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Efficacy of cyhalofop-butyl in controlling weeds in transplanted rice (*Oryza sativa*)

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ABSTRACT

A field experiment was conducted during the rainy season (*Kharif*) of 1994 and 1995 at Palampur, to find out the effective dose of cyhalofop-butyl and surfactant (PG 26-2) to control weeds in transplanted rice (*Oryza sativa* L.). Cyhalofop-butyl was applied 15 days after rice transplanting. Cyhalofop-butyl 90 g/ha +surfactant 0.3% being at par with cyhalofop-butyl 90 g/ha + surfactant 0.2%, cyhalofop-butyl 75 g/ha + surfactant 0.3, cyhalofop-butyl 90 g/ha without surfactant and butachlor 1.5 kg/ha resulted in significantly lower dry-matter accumulation of weeds compared with remaining treatments. Cyhalofop-butyl 90 g/ha + surfactant 0.3% resulted in significantly higher rice yield attributes and yield; however, it was at par with cyhalofop-butyl 90 g/ha + surfactant 0.2% and butachlor 1.5 kg/ha at 5 days after transplanting during both years and also with cyhalofop-butyl 75 g/ha + surfactant 0.3% during first year.

Key words : Cyhalofop-butyl, Surfactant 0.3%, Transplanted, Butachlor, Attributes, Tillers, Weedy check.

Unlike other cereal crops, rice suffers more from weed competition. The degree of competition and extent of yield loss vary with rice cultures. On an average, 15-20% yield is reduced due to weeds in transplanted rice (Pandey and Sukla, 1990). Thus, to realize maximum benefit of applied costly inputs and higher yield, control of weeds in time is of paramount importance. A number of pre-emergence herbicides are being applied for weed control in transplanted rice for the last decade, out of which butachlor and anilophos are most important. Cyhalofop-butyl is relatively a new post-emergence herbicide, the efficacy of which will have to be worked out under mid-hill conditions of Himachal Pradesh. Therefore, the present study was conducted to find out the most effective dose of cyhalofop-butyl and surfactant PG-26-2 for controlling weeds in transplanted rice.

MATERIALS AND METHODS

A field experiment was conducted during the rainy season (*kharif*) 1994 and

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1995 at the experimental farm of Department of Agronomy, Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur. The area represents the mid-hill wet temperate zone of Himachal Pradesh. The soil was silty clay loam in texture, acidic in reaction (pH 5.7), medium in organic carbon (0.7%), available nitrogen (380 kg/ha) and available phosphorus (20.4 kg/ha) and high in available potassium (256 kg/ha). The experiment was laid out in randomized block design with 3 replications and 12 treatment combinations. The treatments include 4 doses of cyhalofop-butyl (45,60,75 and 90 g/ha), each with 2 levels of surfactant PG 26-2 (0.2 and 0.3%), along with the standard checks of butachlor 1.5 kg/ha (5 days after transplanting) and Anilophos 0.6 kg/ha (5 days after transplanting) and a weedy check. Cyhalofopbutyl was applied as post-emergence (15 days after transplanting). Thirty days old seedling of 'HPU 2216' rice were transplanted on 12 and 15 July during 1994 and 1995, respectively, following all recommended package of practices. Observations on dry matter of weeds and yield attributes and yield were recorded and benefit : cost ratio was worked out.

RESULTS AND DISCUSSION

Effect on weeds

The dominant weeds of the experimental field were *Echinochloa* sp. (*E. colonum* and *E. crus-galli)* and *Cyperus* sp. (*C. iria* and *C. difformis)* which constituted 52.8 and 27.5% of total weed flora respectively. The other weeds were *Scirpus* sp., *Commelina benghalensis, Ammania* sp. etc. which constituted 19.2% of total weed flora.

All herbicide treatments significantly reduced the dry-matter accumulation of weeds compared with the unweeded check (Table 1). Cyhalofop-butyl 90 g/ha + surfactant (PG 26-2) 0.3% reduced total dry matter of weeds to the lowest level however, it was at par with butachlor 1.5 kg/ha, cyhalofop-butyl 75 g/ha + surfactant 0.3, cyhalofop-butyl 90 g/ha + surfactant 0.2% and cyhalofop-butyl 90 g/ha without surfactant during both the years. These results are in direct conformity with those of Angiras *et al.* (1996) and Singh *et al.* (1996), who also reported significantly lower dry matter of weeds in these treatments. Cyhalofop-butyl 60 g/ha + surfactant 0.3% and cyhalofop-butyl 60 g/ha + surfactant 0.2% being at par with one another were the next best treatments in reducing the dry matter of the weeds significantly compared with the remaining treatments.

Effect on crop

Nuber of effective tillers/m row length, panicle length, grains/panicle and 1,000-grain weight were found to vary significantly due to herbicide treatments (Table 1). Significantly lowest plant height was recorded in weedy check plots over all other hrbicide treatments which did not differ significantly during both the years. Significantly higher number of effective tillers/m row length, panicle length and grains/panicle were observed in cyhalofop-butyl 90 g/ha + surfactant (PG 26-2) 0.3% however, it was at par with cyhalofop-butyl 75 g/ha + surfactant 0.2 and 0.3% and butachlor 1.5 kg/ha. Kolhe *et al.* (1997) and

Table 1. Effect of treatments on weed dry weight, yield attributes and yield of rice and benefit : cost ratio in transplanted rice

Treatment	Weed dry weight (g/m^2)*		Effective tillers/m row length		Panicle length (cm)		Grains/ panicle		1,000-grain weight (g)		Grain yield (q/ha)		B : C ratio over weedy check Mean
	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	
Cyhalofop-butyl 90 g/ha	5.10 (25.01)	8.46 (70.7)	44.3	50.6	17.6	19.4	102.2	94.2	24.6	30.2	41.97	38.25	2.01
Cyhalofop-butyl 45 g/ha+surfactant (PG 26-2) 0.2%	17.33 (299.3)	16.84 (284.2)	37.7	35.8	14.7	18.3	79.5	68.8	23.1	28.8	31.72	29.79	1.05
Cyhalofop-butyl 60 g/ha+surfactant (PG 26-2) 0.2%	11.06 (121.32)	12.95 (166.6)	38.7	41.5	15.2	20.1	87.6	77.5	24.6	30.2	32.48	31.14	1.16
Cyhalofop-butyl 75 g/ha + surfactant (PG 26-2) 0.2%	4.88 (22.32)	8.32 (67.2)	40.0	43.8	15.1	19.7	98.7	90.3	24.4	30.3	35.57	35.41	1.52
Cyhalofop-butyl 90 g/ha + surfactant (PG 26-2) 0.2%	4.96 (23.60)	7.32 (52.6)	42.3	52.9	16.8	19.7	106.4	96.8	24.5	30.3	41.52	39.09	1.85
Cyhalofop-butyl 45 g/ha + surfactant (PG 26-2) 0.3%	14.6 (213.16)	15.77 (249.6)	37.6	38.8	14.6	19.0	83.3	76.4	23.4	29.4	29.08	30.30	0.98
Cyhalofop-butyl 60 g/ha + surfactant (PG 26-2) 0.3%	8.70 (74.69)	12.41 (153.6)	40.3	40.9	15.4	19.2	89.8	81.2	23.8	29.3	38.27	31.14	1.40
Cyhalofop-butyl 75 g/ha + surfactant (PG 26-2) 0.3%	6.46 (40.73)	8.10 (65.1)	43.3	44.6	16.5	18.6	110.2	100.4	24.8	30.1	41.69	36.83	1.68
Cyhalofop-butyl 90 g/ha + surfactant (PG 26-2) 0.3%	4.90	6.90	46.0	50.8	17.2	19.2	112.7	107.5	25.2	30.8	45.52	40.62	1.86

Table 1. *(Continued)*

Treatment	Weed dry weight (g/m²)*		Effective tillers/m row length		Panicle length (cm)		Grains/ panicle		1,000-grain weight (g)		Grain yield (q/ha)		B : C ratio over weedy check
	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	Mean
Butachlor 1.5 kg/ha (5 DAT)	5.13 (25.32)	7.50 (56.3)	45.6	48.4	17.5	18.8	110.4	107.2	24.7	29.8	41.48	38.50	2.01
Anilophos 0.6 kg/ha (5 DAT)	10.40 (107.16)	9.84 (96.6)	40.3	41.3	15.6	18.9	86.7	77.3	24.5	29.4	34.59	32.50	1.34
Weedy check	20.53 (420.38)	21.72 (471.0)	32.3	35.2	13.4	17.1	70.5	61.5	22.3	30.0	16.20	24.31	
CD (P=0.05)	3.93	2.05	3.3	4.4	1.4	NS	11.8	9.2	1.5	NS	3.10	2.73	

* $\sqrt{x+1}$ transformations used; DAT, days after transplanting; figures in the parentheses are the means of original values.

Angiras *et al.* (1997) also reported similar results in direct-seeded, puddled rice. Similarly, cyhalofop-butyl 90 g/ha with and without surfactant, cyhalofop-butyl 75 g/ha + surfactant 0.3% and butachlor 1.5 kg/ha gave higher values of 1,000-grain weight; however, differences during *kharif* 1995 were not significant.

Cyhalofop-butyl 90 g/ha + surfactant 0.3% being at par with cyhalofop-butyl 90 g/ha surfactant 0.2% and butachlor 1.5 kg/ha resulted in significantly higher rice grain yield compared with the remaining treatments; however during the first year these treatments were also at par with cyhalofop-butyl 75 g/ha + surfactant 0.3%. This may be attributed to significantly lower dry-matter accumulation of weeds and hence higher number of effective tillers, panicle length, grains/panicle and 1,000-grain weight in these treatments (Table 1) over other treatments. Similar results were also observed by Angiras *et al.* (1997), Kolhe *et al.* (1997) and Singh *et al.* (1997). Anilophos 0.6 kg/ha showed poor control of weeds and hence poor rice yield attributes and yield compared with cyhalofop-butyl 90 g/ha with and without surfactant and butachlor 1.5 kg/ha; however, it was on a par with the remaining doses of cyhalofop-butyl with and without surfactant.

Butachlor 1.5 kg/ha (5 DAT) and cyhalofop-butyl 90 g/ha (15 DAT) were found to be economically viable treatments (Table 1). Higher profitability (benefit : cost ratio) of these treatments over others gave a credence to believe that the weeds could be controlled effectively by these treatments.

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