Integrating the management of Fusarium head blight and foliar diseases through fungicide use and variety selection to develop practical strategies for winter wheat growers

an agronomist perspective:

- foliar disease x FHB mgt strategies

- stripe rust complication

- best guess strategies

Martin Nagelkirk

MICHIGAN WHEAT PROGRAM

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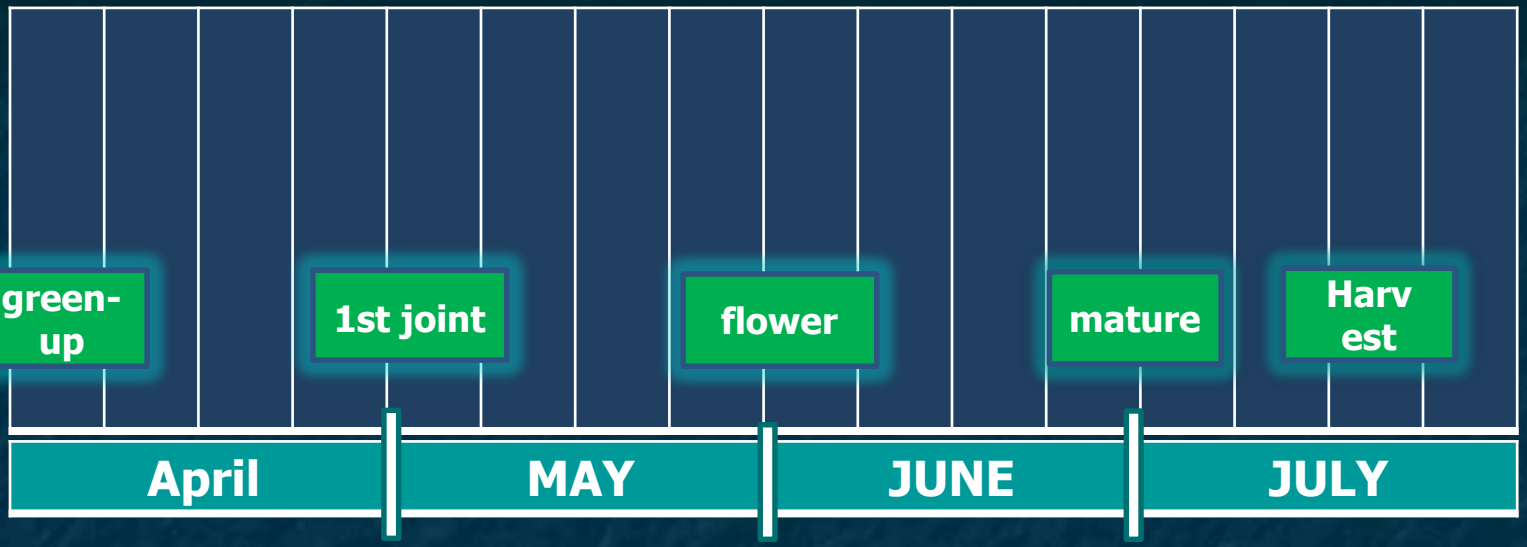
U.S. Wheat & Barley Scab Initiative


Ontario
Lake Huron
Michigan
Lake Michigan
SWW
SRW
Toronto
Lake Ontario
Buffalo
Detroit
Lake Erie
Cleveland
UNITED STATES
Ohio
Pennsylvani
MI Soft winter wheat
- 180,000 ac soft wh
- 260, 000 ac soft re

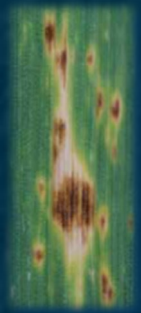
Importance of foliar diseases in Michigan

- many varieties across two subclasses provide a wide range of disease susceptibilities
- Older soft white varieties tend to have greater susceptibility to fungal diseases (and to FHB and 1ppm threshold).
- Work primarily in high yield environments (higher plant densities and higher fertilizer N rates)
- Relatively high use of fungicides
  - In high yield environments, most wheat receives application at flowering

Wheat and foliar disease development



diseases



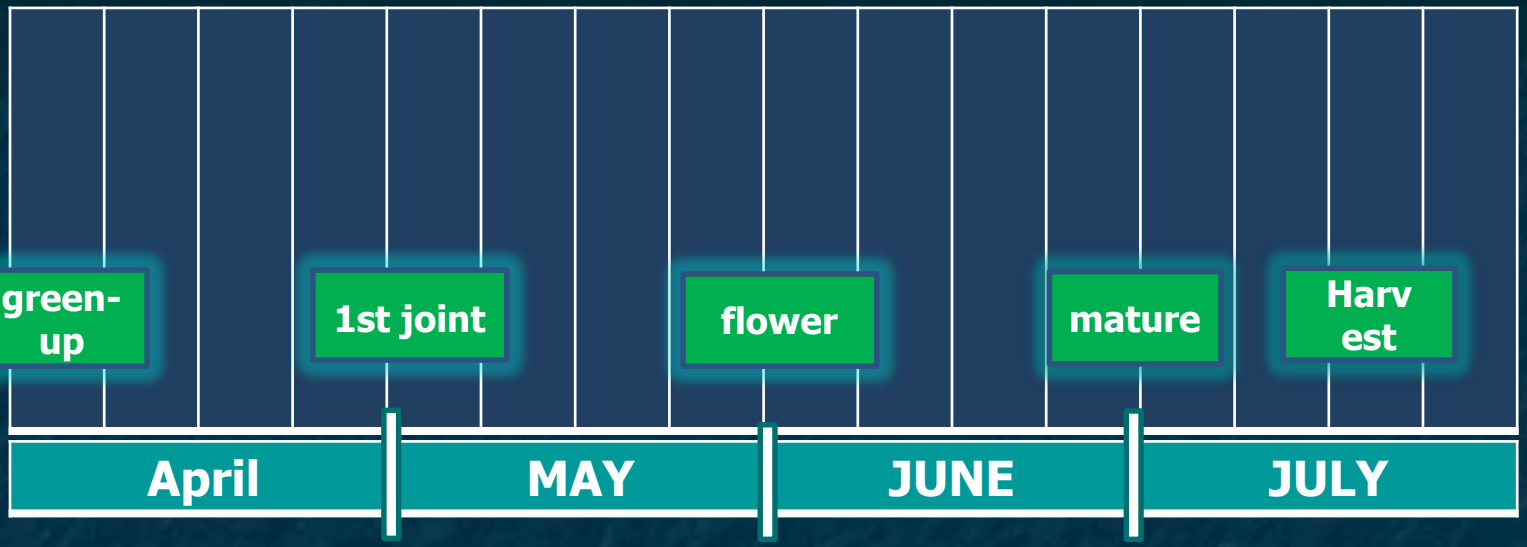
PM

Sep

Stag

LR

Wheat and foliar disease development



diseases

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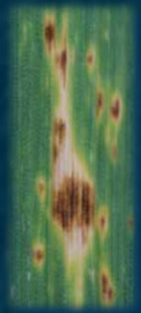


Stag

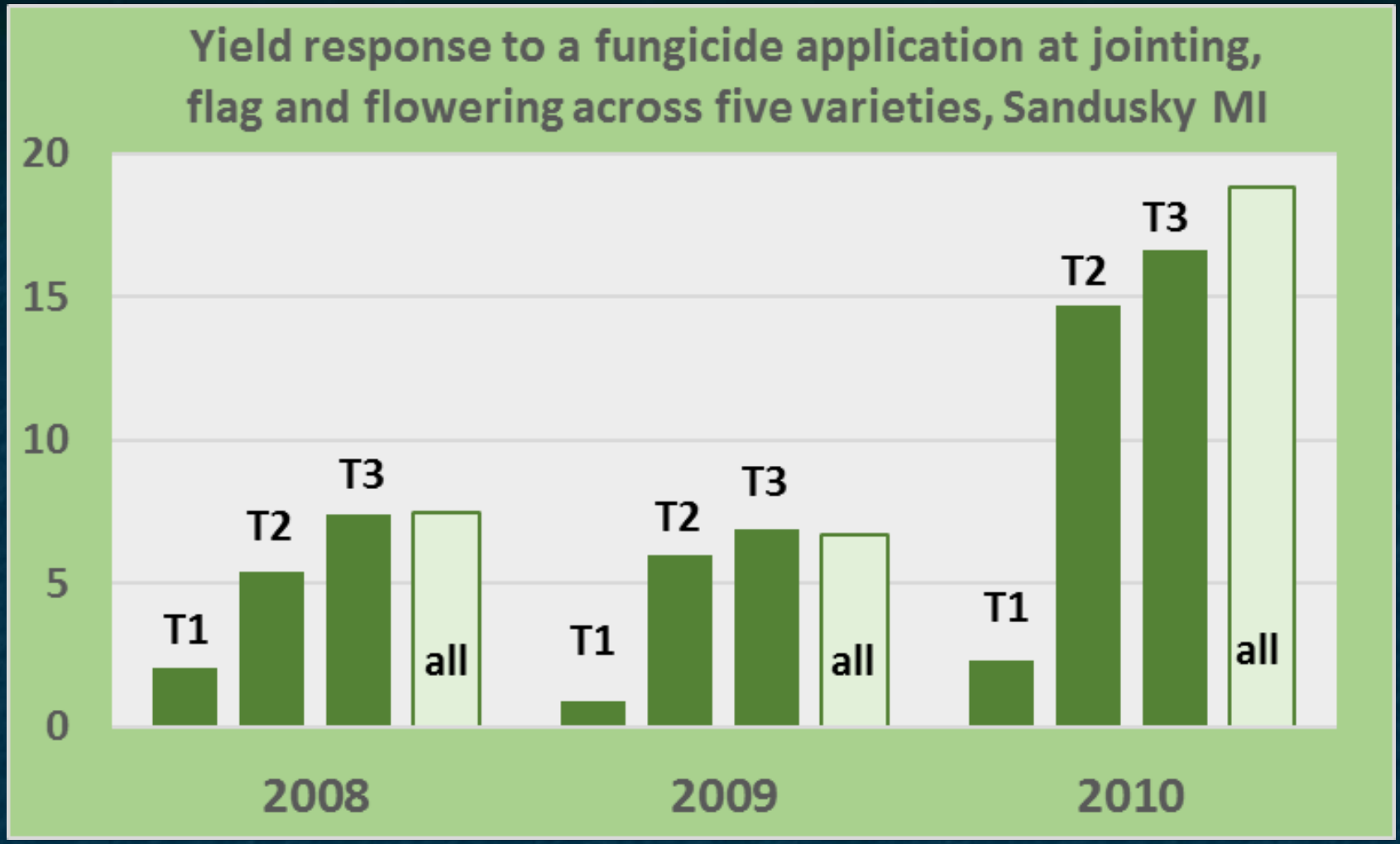
LR

Fungicide application

T1

T2

T3



Flag leaf = optimum timing for fungicide based on earlier work;

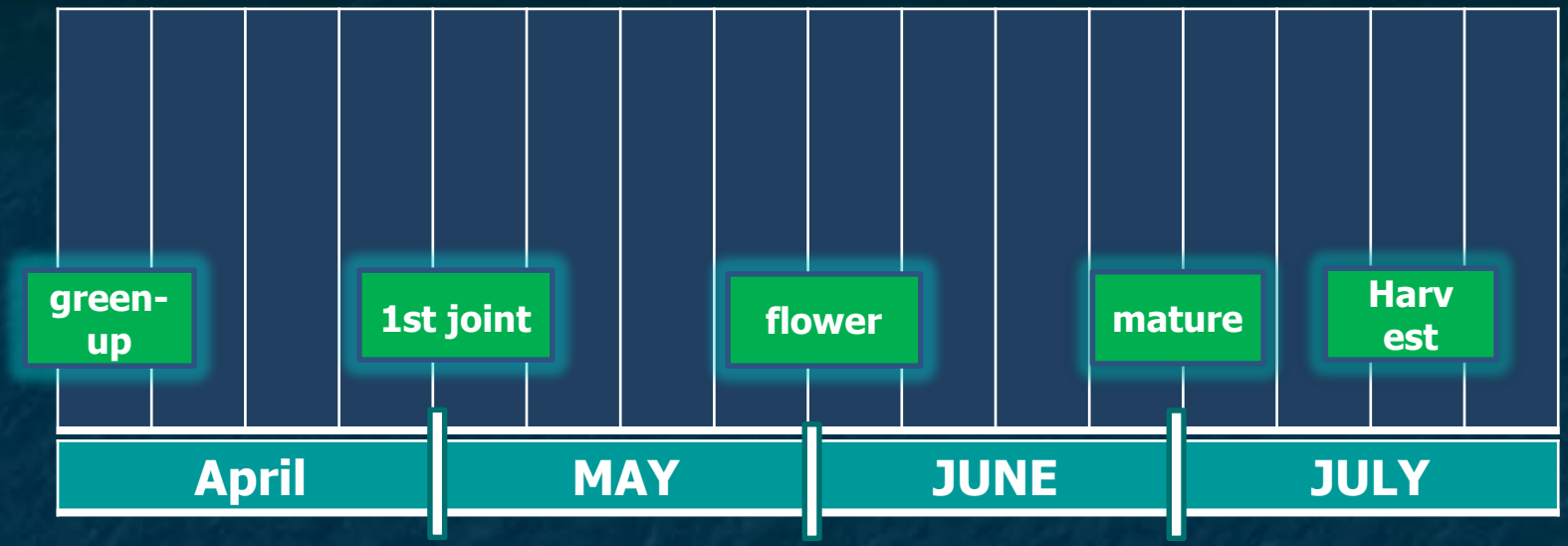
Flowering = optimum timing for foliar disease and FHB based on recent work

Foliar disease reduces yield; FHB reduces quality

…..and then along comes stripe rust in 2016

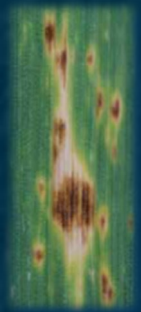
- up to 50 percent yield loss
- Started early; progressed through grain fill
- Previously, only found occasionally

Wheat and foliar disease development



diseases



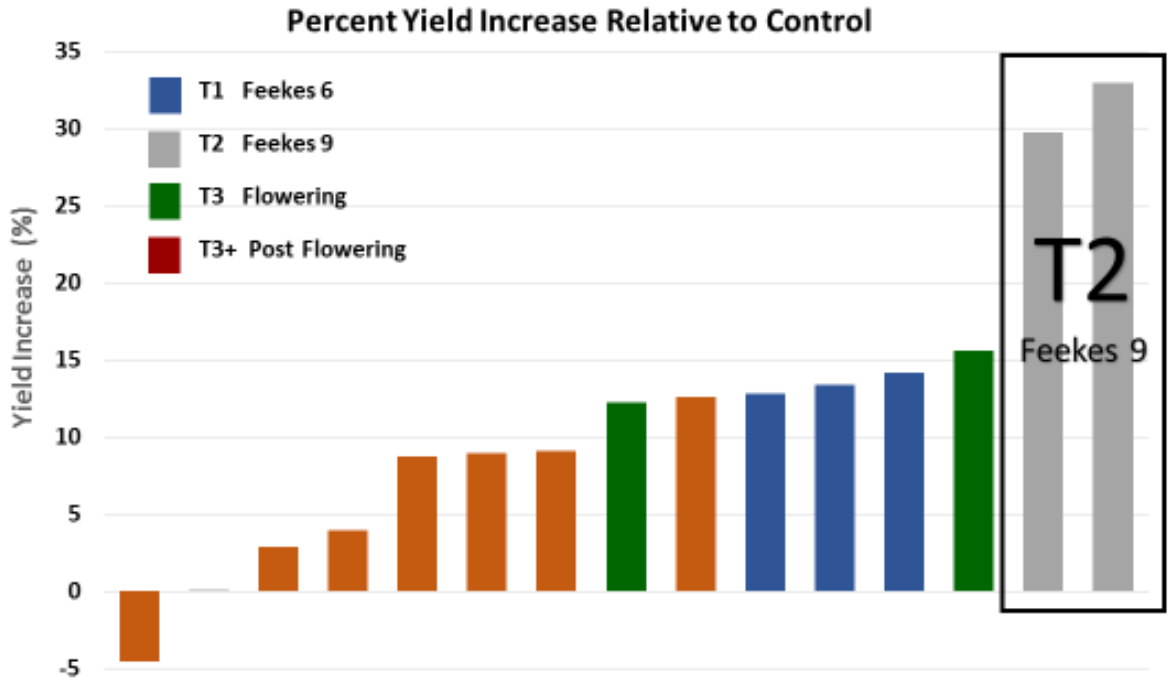




PM
Sep
SR
Stag
LR

Fungicide application

T1
T2
T3

Stripe Rust Yield Response to Fungicides: 2016



Fungicide treatments were applied with Induce at 0.125% v/v
All trials were variety Ambassador, susceptible

Mikaela Breunig & Martin Chilvers, MSU 2016

Rating for stripe rust, 2016

Table 1: Susceptibility of soft white winter wheat varieties to stripe rust in Michigan (L. Siler, A. Wiersma, E. Olson, 2016)

Variety	Infection type	Infection %	Rating
MCIA Venus	2	2	**R**
Jupiter	4	16	**MR**
9242W	5	37	**MR**
MSU 6012	6	7	**MS**
AC Mountain	6	19	**MS**
Aubrey	7	22	**S**
Skeet	7	29	**S**
Ambassador	7	39	**S**
9491W	8	82	**S**

Stripe rust susceptibility of Michigan wheat varieties

Wheat varieties grown in Michigan exhibit a wide range of susceptibility to stripe rust. Because of the severe outbreak of the disease during the 2016 season, members of MSU's wheat breeding team were able to capture the level of resistance varieties were exhibiting at the Ingham and Tuscola sites of the MSU Performance trials

Below are the ratings for the soft white (Table 1) and soft red (Table 2) winter wheat varieties. The varieties were scored based on infection type (0 to 9 scale) and on the infection percent (the relative amount of disease on the flag leaves) to express the way varieties' resistance is expressed. Based on these scores, each variety was given a relative score ranging from resistant (R) to susceptible (S). The experiences during 2016 suggests which varieties and their associated rust rating may benefit from the use of fungicides where stripe rust is found to be prevalent:

Resistant (R) varieties will likely lose little or no yield due to stripe rust.

Moderately Resistant (MR) varieties are at moderate risk to yield losses and, in some cases, may benefit from the use of a fungicide. This is especially true for varieties having infection percent levels (second column) above 10 percent.

Moderately Susceptible (MS) varieties will likely benefit from a fungicide application where the disease is found.

Susceptible (S) varieties will very likely benefit from the use of a fungicide where outbreaks occur.

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AC Mountain	6	19	MS
Aubrey	7	22	S
Skeet	7	29	S
Ambassador	7	39	S
9491W	8	82	S

Table 2: Susceptibility of soft red winter wheat varieties to stripe rust in Michigan (L. Siler, A. Wiersma, E. Olson, 2016)

Variety	Infection type	Infection %	Rating	Variety	Infection type	Infection %	Rating
L 11 S 28	0	2	R	Pioneer 25R50	6	8	MS
AgriMAXX 413	1	1	R	SC 1325-15	6	10	MS
DF 105 R	1	2	R	SC 1315-15	6	14	MS
SY 483	1	2	R	W 203	6	14	MS
SY 100	1	3	R	RS 910	6	22	MS
Dieter 496W	1	5	R	L 11 418	6	24	MS
RS 972	2	4	R	TWS 28-003	6	27	MS
AgriMAXX 438	3	5	MR	Dieter 491W	6	28	MS
AgriMAXX 444	3	5	MR	HS 2848	6	34	MS
DF 112 R	3	5	MR	W 204	6	37	MS
Hilliard	3	5	MR	DynaGro 9692	7	18	S
Pioneer 25R25	3	5	MR	Hagerwell	7	19	S
Pioneer 25R40	3	5	MR	L-241	7	19	S
DynaGro 9552	4	5	MR	W 206	7	20	S
Equity Butler	4	5	MR	Frandx	7	21	S
MCIA Red Devil	4	5	MR	W 204	7	23	S
L-234	4	6	MR	AgriMAXX 454	7	29	S
LCS 2214	4	6	MR	RS 9XP011	7	37	S
MCIA Red Dragon	4	22	MR	Pioneer 25R46	7	38	S
DF 109 R	5	5	MR	SC 1325	7	38	S
DynaGro 9522	5	5	MR	SC 1325-15	7	42	S
W 202	5	11	MR	Shirley	7	47	S
W 207	5	12	MR	Red Ruby	7	50	S
Sunburst	5	14	MR	HS 20 06	8	23	S
LCS 2677	6	27	MS	DF 111 R	8	82	S
MCIA Whale	6	6	MS				

Methodology by Dr. Xianming Chen, USDA-ARS, Pullman WA.

Effect of fungicide on a susceptible vs. moderately resistant variety to stripe rust, Sandusky, 2016

	Ambassador		*P 25R40*	
T3 treatment[1]	yield	S. rust [3]	yield	S. rust [3]
UTC	87	100	134	8
Prosaro	98	68	138	1
Caramba	100	57	135	3
Monsoon (tebuconazole)	93	88	134	2
Proline	103	57	140	1
Prosaro fb Caramba[2]	99	68	137	1
Caramba fb Monsoon [2]	104	65	136	2
Proline fb Monsoon [2]	105	66	140	1
fungicide treated ave	*100*	*67*	*137*	*2*

percent SR on flag, 23 DAT

USWBSI Integrated Management of FHB and DON

Note 1 : Trtmt at flowering (T3) is too late for susceptible variety
Note 2: contrast between S vs MR varieties to stripe rust

Strategies for FHB & SR – high yields

High yield potential - mod to severe Stripe rust/ moderate FHB					
Variety	Susceptibility		fungicide applications		
	FHB	S. rust	T1	T2	T3
Ambassador	S	S	yes	yes	yes

Strategies for FHB & SR – high yields

High yield potential - mod to severe Stripe rust/ moderate FHB					
Variety	Susceptibility		fungicide applications		
	FHB	S. rust	T1	T2	T3
Ambassador	S	S	yes	yes	yes
P 25R40	MS -S	MR	-	-	yes
P 25R46	MR-MS	S	yes	yes	?

Strategies for FHB & SR – mod yield

Low to mod yield potential - mod to severe Stripe rust/ moderate FHB					
Variety	Susceptibility		fungicide applications		
	FHB	S. rust	T1	T2	T3
~~Ambassador~~	S	S	yes	yes	yes
P 25R40	MS -S	MR	-	-	yes
~~P 25R46~~ ????	MR-MS	S	?	yes	?

Complex disease mix calls for

1) More strategic selection of varieties
2) Field scouting

NCERA 184 Fungicide Efficacy

Management of Small Grain Diseases
Fungicide Efficacy for Control of Wheat Diseases (2018 Final)

The North Central Regional Committee on Management of Small Grain Diseases (NCERA-184) has developed the following information on fungicide efficacy for control of certain foliar diseases of wheat for use by the grain production industry in the U.S. Efficacy ratings for each fungicide listed in the table were determined by field testing the materials over multiple years and locations by the members of the committee. Efficacy is based on proper application timing to achieve optimum effectiveness of the fungicide as determined by labeled instructions and overall level of disease in the field at the time of application. Differences in efficacy among fungicide products were determined by direct comparisons among products in field tests and are based on a single application of the labeled rate as listed in the table. Table includes most widely marketed products and is not intended to be a list of all labeled products.

Efficacy of fungicides for wheat disease control based on appropriate application timing

Fungicide(s)												
Class	Active ingredient	Product	Rate/A (fl. oz)	Powdery mildew	Stagonospora leaf/glume blotch	Septoria leaf blotch	Tan spot	Stripe rust	Leaf rust	Stem rust	Head scab[1]	Harvest Restriction
Strobilurin	Picoxystrobin 22.5%	Aproach SC	6.0 – 12.0	G[1]	VG	VG[2]	VG	E[2]	VG	VG	NL	Feekes 10.5
	Dupontstrobin 40.3%	Evito 480 SC	2.0 – 4.0	G	--	--	VG	--	VG	--	NL	Feekes 10.5 and 40 days
	Pyraclostrobin 23.8%	Headline SC	6.0 - 9.0	G	VG	VG[2]	E	E[2]	E	G	NL	Feekes 10.5
Triazole	Metconazole 8.6%	Caramba 0.75 SL	10.0 - 17.0	VG	VG	--	VG	E	E	E	G	30 days
	Tebuconazole 38.7%	Folicur 3.6 F[3]	4.0	NL	NL	NL	NL	E	E	E	F	30 days
	Prothioconazole 41%	Proline 480 SC	5.0 - 5.7	--	VG	VG	VG	VG	VG	VG	G	30 days
	Prothioconazole 19% Tebuconazole 19%	Domark 421 SC	6.5 - 8.2	G	VG	VG	VG	E	E	E	G	30 days
	Propiconazole 41.8%	Tilt 3.6 EC[18]	4.0	VG	VG	VG	VG	VG	VG	VG	F	Feekes 10.5.4
Mixed modes of action[5]	Tebuconazole 22.6% Letbuconazole 22.6%	Absolute Maxx SC	5.0	G	VG	VG	VG	VG	E	VG	NL	35 days
	Cyproconazole 7.17% Picoxystrobin 17.94%	Aproach Prima SC	3.4 - 6.8	VG	VG	VG	VG	E	VG	--	NR	45 days
	Pyraclostrobin 16.0% Letbuconazole 13.7%	Delaro 325 SC	8.0	G	VG	VG	VG	VG	VG	VG	NL	Feekes 10.5 35 days
	Fluxapyroxad 2.8% Pyraclostrobin 16.7% Propiconazole 11.7%	Stratego EC	7.0 - 13.0	G	VG	VG	E	E	E	VG	NL	Feekes 10.5
	Dupontstrobin 14.8% Flutriafol 19.3%	Preempter SC	4.0 - 8.0	--	--	VG	VG	E	VG	--	NL	Feekes 10.5 and 40 days
	Fluxapyroxad 14.3% Pyraclostrobin 28.6%	Domark	4.0 - 8.0	G	VG	VG	E	VG	VG	G	NL	Feekes 10.5
	Propiconazole 11.7% Azoxystrobin 13.5%	Quilt Xcel 2.2 SE[8]	10.5 - 14.0	VG	VG	VG	VG	E	E	VG	NL	Feekes 10.5.4
	Pyraclostrobin 10.8% Letbuconazole 32.3%	Stratego YLD	4.0	G	VG	VG	VG	VG	VG	VG	NL	Feekes 10.5 35 days
	Benzovindiflupyr 2.9% Propiconazole 11.9% Azoxystrobin 16.5%	Trivapro SE	9.4 - 13.7	VG	VG	VG	VG	E	E	VG	NL	Feekes 10.5.4 14 days

Helpful info source for in- season outbreaks

Useful for field retail reps

Wheat Variety Comments—2017 (Huron County, MI)

	Agronomics						Disease Resistance [d]					
Variety	Grain Color	[a] Awns	[b] Flowering	[c] Plant Height	[d] Lodging	[d] Sprouting	Head Scab	Stripe Rust	Leaf Rust	Leaf Blotch	Powdery Mildew	All Sites
			13,14, 15,16	13,14, 15,16	13,14, 15,16	14,15	13,14, 15,16	16	13,14, 15	13,14, 15	13,14, 15,16	13,14, 15,16
AgriMAXX 413	Red	A	E	S	MS	S	MS	R	MS	MS	MR	99
AgriMAXX 438	Red	N/AL	ME	T	S	R	S	MR	MS	MS	MS	101
DF 105R	Red	A	E	S	MR	S	MS	R	MS	MS	MR	99
DF 112R	Red	A	ME	S	MS	S	MR	MR	S	MS	MR	103
25R25 [f]	Red	A	L	M	MR	R	MR	MR	MS	MR	MS	107
25R40 [f]	Red	A	ML	S	MR	S	S	MR	MS	MR	R	101
9692	Red	A	ME	M	MS	MS	MR	S	S	MR	S	106
Hopewell	Red	AL	ML	T	MR	MR	S	S	S	MS	MR	92
Red Devil	Red	A	ML	M	MR	R	MS	MR	R	MR	R	95
Red Dragon	Red	N	ME	T	MS	MR	MR	MR	S	MR	MS	98
Sunburst	Red	N	L	S	R	R	MS	MR	MR	MS	R	95
Whale	Red	N	L	M	R	R	S	MS	R	MR	S	101
W 206	Red	A	ME	M	MR	S	S	S	R	MR	MR	101
Ambassador	White	AL	ML	M	MR	S	S	S	S	S	MR	96
Aubrey	White	AL	E	M	MS	S	S	S	MR	MS	R	92
9242W	White	N/AL	ML	M	MR	MS	MS	MR	S	MR	MR	95
AC Mountain	White	AL	L	T	S	S	S	MS	MS	MS	MS	95
Jupiter	White	AL	L	S	MR	S	S	MR	MS	MS	MS	97
Venus	White	A	E	M	MS	S	S	MR	MR	MS	MR	91
E6012	White	A	ML	M	MS	S	S	MS	S	MR	MR	93

[a] A = awned (bearded), AL = awnletted (short awns), N = awnless (beardless); [b] E = early, ME = moderate-to-early, ML = moderate-
[d] S = susceptible, MS = moderately susceptible, MR = moderately resistant, R = resistant. Classification assignments based on the

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Thanks

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