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Management of composite weed flora of transplanted rice by herbicides

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ABSTRACT

The experiment comprising of twelve treatments was laid out in a randomized block design with three replications. Prominent weeds were *Echinochloa colona* and *Digitaria sanguinalis* among the grasses; *Cyperus iria*, among the sedges and *Spilanthes acmella* and *Ludwigia parviflora* among the broad-leaved weeds throughout the cropping period. Fenoxaprop-p-ethyl at 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl at 4 g/ha at 25 DAT effectively controlled the grasses, broad-leaved and sedges at 50 DAT which was statistically at par with the azimsulfuron at 40 g/ha at 20 DAT. The loss of grain yield of rice due to weed infestation was to the tune of 35-38%. Lower values of weed density, total weed dry weight and higher values of weed control efficiency, yield and net return of rice were registered with combined application of fenoxaprop-p-ethyl at 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl at 4 g/ha at 25 DAT and was followed by sole application azimsulfuron at 40 g/ha at 20 DAT. These treatments may be recommended for managing composite weed flora and obtaining higher yield and net return of transplanted *Kharif* (wet) rice in the lateritic belt of West Bengal, India.

Key words: Azimsulfuron, Metsulfuron-methyl+chlorimuron-ethyl, Pretilachlor, Transplanted rice, Weed management

Rice is the most important cereal crop grown in tropical and subtropical regions of the world and is staple food for more than 60% of the world population (Parthipan *et al*. 2013). India has the largest area (44 million hectares) among the rice growing countries, and it is the second largest producer (131 million tonnes) of rice next to China (197 million tonnes) **(**Govindan and Chinnusamy 2014). The yield reduction due to weed growth may vary from 28-45% in transplanted rice (Kumar *et al*. 2008, Yadav *et al*. 2009). For the last many years, a number of herbicides like butachlor and pretilachlor are being applied as pre-emergence but these herbicides are effective against narrow spectrum of weeds. New generation herbicides like azimsulfuron and ethoxysulfuron have been launched recently which are effective against broad spectrum of weeds with very low dose (Pal *et al*. 2008). But the information on their efficacy in transplanted wet rice is not adequate. With this perspective, the present experiment was conducted to study the effect of azimsulfuron and combined application of other herbicides on weed growth and productivity of wet season transplanted rice in red and lateritic belt of West Bengal.

MATERIALS AND METHODS

Field experiments were conducted during wet season of 2010 and 2011 on the lateritic soil of Agricultural Farm, Institute of Agriculture, Visva-Bharati, Sriniketan, West Bengal, with rice variety '*IR-36*'. The experimental field was situated at about $23^0392`$ N latitude and $87^0422`$ E longitude with an average altitude of 58.9 m above the mean sea level. The soil of the experimental field was sandy loam in texture having acidic in reaction (pH 5.8), low in organic C (0.4%) and available N (148.6 kg/ha), high in available P (27.42 kg/ha) and medium in available K (127.85 kg/ha). Twelve treatments comprising of three different doses of azimsulfuron at 30, 35 and 40 g/ha at 20 DAT, butachlor at 1.25 kg/ha at 3 DAT, pretilachlor at 1.0 kg/ha at 3 DAT, pyrazosulfuron-ethyl at 25 g/ha at 5 DAT, metsulfuron-methyl + chlorimuron-ethyl at 4 g/ha at 10 DAT, combined application of ethoxysulfuron at 15 g/ha + fenoxaprop-p-ethyl at 60 g/ha at 25 DAT, ready mix mixture of fenoxaprop-p-ethyl at 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl at 4 g/ha at 25 DAT, 2,4-D (Na-salt) at 500 g/ha + fenoxaprop-p-ethyl 60 g/ha at 25 DAT, weed free check and unweeded control were assigned in a randomized block design replicated thrice.

The recommended dose of fertilizers *viz.* 60 kg N, 30 kg P_2O_5 and 30 kg K_2O /ha were applied through urea, 10:26:26, respectively. One third quantity of nitrogen and full amount of phosphorus and potassium were applied in each plot as basal during the final land preparation. Rest two third quantity of N was applied in two splits as top dressing

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i.e. one third of nitrogen was top dressed at 25 DAT and rest one third of nitrogen was top dressed at 45 DAT. All the herbicides alone or in combination were applied uniformly in the experimental plots with the help of knapsack sprayer fitted with flat fan nozzle using a spray volume of 500 l/ha. All the recommended agronomic and plant protection measures were adopted to raise the crop. The data on weed density and dry weight were recorded at different growth stages of rice crop. 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 number of panicles/m^2, grains/panicle were recorded at harvest.

RESULTS AND DISCUSSION

Major weed flora of the experimental field comprised of grasses (*Echinochloa colona, Digitaria sanguinalis*), sedges (*Cyperus iria, Fimbristylis miliacea*) and broad-leaved (*Spilanthes acmella, Sphenoclea zeylanica, Ludwigia parviflora*) during both the years. Besides these, *Lindernia ciliata, Alternanthera sessilis* were also observed as major weeds during 2011.

The lowest density as well as dry weight of grasses, sedges, broad-leaved and total weeds was recorded in weed free treatment during both the years. Fenoxaprop-p-ethyl 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 25 DAT significantly reduced the number and dry weight of grasses at 50 DAT which was statistically at par with the azimsulfuron 40 g/ha at 20 DAT and ethoxysulfuron 15 g/ha + fenoxaprop-p-ethyl 60 g/ha at 25 DAT during both the years. Among all the herbicides fenoxaprop-p-ethyl 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 25 DAT registered the lowest number of broad-leaved weeds in both the years 50 DAT which was at par with azimsulfuron 40 g/ha at 20 DAT (Table 1). Similar trend was observed in case of dry weight of broad-leaved weeds. Application of azimsulfuron at 40 g/ha at 20 DAT effectively controlled the sedges and recorded the lowest number as well as dry weight at 50 DAT but it was statistically at par with fenoxaprop-p-ethyl 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 25 DAT. During both the years of 2010 and 2011, combined application of fenoxaprop-p-ethyl 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 25 DAT registered the lower number and dry weight of total weeds which was statistically at par with sole application of azimsulfuron 40 g/ha at 20 DAT (Table 2). Among the herbicidal treatments, azimsulfuron 40 g/ha at 20 DAT registered the highest weed control efficiency (93.28 and 93.47%) at 50 DAT but was very close (90.36 and 93.36%) to fenoxaprop-p-ethyl 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl (Almix) 4 g/ha at 25 DAT (Fig 1). The lower value of weed index was recorded with application of fenoxaprop-p-ethyl 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 25 DAT and azimsulfuron 40 g/ha at 20 DAT (Fig 2). Similar results were reported by Pinna *et al.* (2007), Yadav *et al.* (2008) and Jayadeva *et al.* (2009).

Effect on crop

Weed free treatment recorded the highest number of panicles/m^2 and number of grains/panicle. Among the herbicidal treatments the highest number of panicles/m^2 and number of grains/panicle were recorded in the treatment with application of fenoxaprop-p-ethyl 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 25 DAT which was statistically at par with azimsulfuron 40 g/ha at 20 DAT. Similarly, the highest test weight was registered with azimsulfuron 40 g/ha at 20 DAT which was statistically at par with fenoxaprop-p-ethyl 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl 4 g/ha. Yield reduction due to weed competition in transplanted *Kharif* rice was to the extent of 35-38%. Similar yield reduction in wet season rice due to weed competition in the lateritic belt of West Bengal was also reported by Duary (2014) and Teja *et al.* (2015). During both the years the highest grain yield was recorded under the weed free treatment but it was statistically at par with fenoxaprop-p-ethyl at 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl at 4 g/ha at 25 DAT and azimsulfuron at 40 g/ha at 20 DAT (Table 3). The results were in conformity with the findings of Jayadeva *et al.* (2009). Combined application of fenoxaprop-p-ethyl 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 25 DAT recorded the

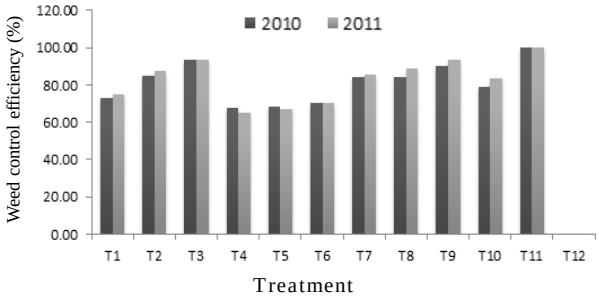

Fig 1. Effect of treatments on weed control efficiency in transplanted rice at 50 DAT

Table 1. Effect of treatments on density of weeds in transplanted rice at 50 DAT

Treatment	Weed density (no./m^2)							
	Grass		Broad-leaved		Sedge		Total	
	2010	2011	2010	2011	2010	2011	2010	2011
Azimsulfuron 30 g/ha at 20 DAT	3.96 (15.3)	4.04 (16.0)	7.06 (49.7)	7.49 (55.7)	4.64 (21.0)	4.81 (22.7)	9.30 (86.0)	9.74 (94.3)
Azimsulfuron 35 g/ha at 20 DAT	3.69 (13.3)	3.94 (15.0)	6.03 (36.3)	5.99 (35.3)	2.48 (5.7)	2.35 (5.0)	7.46 (55.3)	7.47 (55.3)
Azimsulfuron 40 g/ha at 20 DAT	2.97 (8.3)	3.23 (10.0)	5.11 (25.7)	4.02 (15.7)	0.71 (0)	1.35 (1.3)	5.87 (34.0)	5.24 (27.0)
Butachlor 1.25 kg/ha at 3 DAT	3.94 (15.3)	4.29 (18.0)	6.91 (47.3)	7.49 (55.7)	5.26 (27.3)	5.55 (30.3)	9.51 (90.0)	10.22 (104.0)
Pretilachlor 1.0 kg/ha at 3 DAT	3.95 (15.7)	4.17 (17.3)	6.96 (48.0)	7.22 (51.7)	5.24 (27.0)	5.31 (27.7)	9.55 (90.7)	9.86 (96.7)
Pyrazosulfuron-ethyl 25 g/ha at 5 DAT	3.92 (15.0)	4.17 (17.0)	6.92 (47.7)	7.20 (51.3)	4.97 (24.3)	5.18 (26.3)	9.33 (87.0)	9.76 (94.7)
Metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 10 DAT	3.79 (14.0)	3.57 (12.3)	6.18 (37.7)	6.04 (36.0)	3.81 (14.0)	3.54 (12.0)	8.13 (65.7)	7.80 (60.3)
Ethoxysulfuron 15 g/ha + fenoxaprop-p-ethyl 60 g/ha at 25 DAT	2.90 (8.0)	3.22 (10.0)	5.04 (25.0)	4.45 (19.3)	4.12 (16.7)	3.85 (14.3)	7.07 (49.7)	6.65 (43.7)
Fenoxaprop-p-ethyl 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 25 DAT	2.26 (4.67)	2.86 (7.7)	4.54 (21.3)	3.89 (14.7)	2.96 (8.3)	2.74 (7.0)	5.82 (34.3)	5.46 (29.3)
2,4-D (Na-salt) 500 g/ha + fenoxaprop-p-ethyl 60 g/ha at 25 DAT	3.84 (14.7)	3.89 (15.0)	5.59 (31.3)	5.18 (26.3)	4.18 (17.0)	4.06 (16.0)	7.95 (63.0)	7.60 (57.3)
Weed free	0.71 (0)	0.71 (0)	0.71 (0)	0.71 (0)	0.71 (0)	0.71 (0)	0.71 (0)	0.71 (0)
Unweeded control	4.94 (24.0)	5.41 (29.0)	8.43 (71.0)	8.93 (79.3)	7.77 (60.0)	7.60 (57.3)	12.47 (155.0)	12.89 (165.7)
LSD (P=0.05)	0.85	0.78	1.18	1.09	0.58	0.65	0.93	0.86

Figures in parentheses are the original values. The data was transformed to SQRT $\sqrt{x+0.5}$ before analysis

Table 2. Effect of treatments on dry weight of weeds in transplanted rice at 50 DAT

Treatment	Weed dry weight (g/m^2)							
	Grass		Broad-leaved		Sedge		Total	
	2010	2011	2010	2011	2010	2011	2010	2011
Azimsulfuron 30 g/ha at 20 DAT	3.06 (8.97)	2.59 (6.36)	3.22 (9.84)	3.50 (11.74)	2.55 (6.04)	2.63 (6.43)	5.04 (24.86)	5.00 (24.53)
Azimsulfuron 35 g/ha at 20 DAT	2.59 (6.27)	2.18 (4.27)	2.58 (6.15)	2.57 (6.09)	1.48 (1.71)	1.45 (1.59)	3.82 (14.13)	3.53 (11.95)
Azimsulfuron 40 g/ha at 20 DAT	1.85 (2.93)	1.79 (2.72)	1.93 (3.23)	1.75 (2.57)	0.71 (0)	1.25 (1.06)	2.58 (6.16)	2.62 (6.34)
Butachlor 1.25 kg/ha at 3 DAT	3.18 (9.75)	3.24 (10.08)	3.55 (12.13)	3.99 (15.45)	2.79 (7.46)	2.94 (8.12)	5.43 (29.34)	5.84 (33.65)
Pretilachlor 1.0 kg/ha at 3 DAT	3.07 (8.95)	3.12 (9.29)	3.62 (12.60)	3.91 (14.77)	2.80 (7.37)	2.86 (7.67)	5.42 (28.92)	5.68 (31.73)
Pyrazosulfuron-ethyl 25 g/ha at 5 DAT	3.12 (9.24)	3.04 (8.88)	3.44 (11.32)	3.61 (12.53)	2.70 (6.86)	2.83 (7.51)	5.27 (27.43)	5.42 (28.92)
Metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 10 DAT	2.15 (4.16)	2.22 (4.49)	2.65 (6.50)	2.61 (6.32)	2.05 (3.83)	1.92 (3.17)	3.87 (14.48)	3.81 (13.98)
Ethoxysulfuron 15 g/ha + fenoxaprop-p-ethyl 60 g/ha at 25 DAT	2.38 (5.17)	1.91 (3.15)	2.21 (4.38)	2.10 (3.91)	2.27 (4.67)	2.11 (3.95)	3.83 (14.22)	3.39 (11.01)
Fenoxaprop-p-ethyl 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 25 DAT	2.05 (3.70)	1.69 (2.37)	1.85 (2.92)	1.65 (2.23)	1.63 (2.22)	1.53 (1.85)	3.05 (8.84)	2.64 (6.44)
2,4-D (Na-salt) 500 g/ha + fenoxaprop-p-ethyl 60 g/ha at 25 DAT	2.87 (7.76)	2.43 (5.42)	2.67 (6.63)	2.46 (5.55)	2.37 (5.14)	2.31 (4.86)	4.47 (19.53)	4.04 (15.83)
Weed free	0.71 (0)	0.71 (0)	0.71 (0)	0.71 (0)	0.71 (0)	0.71 (0)	0.71 (0)	0.71 (0)
Unweeded control	4.05 (16.21)	4.29 (18.21)	7.32 (53.09)	7.59 (57.16)	4.74 (22.39)	4.71 (21.72)	9.59 (91.68)	9.88 (97.09)
LSD (P=0.05)	0.51	0.50	0.68	0.56	0.54	0.60	0.56	0.56

Figures in parentheses are the original values. The data was transformed to SQRT $\sqrt{x+0.5}$ before analysis

Table 3. Effect of treatments on yield attributes, yield and economics of transplanted rice

Treatment	No. of panicles/ m^2		No. of grains/ panicle		Test weight (g)		Grain yield (t/ha)		Net return ($x10_3$ `/ha)		BC ratio	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
Azimsulfuron 30 g/ha at 20 DAT	393	419	64	70	23.4	22.9	4.19	4.35	25.89	26.15	1.24	1.17
Azimsulfuron 35 g/ha at 20 DAT	424	448	68	74	23.5	23.0	4.66	4.88	30.65	31.46	1.46	1.40
Azimsulfuron 40 g/ha at 20 DAT	472	501	77	84	24.0	24.2	5.09	5.32	35.22	36.06	1.66	1.59
Butachlor 1.25 kg/ha at 3 DAT	358	365	64	67	23.3	22.8	3.85	4.04	23.34	23.61	1.16	1.10
Pretilachlor 1.0 kg/ha at 3 DAT	370	373	64	68	23.7	23.3	3.97	4.20	24.09	24.89	1.18	1.14
Pyrazosulfuron-ethyl 25 g/ha at 5 DAT	381	393	66	69	23.8	23.3	4.10	4.34	25.84	26.68	1.28	1.24
Metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 10 DAT	407	418	69	77	23.5	23.1	4.47	4.64	29.98	30.08	1.50	1.40
Ethoxysulfuron 15 g/ha + fenoxaprop-p-ethyl 60 g/ha at 25 DAT	431	468	74	80	23.7	23.2	4.73	4.94	31.93	32.46	1.54	1.46
Fenoxaprop-p-ethyl 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 25 DAT	489	507	76	82	23.9	23.7	5.08	5.35	35.32	36.55	1.69	1.63
2,4-D (Na-salt) 500 g/ha + fenoxaprop-p-ethyl 60 g/ha at 25 DAT	415	442	72	77	23.3	22.9	4.55	4.61	30.17	29.36	1.48	1.35
Weed free	492	513	79	86	24.0	24.2	5.19	5.46	34.33	35.06	1.47	1.38
Unweeded control	277	305	57	61	22.4	21.9	3.21	3.53	17.03	19.03	0.88	0.91
LSD (P=0.05)	68.3	57.5	8.3	10.1	0.84	0.73	0.63	0.47	-	-	-	-

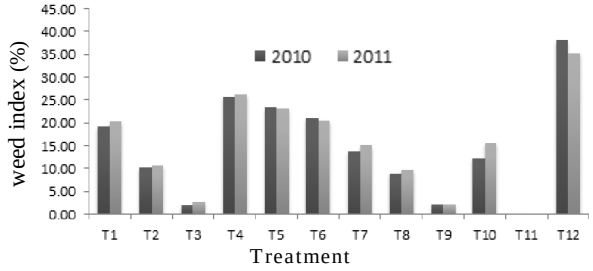

Fig. 2. Effect of treatments on weed index of transplanted rice

highest values of net return and benefit-cost ratio which was closely followed by azimsulfuron at 40 g/ ha at 20 DAT (Table 3).

It was concluded that combined application of fenoxaprop-p-ethyl 60 g/ha + metsulfuron-methyl + chlorimuron-ethyl 4 g/ha at 25 DAT or sole application of azimsulfuron at 40 g/ha at 20 DAT may be recommended for managing composite weed flora and obtaining higher yield and net return of transplanted *Kharif* (wet) rice in the lateritic belt of West Bengal.

REFERENCES

Duary B. 2014. Efficacy of imazosulfuron on weed flora and productivity of wet season transplanted rice in West Bengal. *International Journal of Bioresource Science* **1**(1):1-6.

Govindan R and Chinnusamy C. 2014. Tillage, crop establishment and weed management in rice under conservation agriculture system. *Indian Journal of Weed Science* **46**(2): 117-122.

Jayadeva HM, Bhairappanavar ST, Somashekharappa PR and Rangaswamy BR. 2009. Efficacy of azimsulfuron for weed control in transplanted rice. *Indian Journal of Weed Science* **41**(3&4): 172-175

Kumar S, Angiras NN, Rana SS and Sharma N. 2008. Efficacy of new herbicides to manage weeds in transplanted rice. *Himachal Journal of Agricultural Research* **34**(1): 18-21.

Pal D, Dolai AK, Ghosh RK, Mallick S, Mandal D and Barui K. 2008. Bioefficacy and phytotoxicity of ethoxysulfuron on the weed control and yield performance of transplanted kharif rice in gangetic alluvial soil of West Bengal. *Journal of Crop Weed* **4**(1): 38-40.

Parthipan T, Ravi V, Subramanian E and Ramesh T. 2013. Integrated weed management on growth and yield of transplanted rice and its residual effect on succeeding blackgram. *Journal of Agronomy* **12** (2): 99-103.

Teja KC, Duary B, Kumar M and Bhowmick MK. 2015. Effect of bensulfuron-methyl + pretilachlor and other herbicides on mixed weed flora of wet season transplanted rice. *International Journal of Agriculture, Environment and Biotechnology* **8**(2): 323-329.

Yadav DB, Yadav A and Punia SS. 2009. Evaluation of bispyribac sodium for weed control in transplanted rice. *Indian Journal of Weed Science* **41**(1&2): 23-27.