

Cover Crop Research and Extension Needs in Northern Midwest Farming Operations

Elizabeth J. Bosak and Vince M. Davis

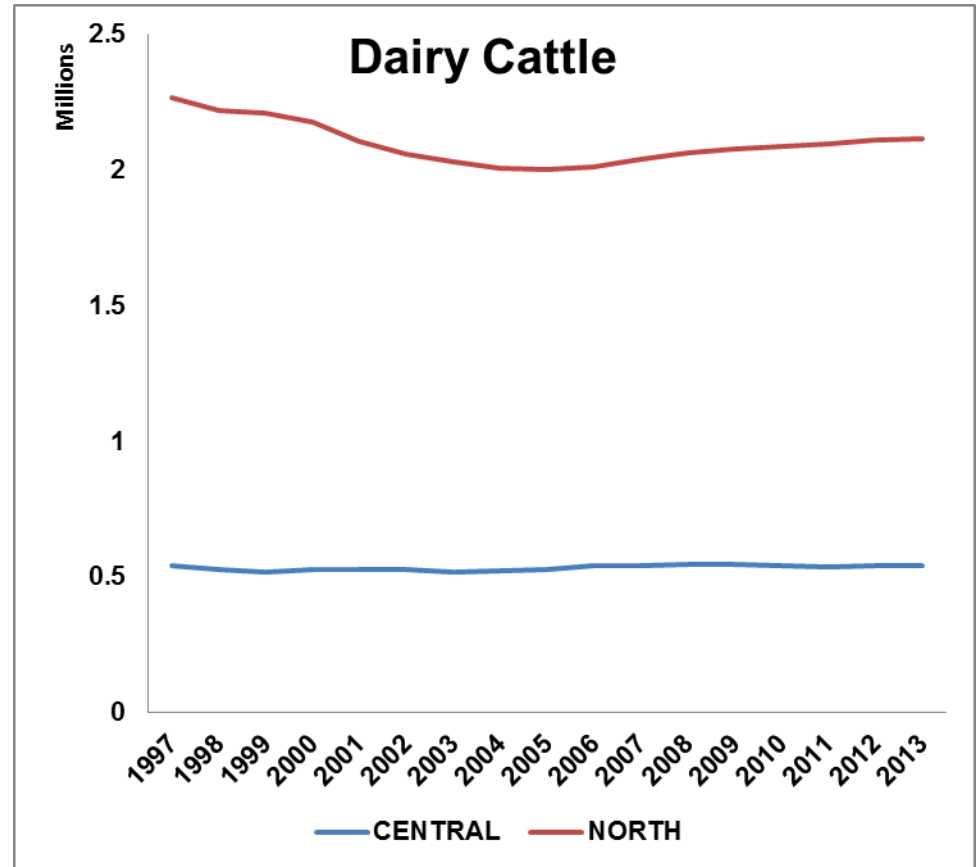
Department of Agronomy, University of Wisconsin-Madison

Cover crop use and adoption in Northern Midwest farming systems differs from central and Southern Midwestern states because of greater demand to produce forage to feed dairy operations and the shorter growing season restricts available time for cover crop establishment. In 2012, the Northern Midwest states of Michigan, Minnesota, and Wisconsin had over 2 million dairy cattle compared to the central states of Illinois, Indiana, and Ohio with 0.5 million dairy cattle. Production of three key components of the dairy herd ration: corn silage, grass hay, and alfalfa hay in the North covered two to three times more acreage than the central states. The Northern Midwest climate poses several challenges for following a cash crop with a cover crop because of a short freeze-free period to establish crops and a limited number of growing degree days to generate biomass. In Michigan, Minnesota, and Wisconsin, the freeze-free period ranges from 60 to 150 days with 1950 growing degree days between March 1 and September 1 compared to central states that range from 120 to 180 days with 3000 growing degree days. Given the restricted growing season and the need to produce forage along with high land rent cost, farmers may consider double-cropping a desirable alternative to purchasing feed. Research is needed to establish the economic and environmental benefits, and consequences, of double-cropping rather than following a cash crop:cover crop rotation. Extension efforts need to include information and discussions of herbicide rotational restrictions when a farmer implements a cash crop:forage crop rotation. To assist farmers with double-cropping forages, we have developed a series of fact sheets based on herbicide rotational restrictions for fifteen different cover crops that could be used for forage. A comprehensive guide, "Herbicide Rotation Restrictions in Forage and Cover Cropping Systems", includes all small grain, soybean, and corn herbicide rotation restrictions. Due to the sheer number of herbicides listed, we then developed two specific forage fact sheets, "Forage Herbicide Quick Sheet: Cereal Rye Forage after Corn Silage" and "Forage Herbicide Quick Sheet: Spring-Seeded Forages after Corn." Both of these fact sheets limit the herbicides to those that are feasible given their rotational restrictions and include the site-of-action group numbers to aid in herbicide resistance management planning.

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Liz Bosak and Vince Davis

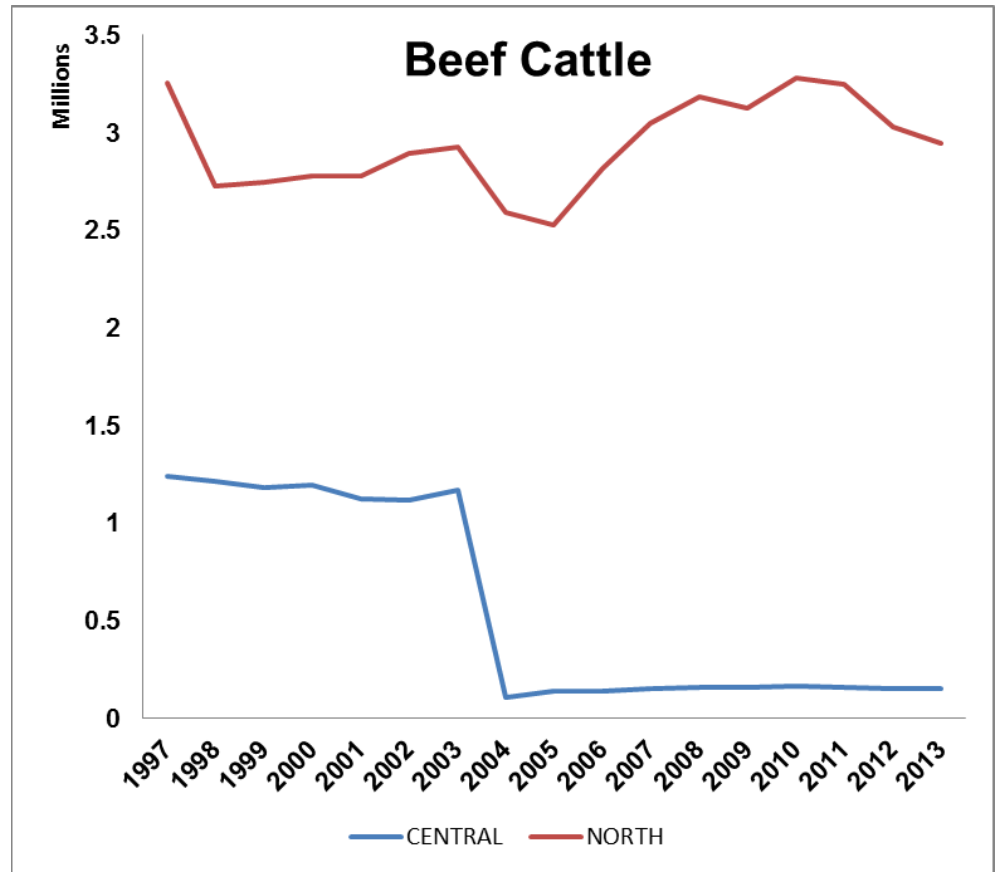




Central (Illinois, Indiana, Ohio)

North (Michigan, Minnesota, Wisconsin)

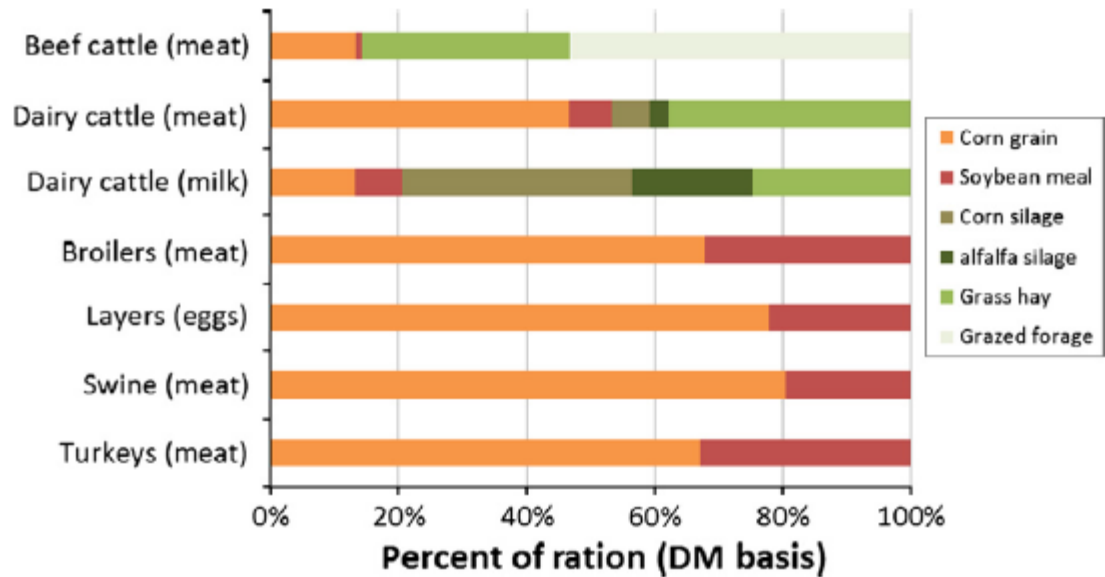
Source: National Agricultural Statistics Service (NASS)



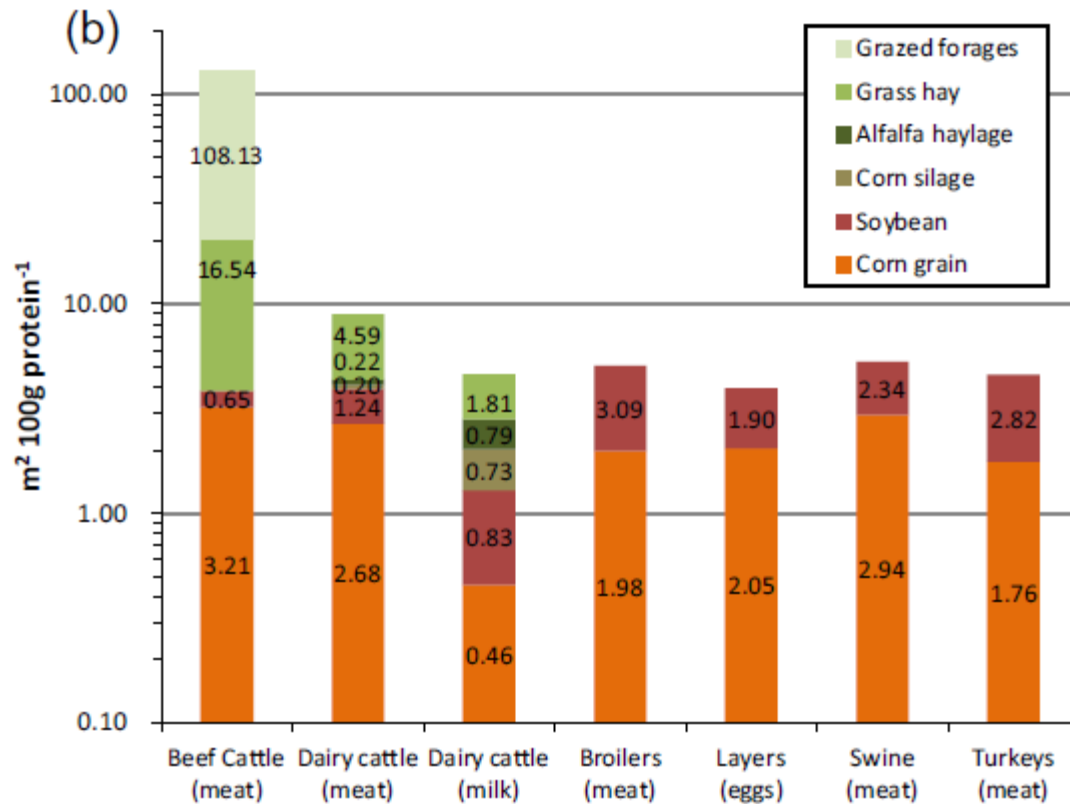
Central (Illinois, Indiana, Ohio)

North (Michigan, Minnesota, Wisconsin)

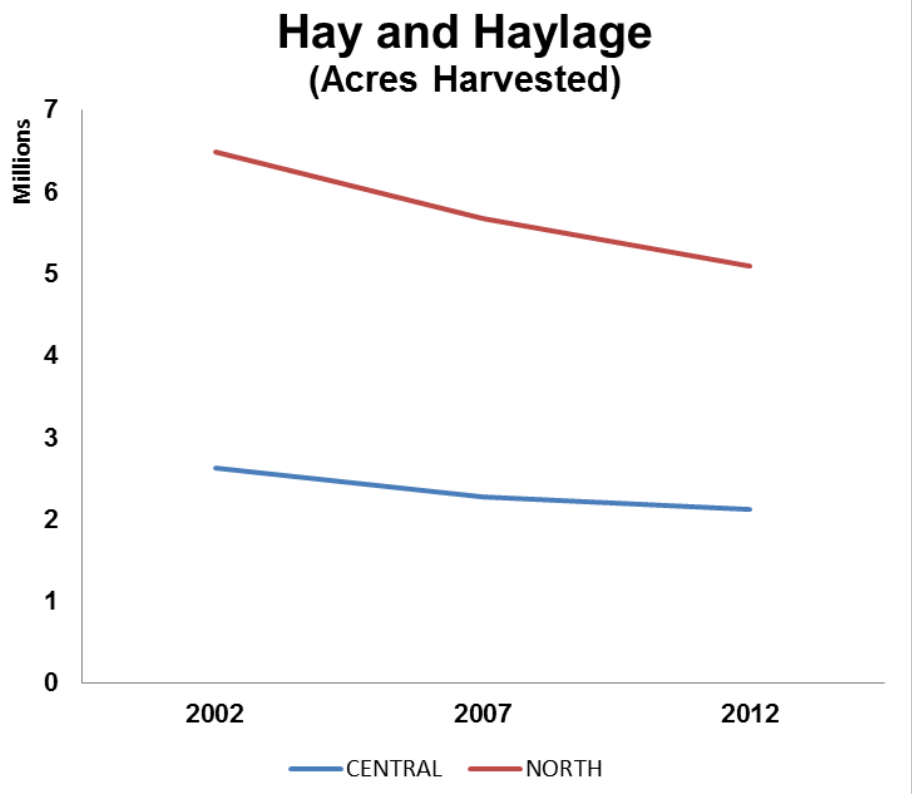
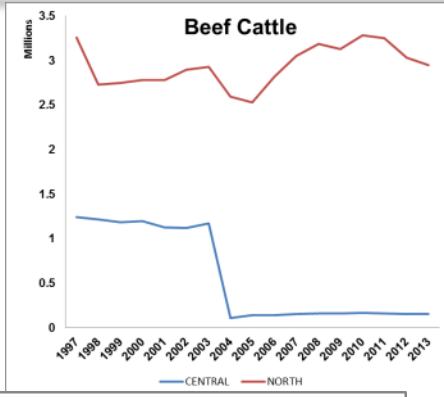
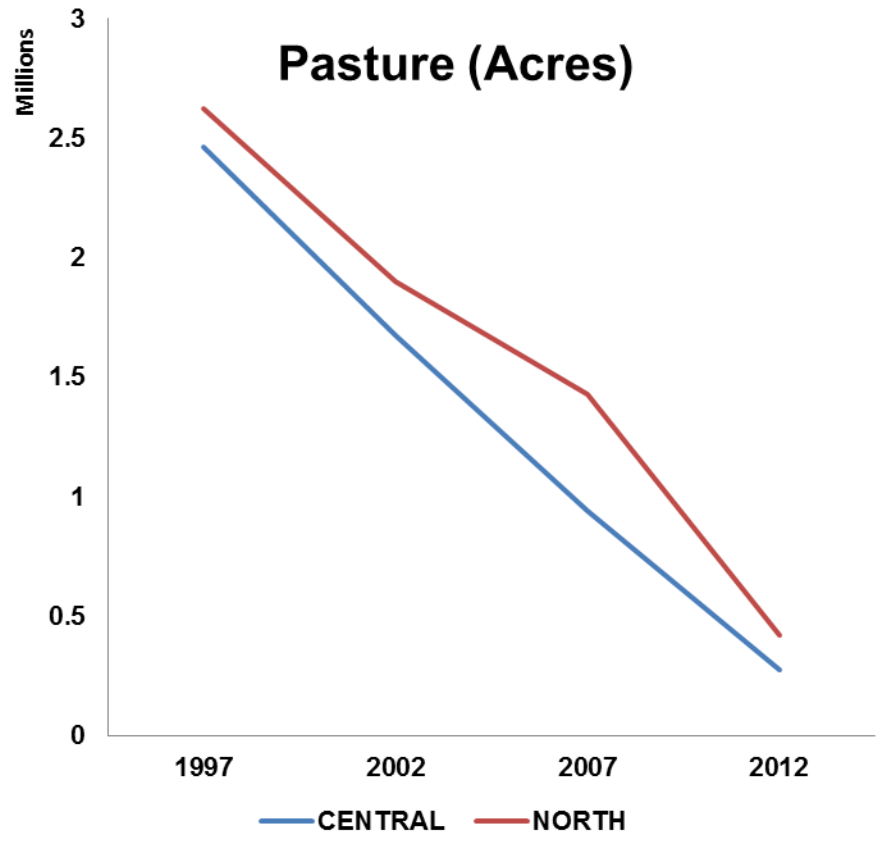
Source: National Agricultural Statistics Service (NASS)



Peters et al. (2014) Agricultural Systems 130: 35-43
Image: University of Minnesota

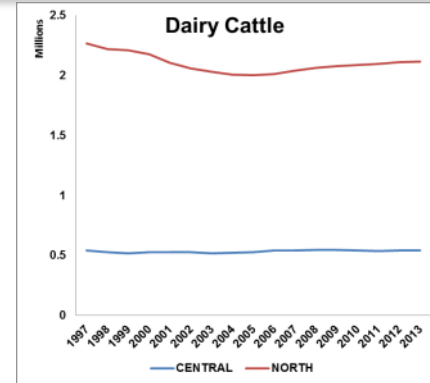
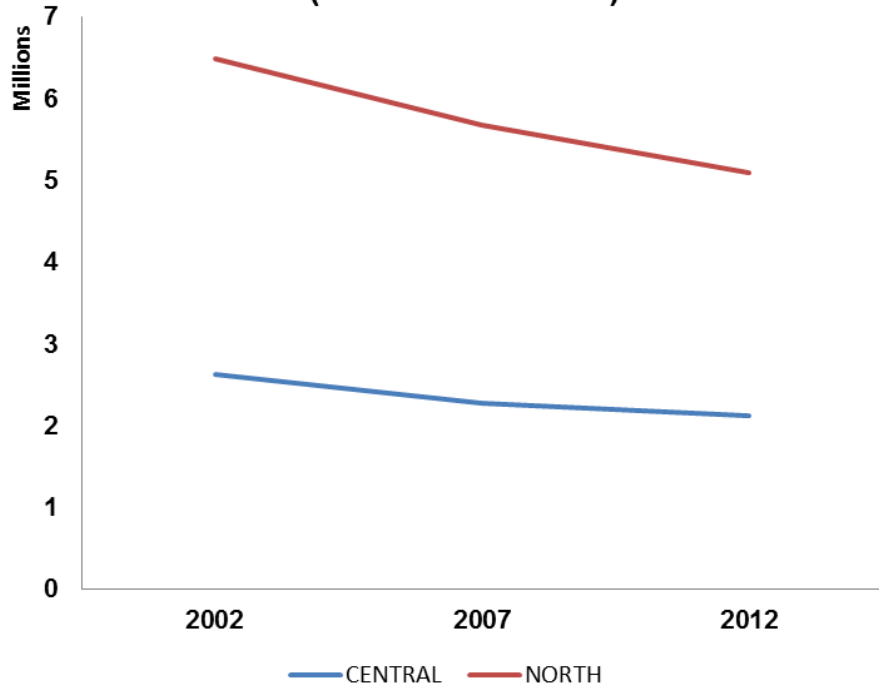


Peters et al. (2014) *Agricultural Systems* 130: 35-43

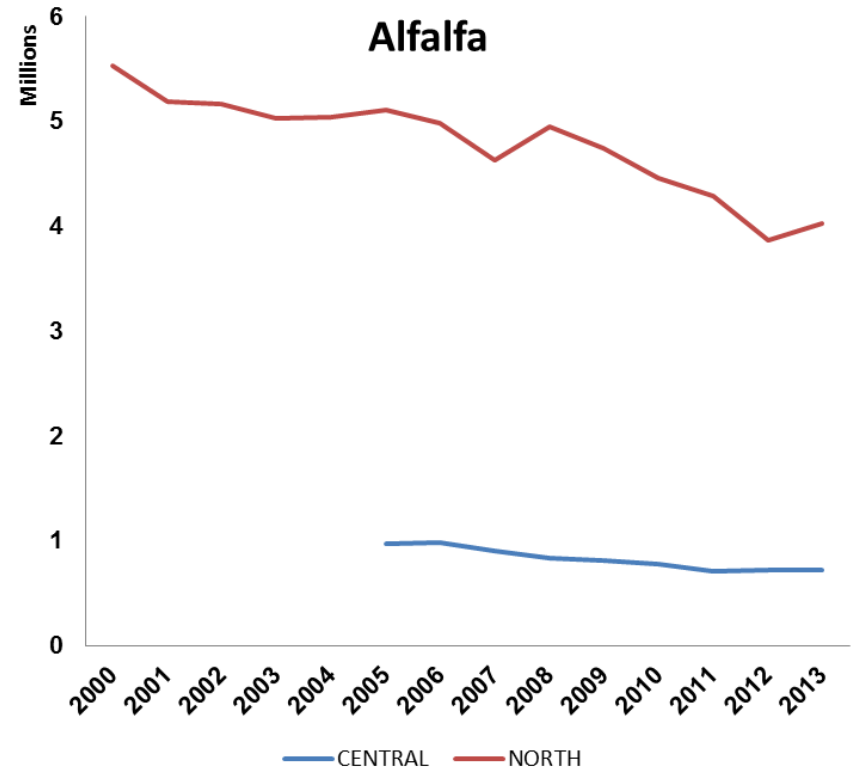


Source: National Agricultural Statistics Service (NASS)

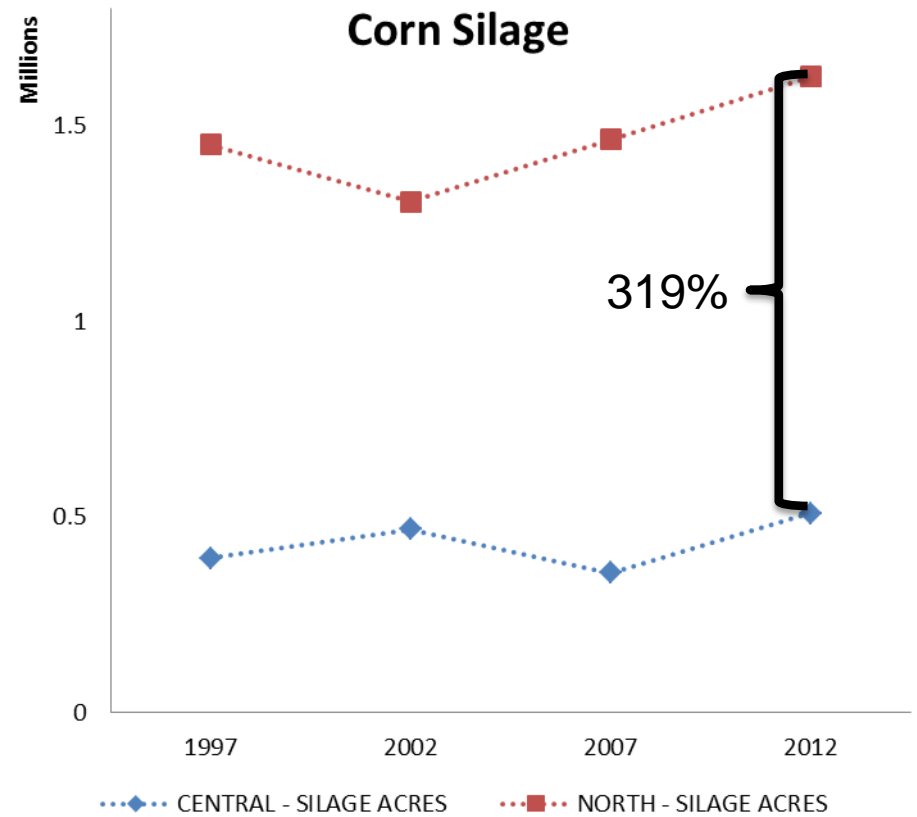
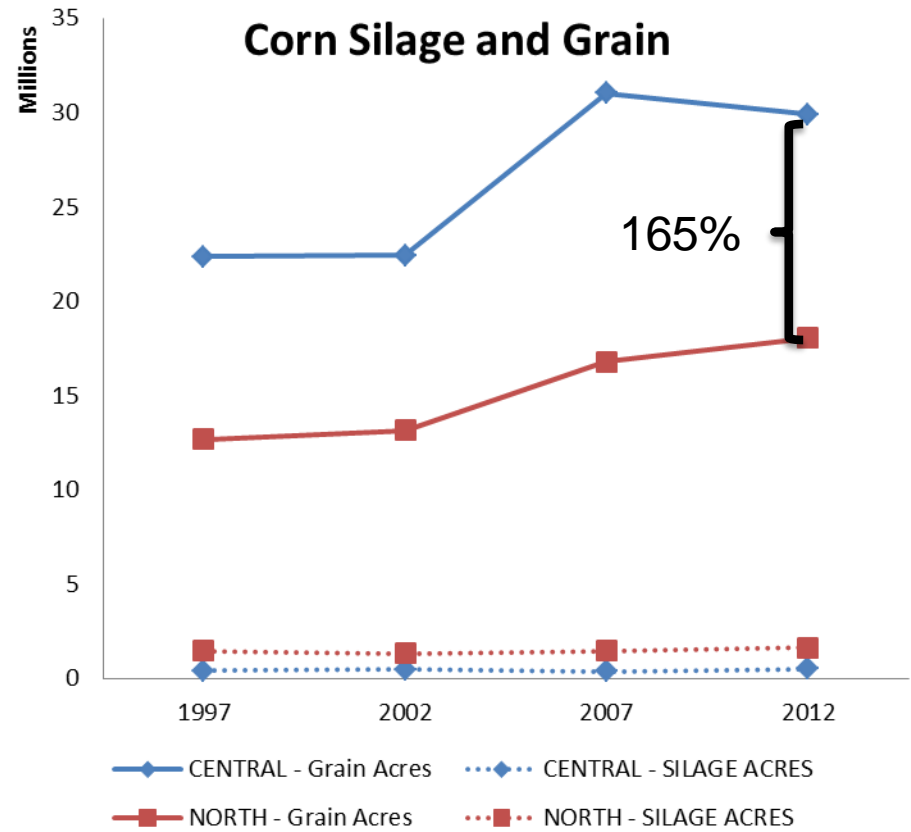
Hay and Haylage (Acres Harvested)



Alfalfa



Source: National Agricultural Statistics Service (NASS)



Source: National Agricultural Statistics Service (NASS)

In summary,

- Diets of beef and dairy cattle are more diverse than other livestock
- Pasture acreage has dramatically decreased in the past 15 years
- Northern Midwest farming operations lead in corn silage, alfalfa, and hay production
- Traditional forage production appears to be at a standstill

What does this mean for cover crops and double-cropping?

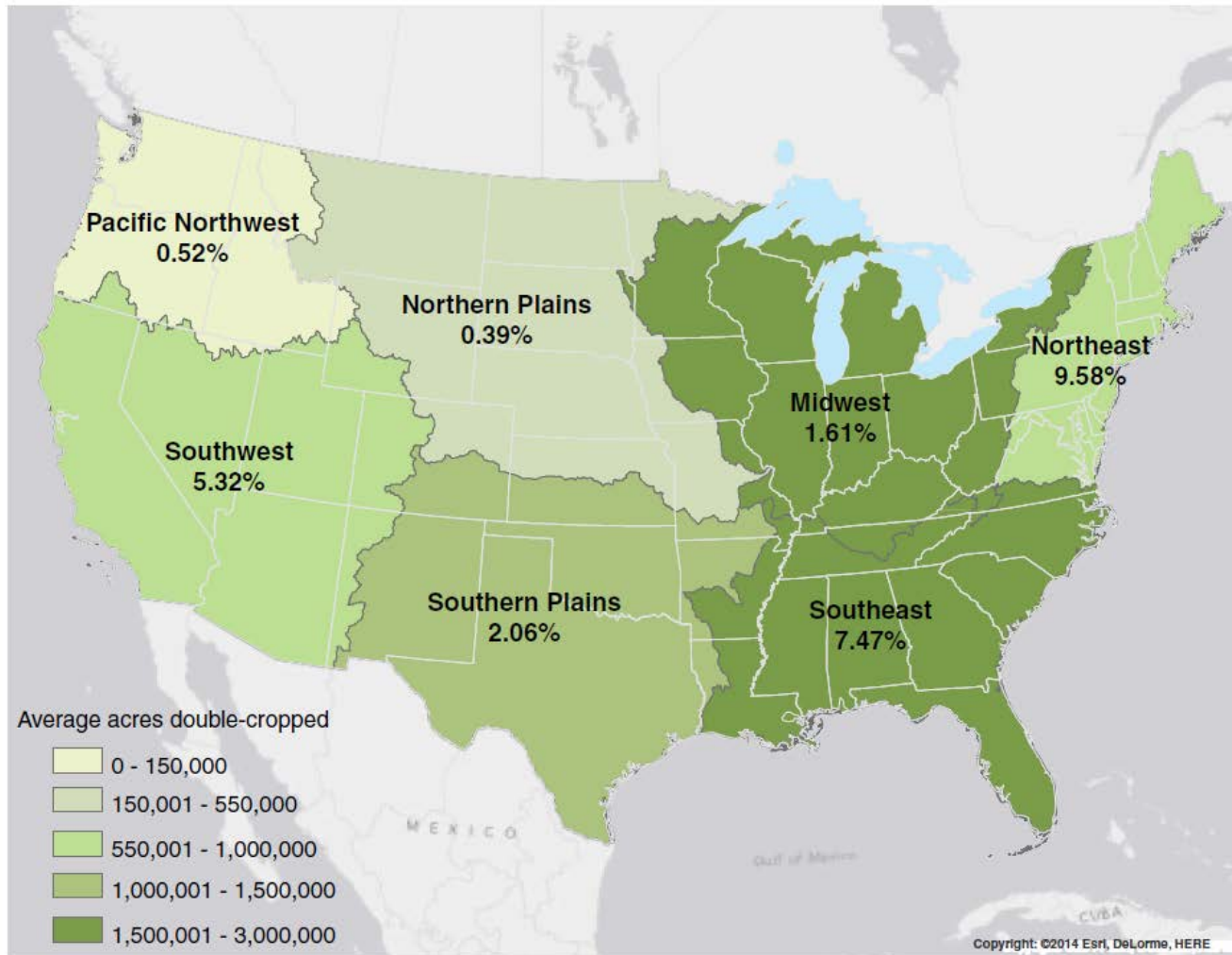
Table 1

Multi-cropping prevalence varies by practice

	Share of acreage	Estimated acreage
Double cropping ¹	2-3 percent of cropland in a given year	About 6 to 11 million acres in a given year
Cover cropping ²	1-2 percent of cropland	6 to 7.7 million acres
Integrated cropland-livestock systems ²	11-26 percent of planted acreage for selected crops is grazed following harvest	Over 20 million acres based on corn and winter wheat estimates
Woodland-based systems:		
Agroforestry (alley cropping, multi-story cropping, silvopasture) ³	Not available	About 15,000 acres in 2011 (includes acres enrolled in USDA programs only)
Woodland pasture ⁴	38 percent of woodland in farms; varies significantly by region.	About 28 million acres

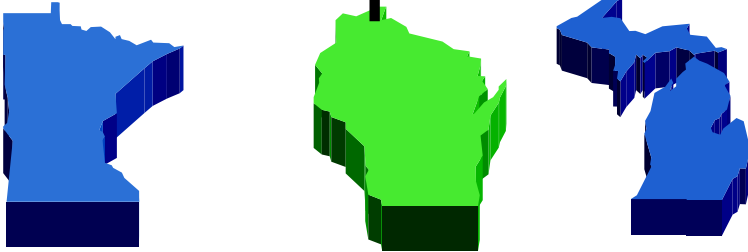
Sources: ¹USDA, Economic Research Service (ERS) estimates based on 1999-2012 June Area Survey; ²ERS estimates based on 2006-2011 Agricultural Resource Management Survey; ³data provided by the USDA Forest Service; ⁴ERS estimates based on 2007 Census of Agriculture.

Average double-cropped acreages vary by region, 1999-2012

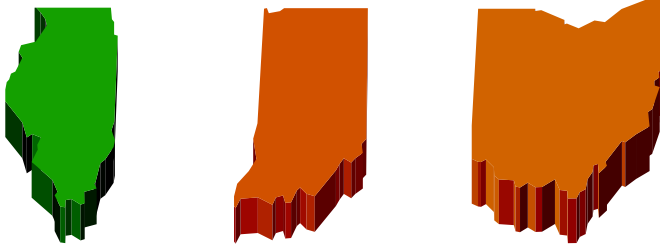


Borchers et al. 2014 USDA Economic Information Bulletin No. 125

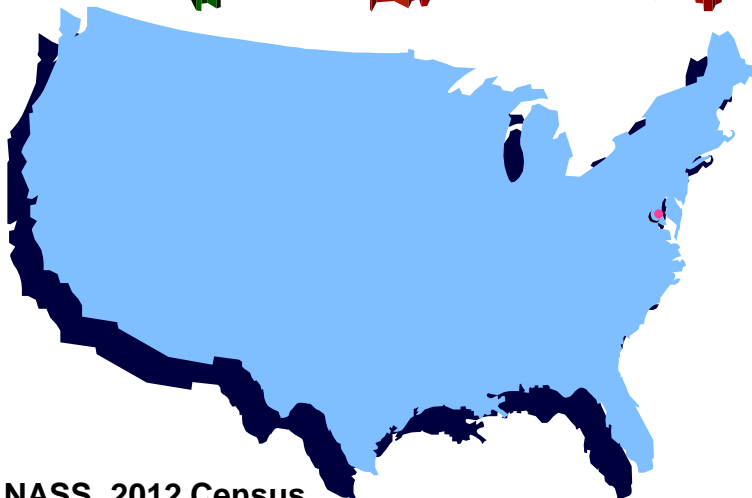
Cover Crops



1.39 million acres



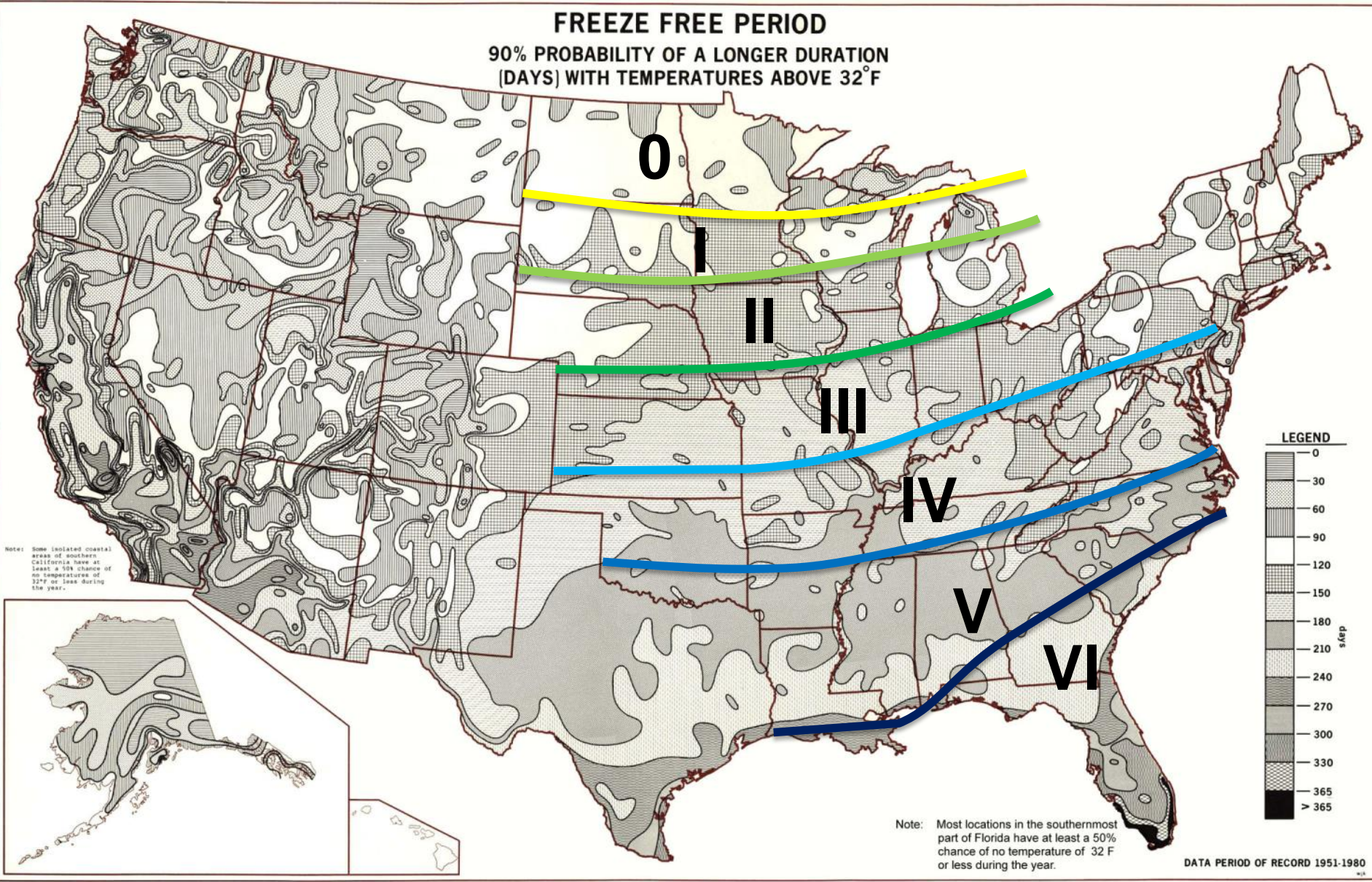
1.27 million acres



10.28 million acres

Source: NASS, 2012 Census

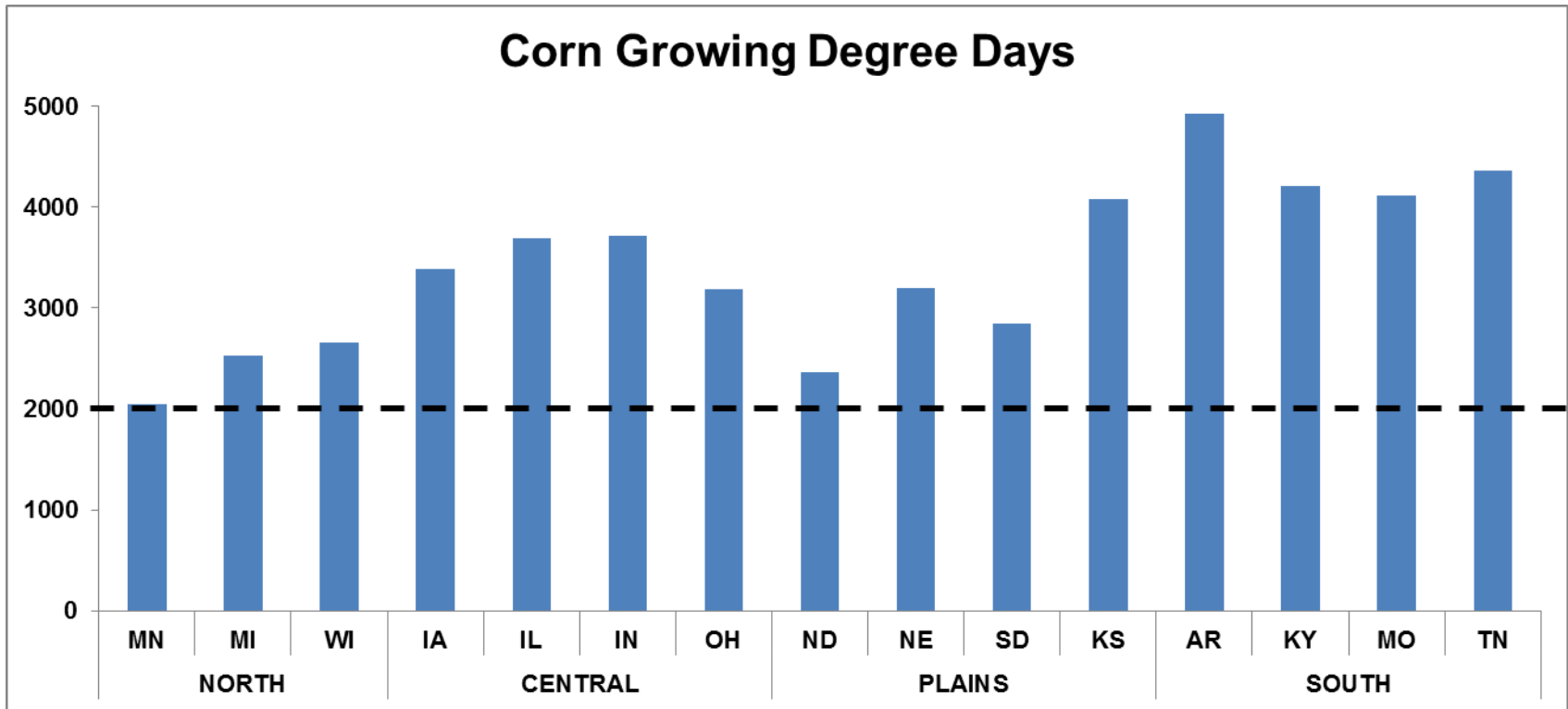
FREEZE FREE PERIOD
90% PROBABILITY OF A LONGER DURATION
(DAYS) WITH TEMPERATURES ABOVE 32°F



Note: Some isolated coastal areas of southern California have at least a 50% chance of no temperatures of 32°F or less during the year.

Note: Most locations in the southernmost part of Florida have at least a 50% chance of no temperature of 32 F or less during the year.

DATA PERIOD OF RECORD 1951-1980



Source: 1971 to 2000 Climate Normals, <http://www.cpc.ncep.noaa.gov>

Cover Crop Window

Central Illinois

- 3018 Growing Degree Days (GDD)
- September 1: 1285 GDD
- September 14: 919
- October 1: 497
- October 15: 254

Central Wisconsin

- 1948 GDD
- September 1: 762 GDD
- September 14: 502
- October 1: 240
- October 15: 122



Cereal rye requires 260 to 350 GDD to establish after seeding.

Wanted: Research

Regionally specific agronomic information

Economic and environmental pros and cons of double-cropping

Herbicide carryover

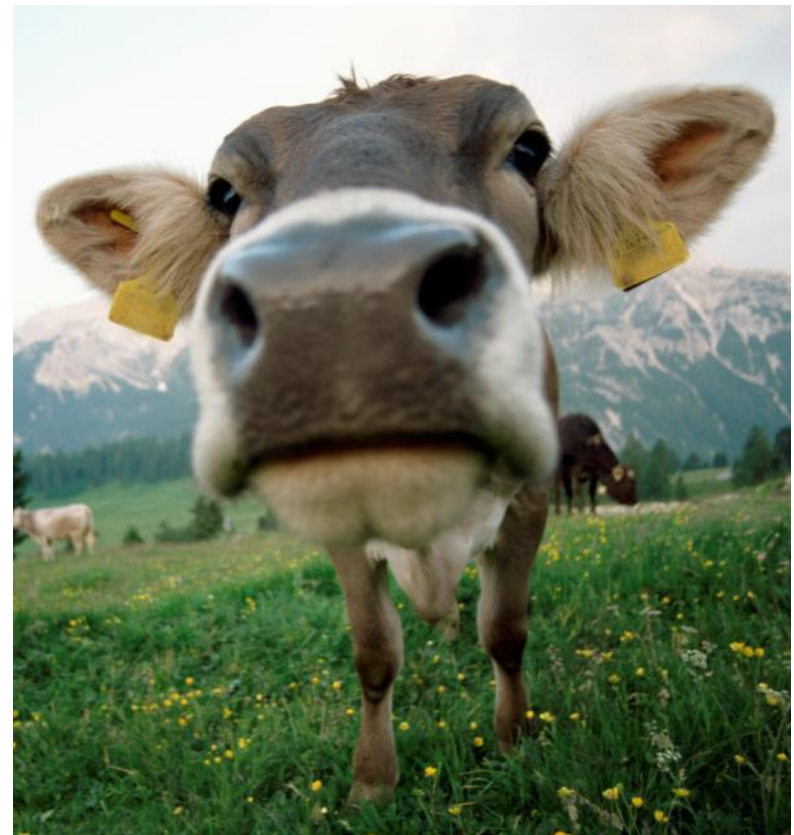
Overwintering success and spring termination of annual ryegrass

Biomass production for weed suppressive mulches

Ongoing Research

- Herbicide Carryover
(NCWSS Presentation #127 Dan Smith)
- Termination of Cereal Rye and Annual Ryegrass Varieties
(NCWSS Poster #84 Dan Smith)
- Summer Annual Weed Suppression in Soybean- *In progress*
- Badger Plot Cover Crop Project in Dodge County- *In progress*

Using cover crops for emergency forage





Images: Wisconsin State Farmer, New York Times, National Pesticide Information Center

The Readability Test Tool

Let's make the unreadable readable

Test by URI
Test by Direct Input
Test by Referer

Test by Direct Input

Enter text to check the readability:

HTML is allowed - it will be stripped from the text.

Calculate Readability

The Readability Test Tool

Let's make the unreadable readable

Readability Test Results

This page has an average [grade level](#) of about 12.
It should be easily understood by 17 to 18 year olds.

[Tweet this result!](#)

Readability Indices

Flesch Kincaid Reading Ease	51.6	<div style="width: 51.6%; background-color: #ccc; border: 1px solid #ccc;"><div style="width: 51.6%; background-color: #ffff00;"></div></div>
Flesch Kincaid Grade Level	10.7	<div style="width: 10.7%; background-color: #ccc; border: 1px solid #ccc;"><div style="width: 10.7%; background-color: #ffff00;"></div></div>
Gunning Fog Score	12.4	<div style="width: 12.4%; background-color: #ccc; border: 1px solid #ccc;"><div style="width: 12.4%; background-color: #ffff00;"></div></div>
SMOG Index	9.8	<div style="width: 9.8%; background-color: #ccc; border: 1px solid #ccc;"><div style="width: 9.8%; background-color: #ffff00;"></div></div>
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Automated Readability Index	12.1	<div style="width: 12.1%; background-color: #ccc; border: 1px solid #ccc;"><div style="width: 12.1%; background-color: #ffff00;"></div></div>

Text Statistics

No. of sentences	7
No. of words	131
No. of complex words	20
Percent of complex words	15.27%
Average words per sentence	18.71
Average syllables per word	1.61



8, 10, 10

The New York Times

10, 12, 14



14, 14, 14

Table 507.10. Literacy skills of adults, by type of literacy, proficiency levels, and selected characteristics: 1992 and 2003

[Standard errors appear in parentheses]

Selected characteristic	Percent of adults at each proficiency level, 2003			
	Below basic	Basic	Intermediate	Proficient
	1	10	11	12
Age				
55 to 64 years old	12 (0.9)	23 (0.9)	54 (1.2)	12 (1.1)

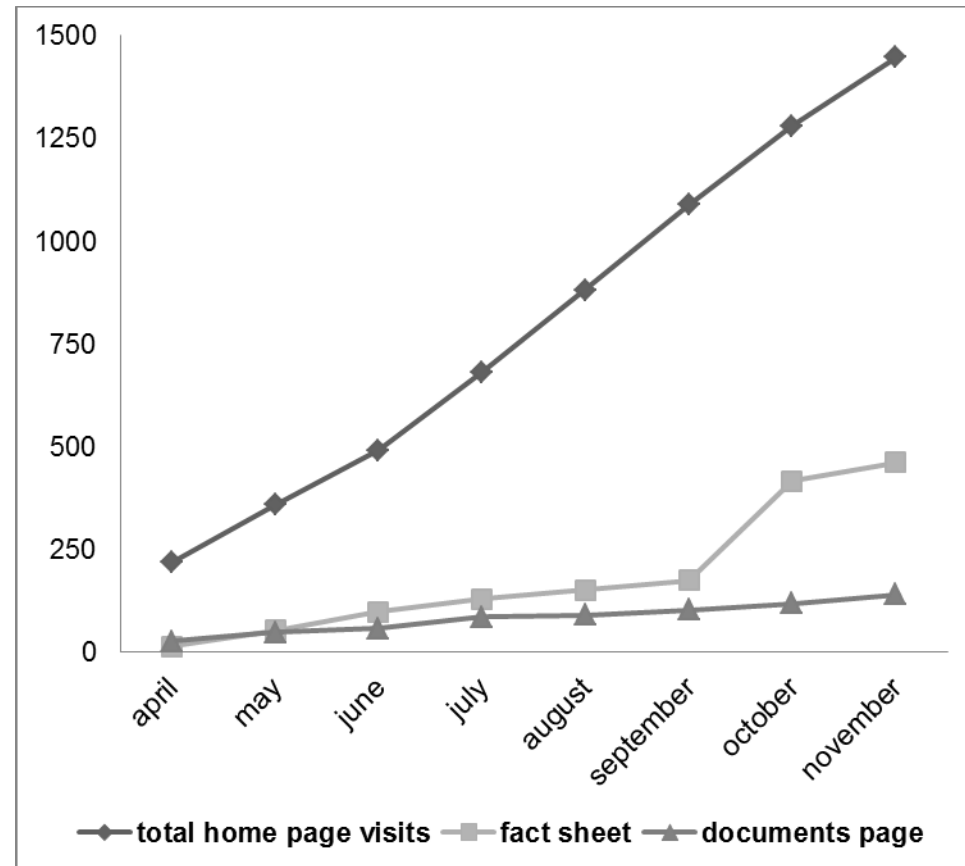
2012 Ag Census: Average Age of a Farmer 58.3 years

“Document literacy refers to the knowledge and skills needed to search, comprehend, and use information from noncontinuous texts in various formats. . . At the Intermediate level, rated 250 to 334, adults are able to locate information in dense, complex documents and make simple inferences about the information. At the Proficient level, rated 335 to 500, adults are able to integrate, synthesize, and analyze multiple pieces of information located in complex documents.”



Herbicide Rotation Restrictions in Forage and Cover Cropping Systems

UW
Extension
University of Wisconsin-Madison



Months to plant forage crops after herbicide application on corn



	PRE-PLANT INCORPORATED	PRE-EMERGENCE HERBICIDES	NON-LEGUMES	LEGUMES
	Acetochlor (Harness) Dual II magnum Outlook Zidua	Acetanilide+ atrazine premix (Harness Xtra) Acetochlor (Surpass EC) Atrazine Anthem (c) Callisto (i) Dicamba (Clarity) (c) (j) Dual II magnum Fierce Hornet WDG Instigate Lumax (h) Outlook Princep 4L Prowl H2O Python WDG Resolve Q (c) Sharpen (c) (j) Surestart Valor (c) Verdict Zemax Zidua	<p>Annual ryegrass</p> <p>Barley</p> <p>Buckwheat</p> <p>Cereal rye</p> <p>Oats</p> <p>Pearl Millet</p> <p>Sorghum</p> <p>Triticale</p> <p>Wheat</p> <p>Radish</p>	<p>Alfalfa</p> <p>Clover</p> <p>Cowpea</p> <p>Field pea</p> <p>Vetch</p>

Months to plant forage crops after herbicide application on corn

		NON-LEGUME FORAGE CROPS						LEGUME FORAGE CROPS				MAX ROTATION (a)	
		PEARL MILLET	SORGHUM	TRITICALE	WHEAT	RADISH	ALFALFA	CLOVER	COMPEA	FIELD PEA	VETCH		
PREPLANT-INCORPORATED	Acetochlor (Harness)	18	18	18	4	18	9	9	9	9	9	18	
	Dual II magnum	12	12	12	4.5	2 (c)	4 (c)	9 (c)	12	12	12	12	
	Outlook	(b)	(b)	(b)	4	(b)	(b)	(b)	(b)	(b)	(b)	(b)	
	Zidua	(e)	(e)	(e)	(e)	12	(e)	(e)	(e)	(e)	(e)	12	
	IDES	Acetanilide+ atrazine premix (Harness Xtra)	18	18	18	4	9	9	9	9	9	9	18
		Acetochlor (Surpass EC)	(b)	(b)	(b)	4	(d)	(b)	(b)	(b)	(b)	(b)	(b)
		Atrazine	(f)	(b)	(f)	(f)(g)(h)	(f)	(f)	(f)	(f)	(f)	(f)	(f)
		Anthem (c)	18	18	18	6	18	10	18	11	11	18	18
		Callisto (i)	0	0	4	4	18	10	18	18	18	18	18
		Dicamba (Clarity) (c) (j)	(k)	(k)	(k)	(k)	4	4	4	4	4	4	4
		Dual II magnum	12	12	12	4.5	2 (c)	4	9	12	12	12	12
		Fierce	(e)	(e)	(e)	(e)	12	(e)	(e)	(e)	(e)	(e)	12
Hornet WDG		26	26	26	4	26	10.5 (l)	26	26	10.5, 18 (l)	26	26	
Warrant		(e)	(e)	(e)	(e)	(e)	(e)	4	(k)	9	9	(e)	
Zidua		(j)	(j)	(j)	(j)	(j)	(j)	(j)	12	(j)	(j)	(j)	
Princep 4L		(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	

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.

- (a) the maximum amount of time required before planting the next crop if it is not listed on the label
- (b) the next crop may be planted the following spring
- (c) rate restriction
- (d) no crop rotation restrictions specified
- (e) only crops listed on the label may be planted in rotation
- (f) the next crop may be planted the second following spring
- (g) planting date restriction
- (h) application timing restriction
- (i) see label for the mesotrione exception- only corn and sorghum can be planted as the next rotational crop
- (j) rotation interval does not include days when the ground is frozen
- (k) 15 days per 8 fl oz/acre east of Mississippi River
- (l) precipitation requirement



Forage Herbicide Quick Sheet

Cereal Rye Forage after Corn Silage



Elizabeth Bosak and Vince Davis
Department of Agronomy, University of Wisconsin-Madison

		SITE OF ACTION GROUP #	CEREAL RYE
PREPLANT- INCORPORATED	Acetochlor (Surpass EC)	[15]	-
	Dual II Magnum	[15]	✓
	Outlook	[15]	✓
PREEMERGENCE HERBICIDES	Acetochlor (Surpass EC)	[15]	-
	Callisto	[27]	✓
	Dicamba (Clarity)	[4]	✓
	Dual II Magnum	[15]	✓
	Hornet WDG	[2]+[4]	✓
	Instigate	[2]+[27]	✓
	Lumax EZ	[5]+[15]+[27]	✓
	Outlook	[15]	✓
	Prowl H2O	[3]	✓
	Python WDG	[2]	✓
	Sharpen	[14]	✓
	Surestart	[2]+[4]+[15]	-
	Valor	[14]	✓
	Verdict	[14]+[15]	✓
Zemax	[15]+[27]	✓	

If there is a "✓" for a specific herbicide and forage crop, then it is likely that the rotational interval will be satisfied with normal crop system operations. A "--" indicates that the rotational interval likely exceeds the time between application and forage crop seeding, therefore legal planting for forage harvest is not possible.

When interpreting label restrictions, remember the time of replant interval listed is the time between application and forage crop planting, not forage crop harvest. For example, if you made an application of Dual II magnum on May 1 and Liberty on July 15 then the rotational intervals for cereal rye would be satisfied 4.5 months after May 1 and 70 days after July 15. So, after September 25, cereal rye could be seeded for a forage crop but not before that date.

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Always follow the product's current label restrictions and instructions.



Forage Herbicide Quick Sheet Spring-Seeded Forages after Corn

Elizabeth Bosak and Vince Davis
Department of Agronomy, University of Wisconsin-Madison



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

		SITE OF ACTION GROUP #	BARLEY	OATS	TRITICALE	FIELD PEAS
PREPLANT-INCORPORATED	Acetochlor (Surpass EC)	[15]	✓	✓	✓	✓
	Dual II Magnum	[15]	✓	✓	--	--
	Outlook	[15]	✓	✓	✓	✓
PREEMERGENCE HERBICIDES	Acetochlor (Surpass EC)	[15]	✓	✓	✓	✓
	Callisto	[27]	✓	✓	✓	--
	Dicamba (Clarity)	[4]	✓	✓	✓	✓
	Dual II Magnum	[15]	✓	✓	--	--
	Hornet WDG	[2]+[4]	✓	✓	--	--
	Instigate	[2]+[27]	✓	✓	✓	--
	Lumax EZ	[5]+[15]+[27]	✓	✓	--	--
	Outlook	[15]	✓	✓	✓	✓
	Prowl H2O	[3]	✓	--	--	--
	Python WDG	[2]	✓	✓	--	✓
	Sharpen	[14]	✓	✓	✓	✓
	Surestart	[2]+[4]+[15]	✓	✓	--	✓
	Valor	[14]	✓	✓	--	✓
	Verdict	[14]+[15]	✓	✓	✓	✓
Zemax	[15]+[27]	✓	✓	--	--	

If there is a "✓" for a specific herbicide and forage crop, then it is likely that the rotational interval will be satisfied with normal crop system operations. A "--" indicates that the rotational interval likely exceeds the time between application and forage crop seeding, therefore legal planting for forage harvest is not possible.

When interpreting label restrictions, remember that the length of the replant interval is the time between application and forage crop planting, not forage crop harvest. For example, if you made an application of Dual II magnum on May 1 and Liberty on July 15 then the rotational intervals for spring barley would be satisfied 4.5 months after May 1 and 70 days after July 15. So, after September 25, spring barley could be seeded for a forage crop but not before that date.

To be continued . . .

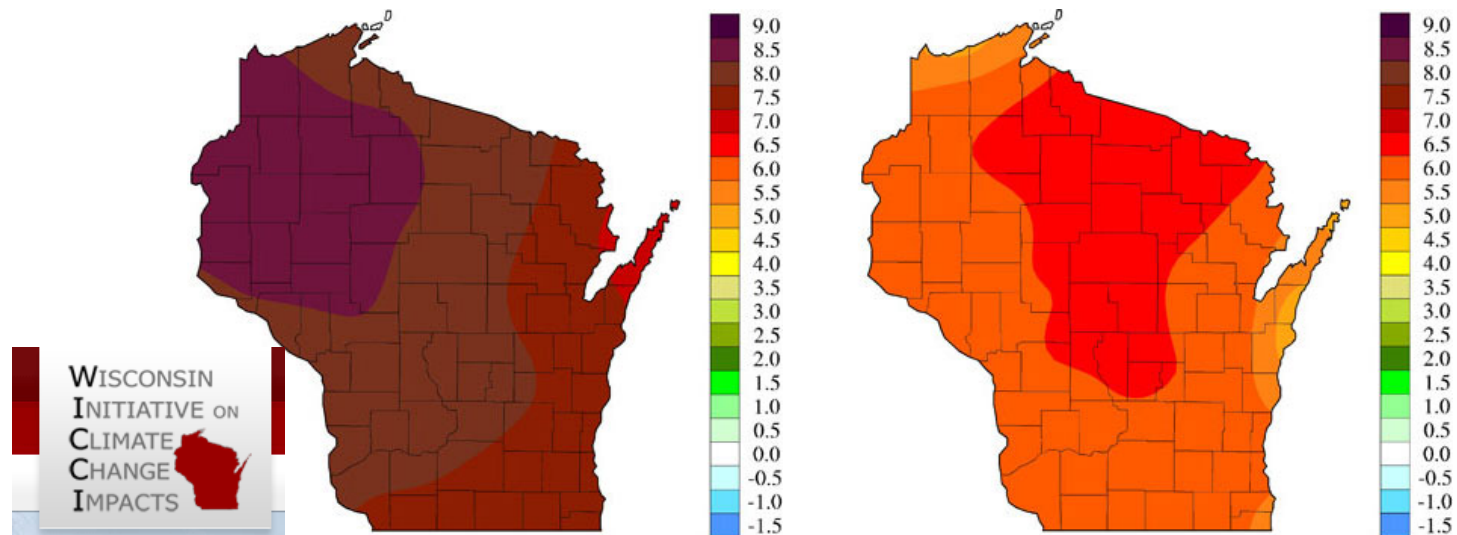
Bottom-line biomass for weed suppression

Annual ryegrass termination now and in the future

Herbicide resistance management for double-cropping forage

Readability of fact sheets

Rotational restrictions and changing behavior





Thank you for your attention!