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Assessment of post-emergence herbicides in direct seeded rice

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ABSTRACT

A field investigation was carried out during the rainy seasons of 2001 and 2002 to test the bioefficacy of post-emergence herbicides for controlling weeds in direct seeded rice (*Oryza sativa* L.). All the herbicidal treatments significantly r educed the density and biomass of weeds and increased grain yield of the crop significantly over unweeded check. Uncontrolled growth of weeds caused 68% reduction in the crop yield as compared to weed free in both the years of investigation. Pre-emergence application of butachlor at 1500 g/ha followed by one hand weeding produced maximum grain yields in both the years among all herbicidal weed control treatments, which were comparable to those obtained with post-emergence application of pyrazosulfuron at 25 g/ha, chlorimuon+metsulfuron at 4 g/ha, butanil 4000 ml/ha and bentazone at 1250 g/ha. The same treatments also resulted in maximum reduction in the density and growth of the weeds. Application of fenoxaprop reduced the population of grassy weeds, whereas butanil and pretilachlor reduced the grassy as well as broad leaved weeds. Post-emergence application of chlorimuon+metsulfuron, bentazone and pyrazosulfuron were most promising for controlling broad leaved weeds and sedges in direct seeded drilled rice.

Key words*:* Direct seeded rice, Herbicides, Weed control.

Heavy infestation of weeds is one of the major constraints to the successful cultivation of direct-seeded rice. Success of direct seeded rice depends largely on effective management of weeds. Various herbicides have been used for controlling weeds in direct seeded rice (Nandal and Om 1998), but efficiency of chemical methods especially pre-emergence herbicides may be unsatisfactory because of narrow range of weed control. Therefore, application of post-emergence herbicides can be more useful for season long weed control. Keeping in view, the present field investigation was carried out to test the performance of various herbicides to find out the best herbicide treatment for control of weeds in direct-seeded rice.

MATERIALS AND METHODS

A field experiment was conducted on direct seeded rice (DSR) JR-201during rainy seasons of 2001 and 2002 at National Research Centre for Weed Science, Jabalpur (Madhya Pradesh). The soil was clay loam in texture, neutral in pH and analyzing low in available N (kg/ha), medium in available P (36kg/ha) and high in available K (249 kg/ha) contents. Twelve treatments consisted with eight post-emergence herbicides, *viz,* butanil 4000 ml/ha, dithiopyr 120g/ha, fenoxaprop 60g/ha, chlorimuon + metsulfuron 4 g/ha, ethoxysulfuron 15 g/ha, pyrazosulfuron 25 g/ha, 2,4-D 500 g/ha and bentazone 1250 g/ha, 2 pre-emergence herbicides with pretilachlor 750 g/ha and butachlor 1500 g/ha + one hand weeding, weed-free and weedy check were tested in a randomized block design with 3 replications. Crop was sown in well prepared seed bed in rows 20 cm apart in both the years using 75 kg seed/ha.The crop was fertilized with 120 kg N, 60 kg P_2O_5 and 25 kg zinc sulphate/ha. Full dose of P_2O_5 and zinc sulphate and one third dose of N were applied at the time of sowing, whereas the remaining N was top-dressed in 2 equal splits at 30 and 50 days after sowing (DAS). The crop was irrigated as and when required to maintain the wet condition in the field. The post-emergence herbicides were applied at 20 DAS. Density of weeds and their dry weight were recorded from randomly selected spots in each plot with the help of a 0.25m x 0.25m quadrate at 45DAS.

RESULTS AND DISCUSSION

Weed flora in weedy check plots of the experimental field consisted of *Phyllanthus niruri, Alternanthera sessilis, Physalis minima, Commelina benghalensis,Cyperus iria* and *Echinochloa colona.* Among these broad leaved weeds and sedges constituted about 82% of total weed flora.

Table 1 : Effect of different herbicides on population and dry matter accumulation of weeds in dir ect seeded rice

Treatment	Rate of application (g/ha)	Weed count species wise/m^2 (average of two years)						Total weed dry weight (g/m^2)		Weed control efficiency (%)
		Phylanthus	*Alternanthera*	*Commelina*	*Cyperus*	*Physalis*	*Echinocloa*	01-02	02-03	01-02
Butanil	4000	9 (3.07)	2(1.49)	2(1.49)	16(4.08)	0 (0.71)	3(1.81)	27.56	43.20	51.5
Dithiopyr	120	22 (4.77)	3(1.81)	2(1.49)	18(4.32)	2(1.49)	5(2.31)	41.88	64.70	26.4
Fenoxaprop	60	21 (4.66)	2(1.49)	3(1.81)	16(4.08)	3(1.81)	2(1.49)	37.48	48.60	34.1
Chlorimuron+Metsu lfuron	20	12 (3.54)	2(1.49)	1(1.08)	15 (3.95)	0 (0.71)	12 (3.54)	26.18	40.00	53.9
Ethoxyfulfuron	15	12 (3.54)	2(1.49)	0 (0.71)	20(4.55)	0 (0.71)	10 (3.24)	32.84	45.20	42.2
Pretilachlor+safener	750	15 (3.95)	2(1.49)	2(1.49)	12 (3.54)	1(1.08)	7 (2.72)	33.65	46.0	40.8
2,4-D	500	14 (3.82)	0 (0.71)	0 (0.71)	18(4.32)	0 (0.71)	10 (3.24)	34.22	52.30	39.8
Bentazone	1250	10 (3.24)	0 (0.71)	1(1.08)	9 (3.07)	0 (0.71)	8 (2.90)	26.48	44.0	53.4
Butachlor+1HW	1500	8 (2.90)	2(1.49)	1(1.08)	10 (3.24)	0 (0.71)	6(2.52)	14.36	22.50	74.5
Pyrazosulfuron	25	7 (2.72)	0 (0.71)	2(1.49)	5(2.31)	1(1.08)	9 (3.07)	15.76	21.30	72.8
Weed free	-	0 (0.71)	0 (0.71)	0 (0.71)	0 (0.71)	0 (0.71)	0 (0.71)	-	-	100
Weedy check	-	28 (5.37)	3(1.81)	4(2.08)	27(5.27)	3(1.81)	14(3.82)	56.89	78.60	-
LSD (P=0.05)		1.02	0.98	0.80	0.87	0.53	1.11	9.62	11.20	-

Data subjected to square root transformation.
Figure in parentheses are transformed values.

Table 2. Effect of herbicides on yield attributes and grain yield of dir ect seeded rice

Treatment	Dose (kg/ha)	Panicles/m^2		Grains/panicle		1000-grain weight (g)		Grain yield(kg/ha)		
		2001	2002	2001	2002	2001	2002	2001	2002	Mean
Butanil	4.0	237.0	207.3	71.3	49.3	25.2	24.0	2371	1370	1870
Dithiopyr	0.120	235.3	203.6	71.5	47.0	26.1	24.7	2089	978	1533
Fenoxaprop	0.060	236.3	211.0	71.0	48.2	24.3	24.0	2112	1125	1618
Chlorimuron+ Metsulfuron	.020	237.0	213.0	72.3	49.2	24.2	24.4	2388	1400	1894
Ethoxysulfuron	0.015	236.7	214.0	72.1	49.0	24.0	25.1	2144	1357	1750
Pretilachlor+safener	0.750	236.0	214.0	71.0	49.1	25.2	24.2	2134	1362	1748
2, 4-D	0.500	236.0	208.7	73.0	47.2	24.7	24.7	2125	1321	1723
Bentazone	1.250	237.3	207.0	72.7	48.2	25.3	25.0	2364	1377	1870
Pyrazosulfuron	0.025	239.3	209.2	69.3	49.7	24.0	25.2	2400	1422	1911
Butachlor+1HW	1.500	240.0	213.0	72.3	49.3	25.2	24.2	2451	1459	1955
Weed free	-	256.5	230.4	79.1	56.2	24.4	25.1	2876	1890	2383
Weedy check	-	163.3	150.6	42.1	32.7	24.7	24.6	987	514	750
LSD (P=0.05)		21.3	22.6	4.3	3.7	NS	NS	197	178	-

Among the grassy weeds *E. colona* was the most dominant species which constituted only 18% of total weed flora.

Effect on weeds

All the herbicidal treatments reduced the population and dry weight of weeds significantly compared with the weedy check but could not excel over weed-free check during both the years (Table1). Among the herbicidal treatments, post-emergence application of pyrazosulfuron at 25 g/ha effectively controlled the infestation of *Phyllanthus niruri, Alternanthera sessilis, Commellina benghalensis, Physalis minima* and *Cyperus iria* which was comparable to pre-emergence application of butachlor followed by one HW. These treatments had greater reduction in total weed density and dry matter accumulation than other herbicidal treatments, hence they led to record higher weed control efficiency. This could be attributed to greater reduction of dry weight of weeds by the combined effect of herbicides and hand weeding at later stage. Application of ethoxysulfuron, bentazone and chlorimuon+metsulfuron curtailed the growth of broad leaved weeds as compared to weedy check. Application of bentazone was effective for the control *Cyperus iria* as compared to butachlor as pre-emergence followed by one hand weeding. On the other hand application of fenoxaprop-p-ethyl at 60 g/ha was highly effective for reducing the density of *Echinochloa colona* due to higher efficacy for controlling grasses in direct seeded rice over other herbicidal treatments. Performance of butanil on weed management ranked next to the fenoxaprop-p-ethyl. This finding is in agreement with that of Subramanian *et al.* (2006)

Effect on crop

The weed management practices adopted in direct seeded rice significantly improved the yield attributing characters and yield by reducing weed competition (Table 2). Different herbicides did not significantly influence the number of panicles/ hill, with each other however; weed free produced higher number of panicles as compared to other herbicidal treatments. The losses in the yield due to uncontrolled growth of the weeds in weedy check plots were found to be 59.7 and 64.7% during 2001 and 2002, respectively, compared to application of pyrazosulfuron at 25g/ha as post-emergence which was at par with butachlor as pre-emergence followed by one hand weeding at 45 days after sowing. It was because of severe crop-weed competition in weedy check, as evident from the data on weed population and their dry weight. Among the herbicidal treatments, pre-emergence application of butachlor followed by one hand weeding (1955 kg/ha) and post-emergence application of pyrazosulfuron at 25 g/ha (1911 kg/ha) produced comparable grain yields, which were 2.6 times higher than that obtained with weedy check (750 kg/ha). These treatments were also at par with post-emergence application of chlorimuron + metsulfuron, butanil and betazone. The higher number of panicles/m^2 and grains / panicle were also recorded under post-emergence application of chlorimuron +metsulfuron, fenoxaprop-p-ethyl and pyrazosulfuron at 25 g/ha, which were on par with pre-emergence application of butachlor followed by one hand weeding. Weed control efficiency was maximum (73%) under post-emergence application of pyrazosulfuron at 25g/ha closely followed by application of butachlor + one hand weeding. The weeds were controlled effectively till the advanced growth stages of rice, which reduced weed competition favouring better utilization of available resources by the crop. Grain yield was significantly minimum in weedy check among all treatments and improvement in grain yield with all treated plots could be associated with the significant reduction in population and dry weight of the weeds, thereby resulting in higher uptake of nutrients by the crop (Singh *et al.,* 1999).

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