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Efficacy of oxyfluorfen for weed control in transplanted rice

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ABSTRACT

An experiment was conducted to study the efficacy of the herbicide oxyfluorfen in transplanted rice. The treatments consisted of oxyfluorfen 23.5 EC in four rates of applications (100g, 150g,200g and 250 g/ha), Butachlor 50 EC@1250 g/ha, hand weeding and an unweeded check. The study revealed that oxyfluorfen @150-200 g/ha can effectively control weeds of rice such as grasses, sedges and broadleaved weeds if applied as pre emergence spray four days after transplanting of paddy. Even though some phyto toxicity effect was noticed in rice seedlings immediately after application of oxyfluorfen, the seedlings recovered and resulted in higher grain and straw yields on par with hand weeding.

Key words: Oxyfluorfen, transplanted rice, weed control

Weeds are a major cause of reduction in crop yields in rice. Though the problem is less severe in the case of transplanted rice, severe crop losses occur in direct seeded rice . Pillai and Rao (1974) estimated the extent of yield reduction due to weeds to be over 50 per cent in direct seeded upland rice, 30-35 per cent in direct seeded rice under puddled condition and around 15-20 per cent in transplanted rice. One estimate at IRRI showed that the weed growth in un weeded plots reduced yield by 34 percent in transplanted rice, 45 per cent in direct seeded rain fed lowland rice and 67 per cent in upland rice(De Datta,1981)

Hand weeding is the traditional weed control measure in rice. However, due to high labour cost, non availability of labour and time taken for manual removal, farmers are forced to opt for cheaper alternative of chemical weed control. Nearly 200 herbicides, often chemically and functionally diverse are available in the world for use in various crops. Many herbicides are being used successfully for weed control in rice both as pre emergence and post emergence spray. Pre emergence herbicides in common use are butachlor, pretilachlor, thiobencarb etc. New herbicides are now coming in the market and the use of herbicides of different chemical composition is desirable to reduce the problem of residue buildup, shift in weed flora and development of herbicide resistance in weeds.

The herbicide oxyfluorfen has both foliar and soil activity. It is generally recommended as a pre emergence herbicide in dry seeded rice.(KAU,1989) Studies on efficacy and selectivity of oxyfluorfen for pre emergence weed control in transplanted rice are scanty and there are different reports of varied dosages and time of application required for effective weed control. Shahi,(1985) reported that oxyfluorfen applied within four days after transplanting of rice effectively controlled weeds when applied at the rate of 0.15 kg/ha. Dawood and Balasubrahmaniam (1988) found that application at five days after transplanting gave better results. Gidnavar (1981) found oxyfluorfen @ 0.4 kg /ha was effective in upland weed whereas Rao and Gupta (1982) found that in transplanted rice 0.56 kg/ha resulted in higher yields and effective weed control. The present study was undertaken to study efficacy of herbicide oxyfluorfen 23.5 EC in pre emergence control of major wetland weeds in transplanted rice and also to arrive at an optimum dosage that can be recommended in rice tracts of Kerala.

MATERIALS AND METHODS

The study was conducted at Agricultural Research Station, Mannuthy, Kerala Agricultural University, Thrissur, located at 10^0 31′ N latitude , 76^0 13′ E longitude and at an altitude of 40.3m above mean sea level, during the *kharif* season of 2006 and 2007. The soil of the experimental site was sandy loam with acidic pH of 5.6, organic carbon content of 0.66% , available N status of 276 kg/ha, available P 19.3 kg/ha and available K 89.6 kg/ha. The experiment was laid out in RBD with seven treatments replicated four times. Plot size was 20 m^2 and the rice variety Remanika was raised. The treatments consisted of Oxyfluorfen 23.5 EC in four rates of applications (100g, 150g,200g and 250 g/ha), Butachlor 50 EC@1250 g/ha, hand weeding and an unweeded check. In the first year of study the crop was transplanted on 05-06-2006 and harvested on 24-09-2006. In the second year the transplantation was done on 26-06-2007 and harvesting on 17-10-2007. In both cases the spraying treatments were imposed on fourth day after transplanting. A high volume spray using knapsack sprayer fitted with flood jet nozzle was used for spraying and the spray fluid was used @ 400 l/ha. In the hand weeding treatment weeds were uprooted at 30 days after transplanting (DAT). The observations on plant height, weed count as well as dry matter production of weeds were

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recorded at 30 and 60 days after transplanting (DAT) from four randomly selected spots of 0.25 m^2 in each plot. Plant height, total tillers per hill, productive tillers per hill, grain yield and straw yield were recorded at harvest.

RESULTS AND DISCUSSION

Weed Flora

The weed flora of the experimental fields included *Echinochloa spp, Cyperus iria, Cyperus difformis, Isachne miliacea, Fimbristylis miliacea, Ludwigia parviflora, Sacciolepis interrupta, Altenanthera sessilis, Monochoria vaginalis* etc.

Effect on weeds

The results indicated that all the herbicide treatments resulted in significant reduction in the weed population and weed dry matter production compared to the unweeded control (Table 1). Weed count as well as drymatter production recorded at 30 and 60days after transplanting (DAT) followed similar trend in both the years of study. Oxyfluorfen @150g/ha or above could effectively control the weeds compared to lower dose and were at par with the hand weeded plot. Oxyfluorfen 100g/ha recorded significantly higher values of weed dry matter production and weed count. However it was significantly superior to the unweeded control. The herbicide oxyfluorfen could effectively control the grasses, sedges and broadleaved weeds and the effectiveness was observed even at 60 DAT as indicated by the low weed dry matter production. Kumar and Gautam (1986) reported that application of Oxyfluorfen @ 0.15 kg gave efficient weed control in direct seeded rice in puddled soil. However Verma *et al.*, (1987) observed that application of oxyfluorfen @ 0.20 kg/ha provided good control of weeds than its lower dose in transplanted rice. Vongasaraj and Prince (1987) concluded that 0.2 kg /ha controlled most weeds in rice except *Monochoria vaginalis.*

Phytotoxicity to rice

Observation on phytotoxicity symptoms like vein clearing, wilting ,leaf tip burning, reduction in plant population etc were also made and it was found that the herbicide was phytotoxic at all the rates of application tried. Oxyfluorfen resulted in yellowing and drying of leaves of rice seedlings and the intensity of phytotoxicity was more at higher doses. However the new leaves emerged were free from any damage and the rice seedlings recovered from the phytotoxicity by 15 days after spraying. Moorthy and Manna (1988) reported that Oxyfluorfen @ 0.1 kg/ha caused phytotoxicity to rice. Pillai *et al* 1983 also reported slight toxicity to rice when Oxyfluorfen was applied @ 0.2 kg/ha six days after transplanting . Singh *et al.*, (1990) reported that oxyfluorfen at rates above 0.5 kg/ha resulted in slight phytotoxicity to the crop during the initial growth period but afterwards the crop recovered. Mukopadhyay and Mandal, (1982) also found that rice seedlings recovered from the phytotoxicity effect of oxyfluorfen within 10 days of application.

Plant height and total number of tillers

The variation in plant height among the various herbicidal treatments was not very conspicuous during the first year of experiment (Table 2). In *kharif* 2007 oxyfluorfen 100g/ha recorded lower values for plant height among the various herbicidal sprays and tallest plants were observed in oxyfluorfen 150g sprayed plots. In 2006, the highest number of total tillers per hill was recorded in hand weeded as well as oxyfloufen 200/ha applied plots which were statistically on par. In 2007, except oxyfluorfen 100g/ha, all other herbicidal sprays recorded statistically comparable values of total tiller number with that of hand weeded control.

Grain and straw yield

The highest grain yield was recorded in hand weeded plot which was comparable with oxyfluorfen 150g/ha and 200g/ha (Table 3). Both the highest and lowest doses of oxyfluorfen recorded lower yields, which were comparable but higher than un-weeded control. The lower yield in 100g/ha oxyfluorfen application might be due to weed competition and in 240g/ha applied plots lower yield might have resulted from the phytotoxicity and resultant shock experienced by the crop during the seedling stage. In *kharif* 2007 also, both hand weeded and oxyfluorfen150g/ha resulted in higher yields which were at par. Oxyfluorfen 150g/ha in turn was at par with oxyfluorfen 200g/ha and butachlor 1250g/ha application. Both lower and higher doses of oxyfluorfen recorded lower yields in 2007 also. In the case of straw yield, hand weeding, butachlor, oxyfluorfen 150g/ha application were at par statistically and were superior to all other treatments in both years.

Azad, *et al.,* (1990) reported that in transplanted rice, oxyfluorfen granules applied @ 0.2 kg/ha controlled all types of weeds from germination stage, gave the lowest dry weight of weeds, highest number of panicles per square meter and the highest yields. Kumar and Gautam (1986) reported that application of oxyfluorfen @ 0.15 kg/ha gave grain yield of 3.96 t/ha in direct seeded rice in puddled soil whereas Jiang *et al.*, (1989) reported higher yield of rice when oxyfluorfen was applied @ 0.1 kg/ha.

The study revealed that oxyfluorfen @150-200 g/ha could effectively control weeds of rice such as grasses, sedges and broadleaved weeds if applied as pre emergence spray four days after transplanting of paddy. As these treatments resulted in the higher grain yields comparable to the hand weeded treatment, it can be concluded that a dose of oxyfluorfen150 g/ha can be recommended for

effective weed control and high returns from paddy cultivation. Even though some phytotoxicity effect was noticed in rice seedlings immediately after application of oxyfluorfen, the seedlings recovered and resulted in higher grain and straw yields at par with hand weeding.

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Table 1: Effect of treatments on weed dry matter production and weed count

Treatments	*Kharif* 2006				*Kharif* 2007			
	Weed count(No.m^{-2}) 30DAT	Weed dry matter(g.m^{-2}) 30DAT	Weed count(No.m^{-2}) 60DAT	Weed dry matter(g.m^{-2}) 60DAT	Weed count(No.m^{-2}) 30DAT	Weed dry matter(g.m^{-2}) 30DAT	Weed count(No.m^{-2}) 60DAT	Weed dry matter(g.m^{-2}) 60DAT
Oxyfluorfen 100g.ha^{-1}	*3.39^{b}(12.5)	2.50^{b}(6.00)	*3.39^{b}(12.5)	2.50^{b}(6.00)	*2.50b(5.25)	2.74b(6.50)	5.93b(34.30)	6.99b(47.85)
Oxyfluorfen 150g.ha^{-1}	1.00^{c}(0.00)	1.10^{c}(0.25)	1.00^{c}(0.00)	1.10^{c}(0.25)	1.72c(2.00)	1.87c(2.50)	1.53c(1.38)	2.54c(5.48)
Oxyfluorfen 200g.ha^{-1}	1.10^{c}(2.50)	1.00^{c}(0.00)	1.10^{c}(2.50)	1.00^{c}(0.00)	1.10d(0.25)	1.00d(0.00)	1.00d(0.00)	1.00d(0.00)
Oxyfluorfen 240g.ha^{-1}	1.00^{c}(0.00)	1.00^{c}(0.00)	1.00^{c}(0.00)	1.00^{c}(0.00)	1.00d(0.00)	1.00d(0.00)	1.00d(0.00)	1.00d(0.00)
Butachlor 1250g.ha^{-1}	3.87^{b}(18.50)	1.37^{c}(1.00)	3.87^{b}(18.50)	1.37^{c}(1.00)	1.93c(2.75)	1.99c(3.00)	3.45c(10.90)	2.88c(7.33)
Hand weeding	1.00^{a}(0.00)	1.00^{c}(0.00)	1.00^{a}(0.00)	1.00^{c}(0.00)	1.00d(0.00)	1.21d(0.50)	1.00d(0.00)	1.35d(0.95)
Unweeded control	6.77^{a}(45.0)	5.66^{a}(33.00)	6.77^{a}(45.0)	5.66^{a}(33.00)	5.08a(25.0)	4.98a(23.75)	12.71a(161.18)	18.49a(341.78)
LSD (0.05)		**1.508**	**1.104**	**2.235**	**0.345**	**0.215**	**0.585**	**0.390**

DAT – Days after transplanting,
** x+1 Transformed values*
*** The values in the parentheses are original values*
In a column, the values followed by same alphabet do not differ significantly in Duncan's Multiple Range Test (DMRT)

Table 2: Effect of oxyfluorfen spray on plant height, total tiller count and productive tiller count of rice

Treatments	*Kharif* 2006			*Kharif* 2007		
	Plant height(cm)	Total tillers/hill	Productive tillers/hill	Plant height(cm)	Total tillers/hill	Productive tillers/hill
Oxyfluorfen 100g.ha^{-1}	90.50^{bc}	11.25^{b}	10.25^{b}	89.00^{b}	11.30^{b}	11.20^{b}
Oxyfluorfen 150g.ha^{-1}	93.50^{bc}	11.30^{b}	11.20^{b}	95.55^{c}	13.25^{c}	11.55^{b}
Oxyfluorfen 200g.ha^{-1}	91.75^{bc}	13.00^{cd}	12.50^{c}	90.75^{bc}	11.75^{bc}	11.50^{b}
Oxyfluorfen 240g.ha^{-1}	94.25^{c}	11.50^{b}	10.60^{b}	92.25^{bc}	12.50^{bc}	10.50^{b}
Butachlor 1250g.ha^{-1}	95.00^{c}	11.75^{bc}	11.20^{b}	91.00^{bc}	13.00^{bc}	11.20^{b}
Hand weeding	89.25^{b}	13.50^{d}	12.25^{c}	93.25^{bc}	13.50^{c}	11.25^{b}
Unweeded control	81.75^{a}	8.50^{a}	7.50^{a}	78.75^{a}	9.00^{a}	8.00^{a}
LSD	**4.51**	**1.37**	**1.21**	**5.72**	**1.85**	**2.01**

In a column, the values followed by same alphabet do not differ significantly in DMRT

Table 3. Effect of treatments on grain and straw yield of rice

Treatments	*Kharif* yield, 2006 (kg.ha^{-1})		*Kharif* yield,2007(kg.ha^{-1})	
	Grain	Straw	Grain	Straw
Oxyfluorfen 100g.ha^{-1}	5750^{c}	5728^{bc}	5282^{c}	6218^{b}
Oxyfluorfen 150g.ha^{-1}	6457^{ab}	5990^{ab}	5999^{ab}	7011^{a}
Oxyfluorfen 200g.ha^{-1}	6510^{ab}	6447^{a}	5911^{b}	6448^{b}
Oxyfluorfen 240g.ha^{-1}	5451^{c}	5193^{c}	4993^{c}	5406^{c}
Butachlor 1250g.ha^{-1}	6387^{a}	6041^{ab}	5866^{b}	7356^{a}
Hand weeding	6963^{b}	5938^{ab}	6371^{a}	7322^{a}
Un weeded control	3554^{a}	3973^{d}	3035^{d}	3214^{d}
LSD	**486.4**	**631.50**	**202.10**	**488.90**

In a column, the values followed by same alphabet do not differ significantly in DMRT