Evaluation of Various Herbicides for Weed Control in Switchgrass

Mikki Eken and Dr. Rodney Lym, NDSU Department of Plant Science

Vehicles capable of ethanol use have increased in number over the past decade which has led to an increase in demand for biofuel. Corn is the most widely used crop for the production of biofuel, and also is a major food crop throughout the world. The use of corn in the production of biofuel has increased food prices. Switchgrass is a native grass with high production potential and is an alternative to corn in the production of ethanol. However, control of grassy weeds has been a problem in switchgrass production. The purpose of this research is to evaluate several herbicides for weed control in switchgrass.

A total of 27 herbicides, 4 pre-emergent and 23 post-emergent, were evaluated in greenhouse experiments conducted during the fall, winter, and spring of 2008 and 2009. The herbicides that did not cause injury to switchgrass, but controlled yellow foxtail, green foxtail, smooth bromegrass, and quackgrass, were selected for field trials (Table 1).

Table 1. Post-emergent herbicide treatments evaluated for weed control in a switchgrass field trial near Streeter, ND, May and June 2009.

Mode of action/herbicide	Adjuvant	Rate 1	Rate 2
ALS[1] enzyme inhibitor		oz/Acre	
Flucarbazone	Non-ionic surfactant	0.21 + 0.25%	0.42 + 0.25%
Propoxycarbazone	Non-ionic surfactant	0.42 + 0.25%	0.84 + 0.25%
Pyroxsulam	Non-ionic surfactant	0.13 + 0.25%	0.26 + 0.25%
Sulfometuron	Non-ionic surfactant	1.5 + 0.25%	3 + 0.25%
Sulfosulfuron	Non-ionic surfactant	0.25 + 0.5%	0.50 + 0.5%
Photosystem II inhibitor			
Atrazine	Non-ionic surfactant	8 + 0.25%	16 + 0.25%
Tebuthiuron	Non-ionic surfactant	2 + 0.25%	4 + 0.25%
HPPD[1] inhibitor			
Topramezone	Methylated seed oil	0.175 + 1%	0.35 + 1%
Unclassified			
Aminocyclopyrachlor	Methylated seed oil	1.5 + 1%	3 + 1%

[1]Abbreviations: ALS = acetolactate synthase; and HPPD = hydroxyphenylpyruvate dioxygenase.

Trials were conducted in a switchgrass field at the Central Grasslands Research Extension center at Streeter, ND. An established field of switchgrass planted in 2001 had become infested with quackgrass and smooth bromegrass. Two experiments were conducted, one sprayed on May 21, 2009 and one sprayed on June 25, 2009. Herbicides were applied at two rates in each experiment. Herbicides were applied using a hand-held boom sprayer delivering 17 gpa at 35 psi. There were four replicates per treatment in a randomized complete block design with plots 10 by 30 feet. At the May application, quackgrass and smooth bromegrass were 5 to 6 inches tall and switchgrass was at the 2- to 3-leaf stage. At the June application, quackgrass was 10 to 18 inches tall, smooth bromegrass was 12 to 28 inches tall, and switchgrass was at the 4- to 5-leaf stage and 15 to 18 inches tall.

After application, weed control and switchgrass injury were visually evaluated 2, 4, and 8 weeks after the May application, and 2 and 4 weeks after the June application. Grasses were harvested between August 3 and 4, 2009. Switchgrass yield was similar regardless of treatment, but smooth bromegrass and quackgrass control varied between treatments after the May application (Table 2). Propoxycarbazone at 0.42 and 0.84 oz(ai)/A, sulfometuron at 1.5 and 3 oz/A, and sulfosulfuron at 0.5 oz/A reduced quackgrass by 90 to 100%; sulfosulfuron at 0.25 oz/A and pyroxsulam at 0.26 oz/A reduced quackgrass by 56 and 65%, respectively. Smooth bromegrass was reduced by 100% by aminocyclopyrachlor at 1.5 and 3 oz/A, sulfosulfuron at 0.25 oz/A, and pyroxsulam at 0.26 oz/A. Switchgrass, quackgrass, and smooth bromegrass yields were similar regardless of treatment when applied in June (data not shown).

In summary, treatments of propoxycarbazone at 0.84 oz/A, sulfometuron at 3 oz/A, or sulfosulfuron at 0.5 oz/A tended to increase switchgrass yield and reduce quackgrass by over 98% compared to the control. The experiments will be continued, and harvested again in 2010.

Table 2. Switchgrass, quackgrass, and smooth bromegrass yield as compared to the untreated check 90 days after treatment near Streeter, ND harvested August 3-4, 2009.

Treatment[1]	Rate oz/acre	Switchgrass	Quackgrass	Smooth bromegrass
		----------% of check----------		
Flucarbazone	0.21	115	52	12
Flucarbazone	0.42	167	42	206
Propoxycarbazone	0.42	150	1	94
Propoxycarbazone	0.84	236	0	111
Pyroxsulam	0.13	157	78	110
Pyroxsulam	0.26	159	35	0
Sulfometuron	1.50	177	1	88
Sulfometuron	3.00	224	1	86
Sulfosulfuron	0.25	202	44	0
Sulfosulfuron	0.50	231	10	321
Atrazine	8.00	164	154	268
Atrazine	16.00	209	108	280
Tebuthiuron	2.00	116	164	332
Tebuthiuron	4.00	204	89	449
Topramezone	0.18	90	115	277
Topramezone	0.35	116	102	79
Aminocyclopyrachlor	1.50	175	62	0
Aminocyclopyrachlor	3.00	104	42	0
Check		--	--	--
LSD (0.05)		NS	45	NS

[1] All herbicides applied with a surfactant. See Table 1.