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Bioefficacy testing of fenoxaprop-p-ethyl against weeds in direct-seeded rice

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ABSTRACT

The trial was conducted for two years during November–February 2006 and during December–April 2007. The treatments included fenoxaprop-p-ethyl at 47.44, 51.75, 56.06, 60.38 g/ha, cyhalofop-butyl 62.5 g/ha, *Echinochloa* spp. were the major weed comprising about 75% of the weed population. *Echinochloa crusgalli* and *Echinochloa stagnina* were present almost in equal proportions. Fenoxaprop-p-ethyl at all the tested doses was effective in controlling *Echinochloa* spp. Fenoxaprop sprayed 60.38 g/ha recorded yields on par with hand weeding and standard check cyhalofop. This dose can be recommended in situations where *Echinochloa* spp. is a major problem.

Key words: Direct seeded rice, Fenoxaprop-p-ethyl, Weed control

The success of rice cultivation depends on effectiveness of weed control measures In direct seeded rice, even total crop loss can occur due to weed competition. Pillai and Rao (1974) estimated the extent of yield reduction due to weeds to be over 50% in direct seeded upland rice, 30-35% in direct seeded rice under puddle condition and around 15-20% in transplanted rice. One estimate at IRRI showed that the weed growth in unweeded plots reduced yield by 34% in transplanted rice, 45% in direct seeded rain fed lowland rice and 67% in upland rice (De Datta 1981). Sankaran and De Datta (1985) reported yield reduction due to weed competition to the tune of 32 to 86% in upland rice. *Echinochloa* is a major crop associated weed of rice and cyhalofop butyl is the only herbicide recommended for the post-emergence control of this weed. Herbicide fenoxaprop-p-ethyl was also reported to control weeds in DSR when applied before the booting stage (Snipes and Street 1987). Fenoxaprop at 0.17 kg/ha applied as post-emergence after pre-emergence application of thiobencarb or pendimethalin controlled barnyardgrass in rice (Smith 1988, Khodayari *et al*. 1989). However Smith (1988) observed that fenoxaprop alone or in tank mixtures with other herbicides applied early as post-emergence either injured rice or failed to control weeds. Under these circumstances, a study was conducted to test the bioefficacy of a new post emergence herbicide fenoxaprop-p-ethyl to control *Echinochloa* spp. in direct seeded rice.

MATERIALS AND METHODS

The trial was conducted for two years during November–February 2006 and during December–April 2007. The experiment was laid out in RBD with six treatments and four replications. The plot size was 50 m^2 and the trial was conducted at the farm of Agricultural Research Station, Mannuthy of Kerala Agricultural University, located at 10 degrees 31' N latitude, 76 degrees 13' E longitude and at an altitude of 40.3m above mean sea level. The variety '*Jyothi*' (a short duration variety with 110-120 days duration) was shown. The soil of the experimental site was sandy loam with acidic pH of 5.6, organic carbon content of 0.66%, available N 276 kg/ha, available P 19.3 kg/ha and available K 89.6 kg/ha. The field was puddled and leveled and pre germinated seeds were sown.

The treatments included fenoxaprop-p-ethyl at 47.44, 51.75, 56.06, 60.38 g/ha (as Rice Star 6.9% EC supplied by M/S Bayer Crop Science Ltd., Mumbai), cyhalofop-butyl 62.5 g/ha (as Clincher 10% EC supplied by M/S Dow Agro Sciences, Mumbai). The herbicides were sprayed at 25-30 DAS with 500 litres/ha water using a knapsack sprayer fitted with a flood jet nozzle. Hand weeding was done at 20 and 40 days after sowing. Count of *Echinochloa* spp. was done before the treatment and 30 days after herbicide application and at flowering stage. Weed dry matter production was taken at 30 days after spraying and at harvest stage of the crop.

RESULTS AND DISCUSSION

Important weeds in the field were: *Echinochloa crusgalli* and *Echinochloa stagnina* among grasses, *Cyperus iria* and *Fimbristylis miliacea* among sedges and *Ludwigia parviflora, Monochoria vaginalis* and *Lindernia* sp. among broad leaved weeds. However *Echinochloa* spp. were the major weed comprising about 75% of the weed

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Table 1. Effect of fenoxaprop on *Echinochloa* spp. population and weed dry matter production during 2006

Treatment (g/ha)	*Echinochloa* spp. count (no./m²)			Dry weight (g/m²)	
	Pre-treatment	30 DAS	Harvest	30 DAS	Harvest
Fenoxaprop 47.44	6.87*(46.25)^{ab}	2.23*(4.00)^{b}	1.54*(1.50)^{b}	1.70* (1.92)^{b}	2.91*(8.75)^{b}
Fenoxaprop 51.75	6.78(45.00)^{b}	1.61(2.00)^{bc}	1.41(1.00)^{bc}	1.30 (0.95)^{bc}	2.39 (4.75)^{bc}
Fenoxaprop 56.06	6.87(46.25)^{ab}	1.30(1.00)^{c}	1.21(0.50)^{bc}	1.12 (0.30)^{c}	1.50 (1.52)^{c}
Fenoxaprop 60.38	6.76(44.75)^{b}	1.00(0.00)^{c}	1.10 (0.25)^{c}	1.00 (0.00)^{c}	1.25 (0.75)^{c}
Cyhalofop 62.5	6.89(46.50)^{ab}	1.61(2.00)^{bc}	1.10 (0.25)^{c}	1.35 (0.97)^{bc}	1.36 (1.00)^{c}
Hand weeded	6.85(46.00)^{ab}	1.00(0.00)^{c}	1.21 (0.50)^{bc}	1.00 (0.00)^{c}	1.20 (0.50)^{c}
Unweeded control	6.97(47.75)^{a}	7.88(62.00)^{a}	7.67(58.00)^{a}	5.54(30.02)^{a}	12.30(153.00)^{a}
LSD (P=0.05)	0.14	0.82	0.36	0.47	1.33

Figures given in the parentheses are original values; *$\sqrt{x+1}$ transformed values

In a column, the figures followed by same alphabet do not differ significantly in Duncan's Multiple Range Test.

Table 2. Effect of fenoxaprop on *Echinochloa* spp. population and weed dry matter production during 2007

Treatment (g/ha)	*Echinochloa* count (no./m²)			Dry weight (g/m²)	
	Pre-treatment	30 DAS	Harvest	30 DAS	Harvest
Fenoxaprop 47.44	11.10(122.00)^{a}	1.20*(0.50)^{b}	1.57*(1.50)^{b}	1.10(0.25)^{b}	2.20(4.50)^{c}
Fenoxaprop 47.44	11.20(124.20)^{a}	1.00(0.00)^{b}	1.49(1.25)^{b}	1.00(0.00)^{b}	1.00(0.00)^{c}
Fenoxaprop 56.06	11.10(123.50)^{a}	1.00(0.00)^{b}	1.49(1.25)^{b}	1.00(0.00)^{b}	1.00(0.00)^{c}
Fenoxaprop 60.38	11.10(123.00)^{a}	1.00(0.00)^{b}	1.31(0.75)^{b}	1.00(0.00)^{b}	1.00(0.00)^{c}
Cyhalofop 62.5	12.10(148.50)^{a}	1.20(0.50)^{b}	1.31(0.75)^{b}	1.10(0.25)^{b}	2.30(4.00)^{c}
Hand weeded	11.20(124.20)^{a}	1.20(0.50)^{b}	1.65(1.75)^{b}	1.00(0.00)^{b}	4.19(17.00)^{b}
Unweeded control	11.20(125.50)^{a}	13.00(169.50)^{a}	10.50(109.5)^{a}	4.40(18.25)^{a}	18.50(344.00)^{a}
LSD (P=0.05)	28.3	0.77	0.41	0.2	1.3

Figures given in the parentheses are original values; *$\sqrt{x+1}$ transformed values

In a column, the figures followed by same alphabet do not differ significantly in Duncan's Multiple Range Test.

Table 3. Effect of fenoxaprop on grain and straw yield of rice (kg/ha)

Treatment (g/ha)	2007		2008	
	Grain	Straw	Grain	Straw
Fenoxaprop 47.44	3932^{a}	3944^{ab}	3824^{c}	4388^{d}
Fenoxaprop 51.75	3800^{a}	3900^{ab}	3934^{c}	4624^{c}
Fenoxaprop 56.06	3800^{a}	3893^{ab}	3983^{c}	4663^{c}
Fenoxaprop 60.38	4050^{a}	4445^{a}	4382^{b}	5175^{b}
Cyhalofop 62.5	3800^{a}	4735^{a}	4501^{b}	5096^{b}
Hand weeded	3900^{a}	3987^{ab}	4860^{a}	5529^{a}
Unweeded control	1950^{b}	3437^{b}	2071^{d}	3680^{e}
LSD (P=0.05)	336	790	591	261

In a column, the figures followed by the same alphabet do not differ significantly in Duncan's Multiple Range Test.

population. *Echinochloa crusgalli* and *Echinochloa stagnina* were present almost in equal proportions.

All the doses of fenoxaprop resulted significant reduction in the count of *Echinochloa* spp. at 30 days after spraying in both the years of study (Table 1 and 2). The weed dry matter production also showed a similar trend. Snipes and Street (1987) also obtained good control of *Echinochloa* spp. by fenoxaprop. Although there was pro-

gressive reduction in the *Echinochloa* population with increase in the doses of fenoxaprop, there was no significant difference among higher three doses (51.75 g/ha, 56.06 g/ha, 60.38 g/ha). These doses were also on par with cyhalofop-butyl, the presently recommended post-emergence herbicide against *Echinochloa*, as well as with hand weeding. As expected, cyhalofop as well as fenoxaprop, did not give control of sedges and broad-leaved weeds.

All the herbicide treatments resulted in significant increase in the grain yield compared to unweeded control in both years (Table 3). In the first year of study, there was no significant difference between different doses of fenoxaprop, which were also on par with cyhalofop and hand weeding. The highest grain yield was in the plots sprayed with fenoxaprop at 60.38 g/ha (4050 kg/ha) followed by hand weeded control (3900 kg/ha) and the standard check cyhalofop (3800 kg/ha). Fenoxaprop at 60.38 g/ha and cyhalofop 62.5g/ha recorded significantly higher straw yields also. There was no significant difference between straw yields in any of the herbicide treatments. The lowest straw yield was recorded in unweeded control (3437 kg/ha), which was significantly lower than fenoxaprop 60.38 g/ha and cyhalofop 62.5 g/ha.

In the second year of study, hand weeding resulted in significantly higher grain yield (4860 kg/ha) than the herbicide applied plots. The highest grain yield was recorded by hand weeding since broad-leaved weeds and sedges had also been hand weeded along with grass weeds. This was followed by cyhalofop (4501 kg/ha) and fenoxaprop 60.38 g/ha (4382 kg/ha), which were on par with hand weeded plot. Maximum straw yield of 5529 kg/ha was also produced by hand weeding where as lowest was in unweeded control (3680 kg/ha). As in the case of grain, cyhalofop 62.5 g and fenoxaprop 60.38g were on par.

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