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Evaluation of Azimsulfuron and Metsulfuron-methyl Alone and in Combination for Weed Control in Transplanted Rice

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ABSTRACT

Efficacy of azimsulfuron and metsulfuron-methyl alone and in combination was evaluated against complex weed flora in transplanted rice at Karnal, Haryana, India during **kharif** 2006 and 2007. The experimental field was infested with grassy, broad-leaved weeds and sedges during two years to the extent of 43-54, 32-46 and 11-14%, respectively. Excellent control of broad-leaved weeds and sedges (90-100%) under all the treatments of azimsulfuron alone or admix with metsulfuron was observed. Pretilachlor and pretilachlor fb chlorimuron+metsulfuron provided better control of grassy weeds compared to azimsulfuron alone and in combination with metsulfuron. In this study, there was no significant effect of addition of metsulfuron to azimsulfuron on rice grain yield. Azimsulfuron and metsulfuron being safe for rice crop were found compatible and azimsulfuron 30 g+metsulfuron-methyl 2 g/ha applied at 15-25 DAT could be exploited in situations where weed flora was pre-dominated with broad-leaved weeds and sedges.

Key words : Herbicide mixture, application time, weed control efficacy

INTRODUCTION

Transplanted rice encounters with problem of complex weed flora in different regions of the country resulting in 15-76% reduction in grain yield (Mishra, 1997; Singh *et al*., 2004). Certain weeds emerging at later growth stages in the season escape the treatment of pre-emergence herbicides. These situations demand for some suitable post-emergence herbicide either alone or in combination for controlling wide spectrum of weeds. Wide range of herbicides is available for the management of grassy weeds (pretilachlor, butachlor, anilofos and oxadiargyl) as well as broad-leaved weeds (metsulfuron, chlorimuron, ethoxysulfuron and 2, 4-D). Herbicides recommended against grassy weeds are mostly used as pre-emergence and weeds emerging later in the season often get escaped. Azimsulfuron is a new herbicide for post-emergence weed control in transplanted rice; however, its efficacy against sedges has been found excellent but not as good against broad-leaved weeds (Yadav *et al*., 2007). Integration of azimsulfuron with metsulfuron applied as post-emergence may provide viable alternative in rice infested with wide spectrum of weeds including sedges and broad-leaved weeds (BLW). Therefore, the present investigation was undertaken to evaluate the rate and time of application of azimsulfuron alone and in combination with metsulfuron-methyl.

MATERIALS AND METHODS

A field experiment was conducted to evaluate the efficacy of tank-mix application of azimsulfuron and metsulfuron against complex weed flora in transplanted rice at CCS Haryana Agricultural University Regional Research Station, Karnal, Haryana, India during **kharif** 2006 and 2007. The soil of 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 8.2). Thirty-five days old seedlings of rice cultivar HKR-47 were transplanted on July 8, 2006 and July 13, 2007, at a spacing of 20 x 15 cm in a plot size of 5.40 x 2.40 m. The treatments included azimsulfuron 25, 27.5 and 30 g/ha each applied at 15 days after transplanting (DAT) and 25 DAT alone as well as tank-mix with metsulfuron 2 g/ha, chlorimuron+metsulfuron (Almix) 4 g/ha applied at 25 DAT, pretilachlor 1000 g/ha applied at 3 DAT alone and in sequence with chlorimuron+metsulfuron 4 g/ha, alongwith weedy and weed free checks. The experiment was laid out in randomized block design with three replications. Post-emergence herbicides were sprayed by knapsack sprayer fitted with flat fan nozzle using 300 l of water per hectare. Pretilachlor was applied at 3 DAT by broadcasting after mixing in 60 kg sand/ha. Crop was raised as per the recommendations of the State University. Weed density and dry weight were recorded at 75 DAT, and rice grain

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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 was harvested on October 25 in 2006 and October 26 in 2007. Data on residual toxicity of azimsulfuron and metsulfuron 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.

RESULTS AND DISCUSSION

Effect on Weeds

The experimental field was infested mainly with *Echinochloa crus-galli* (L.) P. Beauv. and *E. colona* (L.) Link among grasses; *Ammannia baccifera* L. and *Euphorbia hirta* L. among broad-leaved weeds and *Fimbristylis miliacea* (L.) Vahl, *Cyperus iria* L., *C. rotundus* L. and *C. difformis* L. among sedges. Per cent composition of grassy weeds, BLW and sedges during two years was 43-54, 32-46 and 11-14, respectively (Table 1).

Density and dry weight of grassy weeds decreased and visual control increased with increase in dose of azimsulfuron at both the stages of application and during both the years (Tables 1 and 2). There was no effect of addition of metsulfuron visible on density of grassy weeds. All the treatments of azimsulfuron alone and in combination with metsulfuron resulted in higher density of grassy weeds than pretilachlor 1000 g/ha and pretilachlor+ chlorimuron+metsulfuron. No conclusive trend was obtained regarding impact of time of application. Azimsulfuron 30 g/ha+metsulfuron 2 g/ha during both years and azimsulfuron 30 g/ha alone during 2007 resulted in dry weight of grassy weeds at par with pretilachlor and pretilachlor fb chlorimuron+ metsulfuron. All the azimsulfuron based treatments resulted in lower dry weight of grassy weeds than the weedy check.

Density of broad-leaved weeds was lower under azimsulfuron applied at 25 DAT than 15 DAT during 2006 but no trend was visible during 2007 (Table 1). During 2006, density of broad-leaved weeds under admix application of metsulfuron with azimsulfuron 30 g applied at 15 DAT, 25-30 g applied at 25 DAT, and azimsulfuron 30 g alone applied at 25 DAT was at par with chlorimuron+metsulfuron 4 g/ha. Admixture of metsulfuron with azimsulfuron 27.5-30 g/ha at 15 DAT and with 25-30 g/ha at 25 DAT, and azimsulfuron 27.5-30 g/ha alone applied at 25 DAT was better than pretilachlor alone. While other azimsulfuron treatments were at par with pretilachlor. During 2007, all azimsulfuron treatments were at par with pretilachlor, except azimsulfuron 25 g/ha at 15 DAT and its admixture with metsulfuron at 25 DAT which were inferior. Density of broad-leaved weeds under azimsulfuron 30 g/ha, and admix application of metsulfuron with azimsulfuron 27.5-30 g/ha at both the stages of application were at par with chlorimuron+metsulfuron and lower than weedy check. In general, addition of metsulfuron with azimsulfuron resulted in decreased density of BLW; however, the effects were not always significant. Chlorimuron+ metsulfuron alone and admix with pretilachlor resulted in BLW density at par with weed free check during both the years.

All the azimsulfuron treatments except azimsulfuron 25 g+metsulfuron 2 g/ha applied at 15 DAT during 2007 were at par with chlorimuron+metsulfuron and weed free check in respect of density of sedges (Table 1). There was no visible effect of addition of metsulfuron with azimsulfuron on density of sedges.

Dry weights of BLW and sedges under all the doses of azimsulfuron alone or admix treatments were at par with chlorimuron+metsulfuron and pretilachlor fb chlorimuron+metsulfuron, except azimsulfuron 30 g at 25 DAT during 2006 and azimsulfuron 25 g+metsulfuron 2 g at 15 DAT during 2007 (Table 2). Azimsulfuron 30 g/ha at 25 DAT resulted in dry weight of BLW and sedges lower than all herbicidal treatments during 2006. There was no visible effect of addition of metsulfuron on dry weight of BLW and sedges and also there was no difference between stages of application.

Pretilachlor and pretilachlor fb chlorimuron+ metsulfuron provided better control of grassy weeds compared to azimsulfuron alone and in combination with metsulfuron during both the years (Table 1). Under different azimsulfuron treatments, there was 47-65% control of grassy weeds during 2006 and it was 65-82% during 2007. During both the years, there was excellent control of BLW and sedges (90-100%) under all the treatments of azimsulfuron alone or admix with metsulfuron at both the stages of application, and these were better than pretilachlor particularly against sedges.

Table 1. Effect of azimsulfuron (ASN) and metsulfuron-methyl (MSM) on density and per cent control of weeds in transplanted rice

Treatment	Dose (g/ha)	Time (DAT)	Weed density (No. /m^2)						Per cent control (visual)				
			Grassy		Broad-leaved weeds (BLW)		Sedges		Grassy		BLW+ Sedges	BLW	Sedges
			2006	2007	2006	2007	2006	2007	2006	2007		2007	2007
ASN+MSM	25+2	15	6.06 (41.3)	3.86 (14.0)	6.56 (43.3)	3.36 (10.7)	2.10 (4.0)	2.62 (7.3)	58	75	92	96	90
-do-	27.5+2	15	5.40 (31.3)	3.78 (13.3)	5.62 (31.3)	2.65 (6.0)	2.08 (4.0)	1.79 (2.7)	57	80	98	97	92
-do-	30+2	15	5.72 (32.7)	3.29 (10.0)	4.15 (16.7)	2.26 (4.7)	1.79 (2.7)	1.77 (3.3)	65	80	98	98	95
ASN	25	15	8.07 (77.3)	3.59 (12.0)	8.83 (78.0)	4.42 (18.7)	1.55 (2.0)	1.00 (0.0)	52	67	98	97	98
-do-	27.5	15	8.05 (76.7)	3.40 (11.3)	7.98 (65.3)	3.83 (14.0)	1.24 (0.7)	1.00 (0.0)	52	76	98	97	99
-do	30	15	7.74 (67.3)	3.60 (12.0)	6.87 (48.0)	2.83 (7.3)	1.24 (0.7)	1.24 (0.7)	55	78	98	93	99
ASN+MSM	25+2	25	9.05 (94.0)	3.98 (15.3)	4.18 (16.7)	4.19 (16.7)	1.67 (2.7)	1.00 (0.0)	47	68	98	100	98
-do-	27.5+2	25	7.01 (50.0)	3.93 (14.7)	4.48 (19.3)	2.54 (6.7)	1.00 (0.0)	1.00 (0.0)	50	70	98	99	99
-do-	30+2	25	6.21 (38.0)	3.19 (9.3)	4.26 (17.3)	1.96 (4.7)	1.00 (0.0)	1.00 (0.0)	52	75	98	100	100
ASN	25	25	7.99 (63.3)	4.71 (22.7)	6.82 (47.3)	3.74 (17.3)	1.00 (0.0)	1.41 (1.3)	53	65	98	98	99
-do-	27.5	25	6.29 (42.0)	3.70 (13.3)	5.03 (24.7)	3.43 (12.0)	1.00 (0.0)	1.00 (0.0)	63	78	98	97	99
-do-	30	25	5.82 (33.3)	3.44 (11.3)	2.75 (9.3)	3.04 (10.7)	1.41 (1.3)	1.00 (0.0)	63	82	99	98	99
Chlorimuron+ metsulfuron	4	25	7.27 (54.0)	5.74 (32.0)	2.87 (7.3)	1.66 (2.0)	1.55 (2.0)	1.00 (0.0)	10	10	98	100	100
Pretilachlor	1000	3	1.41 (1.3)	1.90 (2.7)	7.76 (60.7)	2.52 (6.0)	3.05 (8.7)	2.32 (4.7)	97	95	89	97	87
Pretilachlor fb chlorimuron+metsulfuron	1000 fb 4	3 fb 25	1.49 (1.3)	2.07 (3.3)	2.76 (6.7)	1.67 (2.7)	2.73 (6.7)	1.00 (0.0)	99	95	98	100	100
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	-	-	8.55 (72.7)	6.07 (36.0)	8.82 (78.7)	4.71 (21.3)	4.49 (19.3)	3.11 (8.7)	0	0	0	0	0
LSD (P=0.05)	-	-	3.48	1.01	1.96	1.55	1.12	0.95	-	-	-	-	-

Original figures in parentheses were subjected to square root transformation ($\sqrt{X+1}$) before statistical analysis.
DAT–Days after transplanting, fb=followed by.

Table 2. Effect of azimsulfuron (ASN) and metsulfuron-methyl (MSM) on dry weight of weeds and yield and yield attributes of transplanted rice

Treatment	Dose (g/ha)	Time (DAT)	Weed 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
ASN+MSM	25	15	164.7	104.9	14.7	0.93	87.4	86.9	56.0	57.3	21.2	21.1	4035	5525
-do-	27.5+2	15	145.0	90.3	14.5	0.53	88.1	86.7	56.3	59.2	22.1	21.1	4240	5803
-do-	30+2	15	91.3	57.6	14.9	0.60	87.6	86.5	57.8	62.2	21.2	20.9	4420	5802
ASN	25	15	248.4	113.3	15.2	0.33	85.6	87.5	55.0	56.0	21.7	21.5	3675	5478
-do-	27.5	15	205.1	96.7	15.8	0.33	87.0	86.0	57.2	63.7	21.5	21.3	3983	5941
-do-	30	15	139.5	49.1	15.7	0.27	86.9	87.2	59.7	64.3	21.4	21.0	4523	5988
ASN+MSM	25+2	25	216.7	105.7	15.0	0.20	85.8	85.9	49.5	62.8	21.9	21.3	3418	5339
-do-	27.5+2	25	184.4	86.9	14.5	0.20	86.3	86.5	52.5	61.2	21.0	21.3	4292	5617
-do-	30+2	25	145.4	76.1	13.5	0.07	84.4	87.1	58.2	63.7	21.1	21.1	4523	6242
ASN	25	25	202.4	140.3	13.7	0.80	86.3	85.7	50.8	58.3	21.4	21.1	3983	5177
-do-	27.5	25	146.8	106.7	16.5	0.47	86.2	85.0	53.3	58.7	21.1	21.9	4034	5548
-do-	30	25	99.4	95.4	8.4	0.27	86.5	86.1	55.7	59.7	21.5	21.4	4009	5895
chlorimuron+ metsulfuron	4	25	286.8	196.1	14.7	0.13	85.9	85.5	47.2	52.3	20.5	21.4	2365	4387
Pretilachlor	1000	3	19.4	28.7	17.2	1.00	86.4	87.3	71.7	65.0	22.5	21.9	5937	6569
Pretilachlor fb chlorimuron+metsulfuron	1000 fb 4	3 fb 25	20	27.9	14.1	0.07	87.3	86.0	69.7	63.5	22.1	21.2	6489	6846
Weed free	-	-	0.0	0.0	0.0	0.00	88.6	88.0	69.2	66.0	23.1	22.2	6117	7170
Weedy check	-	-	342.4	253.3	24.9	6.40	84.4	86.2	38.7	49.7	20.3	20.5	1310	3908
LSD (P=0.05)			73.0	30.0	4.9	0.74	NS	NS	10.5	8.4	0.9	NS	1007	762

DAT–Days after transplanting, BLW–Broad-leaved weeds, mrl–metre row length, fb–followed by.
NS–Not Significant.

Effect on Crop

There was no significant effect of herbicide treatments on the plant height during both the years and panicle length during 2007 (Table 2). During 2006, panicle length under all azimsulfuron treatments, being at par with each other, pretilachlor and pretilachlor+ chlorimuron+metsulfuron and was less than weed-free checks. All the azimsulfuron treatments produced similar number of effective tillers during both the years (Table 2). During 2006, all the azimsulfuron treatments resulted in lower number of effective tillers than pretilachlor, pretilachlor fb chlorimuron+metsulfuron and weed free check except azimsulfuron 30 g/ha applied at 15 DAT. All azimsulfuron treatments produced higher number of tillers than weedy check. But during 2007, all azimsulfuron treatments were at par with pretilachlor fb chlorimuron+metsulfuron. All the azimsulfuron treatments except azimsulfuron 25 g alone and admix with metsulfuron applied at 15 DAT, were at par with weed free check and better than weedy check and chlorimuron+metsulfuron in respect of number of effective tillers.

During 2006, all azimsulfuron based treatments being superior to weedy check and chlorimuron+ metsulfuron alone produced grain yield lower than weed free, pretilachlor and pretilachlor fb chlorimuron+ metsulfuron (Table 2). Among azimsulfuron treatments, maximum yield was obtained under azimsulfuron 30 g +metsulfuron 2 g applied at 25 DAT during both the years and azimsulfuron 30 g/ha applied at 15 DAT during 2006**.** During 2007, all azimsulfuron treatments provided lower yields than weed free check (Table 2). Also, all azimsulfuron based treatments except admixture of azimsulfuron 30 g with metsulfuron at 25 DAT resulted in significantly lower yields than pretilachlor+ chlorimuron+metsulfuron. Azimsulfuron 27.5-30 g/ha applied at 15 DAT and azimsulfuron 30 g alone and admix with metsulfuron applied at 25 DAT were at par with pretilachlor. There was no significant effect of addition of metsulfuron to azimsulfuron on grain yield of rice. This could be due to no additional gains in control of weeds by admixing metsulfuron and secondly impact of BLW on yields could be negligible due to low weed pressure. There was no significant effect of application time of azimsulfuron and metsulfuron on rice grain yield.

There was no phytotoxicity of the herbicides azimsulfuron and metsulfuron on rice and also there was no residual toxicity on succeeding crop of wheat (data not given).

It might be concluded that azimsulfuron and metsulfuron being safe for rice crop were compatible and their combination could be more useful in fields pre-dominated with broad-leaved weeds. Among the azimsulfuron based treatments, azimsulfuron 30 g+metsulfuron-methyl 2 g/ha at 15-25 DAT is the best combination.

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