Managing Winter Wheat Diseases

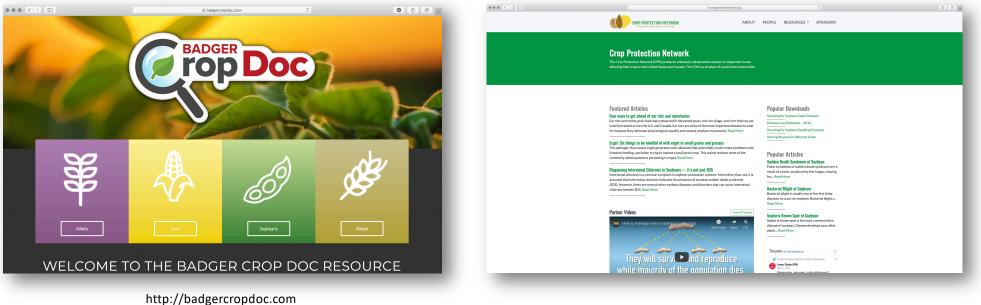
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Electronic Resource Sites



http://cropprotectionnetwork.org





Top Wheat Diseases in Wisconsin (Last 5 years)

- Fusarium head blight (scab)
 - Caused by Fusarium graminearum and F. culmorum
- Stripe rust
 - Caused by Puccinia striiformis f. sp. tritici (Pst)
- Septoria leaf blotch
 - Caused by Septoria tritici
- Leaf rust
 - Caused by Puccinia triticina



Stripe rust



Septoria leaf blotch



Leaf rust



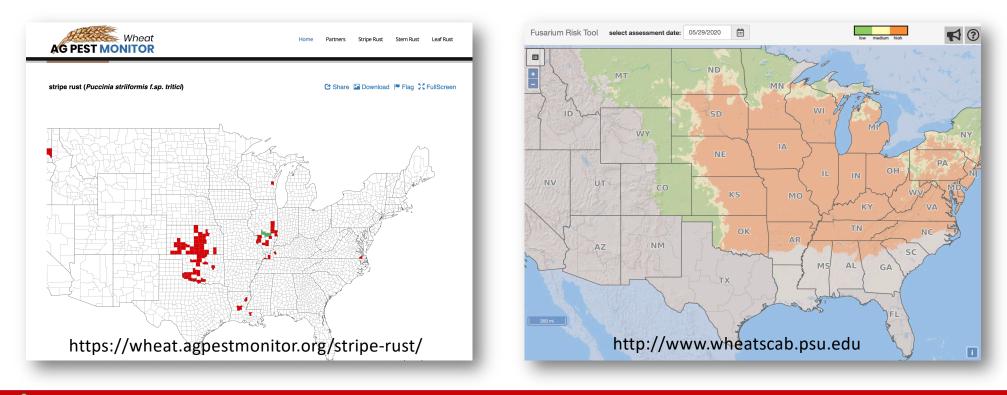
Fusarium head blight



Field Crops Pathology



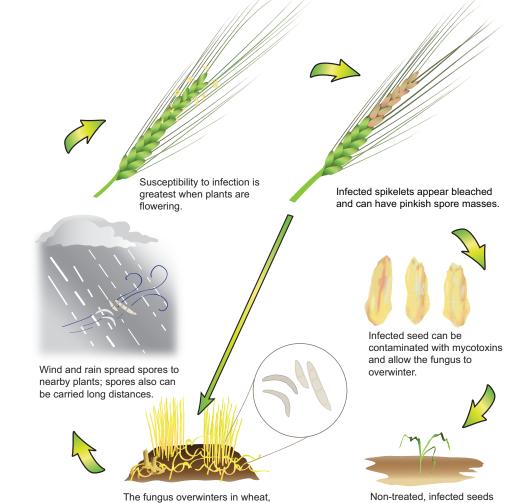
Other Resources to Track







Fusarium head blight cycle



The fungus overwinters in wheat, barley, and corn residue.

can result in seedling blight.

FDA Deoxynivalenol (DON;Vomitoxin) Guidelines



- 1 ppm for finished wheat products (e.g. flour, bran, germ, etc) to be consumed by humans
- 10 ppm for total feed ration for ruminating beef cattle over 4 months
- 5 ppm in the total ration for dairy cattle older than 4 months
- 5 ppm for swine as long as the grain products are not more than 20% of the feed ration
- 5 ppm for as long as the grain products are not more than 40% of the feed ration for all other animals

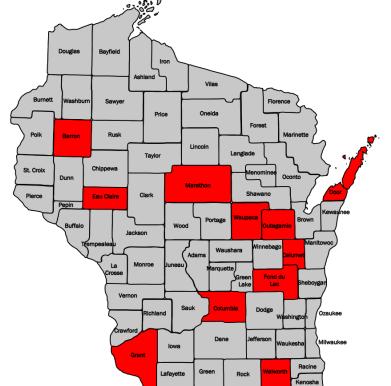
**In Wisconsin elevators typically start discounting (docking) grain at 2 ppm.





Multiple Chemotypes Can be found in Agronomic Landscapes – An example from Wheat

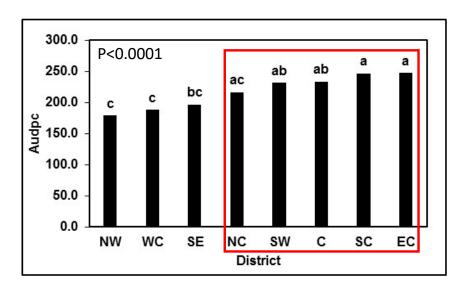
- 2016 Samples
 - Among 195 wheat head samples collected in 2016 in Wisconsin, 145 *Fusarium* spp. were positively chemotyped as 3ADON or 15ADON
 - 90% were of the 15ADON chemotype and 10% of isolates were 3ADON
- 2017 Samples
 - 185 samples were collected and 120 of them were chemotyped
 - 92% of the isolates were identified as 15ADON chemotype and 8% the 3ADON chemotype

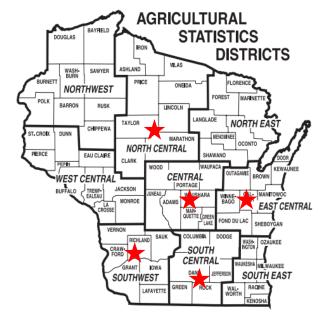






Aggressiveness (AUDPC) by Cropping District





https://www.nass.usda.gov/Statistics_by_State/ Wisconsin/index.php





Management of FHB

Rotation

- Rotation with soybeans is preferred
- o Avoid rotation behind corn, if possible

• Resistant Varieties

- No complete resistance partial only
- Type 1 Resistance Resistance to initial infection
 Pursuing this type of resistance has been elusive
- Type 2 Resistance Resistance to spread within the spike
 -Most breeding emphasis has been here
 -Fhb1 first gene associated with this resistance
- Fungicide application
 - Product choice important
 - -DMI fungicides (Prosaro or Caramba) have been staples
 - -DMI plus SDHI (Miravis Ace) is the new product on the scene
 - -Strobilurin fungicides (ex. Headline) can make FHB worse
 - o Timing of application important
 - -Anthesis (Feekes 10.5.1) applications have been the standard
 - -More recently applications 5-7 days after anthesis show excellent reductions in DON
 - -Applications can be made too early (ex. When the head is still in the boot)
 - -All product effective against FHB also effective against stripe rust





Variety Trials Are Key to Making a Decision on What to Plant



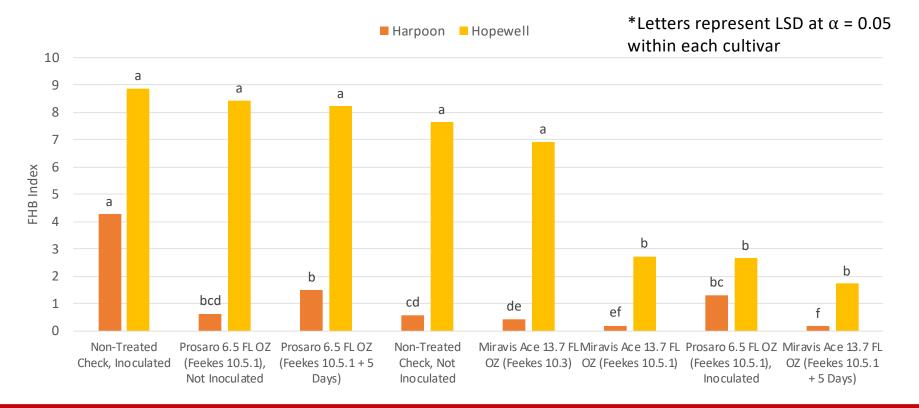
Entry 413 438 463 463 475 485 485 486 495 Exp 1902 SY 100		Yield (bu/a) 60 58 58 56 60 63	Test wt. (lb/bu) 54.4 52.8 54.8 54.8 57.0	Height (in.) 31 34	Lodging (1-5) 1.0	FH 1% ²	IB ¹ 5% ³	۲۲۹ %		Yield (bu/a)	Test wt. (lb/bu)
413 438 463 475 485 486 495 Exp 1902 SY 100		60 58 58 56 60	54.4 52.8 54.8	31 34	. ,		S%3	%		(hui/a)	(lb/bu)
438 463 475 485 486 495 Exp 1902 SY 100		58 58 56 60	52.8 54.8	34	1.0					(bu/a)	(ID/DU)
463 475 485 486 495 Exp 1902 SY 100		58 56 60	54.8			6	10	0	*	98	52.3
475 485 486 495 Exp 1902 SY 100	*	56 60			1.0	6	19	6		85	51.1
485 486 495 Exp 1902 SY 100	*	60	57.0	29	1.0	2	6	1	*	97	54.9
486 495 Exp 1902 SY 100	*		57.0	28	1.0	2	9	18		95	56.1
495 Exp 1902 SY 100	*	62	57.8	31	1.0	2	5	0		94	53.2
Exp 1902 SY 100		05	56.3	33	1.0	8	6	5	*	96	55.5
SY 100		57	57.8	31	1.0	4	13	0			
		57	55.6	29	1.0	4	6	10			
		64	52.4	30	1.0	18	11	3		88	49.8
SY 547		60	56.8	34	1.0	23	13	1	*	96	55.5
SY 576		61	55.7	33	1.0	30	5	14			
SY Viper		62	56.0	33	1.0	10	23	6			
CP8550		61	56.6	34	1.0	7	5	0		95	54.8
CP9203		61	55.6	33	1.0	6	10	6			
CP9415		66	55.3	30	1.0	38	14	0		94	55.0
CP9606	*	65	55.0	31	1.0	19	20	3		88	52.0
D491W		63	54.3	30	1.0	6	10	2	_	99	55.4
D498W	*	64	57.4	30	1.0	3	4	8	*	101	54.7
D505W		60	56.1	33	1.0	34	6	1	*	98	54.4
D510W	*	65	56.4	31	1.0	2	5	2			
XW1901	*	65	55.0	28	1.0	46	10	17			
9522		60	55.0	32	1.0	19	16	3		91	53.5
9701	*	63	57.0	34	1.0	14	6	0	*	96	54.6
9862	*	66	56.9	32	1.0	8	13	13	*	98	53.6
9932		59	56.8	31	1.0	10	13	7			
9941		61	55.7	29	1.0	4	8	0	*	100	52.8
WX18416	*	65	55.2	34	1.0	15	18	8			
WX19711	*	63	57.4	29	1.0	4	6	1			
FS 599		51	58.3	28	1.0	2		1			
									*		55.5
	*										53.9
									*		54.5
FS WX19A		60	57.5	32	1.0	7	10	0			
FS WX19B	*	63	55.5	28	1.0	16	18	22			
5845		53	53.8	33	1.0	5	8	1	*	96	52.7
5850		58	53.5		1.0		29	8		84	50.4
5855		59	55.4	33	1.0	7	16	0		91	53.3
	CP9013 CP9415 CP9605 D491W D498W D505W WX1901 9522 99701 9982 99941 WX18416 WX18416 WX18416 FS 603 FS 624 FS WX198 FS WX198 S850 S855	UP9030 UP9413 UP9413 UP9419 UP9419<	CP9203 61 CP9203 63 CP9405 63 D491W 63 D492W 64 D505W 60 D505W 65 XV1901 65 XV1901 63 9862 66 9902 66 9932 934 61 WX1911 VX1911 63 F5599 51 F5601 57 F5613 64 F524 60 F5345 54 F5345 53 5845 53 5855 58 VX19816 63 F5345 58 F545 53 5855 58	GP9023 61 S5.6 GP9415 66 S5.3 GP9665 65 S5.0 D491W 63 S4.3 D498W 64 S7.4 D498W 60 S5.1 D50W 65 S6.4 D51W 65 S5.6 WX1901 65 S5.0 9701 63 S7.0 9862 66 S5.2 WX1901 63 S7.0 9982 59 S6.8 9941 61 S5.7 FS603 S5 S7.7 FS603 S5 S7.7 FS615 64 S4.9 FS643 S9 S6.3 FSWX198 63 S5.5 FSWX198 63 S5.5 S845 S3 S3.8	CP2D3 61 55.6 33 CP9405 6 55.3 30 D4906 6 55.3 30 D4910 6 6 55.3 30 D492W 6 6 55.3 30 D492W 6 6 55.0 31 D505W 60 56.1 33 D510W 6 55.0 32 9701 6 55.0 32 9701 6 55.70 34 986.2 6 56.9 32 9921 59 56.8 31 9941 6 55.7 39 9921 59 56.8 31 9941 6 55.7 29 9559 51 8.3 32 95615 57.7 29 56.3 32 95635 57.4 59 56.3 32 95645 59 55.5 32	GP3203 61 55.6 33 1.0 (GP341) * 66 55.3 30 1.0 (GP406) * 66 55.3 30 1.0 (GP406) * 63 54.3 30 1.0 (GP407) * 63 54.3 30 1.0 (GP407) * 63 54.3 30 1.0 (GP406) * 64 57.4 31 1.0 (GP307) * 65 55.0 2.8 1.0 (SV1901) * 65 55.0 32 1.0 (SV1901) * 65 55.0 32 1.0 (SV1901) * 65 55.2 34 1.0 (SV1901) * 63 57.4 29 1.0 (SV1911) * 63 57.4 29 1.0 (SV1911) * 63 57.4 32 1.0	GP2D3 G1 S5.6 33 1.0 6 GP9405 * 66 S3.3 0.0 1.0 38 GP9405 * 65 S5.0 31 1.0 6 GP9406 * 64 S7.4 30 1.0 6 D499W * 63 S4.3 30 1.0 34 D50W * 65 S6.4 31 1.0 34 D51W * 65 S6.4 31 1.0 10 9701 * 65 S7.0 32 1.0 4 9922 S9 S6.8 31 1.0 10 941 61 S7.7 29 1.0	GP303 61 55.6 33 1.0 6 10 (GP304) • 66 55.3 30 1.0 1.8 14 (GP405) • 66 55.3 30 1.0 1.9 20 (D9406) • 64 57.4 30 1.0 6 10 (D498W) • 64 57.4 30 1.0 3 4 (D50W) • 65 56.4 13 1.0 2 5 (M1901) • 65 56.4 31 1.0 10 13 9522 60 55.0 32 1.0 8 13 9952 59 56.8 31 1.0 10 13 9952 59 56.8 31 1.0 10 13 9952 59 56.8 31 1.0 10 13 9941 61 55.7 29 1.0	GP3203 61 S5.6 33 1.0 6 10 6 (GP9405 * 66 S5.3 30 1.0 18 14 0 (GP9605 * 66 S5.3 30 1.0 19 20 3 (GP9067 * 64 S5.4 30 1.0 6 10 2 (D493W) * 64 S7.4 30 1.0 6 10 2 D498W * 64 S7.4 30 1.0 3 4 8 D505W 66 S5.0 33 1.0	GP323 61 S5.6 33 1.0 6 10 6 GP343 • 66 S5.3 30 1.0 38 14 0 GP364 • 66 S5.3 30 1.0 19 20 3 D937 • 64 S5.4 30 1.0 6 10 2 * D498W • 64 S7.4 30 1.0 3 4 8 * D505W • 65 S5.4 31 1.0 2 5 2 * D510W • 65 S5.0 32 1.0 46 10 17 9522 60 S5.0 32 1.0 8 13 13 3 9932 59 56.8 31 1.0 10 13 7 9941 61 55.7 29 1.0 4 6 1 9932	GP323 61 S5.6 33 1.0 6 10 6 (GP303) • 66 55.3 30 1.0 18 14 0 94 (GP406) • 65 55.0 31 1.0 19 20 3 88 (P9706) • 64 57.4 30 1.0 6 10 2 * 99 (P498) • 64 57.4 30 1.0 3 4 8 * 101 (D50W) • 65 56.4 31 1.0 2 5 2 SYL1901 • 65 55.0 32 1.0 14 6 10 77 SYL1901 • 65 55.0 32 1.0 18 13 13 9 9 962. 66 55.0 32 1.0 18 8

Integrated Management is Key - Combining Resistance with Fungicide Application





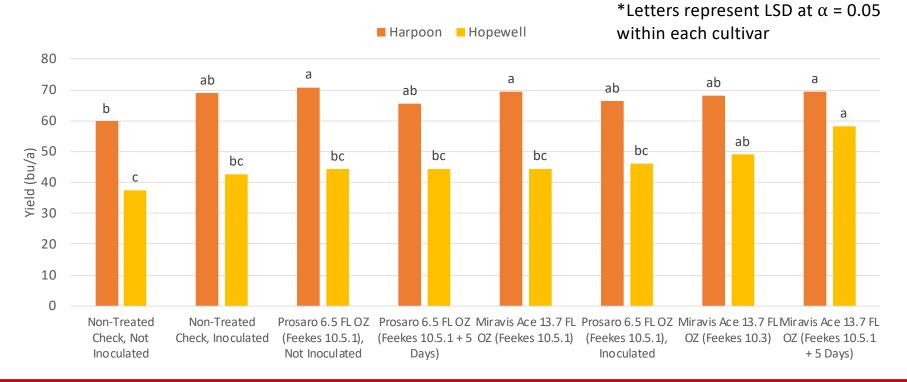
2019 Integrated Management Trial







2019 Integrated Management Trial

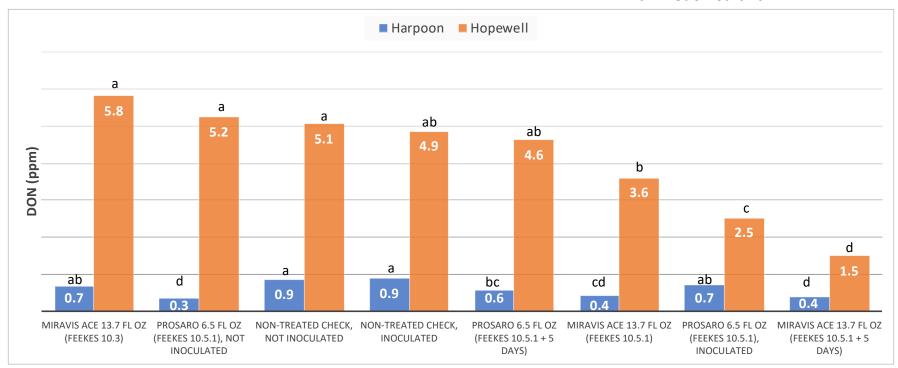






2019 Integrated Management Trial

*Letters represent LSD at α = 0.05 within each cultivar



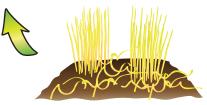


Field Crops Pathology

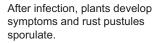
Stripe Rust cycle



Spores are spread by wind to green host plants and can travel long distances.



In warmer climates, the fungus survives on wheat debris, volunteer wheat, and overwintering wheat. In northern climates, the disease initiates from urediniospores blown in from warmer climates each year.



Conducive conditions allow disease to spread to other plants and fields,

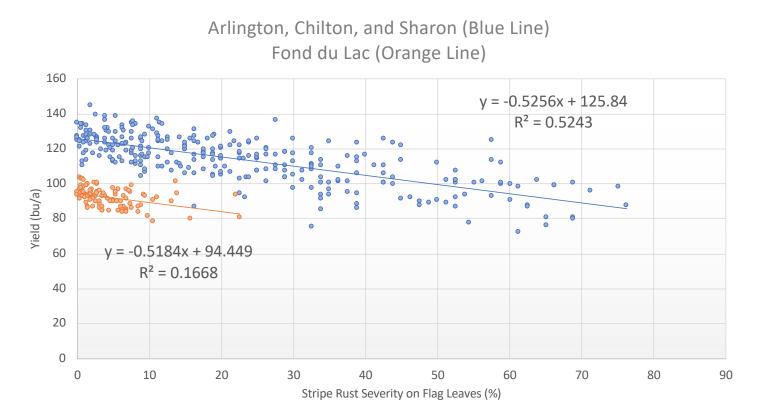
resulting in rust epidemics as the disease cycle repeats.



repeating cycle

0

Yield Loss Due to Stripe Rust In 2016







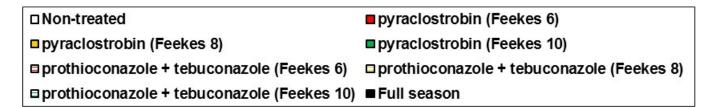
Integrated Management of Stripe Rust in Wisconsin

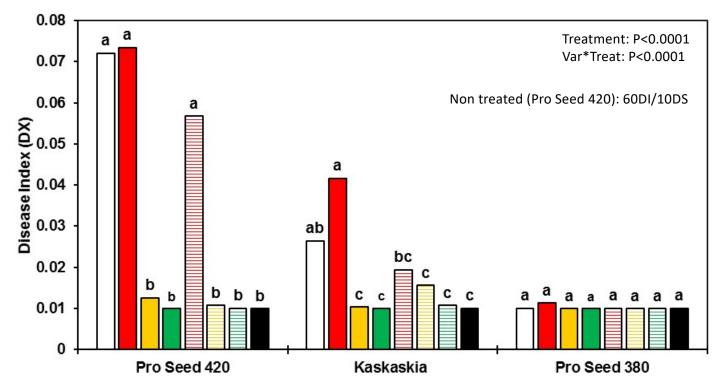
- 2016 and 2017
- Evaluating Fungicide Application Timing on 3 Winter Wheat Varieties
 - Fungicides
 - Prosaro
 - Headline
 - Fungicide Application Timings
 - Non-treated (Negative Control)
 - 1 app at Feekes 5 (Jointing)
 - 1 app at Feekes 8 (Emerging Flag leaf)
 - 1 app at Feekes 10 (Boot Stage)
 - Full-Season Fungicide Application (Positive Control)
 - Varieties
 - Pro Seed 420 (Susceptible)
 - Kaskaskia (Moderately Resistant)
 - Pro Seed 380 (Resistant)



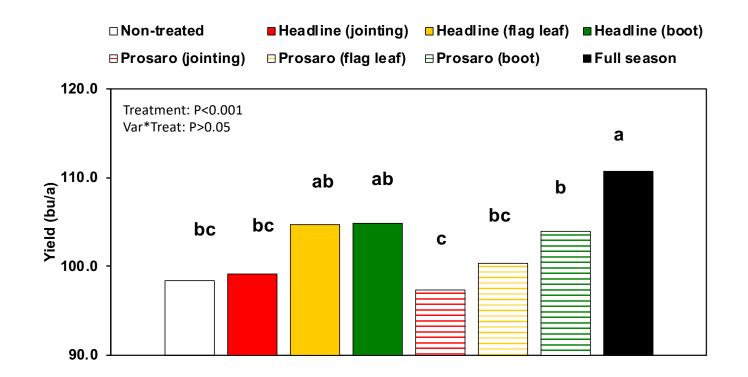


Disease Index 2016





Yield In Stripe Rust Trials, 2016







What is the Return on Investment (ROI) for Intensive Wheat Management?





Intensive Wheat Management Trials (2016-2019) *All treatments applied to 14 will

Table 1. Management treatments at three levels.

*All treatments applied to 14 winter wheat varieties each year

	Management Treatments						
	Current	MidLevel	HighLevel				
Base seed treatment	Same variety/treatment at all levels. See Table 2.						
Base herbicide (14-May)	Huskie 15 fl oz/a	Huskie 15 fl oz/a	Huskie 15 fl oz/a				
Seeding rate (million seeds/a)	1.50	1.75	2.00				
Nitrogen (Ibs N/a) (5-Apr + 3-May)	55	55+30 split	110+30 split				
Growth regulator @ F6 (16-May)			Palisade 12 fl oz/a				
Micronutrients @ F9 (28-May)			Brandt Smart Quatro Plus (N,S,B,Mn,Mo,Zn) 32 fl oz/a				
Fungicide @ F9 (28-May)			EB Mix (N,S,B,Mn,Fe,Zn) 64 fl oz/a Trivapro 13.7 fl oz/a				
Micronutrients @ F10.5.1 (13-June)			TakeOff Phite MZ 32 fl oz/a				
Fungicide @ F10.5.1 (13June)		Miravis Ace 13.7 fl oz/a	Miravis Ace 13.7 fl oz/a				

Roth, M., Mourtzinis, S., Gaska, J., Mueller, B., Smith, D., and Conley, S. 20XX. Intensive management strategies for winter wheat in Wisconsin. Agronomy Journal. In preparation.





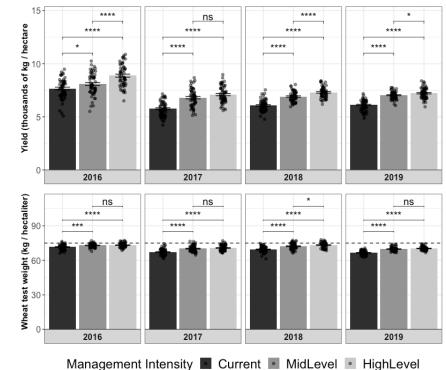
Intensive Wheat Management Trials (2016-2019)

Average Yields Across all Years, across varieties

Current: 95.2 bu/a Mid-level: 107.2 bu/a High-level: 113.4 bu/a

Average Yield Preservation all Years, across varieties

Current to mid = 12 bu / acre Current to high = 18.2 bu / acre mid to high = 6.2 bu / acre



Roth, M., Mourtzinis, S., Gaska, J., Mueller, B., Smith, D., and Conley, S. 20XX. Intensive management strategies for winter wheat in Wisconsin. Agronomy Journal. In preparation.





The "Take-Home"

- Watch your crop rotation Try to plant what after soybean
- Choose a FHB-resistant variety that also has <u>decent stripe rust resistance</u>
- Feekes 5 applications of fungicide not needed in most years in Wisconsin
- In some years apply fungicides for stripe rust on susceptible cultivars around Feekes 8 (will also control Septoria if needed)
- Plan to apply an FHB fungicide application especially on susceptible varieties
 - Shoot for Anthesis or up to 5-days after the start of anthesis for Prosaro and Caramba
 - Can go earlier (Feekes 10.5) up to 5-days after the start of anthesis for Miravis Ace
 - May need other tactics!
 - Rotate to broadleaf crops (soybean/alfalfa) where head scab is problematic
 - Rotating wheat after corn can increase risk of FHB
 - Watch the "Scab Alerts" it isn't perfect, but can help make a decision (<u>http://www.wheatscab.psu.edu</u>)
 - Be sure to track Stripe Rust (<u>https://wheat.agpestmonitor.org/stripe-rust/</u>)





Questions?



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Field Crops Pathology