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Evaluation of Azimsulfuron for the Control of Complex Weed Flora in Transplanted Rice

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ABSTRACT

Azimsulfuron was evaluated for its efficacy in controlling mixed weed flora in transplanted rice at HAU Regional Research Station, Karnal, India. Density and dry weight of grassy weeds in the plots treated with azimsulfuron were higher than pretilachlor 1000 g/ha except azimsulfuron 30 g/ha applied at 15 days after transplanting (DAT). Density of broadleaf weeds was significantly lower under all azimsulfuron doses when applied at 15 DAT compared to 25 DAT. All the treatments of azimsulfuron (10-30 g/ha at 15 and 25 DAT) provided excellent control of sedges, which were significantly better than pretilachlor and were as good as weed free check. Yields under azimsulfuron 30 g/ha at 15 DAT during 2006, and 27.5 and 30 g/ha at 15 DAT and 30 g/ha at 25 DAT during 2007 were statistically at par with pretilachlor. There was no phyto-toxicity of azimsulfuron on rice and also there was no residual toxicity on the succeeding crop of wheat during both the years of experimentation.

Key words : Application time, dose rate optimization, weed control efficacy

INTRODUCTION

Rice is grown in about 45 million hectares with production of 96 million tonnes contributing 45% to the total food grain production of India. Weed competition is one of the prime yield limiting biotic constraints resulting into yield reduction of 28-45% (Raju and Reddy, 1995; Singh *et al*., 2003). Pre-emergence herbicides are most commonly used against grassy weeds in transplanted rice. But post-emergence herbicides are becoming need of the day due to emergence of weeds at later growth stages of crop. Moreover, suitable herbicide is required to manage the growing problem of sedges particularly *Cyperus rotundus* in rice. Azimsulfuron is a recently introduced post-emergence sulfonylurea herbicide useful for controlling weeds in rice fields (Valle *et al*., 2006). Hence, an investigation was carried out for optimization of dose and time of application of azimsulfuron against broad spectrum of weeds including sedges in transplanted rice.

MATERIALS AND METHODS

An investigation was conducted to evaluate the efficacy of azimsulfuron at CCS Haryana Agricultural University Regional Research Station, Karnal during **kharif** 2006 and 2007. Soil of the experimental field was clay loam in texture, low in available nitrogen, medium in available P_2O_5 and high in K_2O with slightly alkaline in reaction (pH 8.1).

The experiment consisting 17 treatments viz., azimsulfuron 10.0, 12.5, 15.0, 22.5 25.0, 27.5 and 30.0 g/ha each with 0.2% surfactant (S) applied at 15 days after transplanting (DAT) and 25 DAT and pretilachlor 1000 g/ha at 3 DAT alongwith weedy and weed free checks was laid out in randomized block design replicated thrice. Azimsulfuron was sprayed with knapsack sprayer fitted with flat fan nozzle using 300 litres of water/ha. Pretilachlor 1000 g/ha was applied as splash after mixing in five litres of water per hectare. Thirty-five days old seedlings of rice cv. HKR-47 were transplanted on July 21, 2006 and July 09, 2007 at a spacing of 20 x 15 cm in a plot size of 5.60 x 2.40 m. Crop was raised as per the recommendations of the State University. Density and dry weight of weeds were recorded at 60 DAT during 2006 and 75 DAT during 2007; and yield and yield attributes at maturity. Crop phytotoxicity was recorded at 15 and 30 days after spray using 0-100 scale (where, 0=no mortality and 100=complete mortality). The crop harvested on October 27 and 19 during 2006 and 2007, respectively. Data on residual toxicity of azimsulfuron was also recorded on succeeding crop of wheat. As there was no crop phytotoxicity on rice and also no residual toxicity on succeeding crop of wheat, the data in these respects have not been included herein.

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RESULTS AND DISCUSSION

Effect on Weeds

Weed flora of the field consisted of *Echinochloa crus-galli* (L.) P. Beauv. and *E. colona* (L.) Link among grasses and *Ammannia baccifera* L. and *Euphorbia hirta* L. among broad-leaved weeds (BLW) and *Fimbristylis miliacea* (L.) Vahl, *Cyperus iria* L., *C. rotundus* L. and *C. difformis* L. among sedges. The composition of grasses, BLW and sedges was 56, 33 and 11% during 2006 and 36, 45 and 19% during 2007 (Table 1).

Density and dry weight of grassy weeds decreased with increase in dose of azimsulfuron at both the stages of application and during both the years (Tables 1 and 2). All the doses of azimsulfuron resulted in higher density and dry weight of grassy weeds than pretilachlor 1000 g/ha, but lower than the weedy check. During 2006, density and dry weight of grassy weeds in the plots treated with azimsulfuron were higher than pretilachlor 1000 g/ha except azimsulfuron 30 g/ha applied at 15 DAT. During 2007, almost similar trend was observed. In general, application of azimsulfuron at 15 DAT was better than its delayed application and these effects were more pronounced during second year. This could be attributed to optimum growth stage of weeds at the time of application.

Density of broadleaf weeds was lower under all azimsulfuron doses when applied at 15 DAT compared to 25 DAT, and the differences were more pronounced during 2007 (Table 1). All doses of azimsulfuron applied at 15 DAT resulted into density of BLW at par with pretilachlor; while its application at 25 DAT was less effective except the highest dose of 30 g/ha.

All the treatments of azimsulfuron provided excellent control of sedges in respect of population of sedges, which were significantly better than pretilachlor and were as good as weed free check during 2006 (Table 1). Similar trend was observed during 2007 also except azimsulfuron 10 g/ha applied at 25 DAT being at par with pretilachlor.

The dry weight of BLW and sedges under all the treatments of azimsulfuron was at par with pretilachlor during 2006 (Table 2). Dry weight of BLW and sedges was lower under azimsulfuron applied at 15 DAT than 25 DAT stage. Azimsulfuron turned out to be as good as weed free check during 2007. Pretilachlor could not reduce the dry weight of BLW and sedges effectively.

During 2006, per cent control of grassy weeds increased with the corresponding increase in dose of azimsulfuron (Table 1). Generally, the control was better when it was applied at 15 DAT than 25 DAT. The maximum control among the azimsulfuron treatments was obtained at 30 g/ha applied at 15 DAT (82%). The control of grassy weeds was 72, 78, and 82% at 25, 27.5 and 30 g/ha azimsulfuron applied at 15 DAT; while the respective figures for 25 DAT applications were 65, 75 and 77%, respectively. Pretilachlor was superior to azimsulfuron against grassy weeds. Similar results were obtained during 2007.

During 2006, per cent control of BLW and sedges was in the range of 60-85% under different azimsulfuron treatments (Table 1). Azimsulfuron 25-30 g/ha at both the stages of application provided > 80% control of BLW and sedges and was similar to pretilachlor (83%). During 2007, the control of BLW was in the range of 77-99% under azimsulfuron treatments at 15 DAT, while it was 55-67 % at delayed application. Azimsulfuron 25-30 g/ha at 15 DAT stage provided 93-99% control of BLW and was better than pretilachlor (85%). There was almost complete control of sedges (100% at 15 DAT, 93-100% at 25 DAT application) under all the treatments of azimsulfuron including the lowest doses (10-15 g/ha). Yadav *et al*. (2007) have also reported better efficacy of azimsulfuron against sedges in rice.

Effect on Crop

Plant height and panicle length of rice were not influenced by different herbicidal treatments during both the years (Table 2). In general, there was an increase in the number of effective tillers with corresponding increase in dose of azimsulfuron. Azimsulfuron 22.5-30.0 g/ha at both stages of application during 2006 and 27.5-30 g/ha applied at 15 DAT during 2007 was at par with weed free check in respect of number of tillers. Azimsulfuron 10.0-12.5 g/ha at 15 DAT during both the years and 10.0-22.5 g/ha dose at 25 DAT during 2007 provided less number of effective tillers, while other azimsulfuron treatments were at par with pretilachlor.

All the herbicidal treatments gave significantly higher yield than weedy check during both the years except azimsulfuron 10.0-15.0 g/ha at 15 DAT and 10.0-22.5 g/ha at 25 DAT during 2007 (Table 2). None of the azimsulfuron treatments could raise the grain yield of rice equivalent to weed free check during both the years, while pretilachlor gave yield at par with weed free check.

Table 1. Effect of azimsulfuron on density and control of weeds in transplanted rice

Treatments	Dose (g/ha)	Time (DAT)	Weed density/m^2						Per cent control (visual)				
			Grassy		Broadleaf weeds (BLW)		Sedges		Grassy		BLW+ Sedges	BLW	Sedges
			2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2007
Azimsulfuron	10	15	5.34 (28.7)	4.80 (22.0)	5.31 (28.7)	4.96 (24.0)	1.00 (0.0)	1.00 (0.0)	45	53	60	77	100
Azimsulfuron	12.5	15	4.20 (16.7)	4.71 (21.3)	5.29 (27.3)	5.06 (25.3)	1.00 (0.0)	1.00 (0.0)	57	63	70	77	100
Azimsulfuron	15	15	3.29 (10.7)	4.90 (23.3)	5.31 (27.3)	5.13 (25.3)	1.00 (0.0)	1.00 (0.0)	68	72	78	92	100
Azimsulfuron	22.5	15	3.48 (11.3)	4.32 (18.7)	5.37 (28.0)	4.79 (22.7)	1.00 (0.0)	1.00 (0.0)	68	80	83	95	100
Azimsulfuron	25	15	3.08 (8.7)	4.27 (17.3)	5.66 (31.3)	5.19 (26.0)	1.00 (0.0)	1.00 (0.0)	72	82	83	93	100
Azimsulfuron	27.5	15	3.05 (8.7)	4.27 (17.3)	5.15 (27.3)	5.04 (25.3)	1.00 (0.0)	1.00 (0.0)	78	80	83	96	100
Azimsulfuron	30	15	2.73 (6.7)	3.93 (15.3)	4.68 (21.3)	3.16 (11.3)	1.00 (0.0)	1.00 (0.0)	82	85	83	99	100
Azimsulfuron	10	25	4.12 (16.0)	6.17 (37.3)	7.66 (61.3)	9.14 (83.3)	1.00 (0.0)	2.54 (6.7)	47	28	67	55	93
Azimsulfuron	12.5	25	3.96 (15.3)	5.89 (34.0)	8.08 (65.3)	7.89 (61.3)	1.00 (0.0)	1.55 (2.0)	53	42	68	58	97
Azimsulfuron	15	25	3.77 (14.0)	5.61 (30.7)	7.35 (56.0)	8.29 (70.0)	1.00 (0.0)	1.00 (0.0)	52	50	77	62	100
Azimsulfuron	22.5	25	3.22 (10.0)	5.17 (26.0)	7.35 (54.0)	7.97 (64.0)	1.00 (0.0)	1.00 (0.0)	60	50	70	62	100
Azimsulfuron	25	25	3.17 (9.3)	5.32 (27.3)	7.23 (52.0)	7.53 (59.3)	1.00 (0.0)	1.00 (0.0)	65	70	82	60	100
Azimsulfuron	27.5	25	3.32 (10.3)	5.11 (25.3)	6.97 (48.7)	7.79 (60.0)	1.00 (0.0)	1.00 (0.0)	75	68	80	65	100
Azimsulfuron	30	25	3.24 (10.0)	4.93 (23.3)	6.42 (40.7)	7.03 (51.3)	1.00 (0.0)	1.00 (0.0)	77	72	85	67	100
Pretilachlor	1000	3	1.55 (2.0)	1.96 (3.3)	4.53 (20.7)	5.02 (24.7)	1.82 (2.7)	2.74 (8.7)	97	98	83	85	68
Weed free	-	-	1.00 (0.0)	1.00 (0.0)	1.00 (0.0)	1.00 (0.0)	1.00 (0.0)	1.00 (0.0)	100	100	100	100	100
Weedy check	-	-	6.29 (38.7)	6.70 (44.0)	4.80 (22.7)	7.46 (55.3)	2.74 (8.0)	4.7 (22.7)	0	0	0	0	0
LSD (P=0.05)			1.29	1.04	1.94	1.93	0.65	1.15	-	-	-	-	-

Original figures in parentheses were subjected to square root transformation (√X+1) before statistical analysis.
DAT–Days after transplanting.

Table 2. Effect of azimsulfuron on weed dry weight, yield and yield attributes of transplanted rice

Treatments	Dose (g/ha)	Time (DAT)	Dry weight (g/m^2)				Plant height (cm)		Effective tillers/ mrl		Panicle length (cm)		Grain yield (kg/ha)	
			Grassy		BLW + Sedges									
			2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
Azimsulfuron	10	15	121.6	138.1	13.3	0.20	86.9	86.2	58.7	57.3	21.6	21.2	4947	5196
Azimsulfuron	12.5	15	77.9	130.5	13.3	0.20	86.7	87.9	59.0	59.7	21.8	21.1	5332	5219
Azimsulfuron	15	15	66.5	122.4	13.6	0.40	86.8	87.9	62.7	61.8	21.6	21.3	5752	5241
Azimsulfuron	22.5	15	64.4	114.3	13.4	0.20	86.4	88.4	64.2	61.7	21.8	21.1	5901	5533
Azimsulfuron	25	15	62.2	108.4	13.4	0.33	87.1	87.3	64.0	62.5	22.0	21.5	5901	5870
Azimsulfuron	27.5	15	50.3	100.0	13.7	0.40	85.7	87.9	65.7	62.8	22.3	21.3	5976	6116
Azimsulfuron	30	15	40.0	74.3	13.0	0.13	86.1	87.5	69.3	67.3	21.9	21.3	6075	6115
Azimsulfuron	10	25	145.9	263.7	18.4	2.40	86.3	86.6	61.0	56.2	21.1	21.1	5379	4797
Azimsulfuron	12.5	25	104.3	186.3	16.9	2.20	87.7	87.1	62.7	56.0	22.1	20.9	5454	4953
Azimsulfuron	15	25	82.6	183.5	15.5	2.13	86.3	87.3	64.7	55.0	21.3	21.6	5405	4973
Azimsulfuron	22.5	25	74.4	174.6	15.7	2.07	87.3	87.3	65.8	60.3	21.3	21.5	5529	5265
Azimsulfuron	25	25	67.0	176.3	16.2	1.73	87.1	87.5	64.8	62.2	21.3	20.9	5678	5513
Azimsulfuron	27.5	25	69.8	140.4	15.6	1.20	87.7	88.2	65.5	62.2	21.9	20.7	5754	5691
Azimsulfuron	30	25	59.1	97.8	14.2	1.40	87.1	87.6	68.7	63.3	21.4	21.3	5977	5825
Pretilachlor	1000	3	13.6	20.7	13.9	8.47	88.2	88.1	70.0	69.7	22.5	21.3	6654	6970
Weed free	-	-	0.0	0.0	0.0	0.00	89.0	89.4	72.8	71.0	22.7	22.1	6771	7187
Weedy check	-	-	138.6	302.4	16.2	4.80	85.5	86.8	44.5	49.2	21.4	20.8	4042	4474
LSD (P=0.05)			34.9	50.8	3.4	4.10	NS	NS	10.1	8.2	NS	NS	667	887

DAT–Days after transplanting, BLW–Broad-leaved weeds, mrl–metre row length.

Yields under azimsulfuron 30 g/ha at 15 DAT during 2006 and 27.5-30.0 g/ha at 15 DAT during 2007 were statistically at par with pretilachlor. There was no phytotoxicity of azimsulfuron on rice at 15 and 30 days after spray and also there was no residual toxicity on the succeeding crop of wheat during both the years of experimentation (data not given).

Based on present investigation it might be concluded that azimsulfuron 30 g/ha applied at 15 DAT could be most suitable treatment against complex weed flora pre-dominated by sedges in transplanted rice. However, more specifically its efficacy was poor against grassy weeds but excellent against sedges particularly *C. rotundus*. It is effective in controlling perennial weeds at very low application rates, whereas higher concentrations are needed to control annual weeds (Shirakura *et al*., 1995). Future research efforts are required to evaluate this herbicide at higher doses and in combination with other herbicides against complex weed flora dominated by grassy weeds.

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