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Treating Wheat as a First Class Citizen

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Geographical Comparison

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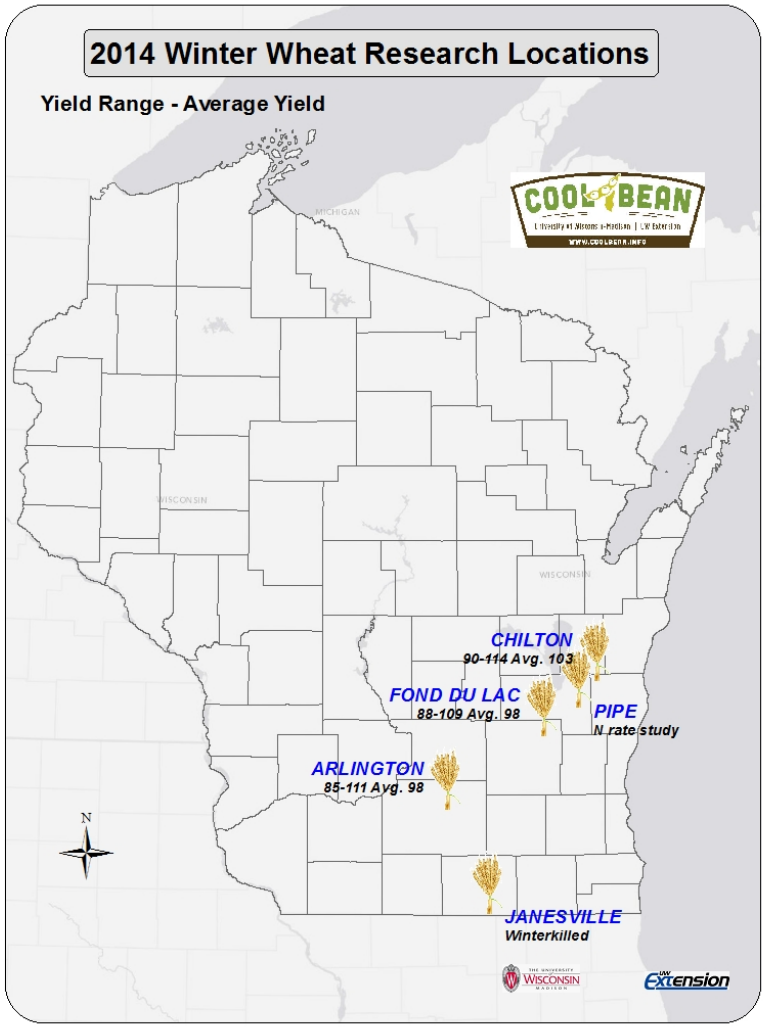
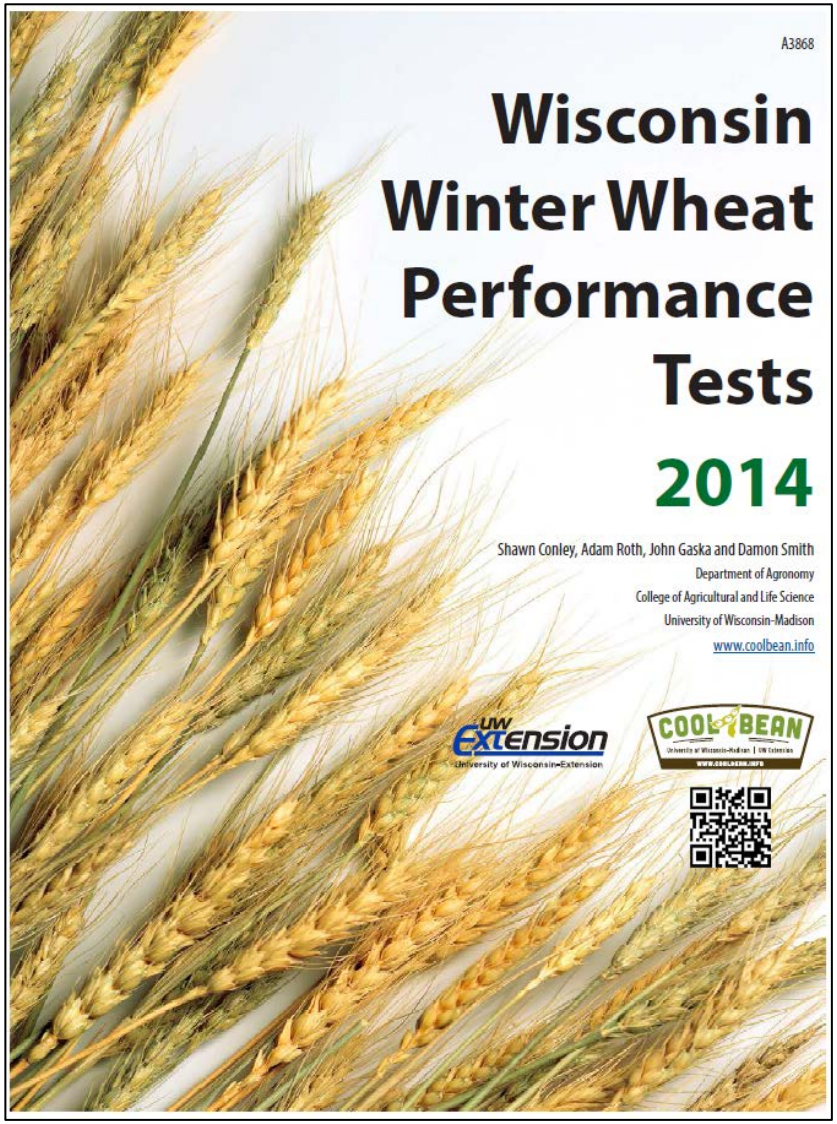
WI Winter Wheat Program: The year in review

Brand	Entry	Yield (bu/A)
PIP	735	109
DuPont Pioneer	25R46	108
Legacy	LXW 1480	106
PIP	737	106
PIP	738	106
PIP	741	106
Legacy	LXW 1485	105
PIP	736	105
Syngenta	SY 483	105
Diener	XW 1401	104
PIP	721	104
PIP	766	104
AgriMAXX	413	103
DuPont Pioneer	25R40	103
Dyna-Gro	9223	103
Legacy	LW 1375	103
PIP	734	103
PIP	760	103
PIP	792	103
Pro Seed Genetics	PRO 320A	103



Performance Tests



A3874

Wisconsin oats and barley performance tests—2015

John Mochon and Shawn Conley

The Wisconsin oats and barley performance trials are conducted each year with the producer's needs in mind. Trials include released varieties, experimental lines from Wisconsin and neighboring states, and lines from private seed companies. The primary objective of these trials is to obtain data on how varieties perform in different locations and years. Growers use these data to help choose the best varieties to plant, and breeders use performance data to determine whether or not to release a new variety.

New varieties developed and released in Wisconsin are entered in the Wisconsin Certification Program. These varieties have demonstrated superior production qualities. In addition, highly rated varieties from other states may be recommended and/or certified in the state. As new varieties are released to the public, older varieties with inferior qualities are removed from the recommended list and eventually dropped from the certified list as seed production declines.

Occasionally, varieties are certified without being recommended to Wisconsin growers. These varieties may include commercial varieties developed by private seed companies or varieties where there is a substantial market for Wisconsin-produced seed. Thus, in Wisconsin, recommendation and certification do not mean the same thing. Recommended varieties are those with superior in-state production performance records, while certification provides the assurance of seed purity and seed quality.

Variety selection

Factors to consider when selecting oat and barley varieties include grain yield, maturity, straw strength (or resistance to lodging), and disease resistance. Disease ratings are performed by the University of Wisconsin–Madison Department of Agronomy. Barley growers should consider whether a variety is acceptable for malting. Several varieties are also evaluated for forage yield (tables 4 and 7).

How the entries were tested

Varieties included in the trial are selected based upon current demand, availability, and adaptation to Wisconsin's climate. Most of these entries are commercially available. Several commercial and public cultivars were included for comparison.

Tests were conducted at seven locations using conventional tillage practices. All plots were planted at a seeding rate of 2.5–3.0 bushels per acre. Agronomic practices at all locations are listed in table 1. Tests were conducted using four randomized replications.

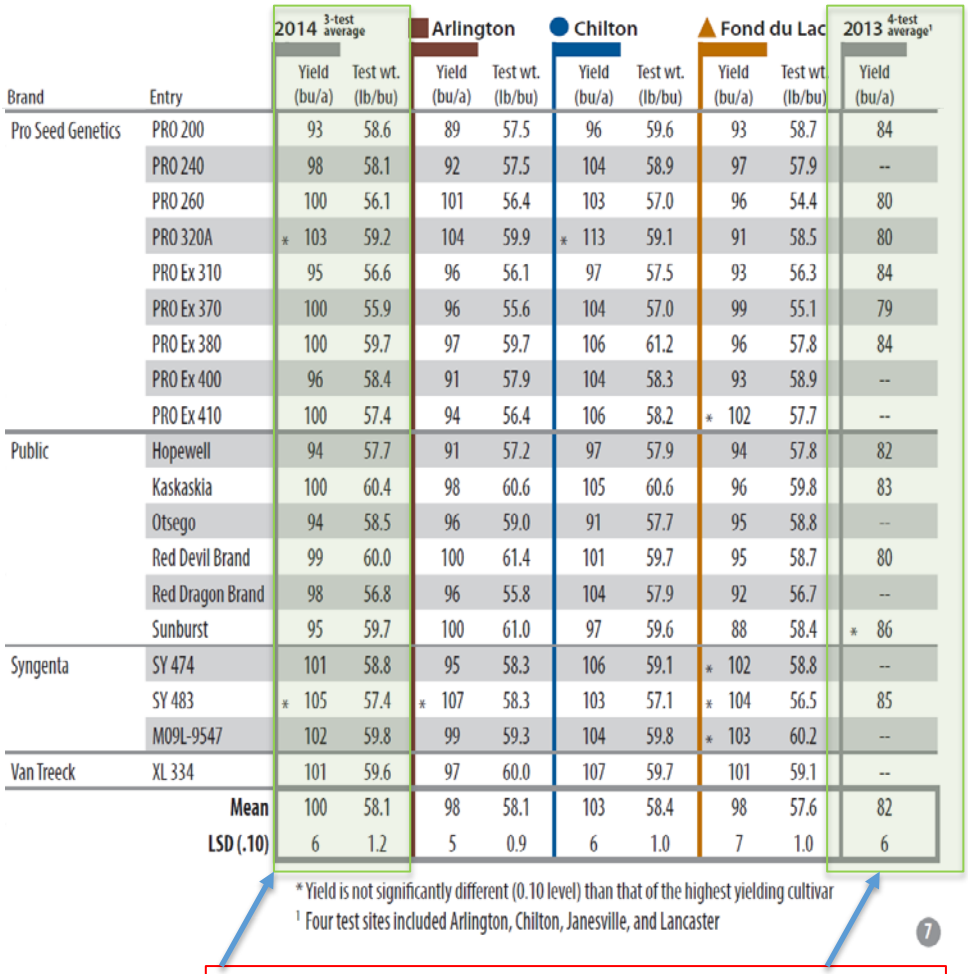
Table 1. Location and agronomics of small grain variety trials in Wisconsin

Location	Cooperators	Soil type	Row spacing (inches)	Average nitrogen applied (lb/a)	Planting date	Harvest date
Arlington	J. Albertson, P. LeMahieu	silt loam	6.0	30*	April 23	Aug. 8
Chilton	Kolbe Seeds, M. Glewen	red clay	12.0	-------	May 23	-------
Lancaster	A. Crooks, B. Meyers	silt loam	7.5	barley: 5, oats: 8	April 22	Aug. 6
Madison	J. Mochon, T. Wright	silt loam	6.0	30*	May 6	-------
Marshfield	J. Cavadini	silt loam	6.0	barley: 50, oats: 40	May 19	Aug. 21
Spooner	P. Holman	sandy loam	7.3	74	May 7	Aug. 25
Sturgeon Bay	M. Stasiak	silt loam	12.0	82	May 27	Aug. 27

* Nitrogen credited from previous alfalfa or soybean.

Data Tables

- Companies, varieties sorted alphabetically
- Mean and LSD shown at bottom
- Stars (*) indicate that variety is not significantly different than the highest yielding variety in the trial.
- Additional winter survival and disease data taken when available



		2014 3-test average		Arlington		Chilton		Fond du Lac		2013 4-test average[1]
Brand	Entry	Yield (bu/a)	Test wt. (lb/bu)	Yield (bu/a)	Test wt. (lb/bu)	Yield (bu/a)	Test wt. (lb/bu)	Yield (bu/a)	Test wt (lb/bu)	Yield (bu/a)
Pro Seed Genetics	PRO 200	93	58.6	89	57.5	96	59.6	93	58.7	84
	PRO 240	98	58.1	92	57.5	104	58.9	97	57.9	--
	PRO 260	100	56.1	101	56.4	103	57.0	96	54.4	80
	PRO 320A	* 103	59.2	104	59.9	* 113	59.1	91	58.5	80
	PRO Ex 310	95	56.6	96	56.1	97	57.5	93	56.3	84
	PRO Ex 370	100	55.9	96	55.6	104	57.0	99	55.1	79
	PRO Ex 380	100	59.7	97	59.7	106	61.2	96	57.8	84
	PRO Ex 400	96	58.4	91	57.9	104	58.3	93	58.9	--
	PRO Ex 410	100	57.4	94	56.4	106	58.2	* 102	57.7	--
Public	Hopewell	94	57.7	91	57.2	97	57.9	94	57.8	82
	Kaskaskia	100	60.4	98	60.6	105	60.6	96	59.8	83
	Otsego	94	58.5	96	59.0	91	57.7	95	58.8	--
	Red Devil Brand	99	60.0	100	61.4	101	59.7	95	58.7	80
	Red Dragon Brand	98	56.8	96	55.8	104	57.9	92	56.7	--
	Sunburst	95	59.7	100	61.0	97	59.6	88	58.4	* 86
Syngenta	SY 474	101	58.8	95	58.3	106	59.1	* 102	58.8	--
	SY 483	* 105	57.4	* 107	58.3	103	57.1	* 104	56.5	85
	M09L-9547	102	59.8	99	59.3	104	59.8	* 103	60.2	--
Van Treeck	XL 334	101	59.6	97	60.0	107	59.7	101	59.1	--
	Mean	100	58.1	98	58.1	103	58.4	98	57.6	82
	LSD (.10)	6	1.2	5	0.9	6	1.0	7	1.0	6

*Yield is not significantly different (0.10 level) than that of the highest yielding cultivar

[1] Four test sites included Arlington, Chilton, Janesville, and Lancaster

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Use multi-location and multi-year data for best prediction of yields

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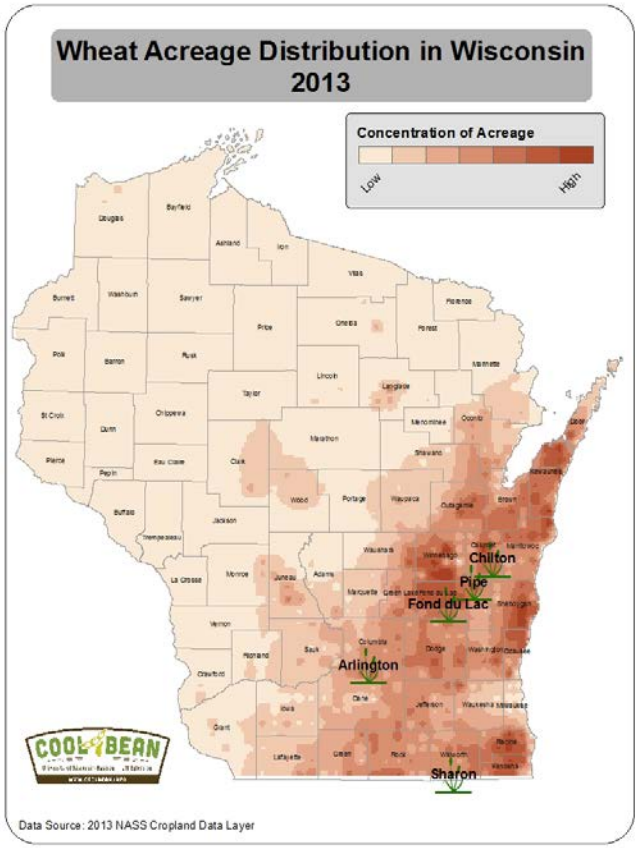
Winter Wheat Variety by Seeding Rate Interactions (13-14 growing seasons)

Seeding rate (million seeds a^{-1})	Grain yield (bu a^{-1})
1.25	88.8
1.50	88.5
1.75	90.8
2.00	90.5
2.25	91.4
2.50	90.8
	LSD (0.10) 1.8

- Significant yield increase from 1.50 to 1.75 million seeds per acre
- No variety by seeding rate interaction
  - Sunburst, Pro260, P25R40



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Wisconsin Certified SEED

Winter Wheat Seeding Rate Recommendations Continued

Seeds/acre Million	Seeds/sq ft	Row Width (in)			
		6	7	7.5	
		Seeds per foot row			
0.4	9.2	5	5	6	
0.5	11.5	6	7	7	
0.6	13.8	7	8	9	
0.7	16.1	8	9	10	
0.8	18.4	9	11	11	
0.9	20.7	10	12	13	Seeding Rate for Sept 1 to Sept 15
1.0	23.0	11	13	14	
1.1	25.3	13	15	16	
1.2	27.5	14	16	17	
1.3	29.8	15	17	19	
1.4	32.1	16	19	20	Seeding Rate for Sept 15 to Oct. 1
1.5	34.4	17	20	22	
1.6	36.7	18	21	23	
1.7	39.0	20	23	24	
1.8	41.3	21	24	26	
1.9	43.6	22	25	27	Seeding Rate for Oct. 1 to Oct 10
2.0	45.9	23	27	29	
2.1	48.2	24	28	30	
2.2	50.5	25	29	32	
2.3	52.8	26	31	33	
2.4	55.1	28	32	34	
2.5	57.4	29	33	36	

- Decreased TW:TKW
  - ↑ seeding rate
  - ↓ seeding vigor
- Delayed planting
  - ↑ lack of tillers

Seeds/lb	Seeds per acre (x 1 million)						
	1.0	1.2	1.4	1.6	1.8	2.0	2.2
	Pounds of seed/acre						
10000	100	120	140	160	180	200	220
11000	91	109	127	145	164	182	200
12000	83	100	117	133	150	167	183
13000	77	92	108	123	138	154	169
14000	71	86	100	114	129	143	157
15000	67	80	93	107	120	133	147
16000	63	75	88	100	113	125	138
17000	59	71	82	94	106	118	129

**This table is based on 100% germination. Adjust your seeding rate by the % germ printed on your bag tag.*

Status of Late Planted Wheat

*Remember that winter wheat will vernalize once the radicle emerges

#1 Wheat Problem in the Midwest

Winterkill

N Demand for Winter Wheat

- N fertilizer has two important functions:
  - Manipulate population
    - Effective population is tillers, not population
  - Supply nutritional needs of crop for production of protein (streamer bars)
- Wheat following soybean vs. corn
  - Residual N following drought conditions
  - Validation of PPNT

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What is the Right Time for N?

- Early spring if the crop looks thin
  - < 70 tillers/ft^2
- If the crop looks good, wait until near jointing
  - Increase yield
  - Increase fertilizer efficiency
  - Avoid growth that is too lush
    - Disease, lodging, water stress
  - Allow better diagnosis of the right amount of N

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Tiller ID and Contribution to Yield

- Each tiller has its own sheath (prophyll)
- Be aware of 2° or 3° tillers
- Tillers > 5th leaf will not produce heads and therefore, do not need to be counted....

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Effect of Spring N on Wheat Yield Components

Seeding rate	% WK	N rate	Grain Yield	Lodging (1-5)	1000 KWT	Tillers sq ft	Heads SM
1.75	0		87.8	2.1	41.3	182	710
1.50	15		79.6	2.1	41.5	150	640
1.25	30		79.4	1.6	40.9	112	576
1.00	45		74.0	1.5	40.5	95	623
0.75	60		73.4	1.3	41.0	95	533
LSD (0.10)			*5.9*	*0.3*	*NS*	*16.9*	*60.8*
		0	68.4	1.0	42.4	124	572
		30	77.2	1.3	42.4	127	630
		60	82.0	1.7	40.6	128	580
		90	82.1	2.2	40.3	135	679
		120	84.7	2.3	39.4	120	622
LSD (0.10)			*3.1*	*0.2*	*0.8*	*NS*	*53.0*

N Recommendations for Wheat

Table 6.2. Suggested nitrogen (N) application rates for wheat at different nitrogen:wheat price ratios.

Soil group	Previous crop	PPNT (lb NO_3-N/a)	Nitrogen:Wheat price ratio 0.05	0.075	0.1	0.125
			total lb N/a to apply[a]			
Loamy						
	Corn	< 50[b] or no PPNT	**75** 65--------85	**70** 55--------80	**60** 50--------70	**55** 40 -------- 65
		51 to 100	**45** 35--------55	**40** 30--------50	**35** 25--------40	**30** 20 -------- 35
		> 100	**0** 0--------0	**0** 0--------0	**0** 0--------0	**0** 0 -------- 0
	Soybean, small grain	All[c]	**55** 45--------65	**50** 40--------60	**45** 35--------50	**40** 35 -------- 45
Sandy						
	All	—[d]	**105** 95--------115	**100** 95--------110	**90** 80--------100	**85** 70 -------- 95

[a] On loamy soils with < 2% organic matter, add 30 lb N/a to all rates. On soils with more than 10% organic matter, reduce rates by 30 lb N/a. Reduce N rates by 10 lb N/a for spring wheat on all soils. No N is required on organic soils. Manure N credits must be subtracted from these values.

[b] If wheat follows a forage legume or leguminous vegetable, use the MRTN rate for wheat following corn with PPNT< 50 and take the legume credit.

[c] Previous crop soybean or small grain: If a PPNT is taken and the PPNT is < 50 lb N/a, use the top end of the profitable range; if the PPNT is 51 to 100 lb N/a, use the bottom end of the profitable range; if the PPNT is > 100 lb/a, no additional N is needed. Do not take a soybean legume credit.

[d] PPNT is not recommended on group S (sand and loamy sand) soils.

Laboski et al. 2013; A2809

Winter Wheat P, K, and S Removal

	----------Pounds per unit ----------				
Crop	**Unit**	**N**	**P_2O_5**	**K_2O**	**S**
Wheat grain	bu	1.5	0.6	0.34	0.1
Wheat straw	ton	14	3.3	24	2.8
Total removal for 100bu + 2T		178	66.6	82	15.6

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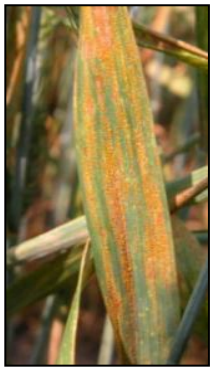
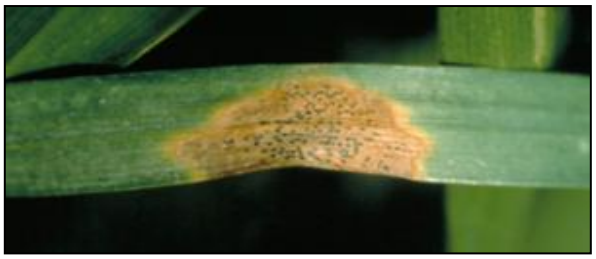
Disease Management





Integrated Management for Wheat Diseases

- Commit to scouting the field
- Know the disease reaction for the wheat variety planted
- Estimate crop yield potential
- Know the disease(s)
- Scout fields
- Determine disease levels
- Determine the potential number of applications
- Select fungicide
- Understand the risks

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Powdery Mildew

- ***(Blumeria graminis)***
- Infection favored under cool (50-71°F), wet weather and high relative humidity
- Management includes: resistance, fungicide seed treatments, foliar fungicides, balanced fertility

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Septoria Leaf Blotch

- ***(Septoria tritici)***
- Infection favored by cool conditions (59-68°F), leaf wetness (minimum of 6 hours)
- Management includes: certified disease-free seed and seed fungicides, rotation, foliar fungicides

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Stripe, Leaf, and Stem Rust

- Conditions vary for infection
  - Temperature:
    - Stripe < Leaf < Stem
  - All require leaf wetness and/or high humidity
- Management focuses on resistance, foliar fungicides, and balanced fertility

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Fusarium Head Scab (Blight)

- ***(Fusarium graminearum)***
- Infection favored by warm temperatures (65-85°F) and prolonged periods of rain (dew) and high relative humidity
- Management includes rotation, fungicide sprays

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Glume Blotch

- ***(Stagonospora nodorum)***
- Infection favored by warmer temperatures (68-81°F) and leaf wetness from 6 to 16 hours
- Management includes certified disease-free seed and seed fungicides, rotation, foliar fungicides

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Wheat Response to Fungicides in 12/13

Treatment and Rate/Acre (Crop Growth Stage at Application)[z]	Leaf Blotch Severity (%)	Powdery Mildew Incidence (%)	Powdery Mildew Severity (%)	FHB Incidence (%)	FHB Severity (%)	DON content (ppm)	Yield (bu/a)
Non-treated control	39.0 a[y]	6.3	5.0	2.3	7.5	0.6 a[y]	79.2 f[y]
Aproach 2.08SC 3 fl.oz. (Feekes 5)	26.3 a	1.3	3.8	3.3	7.5	0.5 a	81.5 ef
Stratego 500SC 2 fl.oz. (Feekes 5)	25.3 b	5.0	7.5	3.3	8.8	0.6 a	84.5 df
Prosaro 421SC 5 fl.oz. (Feekes 8)	22.5 bd	0.0	0.0	2.0	7.5	0.5 a	87.3 cde
Stratego 500 SC 4 fl.oz. (Feekes 8)	21.0 bc	0.0	0.0	1.8	6.9	0.5 a	89.0 bcd
Headline 2.08SC 6 fl.oz. (Feekes 8)	19.0 bc	0.0	0.0	2.8	5.3	0.6 a	92.4 ac
Prosaro 421SC 6.5 fl.oz. (Feekes 10.5.1)	18.8 bc	0.0	0.0	0.3	0.3	0.2 c	88.3 bcde
Aproach 2.08SC 6 fl.oz. (Feekes 8)	17.8 bc	0.3	0.3	2.6	15.3	0.5 ab	91.9 ac
Prosaro 421SC 6.5 fl.oz. (Feekes 8)	17.8 bc	0.0	0.0	3.5	7.5	0.5 a	94.9 ab
Headline 2.08SC 6 fl.oz. (Feekes 8) Prosaro 421SC 6.5 fl.oz. (10.5.1)	13.3 cd	0.0	0.0	0.5	2.8	0.3 bc	97.0 a
Stratego 500SC 2 fl.oz. (Feekes 5) Prosaro 421SC 6.5 fl.oz. (Feekes 10.5.1)	13.0 cd	0.0	0.0	1.0	3.0	0.2 c	94.6 ab
Priaxor 4.17SC 6 fl.oz. (Feekes 8) Prosaro 421SC 6.5 fl.oz. (Feekes 10.5.1)	11.8 c	0.0	0.0	0.5	0.5	0.2 c	91.3 ad
LSD (α=0.05)	9.9	ns[x]	ns	ns	ns	0.2	7.2

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Wheat Response to Fungicides in 13/14

Treatment and Rate/Acre (Crop Growth Stage at Application)[z]	Leaf Blotch Severity Lower Canopy (%)	Leaf Blotch Severity Flag Leaf (%)	FHB Index[y]	DON content (ppm)	Test weight (lbs/bu)	Yield (bu/a)
Headline 2.08SC 6.0 fl oz (Feekes 5)	30.2	3.3	0.4	3.7 ab[x]	60.7	99.0 e[x]
Non-treated check	28.8	2.5	0.3	3.3 bd	61.0	101.3 de
Stratego YLD 500SC 5.0 fl oz (Feekes 8)	20.0	0.0	0.1	4.1 a	60.4	102.5 de
Headline 2.08SC 6.0 fl oz (Feekes 8)	23.8	1.3	0.6	3.5 bc	61.2	102.5 ce
Aproach 2.08SC 6.0 fl oz (Feekes 8)	31.3	1.9	0.3	3.4 bd	60.4	102.5 ce
Prosaro 421SC 6.5 fl oz (Feekes 8)	20.0	0.0	1.0	3.4 bd	61.5	102.8 ce
Quilt Xcel 2.2SE 10.5 fl oz (Feekes 8)	22.5	2.5	0.3	3.5 bc	61.4	103.5 bcd
Stratego YLD 500SC 5.0 fl oz (Feekes 8) Prosaro 421SC 6.5 fl oz (Feekes 10.5.1)	16.7	0.2	0.8	2.8 de	61.4	104.0 acd
Stratego YLD 500SC 2.0 fl oz (Feekes 5) Prosaro 421SC 6.5 fl oz (Feekes 10.5.1)	20.0	0.6	0.3	2.6 ef	61.6	105.3 acd
Priaxor 4.17SC 2.0 fl oz (Feekes 5) Caramba 90EC 13.5 fl oz (Feekes 10.5.1)	22.5	0.0	0.3	2.0 f	61.1	106.4 ac
Quilt Xcel 2.2SE 8.0 fl oz (Feekes 8) Prosaro 421SC 6.5 fl oz (Feekes 10.5.1)	13.3	0.2	0.1	2.7 e	61.4	107.1 ab
Headline 2.08SC 6.0 fl oz (Feekes 8) Prosaro 421SC 6.5 fl oz (Feekes 10.5.1)	19.6	0.0	0.0	3.0 cde	61.8	107.2 ab
Prosaro 421SC 6.5 fl oz (Feekes 10.5.1)	21.8	0.0	0.1	2.4 ef	61.2	107.3 ab
Aproach 2.08SC 6.5 fl oz (Feekes 8) Prosaro 421SC 6.5 fl oz (Feekes 10.5.1)	13.8	0.6	0.3	2.5 ef	61.2	107.9 a
LSD (α=0.05)	ns[w]	ns[w]	ns[w]	0.6	ns[w]	4.2

[z]Induce 90% SL (Non-ionic surfactant) at 0.125% v/v was added to all fungicide treatments.

[y]FHB index = (Fusarium head blight incidence x Fusarium head blight severity)/100

[x]Means followed by the same letter are not significantly different based on Fisher's Least Significant Difference (LSD; α=0.05)

[w]ns=not significant

Impact of Crop Rotation and Nitrogen on Wheat Yield

Materials and Methods

- Research conducted from 2010-2012 at the Arlington Ag Research Station
- Data collected from a long term corn/soybean/wheat rotation study

Source: Google Earth

Materials and Methods

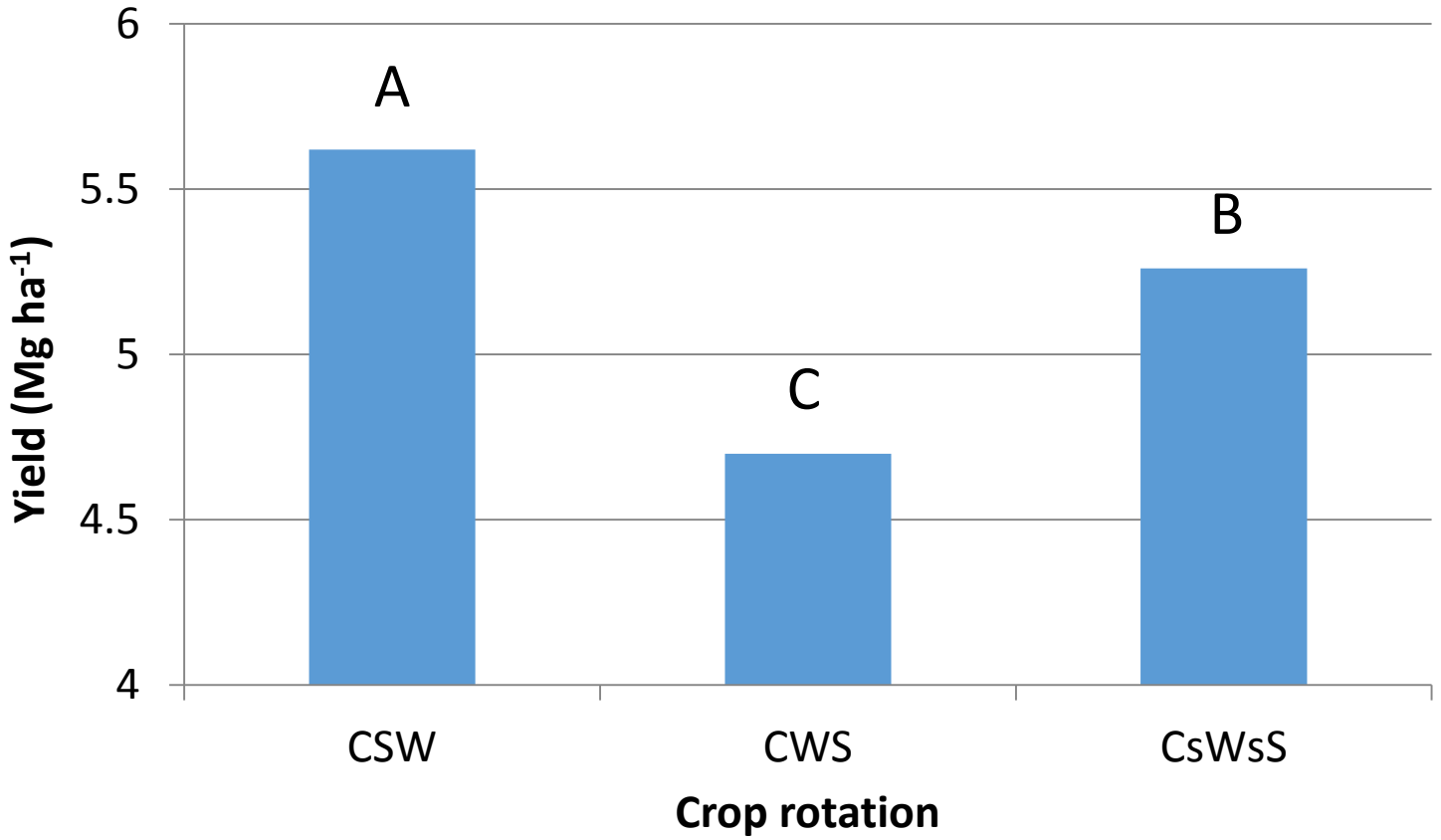
- Experimental design
  - Split-split plot RCB with 3 replications
    - Main plots = 14 crop rotation sequences
    - Subplots = 4 variety rotations: RRR, SSS, RRS, and SSR
    - Sub-subplots = 2 fungicide treatments: fungicide vs. UTC

Table 1. Crop rotation sequences

Rotation			Crop
Name	Number	Sequence	Residue
Continous	1	Cont. C	leave
	2	Cont. S	leave
	3	Cont. W	leave
Alternating	4	CS	leave
	5	SC	leave
Grain system	6	CSW	leave
	7	SWC	leave
	8	WCS	leave
	9	CWS	leave
	10	WSC	leave
	11	SCW	leave
Livestock system†	12	C_sW_sS	remove (except soy)
	13	W_sSC_s	remove (except soy)
	14	S_sCW_s	remove (except soy)

† s, silage/straw removal

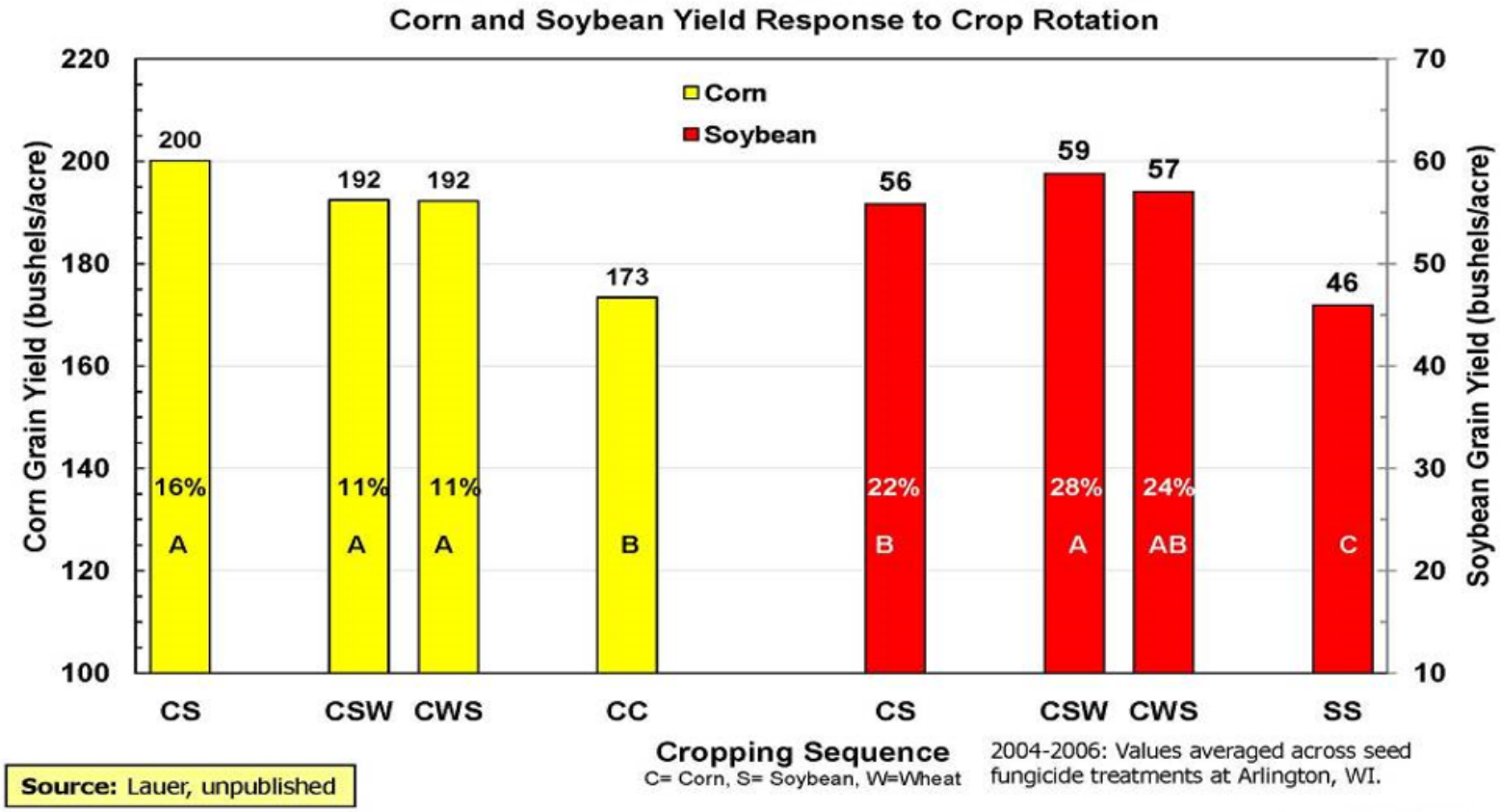
Impact of Rotation Sequence on Wheat Yield



Columns with the same letter are not statistically different at $P \leq 0.10$

Impact of Rotation on Wheat Yield

Adding a third crop does not increase corn grain yield, but does improve soybean grain yield ...



Source: Lauer, unpublished

UW Extension

http://corn.agronomy.wisc.edu

Wheat results

Year x Fungicide use	
——————— Mg ha^{-1} ———————	
2010	
Untreated	4.56 b
Treated	4.79 a
LSD(0.10) = 0.21	
2011	
Untreated	5.21
Treated	5.06
LSD(0.10) = NS	
2012	
Untreated	5.51 b
Treated	6.03 a
LSD(0.10) = 0.24	

Fixed Effect	Pr > F
Year (Y)	***
Crop rotation (C)	***
Y x C	***
Variety selection (VS)	***
Y x VS	**
C x VS	**
Y x C x VS	NS
Fungicide use (F)	***
Y x F	***
C x F	**
Y x C x F	**
VS x F	**
Y x VS x F	NS
C x VS x F	NS

Crop Rotation x Fungicide Use			
	CSW	CWS	C_sW_sS
	Mg ha^{-1}		
Fungicide use	2010		
Untreated	4.44 a	3.87 c	5.31 b
Treated	5.63 b	4.05 c	5.51 b
	LSD(0.10) = 0.36		
	2012		
Untreated	6.05	5.14	5.32
Treated	6.63	5.83	5.63
	LSD(0.10) = NS		

Variety selection x Fungicide use		
	Resistant	Susceptible
Untreated	4.88 c	5.31 b
Treated	4.89 c	5.69 a
	LSD(0.10) = 0.18	

Fixed Effect	Pr > F
Year (Y)	***
Crop rotation (C)	***
Y x C	***
Variety selection (VS)	***
Y x VS	**
C x VS	**
Y x C x VS	NS
Fungicide use (F)	***
Y x F	***
C x F	**
Y x C x F	**
VS x F	**
Y x VS x F	NS
C x VS x F	NS

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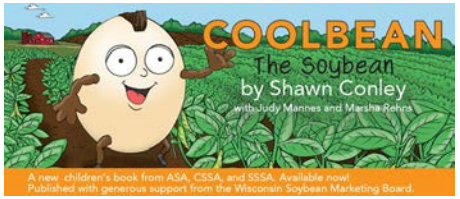

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