

Title: Managing Imazamox-Resistant Wheat in Crop Rotations for Control of Jointed Goatgrass in the Central Great Plains

Personnel: Drew Lyon and Stephen Miller

Time Line: The study was initiated in the fall of 2000 and is scheduled to run through the summer of 2005. The study is on schedule.

Original

Hypothesis: Use of Clearfield wheat every 2 or 3 years, or in conjunction with crop rotations, will provide more sustainable jointed goatgrass control and less risk of developing herbicide resistant jointed goatgrass than continuous use of Clearfield wheat.

Summary of

Progress: Use of the imazomox-resistant wheat system resulted in a significant reduction in jointed goatgrass reproductive tillers and grain dockage compared to the standard wheat treatment in 2003. Wheat yield and dockage in the imazamox-resistant wheat in 2003 was not influenced by whether or not the previous wheat crop was imazamox-resistant or not, but wheat yield and dockage in the standard wheat in 2003 was affected by the previous wheat crop treatment. Standard wheat yields were reduced by 16% when the previous crop treatment was a standard wheat compared to an imazamox-resistant wheat. Grain dockage in the standard wheat was 46% greater when following the standard wheat treatment rather than the imazamox-resistant wheat treatment.

Objectives: Determine the best use of Clearfield wheat for control of jointed goatgrass in wheat-based cropping systems of the Central Great Plains.

Determine the risk of developing imazamox-resistant jointed goatgrass in cropping systems using Clearfield wheat.

Monitor the impacts of Clearfield wheat technology on jointed goatgrass and jointed goatgrass x wheat hybrid population dynamics.

Experimental Design: During the first two years of the study, there were just two treatments: a Clearfield wheat variety and a standard variety, each replicated four times. This year and next year, these two treatments will be split into four treatments, and during the last two years of the experiment there will be eight treatments consisting of various temporal combinations of Clearfield and standard wheat varieties grown in a winter wheat-fallow rotation (Table 1). Clearfield treatments will receive an application of Beyond herbicide to control jointed goatgrass.

Progress/Conclusions: As in the first two years of the study, use of the imazomox-resistant wheat system resulted in a significant reduction in jointed goatgrass reproductive tillers and grain

dockage compared to the standard wheat treatment (Table 2). However, as in 2001, the standard wheat treatment yielded more than the imazamox-resistant wheat treatment. A late spring freeze in 2003 may help to explain the reduced yield of Above compared to Buckskin. The Above wheat was further along in its development at the time of the freeze than Buckskin and may have suffered more yield loss as a result. Wheat yield and dockage in the imazamox-resistant wheat in 2003 was not influenced by whether or not the previous wheat crop was imazamox-resistant or not (Table 3), but wheat yield and dockage in the standard wheat in 2003 was affected by the previous wheat crop treatment. Standard wheat yields were reduced by 16% when the previous crop treatment was a standard wheat compared to an imazamox-resistant wheat. In the same manner, grain dockage in the standard wheat was 46% greater when following the standard wheat treatment rather than the imazamox-resistant wheat treatment. Plots were searched for wheat x jointed goatgrass hybrids and three were found. The spikelets on each spike were checked for viable seed; however, none were obtained. In addition, jointed goatgrass seed were collected from the imazamox-resistant and standard wheat treatments in July of 2003. Response of jointed goatgrass seedlings from seed collected from these two treatments did not differ in response to 0.032 lb ai/acre imazamox. Dry weight reductions ranged from 73 to 81% ($p = 0.276$).

Publications: None

Technology Transfer Activities: None; it is too early in the project for this type of activity. We anticipate beginning activities in 2004, following the second year of the four-way treatment comparisons.

Producer Recommendations: We do not believe that the Clearfield wheat stewardship program developed by BASF is adequate to protect against the development of imazamox-resistant jointed goatgrass in the Central Great Plains, but at this early stage in the study we do not have proof of our concern.

Budget:

Fiscal Year	Nebraska		Wyoming	
	Requested	Received	Requested	Received
	\$-----			
2000	7500	7500	7500	7500
2001	7500	7500	7500	7500
2002	7500	7500	7500	7500
2003	7500	7500	7500	7500
2004	7500	---	7500	---
2005	7500	---	7500	---

Statement of work to be conducted: The standard and Clearfield wheat varieties were planted in September of 2003 (see Table 1). Jointed goatgrass emerged with the wheat. Imazamox will be applied to the Clearfield wheat treatments in late March or early April of 2004. Wheat, jointed goatgrass, and jointed goatgrass x wheat hybrid densities will be quantified in June of 2004. Just prior to harvest in early July, seed heads from wheat x jointed goatgrass hybrids will be collected. The spikelets on each spike will be checked for viable seed. In addition, jointed goatgrass seed will be collected from the Clearfield and standard wheat variety treatments. The seed will be germinated in the greenhouse and the seedlings treated with 0.032 lb ai/acre of imazamox to test for increased tolerance to the herbicide. Plots will be harvested for grain yield and dockage determined. In September of 2004, standard and Clearfield wheat varieties will be seeded as shown in Table 1. This will be the third cycle of this study and should be the most interesting. Imazamox will be sprayed in Clearfield variety treatments in October.

Table 1. Treatment comparisons during the course of the study.

Year ^a	Treatment comparisons							
2001 & 2002	Standard wheat (SW)				Clearfield wheat (CW)			
2003 & 2004	SW-F-SW		SW-F-CW		CW-F-CW		CW-F-SW	
2005 & 2006	SW-F-SW	SW-F-CW	SW-F-CW	SW-F-SW	CW-F-SW	CW-F-CW	CW-F-SW	CW-F-CW

Table 2. Using imazamox and imazamox-resistant winter wheat provides superior jointed goatgrass control compared to the use of a standard wheat variety, but the standard wheat has greater grain yield than the imazamox-resistant wheat at Lingle, WY in the 2002-2003 crop year.

Treatment	Jointed goatgrass		Winter wheat		
	Tillers #/m ²	Spikelets #/spike	Heads #/m of row	Yield kg/ha	Dockage g/kg
Standard	70.4	9.1	93.6	1300	61.0
Imazamox-resistant	3.9	5.0	70.4	1010	17.8
P value	<0.001	<0.001	0.002	<0.001	<0.001

Table 3. Comparison of all combinations of wheat-fallow-wheat rotations involving imazamox-resistant and standard wheat varieties at Lingle, WY for the wheat crop harvested in 2003.

Treatment	Jointed goatgrass		Winter wheat		
	Tillers	Spikelets	Heads	Yield	Dockage
	#/m ²	#/spike	#/m of row	kg/ha	g/kg
Imazamox-resistant – fallow – imazamox-resistant (CC)	2.0	5.1	73.7	1000	17.1
Imazamox-resistant – fallow – standard (CS)	71.0	9.0	94.6	1410	49.6
Standard – fallow – imazamox-resistant (SC)	5.9	4.9	67.1	1030	18.5
Standard – fallow – standard (SS)	69.8	9.2	92.6	1190	72.4
	————— Significance of contrast				
CC+SC vs CS+SS	<0.001	<0.001	0.003	<0.001	<0.001
CC vs SC	0.874	0.772	0.524	0.713	0.880
CS vs SS	0.959	0.851	0.841	0.016	0.018