

Efficacy of New and Traditional Herbicides in Transplanted Rice (*Oryza sativa*)

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Abstract The efficacy of some potential herbicides of sulfonylurea group in conjunction with other traditional recommended herbicides for control of wide spectrum of weeds in transplanted rice (*Oryza sativa*) was studied during the *kharif* of 2006 and 2007. Application of herbicides at different doses and combinations were analyzed through 14 treatments viz. butachlor (1.5 kg/ha), pretilachlor (500 and 750 g/ha), triasulfuron (TSF) (6 and 9 g/ha) at 5-7 DAT, triasulfuron (6 and 9 g/ha) at 12-15 DAT, triasulfuron + pretilachlor (6 + 500 g/ha) at 5-7 DAT, triasulfuron + pretilachlor (9 + 500 g/ha) at 5-7 DAT, bensulfuron-methyl (BSM) (50 and 60 g/ha) along with hand-weeding twice as recommended practice (20 and 40 DAT), weed-free (15, 30, 45 and 60 DAT) and weedy check in randomized block de-

sign with three replications. The major weeds found were *Echinochloa* spp., *Cyperus rotundus*, *C. iria*, *Fimbristylis miliacea*, *Ludwigia parviflora* and *Eclipta alba*. Triasulfuron + pretilachlor (9 + 500 g/ha) applied 7 days after transplanting was found most effective in controlling weeds and maximizing rice yield (58.5 t/ha). This was at par with weed free check. All the new herbicides showed better control of weeds (weed control efficiency 87-96%) in comparison with the traditional recommended herbicides (weed control efficiency 71—74 %). There was more than 46 % reduction in the grain yield of rice due to competition with weeds in the weedy plots.

Keywords Sulfonylurea, Herbicides, Transplanted rice.

Introduction

Rice (*Oryza sativa* L.), the principal food for Indian people is grown in 45 million ha with a production of 99 million tonnes contributing 45% to the total food grain production of the country. There is wide variability in average rice yield, ranging from 948 kg/ha in Madhya Pradesh to 3545 kg/ha in Punjab and with J and K 1971 kg/ha. Weed competition is one of the prime yield limiting factors in rice. Transplanted rice is infested by wide range of weed flora, which can reduce yield upto 50% [1]. Weed control right from the beginning, gives the crop an advan-

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tage of good start and competitive superiority [2]. In view of the above factors, it would be required to use some alternative herbicides. Sulfonylurea group of herbicides due to high level of activity, application flexibility, excellent selectivity even at low dose along with broad spectrum and low mammalian toxicity nature has emerged as one of the most important class of herbicides [3]. Therefore, the present investigation was conducted to find out the efficacy of new herbicidal group sulfonylurea on grasses, sedges and non grassy weeds in transplanted rice field under irrigated conditions.

Materials and Methods

A field experiment was carried out during *kharif* of 2006 and 2007 under AICRIP (Rice) at research farm, SKUAST-J, Chatha, in loam soil with pH 7.24, EC 0.08dS/m with medium organic carbon (0.6%), low available nitrogen (174.5 kg/ha), medium available P (15.2 kg/ha) and K (140 kg/ha) to study the effi-

cacy of different herbicides of sulfonylurea group in comparison with the traditional recommended herbicides with special reference to sedges and non-grassy weeds in transplanted rice field. the treatments were butachlor (1.5 kg/ha), pretilachlor (500 and 750 g/ha), triasulfuron (TSF) (6 and 9 g/ha) at 5-7 DAT, triasulfuron (6 and 9 g/ha) at 12-15 DAT, triasulfuron + pretilachlor (6 + 500 g/ha) at 5-7 DAT, triasulfuron + pretilachlor (9 + 500 g/ha) at 5-7 DAT, bensulfuron-methyl (BSM) (50 and 60 g/ha) along with hand-weeding twice as recommended practice (20 and 40 DAT), weed-free (15, 30, 45 and 60 DAT) and weedy check (Table 1). All other recommended agronomic and plant protection measures were adopted to raise the crop. The data on weed density and dry weight of weeds were recorded at different growth stages of rice with the help of quadrat (0.5 m × 0.5 m) at two places and then converted into per square meter. These were subjected to square-root transformation to normalize their distribution. Weed control efficiency (%) was computed using the dry weight of weeds. Grain yield of rice along with other yield -attributing characters like effective panicles/

Table 1. Effect of treatments on distribution patterns of different weed flora at vegetative growth stages of rice (mean of 2 years).

Treatments	Dose (g/ha)	TA (DAT)	Weed density (no./m ²)											
			Grass		Sedges				Broad-leaf weeds					
			<i>Echinochloa</i> spp.		<i>Cyperus</i> <i>rotundus</i>		<i>Cyperus</i> <i>iria</i>		<i>Fimbristylis</i> <i>miliacea</i>		<i>Ludwigia</i> <i>parviflora</i>		<i>Eclipta</i> <i>alba</i>	
			30 (DAT)	60 (DAT)	30 (DAT)	60 (DAT)	30 (DAT)	60 (DAT)	30 (DAT)	60 (DAT)	30 (DAT)	60 (DAT)	30 (DAT)	60 (DAT)
Butachlor.....T ₁	1500	5	1	1	11	8	13	10	12	10	11	15	5	8
Pretilachlor.....T ₂	500	5	2	0	10	6	12	9	10	7	9	14	8	11
Pretilachlor.....T ₃	750	5	0	0	5	5	8	7	7	6	7	11	6	10
Triasulfuron.....T ₄	6	7	8	3	2	0	3	1	3	1	4	8	5	9
Triasulfuron.....T ₅	9	7	6	4	1	0	1	1	2	0	2	5	4	9
Triasulfuron.....T ₆	6	15	9	6	2	1	2	2	3	2	5	10	7	10
Triasulfuron.....T ₇	9	15	7	5	1	0	2	1	2	1	3	7	6	9
Triasulfuron + Pretilachlor.....T ₈	6 + 500	7	3	0	2	1	2	1	3	2	2	4	3	5
Triasulfuron + Pretilachlor.....T ₉	9 + 500	7	2	0	1	1	1	0	2	0	1	3	2	4
Bensulfuron Methyl.....T ₁₀	50	25	9	5	5	3	4	3	6	4	4	8	4	6
Bensulfuron Methyl.....T ₁₁	60	25	8	4	4	3	3	2	6	4	2	4	3	5
Weed free.....T ₁₂ (check)	....	15, 30 45, 60	0	0	0	0	0	0	0	0	0	0	0	0
Two hand weeding... T ₁₃	....	20 and 40	3	2	5	8	6	9	6	8	3	8	8	10
Un weeded control.... T ₁₄	.....		15	7	25	20	22	19	22	24	15	20	11	18

m² were recorded at harvest.

Results and Discussion

Effect on weeds

All the treatments showed significantly lower number of weeds and total dry weight than weedy check. The distribution pattern of different weeds in weedy plots recorded at 30 DAT was 22, 20, 13.6, 20, 13.6 and 11% for *Echinochloa* spp., *Cyperus rotundus*, *C. iria*, *Fimbristylis miliacea*, *Ludwigia parviflora* and *Eclipta alba* respectively (Table 1). Thus grasses constituted 13.6%, sedges 62.7% and broad-leaf weeds 23.6% of the total weed population at 30 DAT and almost similar trend was found at 60 DAT. All the herbicides of sulfonylurea group were found effective in decreasing the weed density and their growth compared with the traditional recommended herbicides viz. butachlor and pretilachlor. Among sulfonylurea herbicides, bensulfuron-methyl was found effective on sedges and broad leaf weeds but not on grassy weeds. Almost all weeds were reduced due to

mixing of trisulfuron and pretilachlor with both the doses in comparison with the application of trisulfuron alone. It shows compatibility of mixing of trisulfuron and pretilachlor. All the weed control measures significantly reduced the dry weight (90 DAT) compared with the weedy check. The effect of various treatments on total dry matter weight were similar to that of weed density (Table 2).

Among the tested herbicides, trisulfuron + pretilachlor at both the doses (6 + 500 and 9 + 500 g/ha) showed very good suppression of all the types of weeds, with WCE 96 and 93% respectively. There was an effective control of sedges and non-grassy weeds in the plots of trisulfuron alone (at 9 g/ha) and bensulfuron methyl (at 60 g/ha) with WCE 89 and 92% respectively. All the sulfonylurea herbicides were found superior in reducing the weed density and dry matter production irrespective of their dose with WCE ranging from 87 to 96% in comparison with the traditional recommended rice herbicides with WCE 71 to 74%.

Table 2. Effect of weed control treatments on weed density, dry weight of weed, weed control efficiency, panicle number and grain yield of transplanted rice (mean of 2 years). * Figures in parentheses indicate transformed values.

Treatments	Dose (g/ha)	Time of application (DAT)	Weed density (no/m ²) at harvest	Dry weight of weeds (g/m ²) at harvest	Weed control efficiency (%)	Effective panicles (no/m ²)	Grain yield (t/ha)	N use efficiency kg grain/kg N applied
Butachlor.....T ₁	1500	5	31 (5.61)*	26.7	71	221	4.1	34.33
Pretilachlor.....T ₂	500	5	29 (5.43)	24.2	73	229	4.2	35.25
Pretilachlor.....T ₃	750	5	26 (5.13)	23.2	74	237	4.5	37.83
Trisulfuron.....T ₄	6	7	10 (3.24)	8.3	90	256	5.4	45.58
Trisulfuron.....T ₅	9	7	5 (2.16)	5.5	94	266	5.7	44.08
Trisulfuron.....T ₆	6	15	16 (4.06)	12.1	87	252	5.2	45.08
Trisulfuron.....T ₇	9	15	15 (3.91)	10.3	89	255	5.4	46.75
Trisulfuron + Pretilachlor.....T ₈	6 + 500	7	6 (2.46)	6.4	93	263	5.6	48.75
Trisulfuron + Pretilachlor.....T ₉	9 + 500	7	3 (1.60)	3.3	96	270	5.8	46.91
Bensulfuron.....T ₁₀	50	25	9 (3.01)	7.5	91	258	5.5	50.16
Methyl Bensulfuron.....T ₁₁	60	25	8 (2.76)	6.8	92	260	5.6	43.75
Weed free (check).....T ₁₂	.....	15, 30, 45, 60	0 (0.00)	0.00	100	274	6.0	21.00
Two hand weeding.....T ₁₃	.....	20 and 40	17 (4.17)	12.9	86	251	5.2	.....
Non weeded control.....T ₁₄	.....	.....	102 (10.1)	90.7	—	190	3.2	.....
CD (p=0.05)	.....	.....	0.3	3.2	.....	12	0.2	.....

Effect on crop

On an average, there was more than 46% reduction in the grain yield of rice due to competition with weeds in weedy plots (Table 2). All the herbicide-treated plots gave grain yields significantly higher than the weedy plots. The highest grain yield of rice (60.2 q/ha) was obtained in weed-free check, which was on par with triasulfuron + pretilachlor at 9+500 g/ha (T_9). In a similar study, the effectiveness of sulfonyl group of herbicides for chemical control of weeds in transplanted rice was confirmed [4]. It is due to broad spectrum nature of sulfonyl herbicides due to which it controls almost all the weeds as compared to traditional herbicides. Moreover, effective weed control resulted into all the traditional herbicides viz. butachlor at 1500 g/ha and pretilachlor at both the doses (500 and 750g/ha), yielded significantly less than all the doses of different sulfonylurea herbicides i.e. bensulfuron methyl and triasulfuron whether applied alone or as tank mixture with pretilachlor at 500 g/ha. Non-control of predominant sedges and broad-leaf weeds are the cause of low yield in traditional herbicides treated plots. The difference in grain yield due to two tank mixtures of triasulfuron + pretilachlor were non-significant. There was 8% increase in the grain yield due to tank mixing of pretilachlor with triasulfuron at 9 + 500 g/ha over the application of triasulfuron at 9 g/ha. However, there was significant yield increase in bensulfuron methyl and triasulfuron at their respective higher doses of application over lower doses as well as with the hand-weeding twice (at 20 and 40 DAT). The results are in conformity to the earlier results obtained [3].

N use efficiency

On the basis of mean data (2 years), higher N-use

efficiency was recorded with weed free treatment (Table 2). Among the chemical treatments, triasulfuron + pretilachlor (6 + 500 g/ha) (T_8) recorded the higher N use efficiency (48.75 kg grain/kg N applied) followed by the other treatments viz. triasulfuron + pretilachlor @ 9 + 500 g/ha (T_9) (46.91 kg grain/kg N applied), triasulfuron @ 9 g/ha (T_7) on 15 DAT (46.75 kg grain / kg N applied), triasulfuron @ 6 g/ha on 7 DAT (T_4) (45.5 kg grain / kg N applied), triasulfuron @ 6 g/ha on 15 DAT (T_6) (45.08 kg grain / kg N applied) and triasulfuron @ 9 g/ha on 7 DAT (T_5) (44.08 kg grain / kg N applied). These results are similar to the earlier findings [5].

Conclusion

Application of sulfonylurea herbicides had wide-spectrum weed control especially of sedges and broad leaved weeds in transplanted rice. Tank mix of triasulfuron + pretilachlor at 9 + 500 g/ha at 7 DAT was most effective and checked all weed growth and hence may be recommended for transplanted rice cultivation.

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