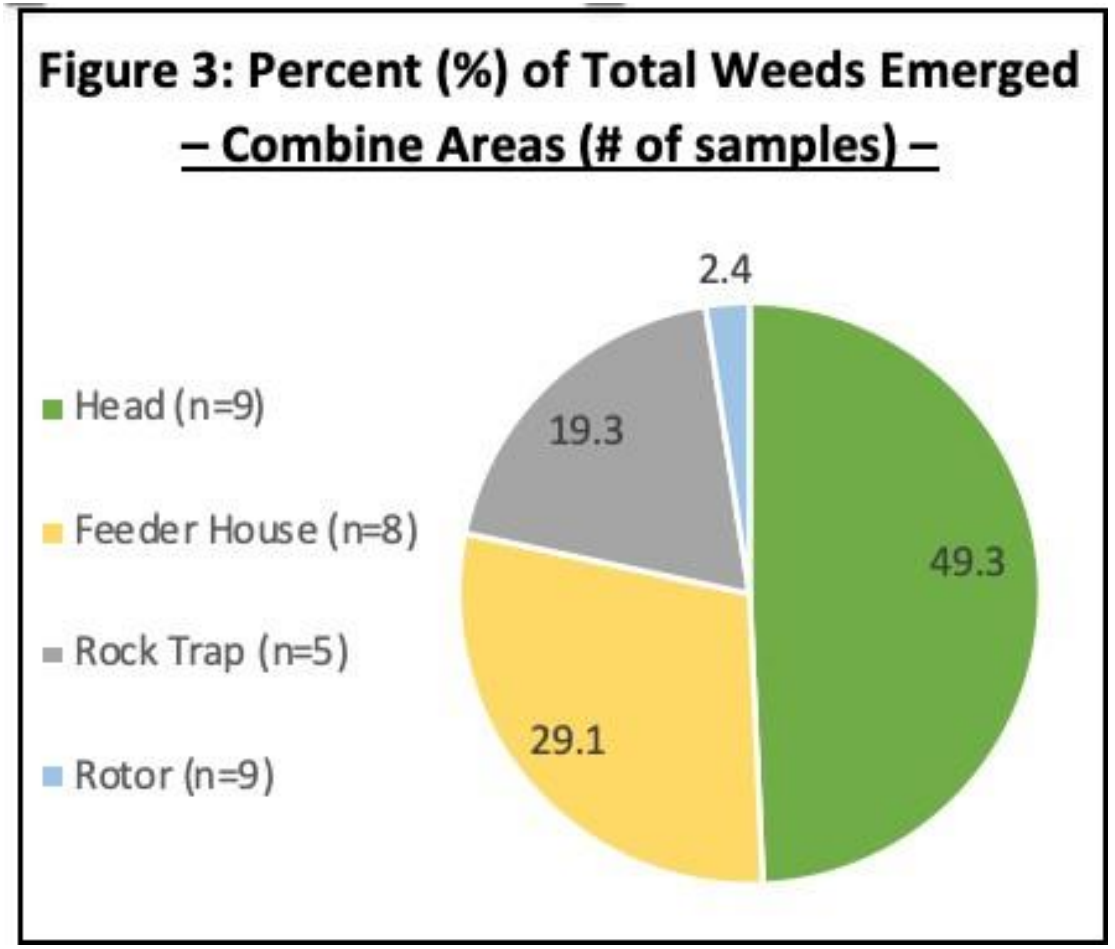
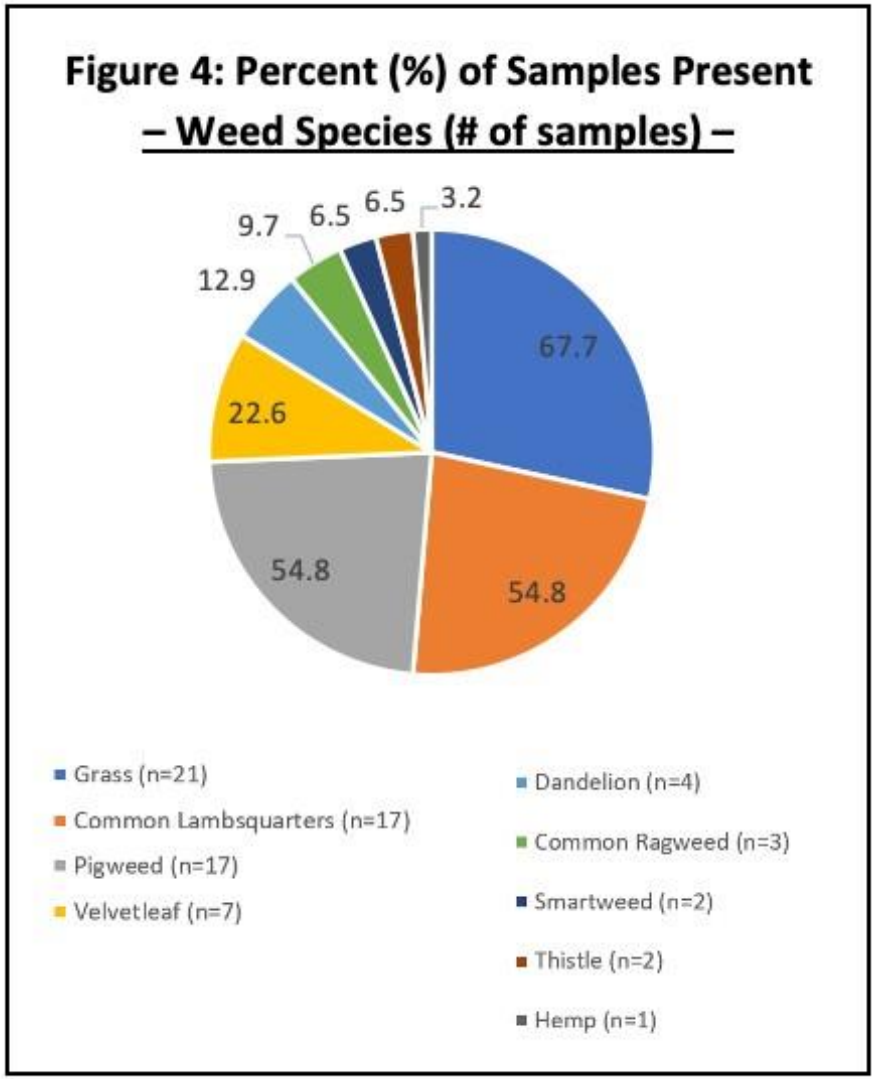
Weed Seed Movement Through Combines: 2020 Study





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Arneson, N.J., D.H. Smith, R. Werle (*2020*) Weed Seed Movement Through Combines: 2020 Case Study. WI Cropping Systems Weed Science Research Brief (in-review)

Tillage Weed Seed Movement

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Tillage Weed Seed Movement

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Cost of Spreading Waterhemp Seed

Yield Loss

- Light
- Water
- Soil Fertility

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Vencill et. al (*2012*) Herbicide Resistance: Toward an Understanding of Resistance Development and the Impact of Herbicide-Resistant Crops. Weed Science: Special Issue 2012, Vol. 60, No. sp1, pp. 2-30.

Future Cost of Waterhemp Seed Dispersal

- **Hand weeding**
- **Failed herbicide attempts**
- **Tillage**
- **Yield loss** in current and <u>future years</u>
- **Increased cost** to reduce seed bank
- **Export** Restrictions

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Preventing Waterhemp Seed Movement

- **Avoid Weed Seed Production!**
- **Clean equipment!**
- **Harvest fields with resistance last!**
- **Prevent field-to-field and within-field movement** of weed seed or vegetative propagules
- **Manage weed seed at harvest and after harvest** to prevent a buildup of the weed seedbank
- **Prevent influx of weeds** into the field by managing field border

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Norsworthy et. al (*2012*) Reducing the Risks of Herbicide Resistance: Best Management Practices and Recommendations. Weed Science: Special Issue 2012, Vol. 60, No. sp1, pp. 31-62.

Dedicate Time to Fall Weed Seed Management

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Considerations for Fall 2021: Cover Crop Establishment

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Southwest Regional Specialist
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Possible Cover Crop Benefits:

- Protect soil from erosion
- Reduce nutrient losses
  - Preventing runoff
  - Scavenging residual nitrogen
- Nitrogen fixation- legumes
- Suppress weed growth
- Insect support/suppression
- Soil conditioning/improve soil health
  - Add soil organic matter
  - Enhance soil biology
  - Alleviate/prevent compaction
- Supplemental forage production

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Cover Crop Establishment Timing

- After harvest of early-season crops such as winter wheat/small grains or early vegetables
- Frost-seeded into winter wheat/winter cereal grains
- Following harvest of corn as silage
- Inter-seeded into corn or soybeans
    - Early, V5 corn
- Overseeded
    - Late summer (corn- 50% dry down; soybeans R7 or later)

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Cover Crop Challenges

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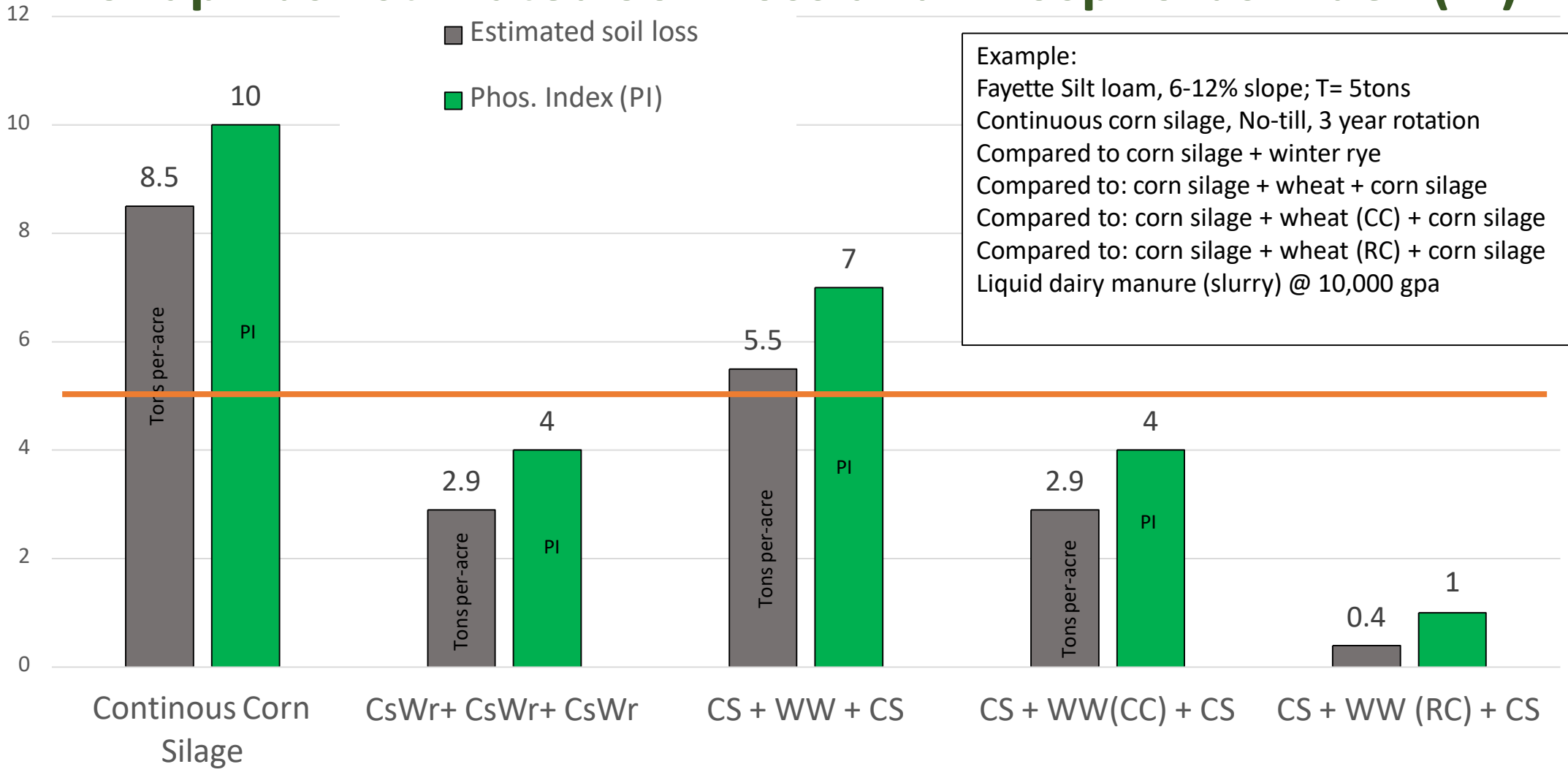
Nutrient Management and Cover Crops
SnapPlus Estimated Soil Loss and Phosphorus Index (PI)



Example:
Fayette Silt loam, 6-12% slope; T= 5tons
Continuous corn silage, No-till, 3 year rotation
Compared to corn silage + winter rye
Compared to: corn silage + wheat + corn silage
Compared to: corn silage + wheat (CC) + corn silage
Compared to: corn silage + wheat (RC) + corn silage
Liquid dairy manure (slurry) @ 10,000 gpa

Nutrient Management and Cover Crops- N Scavenging

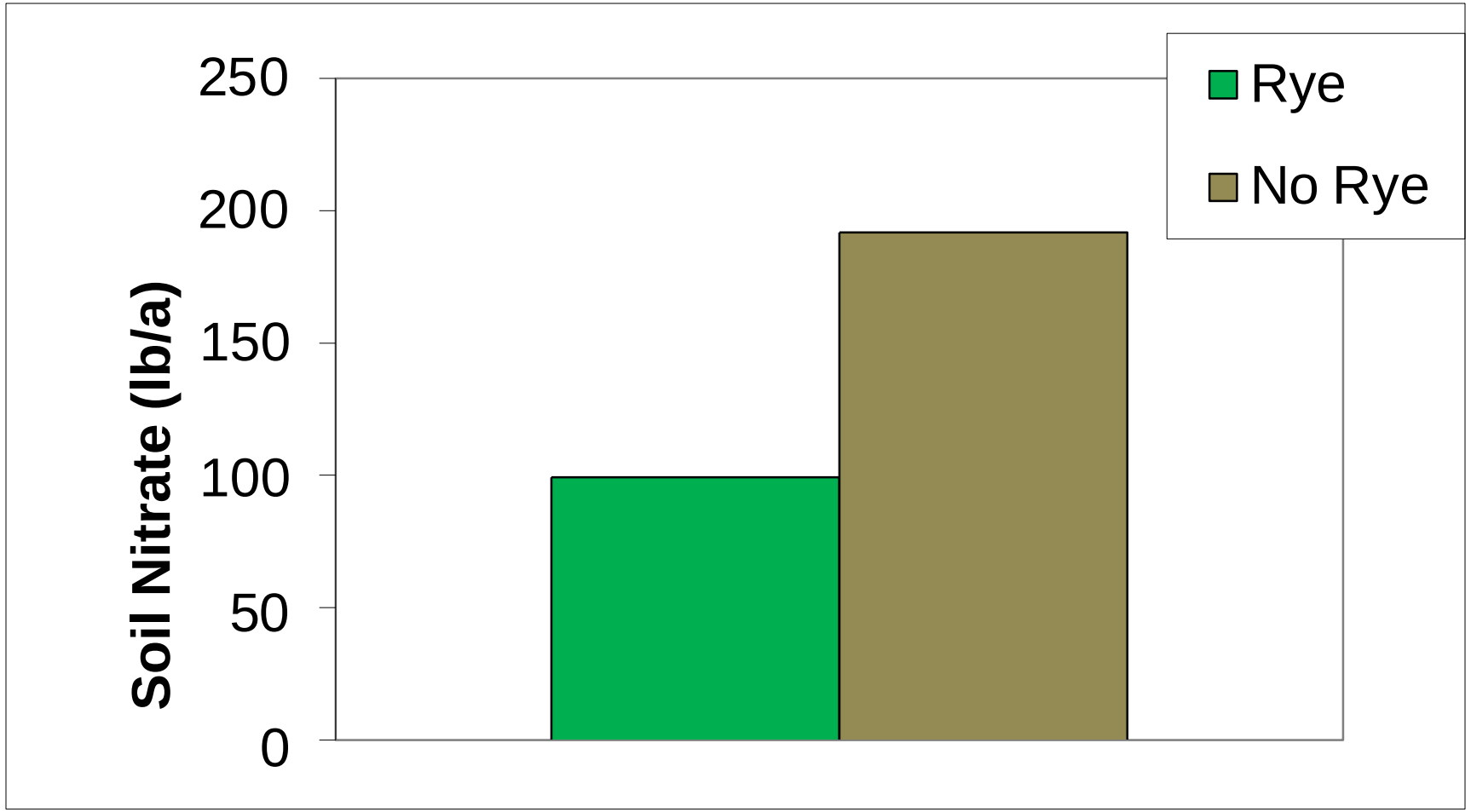


Figure 1. Effectiveness of rye reducing soil profile nitrate at spring rye harvest following fall application of 40 T ac^{-1} dairy manure at Lancaster, Wisconsin.

Stute, et. al. "Planting Winter Rye after Corn Silage: Managing for Forage" University of WI, NPM Program

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Nutrient Management and Cover Crops - Nitrogen fixation w/legumes – e.g., Clovers, Field Peas, Vetches, Alfalfa

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Cover Crop Species Selection

Cover Crop Goals:
Reduce Erosion
Suppress Weeds
Build Soil Health

https://mccc.msu.edu/covercroptool/

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Cover Crops <u>after</u> Vegetables/Small Grains

Local weather and soil conditions may affect establishment dates!

Cover Crop Species after Small Grains and Vegetable Crops Established by mid-August

	Drilled Seeding Rate [1] (lb/a)	Broadcast Seeding Rate [2] (lb/a)	Incorporated Broadcast Seeding Rate (lb/a)	Seeding Depth (inches)
SMALL GRAIN/GRASS SPECIES[3]				
Annual Ryegrass	12-20	14-24	13-22	0.25-0.5
Oat[4]	30-60	36-72	33-66	0.75-1.5
Sorghum-sudangrass	15-20	Not Recommended	17-22	0.5-1.5
Spring Barley[4]	50-75	60-90	55-82	0.75-1.5
Winter Triticale	40-60	48-72	44-66	0.75-1.5
Winter Barley[5]	50-75	60-90	55-82	0.75-1.5
Winter Rye	40-60	60-90	44-66	0.75-1.5
Winter Wheat[6]	40-60	48-72	44-66	0.75-1.5
BRASSICAS[7]				
Radish	3-6	3-7	3-7	0.5-.075
Rapeseed	2-5	2-6	2-5	0.25-.05
Turnip	1-4	1-5	1-4	0.25-0.5
LEGUMES/BROADLEAVES				
Berseem Clover	8-12	10-18	9-17	0.25-0.5
Cowpea	50-90	Not Recommended[8]	55-99	1.0-1.5
Crimson Clover	10-12	12-18	11-17	0.25-0.5
Field Pea/Forage Pea	50-80	Not Recommended[8]	55-88	1.0-1.5
Hairy Vetch	15-20	18-24	16-22	1.0-1.5
Medium Red Clover	8-12	9-14	9-13	0.25-0.5
Sunflower (mixture only)	5-7	Not Recommended[8]	5-7	1.0-1.5

[1] Seeding rates should be based on Pure Live Seed. [2] Broadcast establishment may be incorporated. However, care should be given to ensure planting depth is monitored.
[3] Seeding rates are for cover crop use, forage seeding rates will be higher. [4] Oats and spring barley planted following small grains will more reliably establish in Southern WI.
[5] Winter barley may not overwinter in Wisconsin. [6] Volunteer winter wheat may provide beneficial cover. [7] Brassicas should be seeded in a mixture to prevent soil erosion.
[8] Species is not recommended for broadcast without incorporation due to seed size.

Smith et al. 2019. "Cover Crops 101" University of Wisconsin-Madison. Extension Publication A4176.

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Cover Crops after Silage Corn

Cover Crop[1] Species Selection after Corn Silage
Established by mid-September

	Drilled Seeding Seeding Rate [2] (lb/a)	Broadcast Seeding Rate [3] (lb/a)	Incorporated Broadcast Seeding Rate (lb/a)	Seeding Depth (inches)
SMALL GRAIN/GRASS SPECIES[4]				
Oat[5]	30-60	36-72	33-66	0.75-1.5
Spring Barley[5]	50-75	60-90	55-83	0.75-1.5
Winter Triticale	40-60	48-72	44-66	0.75-1.5
Winter Barley[6]	50-75	60-90	55-82	0.75-1.5
Winter Rye	40-60	60-90	44-66	0.75-1.5
Winter Wheat	40-60	48-72	44-66	0.75-1.5

[1] Other grass species, brassicas, and legumes are not recommended following silage corn due to lack of growing degree days left in the season. Interseeding and overseeding options may provide a wider variety of cover crop options. [2] Seeding rates should be based on Pure Live Seed. [3] Broadcast establishment may be incorporated. However, care should be given to ensure planting depth is monitored. [4] Seeding rates are for cover crop use, forage seeding rates will be higher. [5] Oats and spring barley planted following silage corn harvest will more reliably establish in Southern WI. [6] Winter barley may not overwinter in Wisconsin.

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Smith et al. 2019. “Cover Crops 101” University of Wisconsin-Madison. Extension Publication A4176.

Southern WI Cover Crops <u>after</u> Grain Soybean and Corn

Page 3

Cover Crop[1] Species Selection Following Grain Corn and Soybeans Established by Late October

	Drilled Seeding Seeding Rate [2] (lb/a)	Broadcast Seeding Rate [3] (lb/a)	Incorporated Broadcast Seeding Rate (lb/a)	Seeding Depth (inches)
SMALL GRAIN/GRASS SPECIES[4]				
Winter Rye	40-60	60-90	44-66	0.75-1.5
Winter Triticale	40-60	48-72	44-66	0.75-1.5

[1] Other grass, brassica, and legume species are not recommended following grain harvest due to lack of growing degree days left in the season. Interseeding and overseeding options may provide a wider range of cover crop options due to the extended growing season . [2] Seeding rates should be based on Pure Live Seed. [3] Broadcast establishment may be incorporated. However, care should be given to ensure planting depth is monitored. [4] Seeding rates are for cover crop use, forage seeding rates will be higher.

Smith et al. 2019. "Cover Crops 101" University of Wisconsin-Madison. Extension Publication A4176.

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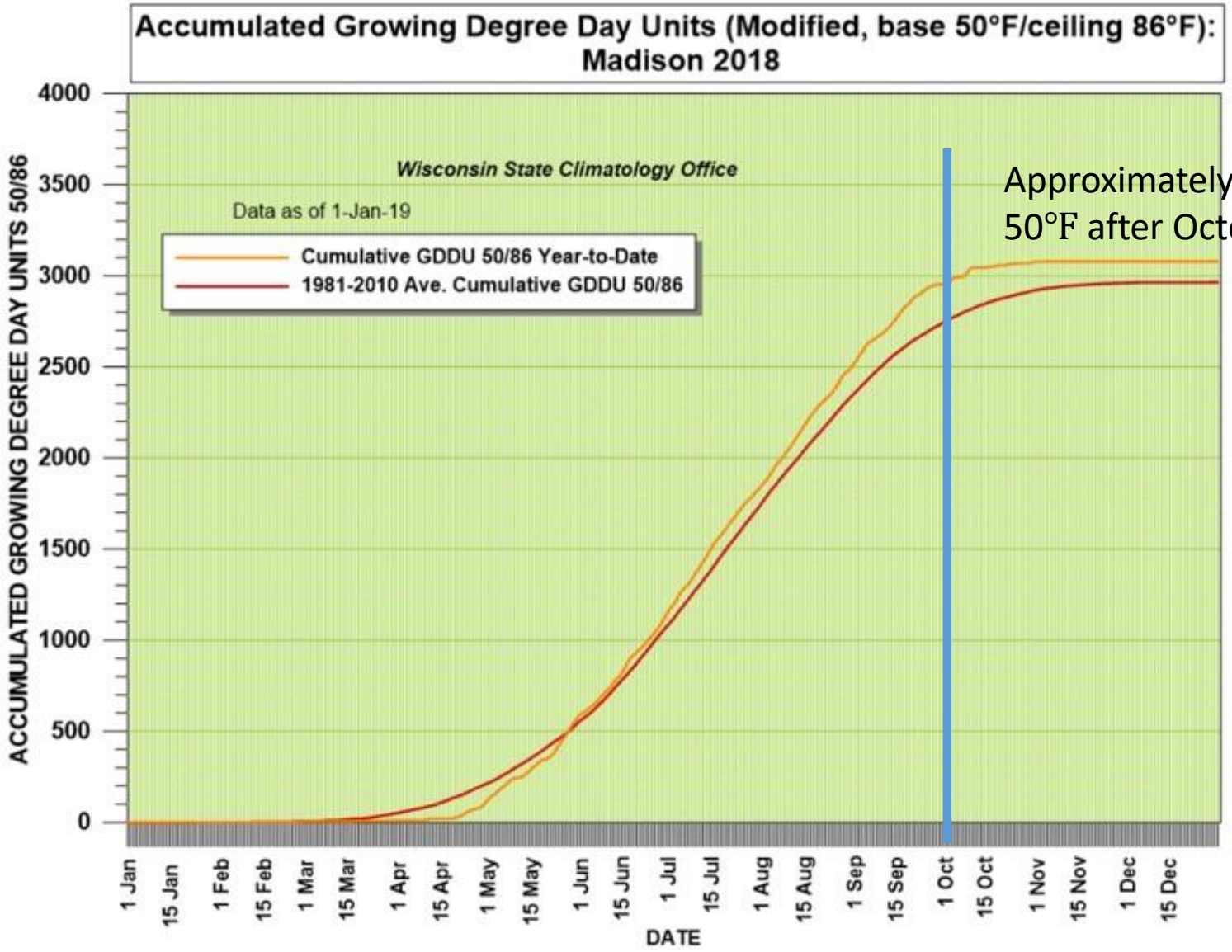
Why Only A Few Cover Crop Options?



Approximately 200 GDD at base 50°F after October 1

Source: http://www.aos.wisc.edu/~sco/clim-history/stations/msn/msn-gddu-2018.gif

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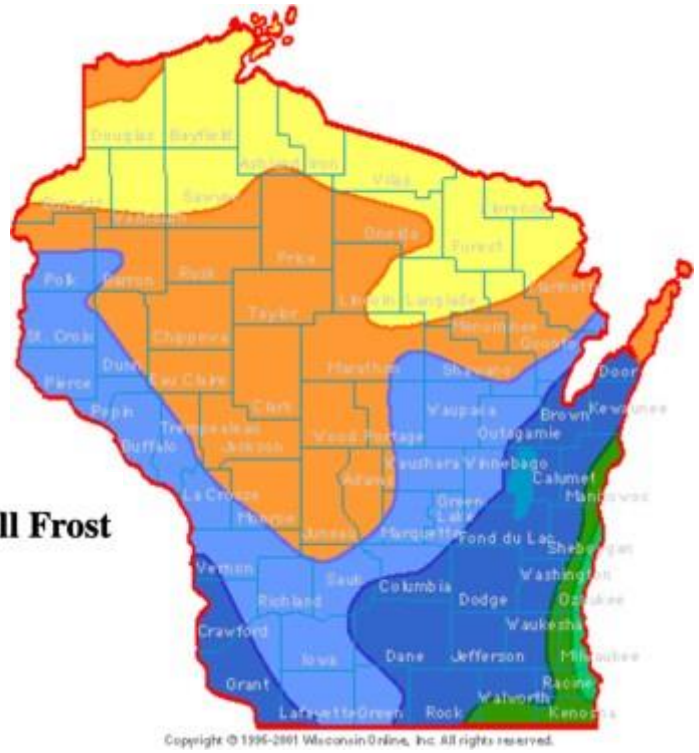
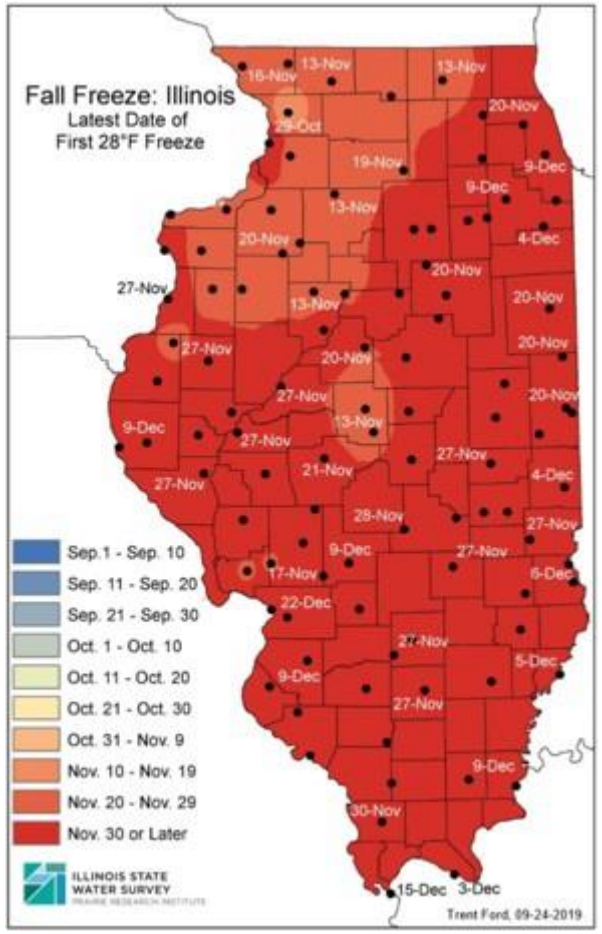
Why Only A Few Cover Crop Options?



Color Key to Typical Dates of First Fall Frost

Zone	Typical Dates*
	September 13 - 19
	September 20 - 26
	September 27 - October 3
	October 4 - 10
	October 11 - 17
	October 18 - 24



Sources: https://www.wisconline.com/almanac/gardening/fallfrost.html
https://stateclimatologist.web.illinois.edu/2019/09/24/illinois-first-fall-freeze-climatology/

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Why Only A Few Cover Crop Options?

	Winterkill
SMALL GRAIN/GRASS SPECIES	
Annual Ryegrass	Maybe
Oat	Yes
Sorghum-sudangrass	Yes
Spring Barley	Yes
Winter Triticale	No
Winter Barley	Maybe
Winter Rye	No
Winter Wheat	No

BRASSICAS	
Mustards	Yes
Radish	Yes
Rapeseed	Maybe
Turnip	Yes
LEGUMES	
Berseem Clover	Yes
Cowpeas	Yes
Crimson Clover	Maybe
Field Pea/Forage Pea	Yes
Hairy Vetch	No
Red Clover	No
Sunflower	Yes

Smith et al. 2019. "Cover Crops 101" University of Wisconsin-Madison. Extension Publication A4176.

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Opportunities to Increase Species Diversity?

For Success:

- Overseed when corn is 50% dry or dry to the ear.
- Consider harvest timing.
- Plant a species that overwinter (or a mix of overwintering and species susceptible to winterkill.

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Opportunities to Increase Species Diversity?

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Opportunities to Increase Species Diversity?

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Opportunities to Increase Species Diversity?

Consider Hybrid Maturity!

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Cover Crop Establishment Method

November 10, 2019

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Cover Crop Establishment Method

May 6, 2020

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Herbicide Carryover

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Herbicide Carryover/Persistence

- **May result in cover crop damage and stand failure**
- **Can be avoided by careful selection of herbicides**

Influence Factors

- Chemical properties of the herbicide- half life
- Rate of application
- Soil pH- heavy soil and high pH= longer residual
- Organic matter content
- Amount of surface plant residue- tillage dilutes residues
- Temperature
- Rainfall- less rainfall=longer residual
- Microbial degradation

Nontreated

Example of herbicide carryover

Citation: Walsh, Joseph D., Michael S. Defelice, and Barry D. Sims. "Soybean (*Glycine Max*) Herbicide Carryover to Grain and Fiber Crops." *Weed Technology* 7 (1993): 625-32

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Why is Herbicide Carryover Complicated?

- **Herbicide Persistence**
- **Crop Rotation**
- **Herbicide Rotation Intervals**
- **Weed Resistance**
- **Troublesome Weeds**

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GUIDE TO RELATIVE SENSITIVITY OF COMMON COVER CROPS TO VARIOUS HERBICIDES

Herbicide	Common Name	Crimson Clover	Austrian winter pea	Hairy Vetch	Rape-seed	Radish	Turnip	Annual Rye-grass	Oats	Rye	Winter Wheat
2,4-D amine	2,4-D										
atrazine	Atrazine										
S-metolachlor	Dual/Brawl										
imazethapyr	Pursuit										
chlorimuron	Classic										
cloransulam	FirstRate										
dicamba	Clarity										
flumioxazin	Valor										
fomesafen	Flexstar										
isoxaflutole	Balance Flexx										
mesotrione	Callisto										
pyroxasulfone	Zidua										
sulfentrazone	Spartan										
sulfen+chlorim	Authority XL										

more tolerant range when planted 90 days after application dependent on other variable factors

less tolerant range so >90 days after application dependent on other variable factors

least tolerant range so >120 days after application dependent on other variable factors

Source: Compiled by West Central Distribution; University Data: University of Missouri, Penn State, University of Wisconsin

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Bioassay

- Field vs. Greenhouse
- Plant small area of cover crop in field soil
- Assess for injury
- Does not replace the legal rotational restrictions

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Cover Crop vs. Forage Crop

- **Cover Crop= No Biomass Harvest**

- **Forage Crop= Biomass is Harvested**

- **Cover Crop can be utilized as Forage**

Most Pesticide labels may not have cover crop data only forage crop!

- **Plan for pesticide applications and restrictions**

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Rotational Restrictions

- **Herbicide Label (Search for Rotational Interval, Restriction, Cover Crops, Crop Rotation)**

- **Extension Publications- Provide high level overview**

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Herbicide Rotational Restrictions
FOR COVER AND FORAGE CROPPING SYSTEMS

Daniel H. Smith, Richard Proost, Nutrient and Pest Management Program;
Maxwel Coura Oliveira, Ryan Dewerff and Rodrigo Werle, Department of Agronomy;
University of Wisconsin-Madison

This publication provides a starting point of reference when considering using cover crops following herbicides in the cropping system. This publication does not replace the herbicide label. This publication outlines rotational intervals for many commonly used herbicides in Wisconsin. The rotational interval is the required amount of time from herbicide application to subsequent crop establishment for forage or harvest value. For example, a herbicide is applied to soybeans with a 10-month rotational interval for winter cereal rye. The rye could be established 10 months after the herbicide application for food or feed value. This rotational interval is legally required period prior to crop harvest for feed or forage. Cover crops intended for forage value must follow the rotation interval. Cover crops utilized for soil building do not need to follow the rotational interval, however, they may still be prone to herbicide injury. This herbicide injury is often attributed to herbicide carryover and the chances of injury can be better understood after a field bioassay. The herbicide label must be referenced prior to making any management decisions. The rotational intervals stated in this publication are the maximum rotational restriction taken from the most current herbicide label available at time of printing.

Herbicide Carryover

For cover crops to accomplish their intended goals, they must establish well; establishment of cover crops can be compromised by use of residual herbicides, the herbicide activity in the soil for a period of time after application and are applied to the preceding cash crop. The persistence of these residual herbicides may affect cover crop establishment later in the growing season and can be affected by a wide range of management (tillage, application rate, and herbicide application method) and soil properties (moisture, temperature, soil colloid properties, chemical reactions, pH, microbial population, soil texture and organic matter) (Krausz et al., 1992). Cover cropping and using residual herbicides is not impossible but is challenging. Herbicide resistant weed management should be considered when planning herbicide applications. The cost of herbicide program, cover crop benefits, and resistance management should all be considered.

Source: https://ipcm.wisc.edu/download/pubsPM/2019_RotationalRestrictions_final.pdf

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Corn Herbicides Often Injurious to Cover Crop Establishment

- Topramezone (Impact)
- Mesotrione (Callisto, Halex GT, etc.)
- Clopyralid (Stinger, SureStart, Resicore)
- Isoxaflutole (Balance Flexx)
- Pyroxasulfone (Zidua)
- Nicosulfuron (Accent Q)
- Flumetsulam (Python)
- S-metolachlor (Dual II Magnum)
- Atrazine (AAtrex)

Cover Crop Establishment

Silage Corn- Still limited

Interseeding- V4

Overseeding- 50% dry down

Fall- Winter/Cereal Rye

Winter/ Cereal Rye= almost no herbicide issues

Sources: UW-Madison (data unpublished), Mizzou Weed Science, U of M Weed Science, Penn State, Purdue

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Soybean Herbicides Often Injurious to Cover Crop Establishment

- Fomesafen (Flexstar/Prefix)
- Pyroxasulfone (Zidua)
- Imazethapyr (Pursuit)
- Acetochlor (Warrant)
- Sulfentrazone (Authority products)
- Flumioxazin (Valor products)
- S-metolachlor (Dual II Magnum)
- Chlorimuron (Classic)

Cover Crop Establishment

Interseeding- Maybe 30 inch rows

Overseeding- R7 leaf drop

Fall- Winter/Cereal Rye

Winter/ Cereal Rye= almost no herbicide issues

Sources: UW-Madison (data unpublished), Mizzou Weed Science, U of M Weed Science, Penn State, Purdue

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Cover Crop Termination

	Winterkill	Crimping	Mowing	Tillage[1]	Herbicide
SMALL GRAIN/GRASS SPECIES					
Annual Ryegrass	Maybe	No	No	Yes	Glyphosate[2] 16-32 fl oz per acre
Oat	Yes	Yes	Yes	Yes	
Sorghum-sudangrass	Yes	No	No	Yes	
Spring Barley	Yes	No	Yes	Yes	
Winter Triticale	No	Yes	Yes	Yes	
Winter Barley	Maybe	Yes	Yes	Yes	
Winter Rye	No	Yes	Yes	Yes	
Winter Wheat	No	Yes	Yes	Yes	
BRASSICAS					
Mustards	Yes	No	No	Yes	Glyphosate[2] 16-32 fl oz per acre
Radish	Yes	No	No	Yes	
Rapeseed	Maybe	No	No	Yes	
Turnip	Yes	No	No	Yes	
LEGUMES					
Berseem Clover	Yes	No	No	Yes	Glyphosate[2] 16-32 fl oz per acre + Growth Regulator 8-16 fl oz per acre
Cowpeas	Yes	No	Maybe	Yes	
Crimson Clover	Maybe	No	No	Yes	
Field Pea/Forage Pea	Yes	No	Yes	Yes	
Hairy Vetch	No	Yes	No	Yes	
Red Clover	No	No	No	Yes	
Sunflower	Yes	Yes	Yes	Yes	

[1] Tillage is not a recommended termination practice unless the cropping systems has limited termination options. Frequent tillage can degrade soil health. Note that tillage may require multiple passes to fully incorporate the cover crop.

[2] Glyphosate formulation - 4.5 lb acid equivalent per gallon. Always read and follow the herbicide label. The label is the law.

Smith et al. 2019. "Cover Crops 101" University of Wisconsin-Madison. Extension Publication A4176.

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Cover Crop Termination

- Termination should occur during a period of active growth
- Day/ night temperatures should be 55/40°F and should be above theses temperatures for 3 days pre and post application
- Application should occur four hours prior to sunset

Smith et al. 2019. “Cover Crops 101” University of Wisconsin-Madison. Extension Publication A4176.

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Spring Management Beyond the Basics

Source: https://www.youtube.com/watch?v=YuvSbmumgcI

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Spring Management Beyond the Basics

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Interseeding cover crops in row-cultivated corn

Daniel H. Smith, Virginia M. Moore, Matt Ruark, Erin Silva

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Key facts

- Interseeding involves planting a cover crop while a cash crop is still growing in the field.
- It can be challenging to establish cover crops after corn harvest, but interseeding allows for earlier planting (before corn is harvested).
- Wisconsin research has demonstrated red clover, winter rye, and radish established well in an interseeding system.

Why interseeding?

There are many known benefits of including overwintering cover crops in a crop rotation. Cover crops can have positive impacts on soil and water quality as well as nutrient and pest management (Clark 2007, Curran et al. 2018, Reicosky and Forcella 1998). However, in the Upper Midwest it can be challenging to establish cover crops due to the lack of growing degree days after corn is harvested. This late planting window also limits the diversity of cover crop species that can be used (Curran et al. 2018, NCR SARE and CTIC 2016, ding provides a way to establish y planting cover crops when corn

Interseeding methods

Planting methods

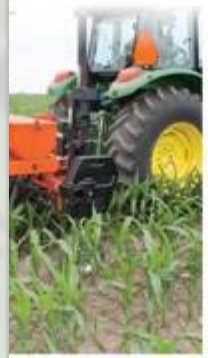
Cover crops can be interseeded into corn during the growing season by broadcasting, using either aerial or ground equipment (e.g. airflow or broadcast fertilizer spreader). Cover crops can also be interseeded using a high-clearance or modified grain drill, which increases seed-to-soil contact (Curran et al. 2018, Noland et al. 2018, Wilson et al. 2014). Noland et al. (2018) found that drill interseeding had better cover crop establishment than broadcasting for most cover crop species tested.

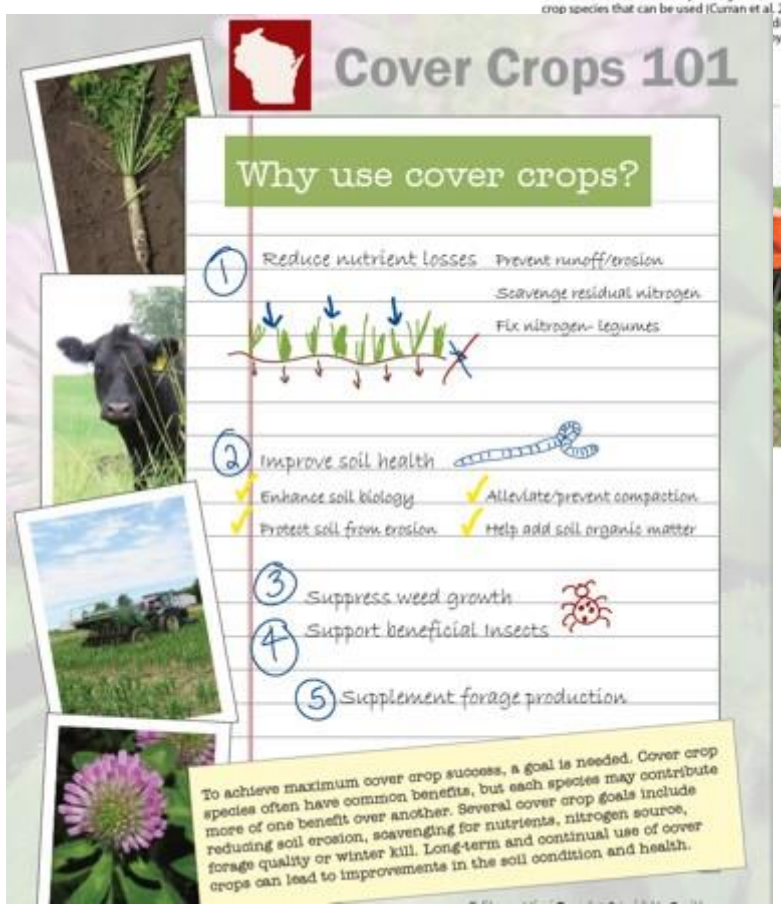
Corn growth stage

If interseeded too early, cover crops have the potential to affect corn yields. On the other hand, cover crops may not successfully establish if interseeded too late (due to corn canopy closure). Curran et al. (2018) found that cover crops did not affect corn yield when interseeded at the V4 corn growth stage or later. Noland et al. (2018) were able to establish cover crops as late as the V7 corn growth stage.

Cover crop species

A wide range of cover crop species have been tested in interseeding systems. It important to select species that can tolerate the shaded environment under the corn canopy and that can overwinter in your climate. The cover crop should also have limited growth under the corn canopy to avoid competing with the corn. Success of a particular species in an interseeding system will also depend on season-specific conditions – for example, drought stress may increase competition between the cover crop and corn.





Herbicide Rotational Restrictions for Cover and Forage Cropping Systems

This publication is intended to be a starting point when considering using cover crops while utilizing herbicides in the cropping system. This publication does not replace the herbicide label. This publication outlines rotational intervals for many commonly used herbicides in Wisconsin. The rotational interval is the required amount of time from herbicide application to subsequent crop establishment for forage or harvest value. Example- A herbicide is applied to soybeans with a 10 month rotational interval for winter rye. Winter rye could be established 10 months after the herbicide application for food or feed value. This rotational interval is legally required prior to crop harvest for feed or forage. Cover crops intended for forage value must follow the rotation interval. Cover crops utilized for soil building do not need to follow the rotational interval, however, they may still be prone to herbicide injury. This herbicide injury is often attributed to herbicide carryover and the chances of injury can be better understood after a field bioassay. The herbicide label must be referenced prior to making any management decisions. The rotational intervals stated below are the maximum rotational restriction taken from the most current herbicide label available at time of printing.

Herbicide Carryover

For cover crops to accomplish their intended goals, they must establish well; establishment of cover crops can be compromised by use of residual herbicides, those have activity in the soil for a period of time after application, applied to the preceding cash crop. The persistence of these residual herbicides is what will affect the cover crop establishment later in the growing season and can be affected by a wide range of management (tillage, application rate, and herbicide application method) and soil properties (moisture, temperature, soil colloid properties, chemical reactions, pH, microbial population, soil texture and organic matter) (Krausz et al., 1992). Cover cropping and using residual herbicides is not impossible but is challenging. Herbicide resistant weed management should be considered when planning herbicide applications. The cost of herbicide program, cover crop benefits, and resistance management should all be considered.

Cover Crop vs. Forage Crop

A crop is classified as a cover crop when no biomass is harvested. A cover crop is established for benefits to
cover crop becomes a forage crop when biomass is harvested
grazing or mechanical collection. A cover crop can be used for
rovide the plant back restriction time required from pesticide
, only forage crops. Therefore, requiring the maximum rota-
ns are not followed, harvesting a cover crop for forage value
ngth and should be examined for all pesticides and crops in
sted for any value can be legally established following any
es all responsibility for cover crop injury or failure that may re-

Rotational Restriction Intervals for Labeled Herbicides in Wisconsin

			COMMON WI CROPS			SMALL GRAINS/GRASSES						BRASSICAS			LEGUMES						
Herbicide- Trade Name	Rotation Required or Recommended	Cover Crop Language	CORN (field & silage)	SOYBEAN	ALFALFA	WHEAT	OATS	WINTER RYE	WINTERTRITICALE	BARLEY	ANNUAL RYEGRASS	RADISH	TURNIPS	RAPESEED	BERSEEM CLOVER	CRIMSON CLOVER	RED CLOVER	VETCH	FIELD PEAS	COWPEA	Max Rotation
2,4-D Amine 4, Shredder	n/a	n/a	14 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D
2,4-D EHI Shredder	n/a	n/a	14 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D
Aatrex	n/a	n/a	0	12 M	24 M	24 M	24 M	24 M	24 M	24 M	24 M	24 M	24 M	24 M	24 M	24 M	24 M	24 M	24 M	24 M	24 M
Accent Q	n/a	n/a	0	0.3 M	12 M	4 M	4 M	4 M	10 M	4 M	10 M	10 M	10 M	10 M	10 M	10 M	12 M	10 M	10 M	10 M	10 M
Arsenal	n/a	n/a	0	10 M	18 M	4 M	10 M	4 M	36 M	4 M	18 M	18 M	18 M	18 M	18 M	18 M	18 M	18 M	18 M	18 M	18 M
Arsenal Flexi	n/a	n/a	0	10 M	18 M	4 M	10 M	4 M	18 M	4 M	18 M	18 M	18 M	18 M	18 M	18 M	18 M	18 M	18 M	18 M	18 M
Athletic Broadspec	n/a	n/a	1.5 M	1.5 M	1.5 M	0	1.5 M	0	0	0	1.5 M	1.5 M	1.5 M	2 M	1.5 M	1.5 M	1.5 M	1.5 M	1.5 M	1.5 M	1.5 M
Atlantis	yes	n/a	14 D	0	10 M	2 M	10 M	4 M	12 M	4 M	12 M	12 M	12 M	12 M	10 M	10 M	10 M	10 M	4 M	10 M	12 M
Atoll	n/a	n/a	0	0	0	0	0	0	0	0	12 M	0	0	0	0	0	0	0	0	0	12 M
Ally DF	yes	n/a	14 M	14 M	14 M	1 M	10 M	14 M	14 M	10 M	14 M	14 M	14 M	14 M	14 M	14 M	14 M	14 M	14 M	14 M	14 M
Alphamex	n/a	n/a	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL
Anthem	n/a	n/a	0	4 M	10 M	4 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	8 M	10 M	10 M
Anthem ATZ	n/a	n/a	0	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL	10 M
Anthem Flex	n/a	n/a	0	4 M	10 M	4 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	8 M	10 M	10 M
Anthem Maxx	n/a	n/a	0	4 M	10 M	4 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	4-8 M	10 M	10 M
Armezon	n/a	n/a	0	9 M	9 M	1 M	1 M	1 M	1 M	1 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	9-10 M	10 M	10 M
Armezon Pro	n/a	n/a	0	9 M	9 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	9-10 M	10 M	10 M
Assure II	n/a	n/a	120 D	0	120 D	120 D	120 D	120 D	120 D	120 D	120 D	120 D	120 D	120 D	120 D	120 D	120 D	120 D	0	120 D	120 D
Authority Assist	yes	n/a	10 M	0	12 M	4 M	10 M	4 M	10 M	0.3 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M
Authority Elite	yes	yes	10 M	0	12 M	4.5 M	12 M	4.5 M	4.5 M	4.5 M	12 M	12 M	12 M	12 M	12 M	12 M	12 M	12 M	12 M	12 M	12 M
Authority First	yes	yes	10 M	0	12 M	4 M	12 M	12 M	10 M	12 M	36 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M
Authority Maxx	yes	yes	10 M	0	18 M	4 M	10 M	4 M	36 M	4 M	36 M	36 M	36 M	36 M	10 M	10 M	10 M	10 M	36 M	36 M	36 M
Authority MTZ	yes	n/a	10 M	0	12 M	4 M	10 M	10 M	10 M	4 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M
Authority Supreme	yes	n/a	4 M	4 M	10 M	6 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M
Authority XL	yes	yes	10 M	0	12 M	4 M	12 M	4 M	36 M	4 M	36 M	36 M	36 M	36 M	10 M	10M	10 M	36 M	36 M	36 M	36 M
Autumn	yes	n/a	30 D	90 D	10 M	8 M	9 M	4 M	10 M	8 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M

Restrictions assume cover crop planted in summer/fall shown in months; the most restrictive data is shown.

D=days; M=months; NL= not listed; 0= typically a labeled crop with no plant-back restriction; FF= fall year

The product information compiled here is intended to be as accurate as possible at the time of printing. Refer to product label for more detailed restriction information. **Always follow the product's current label restrictions and instructions.**

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Thanks!

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Questions?