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Bioefficacy of post emergent herbicides in weed management of transplanted rice (*Oryza sativa* L.)

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ABSTRACT

A field investigation was carried out during summer 2008, kharif 2008 and kharif 2009 in red loamy soil at Agricultural Research Station, Kathalagere, Channagiri taluk, Davangere district coming under the southern transitional zone of Karnataka. The present investigation was taken up to know the bioefficacy of Azimsulfuron 50 DF alone and Butachlor 50 EC (Standard check) in comparison with hand weeding on weeds control, crop safety and grain yield of transplanted rice. The field experiment was laid out in Randomized Complete Block Design with 10 treatments viz., T_1: Azimsulfuron 50 DF @ 27.5 g a.i ha^{-1} + 0.2% Surfactant, T_2: Azimsulfuron 50 DF @ 30.0 g a.i ha^{-1} + 0.2% Surfactant, T_3: Azimsulfuron 50 DF @ 35.0 g a.i ha^{-1} + 0.2% Surfactant, T_4: T_2 + 1 hand weeding @ 40 DAT, T_5: Pyrazosulfuron 10 WP 25 g a.i ha^{-1} (3 DAT), T_6: 2,4-DEE 2.0 kg a.i ha^{-1} (4 Weeks after transplanting), T_7: Butachlor 50 EC @ 1.25 kg a.i ha^{-1} (standard check), T_8: Butachlor 50 EC 0.9 kg a.i ha^{-1} + Almix @ 2.0 g ha^{-1}, T_9: Hand weeding twice (20 and 40 DAT) and T_{10}: Weedy check. These treatments were replicated thrice. Application Azimsulfuron 30.0 g a.i ha^{-1} (19 DAT) + 0.2 % surfactant followed by one hand weeding at 40 DAT recorded significantly higher grain yield (6834, 6683 and 6102 kg ha^{-1} in summer 2008, kharif 2008 and kharif 2009, respectively) and straw yield (7008, 7030 and 6494 kg ha^{-1} in summer 2008, kharif 2008 and kharif 2009, respectively). This treatment recorded significantly lower total weed density (0.00, 2.68 and 6.68 m^{-2}) in summer 2008, kharif 2008 and kharif 2009, respectively) and total weed dry weight (0.00, 0.08 and 1.04 g m^{-2} in summer 2008, kharif 2008 and kharif 2009, respectively).

Key words: Azimsulfuron, grain yield, straw yield, weed density and weed dry weight

Rice is the staple food of more than 60 per cent of the world's population (Anon., 2004). With the advent of capital intensive technology, farmers have achieved a breakthrough in increasing the yield of transplanted rice. But weeds are the major threats, which compete with rice for resources and thus reducing the yield levels. Since hand weeding and other weed control methods are difficult, chemicals are the obvious and cost efficient weed control practices. For this, many pre-emergent herbicides (Anon., 2008) whose were released and used by farmers. But, very few post emergent weedicides (Anon., 2008) effect on crop safety and weed control efficiency are available. To know the effect of post emergent weedicide (Azimsulfuron) on crop safety and weed control, the experiments were laid out at Agricultural Research Station, Kathalagere.

MATERIALS AND METHODS

A field investigation was carried out during summer 2008, *kharif* 2008 and *kharif* 2009 in red loamy soil at Agricultural Research Station, Kathalagere, Channagiri taluk, Davangere district coming under the southern transitional zone of Karnataka. The present investigation was taken up to know the bioefficacy of Azimsulfuron 50 DF alone and Butachlor 50 EC (Standard check) in comparison with hand weeding on weeds control, crop safety and grain yield of transplanted rice. The field experiment was laid out in Randomized Complete Block Design with 10 treatments T_1: Azimsulfuron 50 DF @ 27.5 g a.i ha^{-1} + 0.2% Surfactant, T_2: Azimsulfuron 50 DF @ 30.0 g a.i ha^{-1} + 0.2% Surfactant, T_3: Azimsulfuron 50 DF @ 35.0 g a.i ha^{-1} + 0.2% Surfactant, T_4: T_2 + 1 hand weeding @ 40 DAT, T_5: Pyrazosulfuron 10 WP 25 g a.i ha^{-1} (3 DAT), T_6: 2,4-DEE 2.0 kg a.i ha^{-1} (4 Week after transplanting), T_7: Butachlor 50 EC @ 1.25 kg a.i ha^{-1}, T_8: Butachlor 50 EC 0.9 kg a.i ha^{-1} + Almix @ 2.0 g ha^{-1} , T_9: Hand weeding twice (20 and 40 DAT) and T_{10}: Weedy check These treatments were replicated thrice. The Azimsulfuron 50 DF + 0.2 % Surfactant treatments were applied at 19 DAT, while Butachlor 50 EC @ 1.25 kg g a.i ha^{-1} and Pyrazosulfuron 10 WP @ 25 g a.i ha^{-1} were applied at 3 DAT. The Almix @ 2.0 g/ha was applied at 12 DAT.

The gross plot size of the experiment was 18.0 m^2 (6.0 m x 3.0 m). After puddling and leveling the land, a thin film of water was stagnated in the field. 50 % of recommended N (100 and 125 kg ha^{-1} in *kharif* and summer, respectively) and 100 per cent recommended P_2O_5 and K_2O (50 and 162 kg ha^{-1} each in *kharif* and summer, respectively) were applied as basal dose. The remaining 50% N was top dressed in two equal splits at 25 and 50 days after transplanting (DAT). Twenty six days old seedlings of Cv. IR-64 were transplanted at 20 cm x 10 cm spacing. The herbicides were sprayed by using hand operated

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knapsack sprayer fitted with herbicide nozzle of Aspee ULV 100. The spray volume used was 300 L ha^{-1}. The Inditran (non surfactant) surfactant was used at 0.2% as per the treatments (Table 1).

Density of weeds *viz.*, grasses, sedges and broad leaf weeds were recorded species wise in a fixed m^2 area at pre-treatment, 15, 30 and 45 DAS. Dry weight of these weeds was recorded from 0.25 m^2 destructive sampling area. The data on density and dry weight of weeds were computed using square root ($\sqrt{x + 0.5}$) transformation and also represented m^2 basis. The grain and straw yield (kg ha^{-1}) were recorded at harvest.

RESULTS AND DISCUSSION

Grain and straw yield

Application of Azimsulfuron 30.0 g *a.i* ha^{-1} (19 DAT) + 0.2 % surfactant followed by one hand weeding at 40 DAT recorded significantly higher grain yield (6834, 6683 and 6102 kg ha^{-1} in summer 2008, *kharif* 2008 and *kharif* 2009, respectively) and straw yield (7008, 7030 and 6494 kg ha^{-1} in summer 2008, *kharif* 2008 and *kharif* 2009, respectively), followed by hand weeding twice at 20 and 40 DAT (6740, 6669 and 6075 kg ha^{-1} in summer 2008, *kharif* 2008 and *kharif* 2009, respectively) and straw yield (6983, 7018 and 6487 kg ha^{-1} in summer 2008, *kharif* 2008 and *kharif* 2009, respectively) than other weed control treatments. The increase in grain and straw yield was mainly due to effective weed control i.e. reduction in weed density and weed dry weight. The findings of the investigations are in line with the findings of Prasad (1995) and Kathirvelan and Vaiyapuri (2003). The weedy check recorded significantly lower grain yield (2771, 2882 and 3025 kg ha^{-1} in summer 2008, *kharif* 2008 and *kharif* 2009, respectively) and straw yield (2914, 3095 and 3232 kg ha^{-1} in summer 2008, *kharif* 2008 and *kharif* 2009, respectively). This was mainly due to heavy infestation of weeds in these treatments during the crop growth period.

Weed flora

The major weeds observed in the experimental plots were *Echinochloa glabrascence* among the grasses. *Cyperus sps., Scripus rayali* and *Fimbristylis miliaceae* among sedges. *Ludwizia parviflora, Lindernia vernicaefolia* and *Glinus oppositifolia* among the broad leaf weeds. The other weeds observed in lesser numbers were *Alternanthera sessalis, Eclipta alba, Rotala verticilaris and Spilanthus acmella.* The some of the similar weeds species in transplanted rice are also reported by Natarajan and Kuppusamy (2001), Bhattacharya *et al.* (2004) and Ramphool *et al.* (2007).

Table 1: Grain and straw yield

	Treatments	Grain yield (kg ha^{-1})			Straw yield (kg ha^{-1})		
		Summer 2008	*Kharif* 2008	*Kharif* 2009	Summer 2008	*Kharif* 2008	*Kharif* 2009
T_1	Azimsulfuron 27.5 g *a.i.* ha^{-1} (15-20 DAT) + 0.2% surfactant	5882	5736	-	6120	5947	-
T_2	Azimsulfuron 30.0 g *a.i.* ha^{-1} (15-20 DAT) + 0.2% surfactant	6475	6223	6065	6467	6491	6479
T_3	Azimsulfuron 35.0 g *a.i.* ha^{-1} (15-20 DAT) + 0.2% surfactant	6699	6358	-	6845	6710	-
T_4	T_2 + 1 hand weeding @ 40 DAT	6834	6683	6102	7008	7030	6494
T_5	Pyrazosulfuron 10 WP 25 g *a.i.* ha^{-1} (3 DAT)	6561	6318	5784	6818	6642	6169
T_6	2,4-DEE 2.0 kg a.i./ha (4 WAT)	5917	5777	5274	6191	6107	5636
T_7	Butachlor 50 EC 1.0 kg *a.i.* ha^{-1}, 3 DAT	6253	6209	6021	6342	6637	6390
T_8	Butachlor 50 EC 0.9 kg a.i./ha + Almix @ 2.0 g ha^{-1}	6020	5831	5843	6264	6155	6198
T_9	Hand weeding 20 and 40 DAT	6740	6669	6075	6983	7018	6487
T_{10}	Weedy check	2771	2882	3025	2914	3095	3232
	S.Em(±)	**407.3**	**381.7**	**28.9**	**357.9**	**411.4**	**27.9**
	LSD(0.05)	**1210**	**1134**	**85**	**1060**	**1223**	**83**

Table 2: Total weed density at 45 DAA

	Treatments	Total weed density (No. m^{-2})		
		Summer 2008	***Kharif* 2008**	***Kharif* 2009**
T_1	Azimsulfuron 27.5 g *a.i.* ha^{-1}(15-20DAT)+0.2% surfactant	5.46 (29.32)	6.04 (36.00)	-
T_2	Azimsulfuron 30.0 g *a.i.* ha^{-1} (15-20 DAT) + 0.2% surfactant	4.81(22.68)	5.34 (28.00)	5.46(29.32)
T_3	Azimsulfuron 35.0 g *a.i.* ha^{-1} (15-20 DAT) + 0.2% surfactant	3.54(12.00)	4.53(20.00)	-
T_4	T_2 + 1 hand weeding @ 40 DAT	0.71 (0.0)	1.78(2.68)	2.68(6.68)
T_5	Pyrazosulfuron 10 WP 25 g *a.i.* ha^{-1} (3 DAT)	6.87(46.68)	6.67 (44.00)	7.86(61.32)
T_6	2,4-DEE 2.0 kg *a.i.* ha^{-1} (4 WAT)	4.95(24.00)	6.26 (38.68)	6.47 (41.32)
T_7	Butachlor 50 EC 1.0 kg *a.i.* ha^{-1}, 3 DAT	5.21(26.68)	6.36 (40.00)	7.15(50.68)
T_8	Butachlor 50 EC 0.9 kg *a.i.* ha^{-1} + Almix @ 2.0 g ha^{-1}	3.90 (14.68)	4.22 (17.32)	5.46(29.32)
T_9	Hand weeding 20 and 40 DAT	4.06 (16.00)	4.06(16.00)	3.90(14.68)
T_{10}	Weedy check	25.31 (640.00)	24.64(606.68)	26.24 (688.00)
	S.Em(±)	**0.41**	**0.19**	**0.32**
	LSD(0.05)	**1.22**	**0.56**	**0.96**

DAA: Days after application , Figures in the parentheses are the original data

Table 3: Total weed dry weight at 45 DAA

	Treatments	Total weed dry weight (g m^{-2})		
		Summer 2008	***Kharif* 2008**	***Kharif* 2009**
T_1	Azimsulfuron 27.5 g *a.i.* ha^{-1}(15-20 DAT)+0.2% surfactant	2.05(3.72)	1.96(3.36)	-
T_2	Azimsulfuron 30.0 g *a.i.* ha^{-1} (15-20DAT)+0.2% surfactant	1.89(3.08)	1.77(2.64)	2.17(4.20)
T_3	Azimsulfuron 35.0 g *a.i.* ha^{-1} (15-20DAT)+0.2% surfactant	1.56 (1.92)	1.48(1.68)	-
T_4	T_2 + 1 hand weeding @ 40 DAT	0.71 (0.0)	0.76(0.08)	1.24(1.04)
T_5	Pyrazosulfuron 10 WP 25 g *a.i.* ha^{-1} (3 DAT)	1.94(3.28)	1.61(2.08)	2.96(8.24)
T_6	2,4-DEE 2.0 kg *a.i.* ha^{-1} (4 WAT)	1.94 (3.28)	2.72(6.88)	2.49(5.68)
T_7	Butachlor 50 EC 1.0 kg *a.i.* ha^{-1}, 3 DAT	1.87 (3.00)	1.95(3.32)	2.71(6.84)
T_8	Butachlor 50 EC 0.9 kg *a.i.* ha^{-1} + Almix @ 2.0 g ha^{-1}	1.16 (0.84)	1.19(0.92)	1.99(3.48)
T_9	Hand weeding 20 and 40 DAT	1.01(0.52)	1.05(0.60)	1.61(2.08)
T_{10}	Weedy check	5.68 (31.76)	5.38(28.44)	7.09(49.80)
	S.Em(±)	**0.03**	**0.05**	**0.18**
	LSD(0.05)	**0.09**	**0.14**	**0.55**

DAA: Days after application; Figures in the parentheses are the original data

Weed density

Application of Azimsulfuron 30.0 g *a.i.* ha^{-1} (19 DAT) + 0.2 % surfactant followed by one hand weeding at 40 DAT recorded significantly lower total weed density ((0.00, 2.68 and 6.68 m^{-2} in summer 2008, *kharif* 2008 and *kharif* 2009, respectively). This was followed by hand weeding twice at 20 and 40 DAT (16.00, 16.00 and 14.68 m^{-2} in summer 2008, *kharif* 2008 and *kharif* 2009, respectively). This was mainly due to killing of emerged weeds by azimsulfuron and hand removal of weeds. The weedy check recorded significantly higher density of total weeds (640.00, 606.68 and 688.00 m^{-2} in summer 2008, *kharif* 2008 and *kharif* 2009, respectively).

Weed dry weight

Application of Azimsulfuron 30.0 g *a.i.* ha^{-1} (19 DAT) + 0.2 % surfactant followed by one hand weeding at 40 DAT recorded significantly lower total weed dry weight (0.00, 0.08 and 1.04 g m^{-2} in summer 2008, *kharif* 2008 and *kharif* 2009, respectively). This was followed by hand weeding twice at 20 and 40 DAT (0.52, 0.60 and 2.08 g m^{-2} in summer 2008, *kharif* 2008 and *kharif* 2009, respectively). The decrease in dry weight of weeds in these treatments was mainly due to effective control of weeds. Azimsulfuron controled the weeds by inhibiting biosynthesis of the essential amino acids valine and isoleucine, hence stopping cell division and plant growth. The weedy check recorded significantly higher dry weight of total weeds (31.76, 28.44 and 49.80 g m^{-2} in summer 2008, *kharif* 2008 and *kharif* 2009, respectively). The decrease in dry weight of weeds was mainly due to effective control of weeds by application of Azimsulfuron 30.0 g *a.i.* ha^{-1} (19 DAT) + 0.2 % surfactant followed by one hand weeding at 40 DAT. The results were in conformity with the findings of Saini (2003).

Thus, it is inferred from the above study that application of Azimsulfuron 30.0 g *a.i.* ha^{-1} (19 DAT) + 0.2 % surfactant followed by one hand weeding at 40 DAT found to be superior in producing higher grain and straw yield by effective control of weeds during the critical crop weed competition period.

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