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Herbicide combinations for control of complex weed flora in transplanted rice

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ABSTRACT

A field experiment was conducted to evaluate the bioefficacy of some potent low dose herbicides of sulfonylurea group in conjunction with other traditional recommended herbicides for control of broad spectrum of weeds in transplanted rice (*Oryza sativa* L) during the wet season of 2012 and 2013. Pretilachlor 750 g/ha as pre-emergence (PE) *fb* ethoxysulfuron 18.75 kg/ha as post-emergence or pretilachlor 750 g/ha followed by metsulfuron-methyl + chlorimuron-ethyl 4 g/ha or pyrazosulfuron 20 g/ha (PE) followed by manual weeding were better options for efficient weed control, higher grain yield and B:C ratio in transplanted rice.

Key words: Transplanted rice, Herbicides, Weed flora

Rice (*Oryza sativa* L) is an important food crop contributing major share in the total food grain production. Generally, low rice production is attributed to infestation of pests and diseases, weeds, poor water quality and its management, fertility management besides low yield potential of varieties. Weed management is one of the major factors, which affect rice yield. Uncontrolled weeds cause grain yield reduction up to 76% under transplanted conditions (Rao *et al.* 2007). Therefore, timely weed control is imperative for realizing desired level of productivity. Therefore, an efficient and economic weed management program is necessary to control different types of weeds throughout the cropping period. Hand weeding though efficient is expensive, time consuming, difficult and often limited by scarcity of labour in time. On the other hand, herbicides offer economic and efficient weed control if applied at proper dose and stage. However, the continuous use of single herbicide or herbicides having the same mode of action may lead to the weed resistance problem and also weed shifts. Hence it is necessary to test some high efficacy herbicides to control mixed weed flora in transplanted rice. Keeping this in view, a field experiment was carried out to evaluate the performance of pre- and post-emergence herbicides alone and in combination in transplanted rice

MATERIALS AND METHODS

Experiment was conducted at college farm, Rajendranagar, Hyderabad, during rainy season of 2012 and 2013. Twelve treatments *viz*., bispyribac-Na 25 g/ha at 25 DAT, pretilachlor 1000 g/ha at 3 DAT, pyrazosulfuron 20 g/ha at 0-3 DAT, bispyribac + ethoxysulfuron 25 + 18.75 g/ha, bispyribac + metsulfuron-methyl + chlorimuron-ethyl (Almix) 20 + 4 g/ha, pretilachlor *fb* ethoxysulfuron 750 + 18.75 g/ha, pretilachlor *fb* Almix 750 + 4 g/ha at 25 DAT pyrazosulfuron 20 g/ha (PE) *fb* manual weeding at 0-3 *fb* 25 DAT, pretilachlor (6%) + bensulfuron (0.6%) 6.6%) 660 g/ha at 0-5 DAT, weedy, hand weeding at 25 and 45 DAS were taken. Experiment was laid out in randomised block design with three replications. All herbicides were applied using knapsack sprayer fitted with flatfan nozzle at spray volume of 500 l/ha. Thirty days old seedlings of rice variety '*MTU 1010*' were transplanted at a spacing of 15x15 cm. Recommended dose of 120: 60: 40 kg/ha of NPK was applied uniformly. Half of the nitrogen and whole of phosphate and potash were applied at the time of final puddling and the remaining quantity of nitrogen was applied at panicle initiation stage. Weed dry weight were sampled randomly at two places with the help of a 0.25 m^2 sized quadrate at 60-day growth stage. Yield was recorded at crop harvest. Weed control efficiency was also calculated on the basis of dry matter production by weeds.

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RESULTS AND DISCUSSION

Weed flora

Major weed flora on weedy plot at 60 days stage of crop growth comprised of *Echinochloa colona*, *Echinochloa crusgalli*, *Eclipta alba*, *Commelin* , *Celosia* sp., *Ammania baccifera*, *Panicum repens*, *Bacopa monneri* and *Cyperus difformis*, *Cyperus* spp, *Scirpus supinus*,*Cyperus rotundus*, *Cyperus iria*. In weedy plot, grassy weeds constituted 52.8%, sedges 24.2% and broad-leaf weeds 22.9% of the total weed

population. Different herbicidal treatments expressed differential influence on weed control in transplanted rice during both the years. Similar results were also recorded by Halder and patra (2007).

Effect on weed dry matter

All the weed control measures caused significant reduction in the density of all the weeds over weedy check. Weed dry matter was highly influenced by differential application of herbicides, their combinations and integration with manual weeding. Significantly lowest weed dry matter was recorded (18.8 g/m^2) in weed free treatment *i.e.* hand weeding at 25 and 45 DAT and was at par with pyrazosulfuron-ethyl 20 g/ha (PE) *fb* manual weeding (19.9 g/m^2 and 19.1% g/m^2 in 2012 and 2013, respectively) and it was at par with pretilachlor 750 g/ha (PE) *fb* Almix 4 g (POE) (21.8 g/m^2 and 20.8 g/ m^2 in 2012 and 2013, respectively), pretilachlor 750 g/ha (PE) *fb* ethoxysulfuron 18.75 g/ha (POE) (22.5 and 22.67 g/m^2 in 2012 and 2013, respectively), bispyribac-sodium 20 g/ha + almix 4 g (POE) (22.9 and 23.6 g/m^2 in 2012 and 2013, respectively) and bispyribac sodium + ethoxysulfuron (POE) (23.2 and 25.4 g/m^2 in 2012 and 2013, respectively) were at par with each other indicating the significant influence of sequential application of pre-emergence and post-emergence herbicides (Table 1). These were significantly superior to lone application of bispyribac-sodium, pretilachlor 1000 g/ha and pyrazosulfuron-ethyl 20 g/ha or pretilachlor + bensulfuron-methyl. Similar trend has also been observed by Mandal (1995).

Weed control efficiency (WCE) ranged from 73.3-76.8% and 75.2-80.6% in respective years with various herbicide combinations. Highest WCE was recorded (86.6 and 88.0% in 2012 and 2013, respectively) with weed free conditions. Among herbicdes treamtents, highest WCE was recorded (76.8 and 80.6% in 2012 and 2013, respectively), while lowest was recorded with pyrazosulfuron 20 g/ ha (48.1 and 52.0 in 2012 and 2013, respectively). The results were in conformity with the findings of Saini (2003) Yadav (2009) and Suganthi *et al.* (2010).

Effect on yield

Data revealed that significantly higher grain yield was recorded with weed free twice at 25 and 45 DAT (5.85 and 7.35 t/ha in 2012 and 2013, respectively), and was at par with the grain yield obtained with sequential application of pre- and post-emergence herbicides, *viz.* pyrazosulfuron-ethyl 20 g/ha (PE) *fb* manual weeding (5.83 and 7.34 t/ha in 2012 and 2013, respectively) during both the years This trend indicated the significance of integrated weed management. Grain yield recorded from pretilachlor (PE) *fb* Almix (5.59 and 7.05 t/ha in 2012 and 2013, respectively), pretilachlor *fb* ethoxys-ulfuron (POE) (5.47 and 7.09 t/ha in 2012 and 2013, respectively), bispyribac-sodium + Almix (POE) (5.28 and 6.78 t/ha in 2012 and 2013, respectively) and bispyribac sodium + ethoxysulfuron (POE) (5.16 and 6.65 t/hain 2012 and 2013, respectively) and all these treatment were significantly superior to grain yield obtained from lone application of bispyribac-sodium or pretilachlor or pyrazosulfuron or pretilachlor + bensulfuron-methyl (Table 2) indicating the importance of weed management in the critical growth period of crop by herbicide application, which facilitated the efficient use of resources. The findings of this investigations were in line with Kathirvelan and Vaiyapuri (2003) and Dhiman Mukerjee (2005).

Table 1. Effect of different pre- and post-emergence herbicides on weed dry matter (WDM) and weed control efficiency in transplanted rice

Treatment	WDM (g/m^2)		Weed control efficiency (%)	
	2012	2013	2012	2013
Bispyribac-Na 25 g/ha (POE)	5.50 (29.3)	5.51 (30.7)	65.9	68.9
Pretilachlo 1000 g/ha (PE)	6.36 (39.5)	6.59 (43.6)	53.9	55.8
Pyrazosulfuron 20 g/ha (PE)	6.74 (44.5)	6.88 (47.3)	48.1	52.0
Bispyribac + ethoxysulfuron 25 + 18.75 g/ha (POE)	4.91 (23.2)	4.94 (24.4)	67.1	75.2
Bispyribac 20 g/ha + Almix 4 g/ha (POE)	4.87 (22.9)	4.86 (23.6)	73.3	76.0
Pretilachlor 750 g/ha (PE) *fb* ethoxysulfuron 18.75 g/ha (POE)	4.85 (22.5)	4.76 (22.7)	73.8	77.0
Pretilachlor 750 g/ha (PE) *fb* Almix 4 g/ha (POE)	4.77 (21.8)	4.56 (20.8)	74.6	78.9
Pyrazosulfuron 20 g/ha (PE) *fb* manual weeding	4.56 (19.9)	4.37 (19.1)	76.8	80.6
Pretilachlor + bensulfuron 660 g/ha	5.58 (30.2)	5.68 (32.3)	64.8	67.3
Weed free (hand weeding at 25 and 45 DAS)	3.53 (11.5)	4.34 (18.8)	86.6	88.0
Weedy check	9.31 (85.8)	9.93 (98.5)	-	
LSD (P=0.05)	0.48	0.51		

*Figures in parantheses are original values and data are square root transformed

Table 2. Yield and economics as influenced by different weed control treatments in transplanted rice

Treatment	Grain yield (t/ha)		2012			2013		
	2012	2013	Gross returns (x10^3 `/ha)	Net returns (x10^3 `/ha)	BCR	Gross returns (x10^3 `/ha)	Net returns (x10^3 `/ha)	BCR
Bispyribac-Na 25 g/ha (POE)	4.48	5.96	58.24	20.18	1.82	78.03	39.98	2.05
Pretilachlo 1000 g/ha (PE)	4.27	5.77	55.57	18.35	1.78	75.56	38.28	2.03
Pyrazosulfuron 20 g/ha (PE)	4.37	5.83	56.87	19.96	1.84	76.42	39.54	2.07
Bispyribac + ethoxysulfuron 25 + 18.75 g/ha (POE)	5.16	6.65	67.14	28.40	2.05	87.16	48.42	2.25
Bispyribac 20 g/ha + Almix 4 g/ha (POE)	5.28	6.78	68.64	30.18	2.11	88.84	50.39	2.31
Pretilachlor 750 g/ha (PE) *fb* ethoxysulfuron 18.75 g/ha (POE)	5.47	7.09	71.17	33.11	2.22	92.87	54.82	2.44
Pretilachlor 750 g/ha (PE) *fb* Almix @4 g/ha (POE)	5.59	7.05	72.73	35.04	2.29	92.35	54.59	2.45
Pyrazosulfuron 20 g/ha (PE) *fb* manual weeding	5.83	7.34	75.85	35.97	2.24	96.13	56.26	2.41
Pretilachlor + bensulfuron 660 g/ha	4.57	6.07	59.47	21.44	1.86	79.49	41.49	2.09
Weed free (hand weeding at 25 and 45 DAS)	5.85	7.35	76.05	33.61	2.09	96.33	53.98	2.27
Weedy check	2.97	4.45	38.67	2.47	1.28	58.29	22.19	1.61
LSD (P=0.05)	0.67	0.41						

Economics

Economics of different herbicides their combinations and integrated weed managment were calculated on the basis of cost of cultivation and gross returns (₹/ha) accrued from the treatment and based on this, benefit cost ratio was calculated (BCR). Hand weeding at 25 and 45 DAT, pyrazosulfuron-ethyl 20 g/ha *fb* manual weeding, though was effective in efficient weed control and higher yield but its higher cost pulled down the profit with low B.C ratio of 2.27 and 2.41, respectively in 2013. Based on BCR it was reported that for transplanted paddy, pre-emergence application of pretilachlor 750 g/ha (PE) *fb* Almix 4 g/ha (POE) was the best as it gave highest BCR (2.29 and 2.45 in 2012 and 2013, respectively). The next best treatment was pretilachlor 750 g/ha (PE) *fb* ethoxysulfuron 18.75 g/ha (POE) as it gave B: C ratio 2.24 and 2.44 in 2012 and 2013, respectively.

It was concluded that pretilachlor 750 g/ha (PE) *fb* ethoxysulfuron (POE) or Almix 4 g/ha and pyrazosulfuron 20 g/ha (PE) *fb* manual weeding were better options for efficient weed control, higher grain yield and profit in transplanted rice.

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