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Effect of tillage practices and pre-emergence herbicides application for weed control in wet-seeded rice

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Abstract : Investigations were carried out for two seasons (July 1998 - November 1998 and June 1999 October 1999) at FIPPAT Agricultural experimental farm, Padappai, to study the efficiency of three pre-emergence herbicides applied under different tillage systems *viz.* conventional tillage, conservation tillage and tillage - fallow (no-till), for controlling the mixed population of weeds in wet-seeded rice. The herbicides *viz.* Pretilachlor 750 g ha^{-1}, Butachlor 1250 g ha^{-1} and Oxadiargyl 100 g ha^{-1} were applied at 4 DAS, compared with hand weeding (twice) and unweeded control. Results revealed that, Oxadiargyl and Pretilachlor application effectively controlled the weeds in both the season. Among different tillage systems, conservation tillage was found effective. Hence, Oxadiargyl 100 g ha^{-1} and Pretilachlor 750 g ha^{-1} applied at 4 DAS under conservation tillage system compared with other tillage systems may therefore be recommended for effective weed control in wet-seeded rice.

Rice is the most important food cereal, grown under direct and transplanting methods. Among this, direct seeded rice under wet condition is less costly than transplanting due to lower requirement of labour and water. In view of this, wet-seeded rice is gaining popularity in most of the rice growing countries including in India. The main disadvantage of wet-seeded rice is high weed infestation, so effective and timely weed control is necessary. Yield loss in wet-seeded rice due to weed competition was estimated to be 30 - 35 per cent (Pillai, 1977). When weeds are controlled properly, grain yield from wet-seeded rice can be increased considerably (Biswas *et al.* 1991). Under ideal conditions and proper weed management, wet-seeded rice can yield on par or even higher than transplanted rice (Venkateshwarlu, 1980). Most of the occasions, adoption of tillage practices drastically reduced weed infestation (Balasubramanian, 1997). Tewari and Singh (1991) reported that the tillage destroyed the top and underground growth of perennials and exposed the tubers of sedges. Apart from this, pre-emergence herbicides application in rice resulted effective control of annual and perennial weeds (Smith and Moody, 1979). Now-a-days, labour for hand weeding is becoming too expensive. It is therefore the greatest interest and necessity to develop new integrated strategies for weed management in wet-seeded rice to ensure sustainable rice production to meet the requirements of the growing population.

Adoption of integrated weed control systems will be a holistic approach to the control of weeds using a range of techniques including choice of cultural methods and chemical inputs. Hence, the present study was designed to investigate the impact of cultural methods in conjunction with the application of pre-emergence herbicides for the control of mixed population of weeds in wet-seeded rice.

Materials and Methods

Field studies were conducted at FIPPAT Agricultural experimental farm, Padappai, during July 1998-November 1998 (Season 1) and June 1999 - October 1999 (Season 11), keeping three replications in a Split-plot design. The soil of the field was sandy loam. Both the field study, tillage practices *viz.* conventional tillage (T_1),

Table 1. The effect of tillage and pre-emergence herbicides on weed density and weed dry weight in wet-seeded rice

Treatment	Total weed density* (No/m²)				Total weed dry weight at harvest (g/m²)	
	20 DAS		At harvest			
	Season I	Season II	Season I	Season II	Season I	Season II
Conventional tillage	21.3 (4.82)	25.0 (5.19)	34.6 (6.04)	44.9 (6.84)	47.6 (7.04)	48.5 (7.10)
Conservation tillage	13.1 (3.88)	16.0 (4.24)	30.2s (5.67)	35.4 (6.11)	38.4 (6.35)	39.9 (6.47)
Tillage-fallow (no-till)	34.6 (6.04)	36.5 (6.20)	5.18 (7.33)	58.6 (7.78)	59.2 (7.82)	61.8 (7.98)
S.Ed	*0.014*	*0.017*	*0.024*	*0.026*	*0.14*	*0.17*
CD. (P=0.05)	*0.037*	*0.042*	*0.067*	*0.072*	*0.38*	*0.46*
Pretilachlor 750 g/ha	8.2 (3.19)	12.6 (3.82)	21.7 (4.86)	26.9 (5.37)	21.7 (4.86)	23.4 (5.03)
Butachlor 1250 g/ha	11.8 (3.71)	14.5 (4.06)	27.3 (5.41)	32.7 (5.89)	30.5 (5.7)	31.9 (5.82)
Oxadiargyl I 00 g/ha	9.1 (3.33)	11.4 (3.66)	20.6 (4.75)	27.2 (5.40)	21.2 (4.81)	23.1 (5.00)
Hand weeding (twice)	0 (1.41)	0 (1.41)	43.6 (6.75)	50.1 (7.21)	37.1 (6.25)	40.3 (6.50)
Unweeded control	48.5 (7-10)	65.7 (8.22)	83.1 (9.22)	92.5 (9.72)	126.7 (11.34)	142.5 (12.02)
S.Ed.	*0.016*	*0.021*	*0.029*	*0.032*	*0.33*	*0.43*
CD. (P=0.05)	*0.032*	*0.042*	*0.076*	*0.082*	*0.68*	*0.86*

Values in paranthesis are log (x+2) transformed values

conservation tillage (T_2) and tillage-fallow (no-till)-(T_3) were imposed prior to the sowing of rice seeds (cv. ADT 36), which was considered as main factor.

The herbicide treatments comprised of Pretilachlor 750 g ha^{-1}, Butachlor 1250 g ha^{-1} and Oxadiargyl 100 g ha^{-1} were compared with hand weeding twice and unweeded control. The above herbicides were sprayed at 4 days after sowing of rice by using hand operated knapsack sprayer fitted with flat fan nozzle using a spray volume of 500 1 ha^{-1}. Fertilizers and irrigations were applied according to recommended package of practices for wet-seeded rice. Observations on weed density were taken at 20 DAS and at harvest. Apart from this, observations on weed dry weight, nutrient removal by weeds and grain yield of rice were also recorded at harvest.

For taking observation on weed density and dry weight, a quadrate (0.25 x 0.25 m) was placed randomly at two places in each plot. For recording weed dry weight, weeds cut at the ground level with sickle were sun dried for three days followed by oven drying at 65±5°C. Data on weed density was subjected to log transformations (log x +2) as suggested by Bartlett (1947) before statistical analysis. All other data were statistically analysed as per the method suggested by Gomez and Gomez (1984).

Results and Discussion

Treatments with Pretilachlor 750 g ha^{-1} and Oxadiargyl 100 g/ha applied at 4 DAS under conservation tillage gave very good control of total weed density *viz.* grasses like *Echinochloa colonum, Echinochloa crusgalli, Cynodon dactylon, Panicum repens* and sedges like *Cyperus rolundus, Cyperus difformis* and broad leaved weeds like *Ludwigia parviflora, Ammania baccifera, Eclipta alba* as well as *Marsilea quadrifolia*. The total density of weeds at all stages of rice crop was lower in conservation tillage compared with conventional tillage and tillage-fallow (no-till)

Table 3. The effect of tillage and pre-emergence herbicides on nutrient removal by weeds in wet-seeded rice

Treatments	Nutrient removal by weeds at harvest (kg ha^{-1})					
	Nitrogen		Phosphorus		Potassium	
	Season I	Season II	Season I	Season II	Season I	Season II
Conventional tillage	8.72	9.34	2.42	2.67	7.26	8.52
Conservation tillage	7.96	9.12	2.33	2.46	6.89	8.37
Tillage-fallow (no-till)	9.34	10.23	2.78	2.94	8.47	9.73
S.Ed.	*0.05*	0.07	*0.02*	*0.03*	*0.03*	*0.05*
C.D. (P=0.05)	*0.14*	*0.20*	*0.06*	*0.08*	*0.08*	*0.14*
Pretilachlor 750 g ha^{-1}	7.23	8.64	1.72	1.90	6.26	7.86
Butacholor 1250 g/ha^{-1}	7.57	8.95	2.03	2.12	6.48	8.14
Oxadiargyl 100 g/ha^{-1}	7.19	8.71	1.76	1.88	6.21	7.93
Hand weeding (twice)	7.53	8.92	2.07	2.15	6.54	8.10
Unweeded control	24.50	27.35	5.93	6.24	19.76	20.32
S.Ed	*0.09*	*0.11*	*0.03*	*0.05*	*0.08*	*0.09*
C.D. (P=0.05)	*0.18*	*0.22*	*0.06*	0.10	*0.15*	*0.18*

Table 4. The effect of tillage and pre-emergence herbicides application on grain yield of wet-seeded rice

Treatments	Rice grain yield (t ha^{-1})	
	Season I	Season II
Conventional tillage	3.95	4.15
Conservation tillage	4.73	4.91
Tillage fallow (no-till)	3.55	3.80
S.Ed.	*0.75*	*0.80*
CD. (P=0.05)	*2.12*	*2.26*
Pretilachlor 750 g/ha	5.11	5.35
Butachlor 1250 g/ha	4.64	4.80
Oxadiargyl 100 g/ha	5.10	5.38
Hand weeding (twice)	4.77	4.85
Unweeded control	1.72	1.97
S.Ed	1.17	*1.21*
CD. (P=0.05)	*2.36*	*2.44*

(Table 1).

The effect was much pronounced in early stage of rice. Klingman *et al.* (1982) reported that, conservation tillage practice followed by pre-emergence herbicide application was very effective for the control of annual and perennial grasses, sedges and broad-leaved weeds in wet-seeded rice.

A consistent reduction in total weed dry weight could possibly attained not only after application of Pretilachlor 750 g ha^{-1} at 4 days after sowing of wet-seeded rice under conservation tillage, but also obtained under the similar condition, after the application of Oxadiargyl 100 g ha^{-1} (Table 2). Both the treatment was on par with each other.

The reduction in density of total weeds observed in Pretilachlor 750 g ha^{-1} and Oxadiargyl 100 g ha^{-1} applied plots under conservation tillage, controlled their dry weight and subsequently curtailed nitrogen, phosphorus and potassium nutrients removal by weeds (Table 3). It was earlier reported by Malik *et al.* (1973).

Rice grain yield data showed that, Pretilachlor and Oxadiargyl applied under conservation tillage system recorded considerable increase in rice grain yield (Table 4).

Next best treatments were hand weeding twice and Butachlor 1250 g ha^{-1}, which recorded higher grain yield than unweeded control.

From the results of this study, it is clear that due to the impact of conservation tillage, the density of weeds after rice sowing was effectively curtailed, which leads to lesser nutrient removal and higher grain yield. This was earlier confirmed by Tewari and Singh (1991) and Balasubramanian (1997). The significant effect of pre-emergence herbicides *viz.* Pretilachlor 750 g ha^{-1} and Oxadiargyl 100 g ha^{-1} at 4 DAS contributed lesser weeds problem after sowing of rice. This finding was in accordance with the results of Smith and Moody (1979). Therefore, in terms of weed control and higher grain yield, application of Pretilachlor 750 g ha^{-1} (or) Oxadiargyl 100 g ha^{-1} at 4 DAS under conservation tillage system might be considered as an effective weed management practice for wet-seeded rice.

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Effect of Iron and Zinc fertilization on yield, quality and their availability in Sugarcane

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Abstract : Field experiments were conducted on plant and its ratoon crop of sugarcane (Co.Si.96071) during 1998-99 and 1999-2000 in a clay loam marginally-saline alkaline soil. The results on cane yield and quality parameters showed that foliar spray of ferrous sulphate (1%)+zinc sulphate (0.5%) at 45 and 90 days after planting along with basal application of pressmud (5t ha^{-1}) increased the cane yield and sugar yield significantly over soil application of $FeSO_4$ and $ZnSO_4$ and control treatments. Application of pressmud enriched with $FeSO_4$ and $ZnSO_4$ increased the cane yield, commercial cane sugar content and sugar yield over soil application of state micro nutrient mixture. Enriched pressmud with micro nutrients also improved the availability of DTPA extractable iron and zinc in soil. *(Key words : Iron and zinc enriched pressmud, foliar spray, cane yield and sugar yield, DTPA extractable micro nutrients)*