Using IMI-Resistant and Susceptible Wheat Cultivar Blends to Simulate Winter Damage

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Introduction

Occasionally, winter wheat in the Great Plains experiences winter damage. When this occurs, farmers must determine the level of damage, its effects on grain yield, and whether they should destroy the crop or leave it for eventual harvest.

Objectives

How is winter wheat affected by increasing levels of stand loss and how much does damage in the fall or spring affect wheat yields.

Materials and Methods

- The experiment was a RCBD with a split-plot treatment arrangement
- The whole-plot treatment, imazamox (IMI) was applied at two timings: fall (3 leaf) and spring (green-up); plus late spring (flag leaf) in 2002, to kill the susceptible cultivar
- The sub-plot treatment, Tam110 (susceptible) and Above (tolerant), were planted in 3 blends, 1:2, 1:1, 2:1, and 2 controls, to simulate a stand loss of 33%, 50%, 66%, 100%, and 0%, respectively
- The experiment was conducted in Kansas in four locations, Hays, Manhattan, Hutchinson, and Belleville, over 5 years (2002, 2003, 2006, 2011, and 2012)
- Plots were 1.83 by 9.14 meters and there were four replications at each location-year
- Statistical analyses were preformed using SAS Proc Mixed, by location, nested within year
- Year, replication nested within year, and the whole-plot/replication within year interaction, were treated as random

Table 1. Effect of stand loss on the grain yield of winter wheat by simulated damage

Location	Treatment	Imazamox Treatment							
		Control		Fall		Spring		Late Spring	
(Year)	Blend	Mg ha^{-1}							
Hays	1:1 Tam110 to Above	3.22	AB	2.88	BCD	2.56	DE	1.95	FGH
(2002)	1:2 Tam110 to Above	3.10	AB	3.01	ABC	3.00	ABC	2.13	EFG
(2003)	2:1 Tam110 to Above	3.04	AB	2.92	ABCD	2.09	FG	1.61	GH
	Above	2.95	ABCD	3.20	AB	3.35	A	2.47	CDEF
	Tam110	3.09	AB	1.45	HI	0.00	J	0.99	I
	LSD (0.05)*	0.48							
Manhattan	1:1 Tam110 to Above	3.07	AB	2.81	BC	2.52	CD	-	
(2006)	1:2 Tam110 to Above	3.11	AB	2.99	AB	2.76	BCD	-	
(2011)	2:1 Tam110 to Above	3.05	AB	2.39	DE	2.12	E	-	
(2012)	Above	2.94	ABC	3.28	A	3.11	AB	-	
	Tam110	3.10	AB	0.69	F	0.62	F	-	
	LSD (0.05)*	0.43							
Hutchinson	1:1 Tam110 to Above	2.92	AB	2.76	ABC	2.06	GH	1.28	EF
(2002)	1:2 Tam110 to Above	2.89	AB	2.90	AB	2.44	FG	1.55	CD
(2006)	2:1 Tam110 to Above	2.80	AB	2.62	BCD	1.77	HI	0.78	EFG
(2011)	Above	2.88	AB	2.98	A	2.84	DE	2.17	AB
(2012)	Tam110	2.83	AB	0.50	I	0.38	J	0.00	IJ
	LSD (0.05)*	0.44							
Belleville	1:1 Tam110 to Above	3.80	ABC	3.73	ABC	3.20	C	-	
(2011)	1:2 Tam110 to Above	3.65	ABC	3.84	ABC	3.64	ABC	-	
(2012)	2:1 Tam110 to Above	3.80	ABC	3.32	BC	2.43	D	-	
	Above	3.75	ABC	4.11	A	4.13	A	-	
	Tam110	3.88	AB	0.72	E	0.27	E	-	
	LSD (0.05)*	0.66							

*LSD (0.05)- Fischer's Protected Least Significant Difference test at an alpha of 0.05

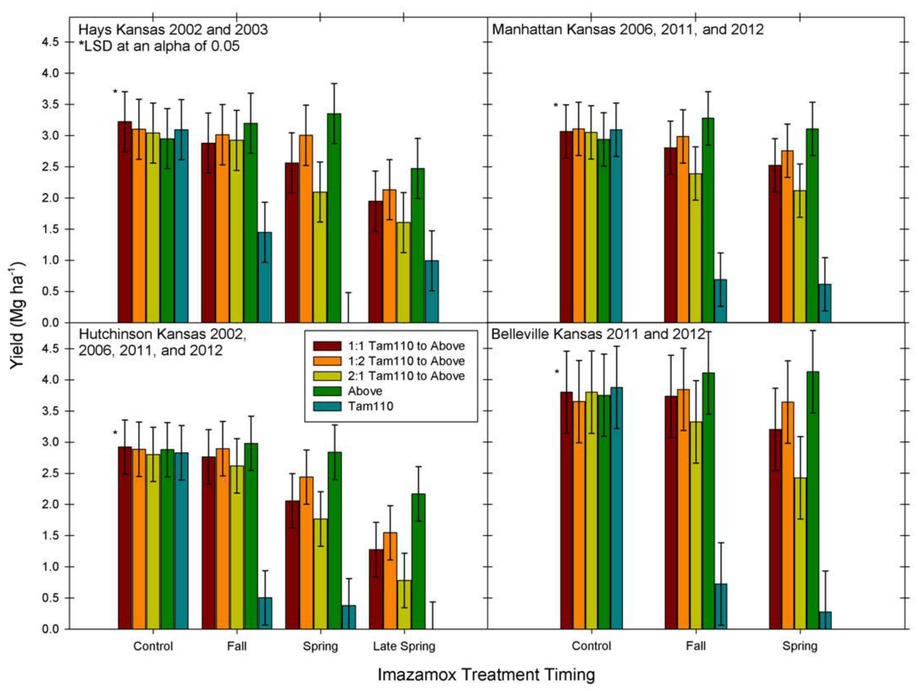

Figure 1. Interaction of imazamox spray timing and 50%, 33%, 66%, 100%, and 0% stand reduction on winter wheat yields (Mg ha^{-1}) at four locations in Kansas; Hays (2002 and 2003), Manhattan (2006, 2011, and 2012), Hutinson (2002, 2006, 2011, and 2012), and Belleville (2011 and 2012)

Results

- The interaction between stand loss and time of year was significant and had a negative impact on yield
- Fall simulated damage had a small, negative impact on yield (8-27%) but only when stand reductions were greater than 50%
- This suggests there is usually time for wheat to compensate and recover from stand loss
- Spring simulated damage had a larger negative impact on yield (10-41%), maximum reduction occurred when stand loss was greater than 50%
- Late spring damage resulted in the largest yield decrease (14-60%) at all stand reductions including the control, Above (20%)
- This shows that any late season damage can decrease grain yield, including spraying a herbicide (usually considered safe)

Conclusions

- Across all locations, grain yield decreased (18-58%) depending on cultivar blend and treatment timing
- Fall damage was not as serious (18% at the worst) and wheat usually had time to compensate/recover
- Spring and late spring damage reduced yield the most (39-58% at the worst) but more so when stand loss was greater then 50%
- If wheat is winter damaged and the stand is reduced evenly by 50-66% and it is still early in the season, the destruction of the crop should be avoided or at least reconsidered

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If you have any questions, please contact Kyle Shroyer at kjs8844@ksu.edu