Indian Journal of Agronomy **44** (3) : 543–547 (September 1999)

Weed management in transplanted rice (*Oryza sativa*) under Ghaggar flood plains of north-west Rajasthan

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Received: August 1997

ABSTRACT

A field experiment was conducted during the *kharif* seasons of 1994, 1995 and 1996 to work out the relative efficacy of herbicides applied alone or in combination with supplemental hand weeding to control weed in transplanted rice (*Oryza sativa* L.). Pre-emergence application of pendimethalin @ 1.5 kg a. i./ha supplemented with 1 hand weeding at 30 days after transplanting showed the highest weed control efficiency (80.37%) and yield attributes (248.1 effective panicles/m^2, 137.0 filled grains/ panicle and 29.64 g 1000-grain weight) as well as grain (72.64 q/ha) and straw (88.13 q/ha) yields of rice with maximum additional net return (Rs 4,056). However, butachlor and benthiocarb proved on par with pendimethalin when applied alone. Though 2 hand weedings treatment significantly reduced the weed biomass and improved the grain yield, owing to higher labour cost reduced the benefit : cost ratio.

Key words : Rice, Weed management

Weeds are real menace in Ghaggar flood plains of north-west Rajasthan in rice (*Oryza sativa* L.). Problem of weeds has become aggravated due to introduction of fertilizer responsive high yielding dwarf and semi-dwarf varieties coupled with intensive cultural prastices. Further the standard rice-wheat rotation followed over last many decades has added to weed infestation problems in Ghaggar flood plains. Immediately after transplanting, the field dries up and as a consequence of alternate drying and wetting an aggressive flush of both terrestrial and aquatic weeds come up in the early stage of crop growth.

The type of weed flora under Ghaggar flood plains is so variable and intensive that it may not be possible to control them by hand weeding or use of any herbicide alone. However, it seems possible that weeds grown at early stages can be reduced to a minimum by pre-emergence application of herbicide and removal of late emerged weeds by supplemental hand weeding. Keeping in view the situation, the present experiment was planned and conducted

MATERIALS AND METHODS

A field experiment was conducted during *kharif* seasons of 1994, 1995 and 1996 in

Table 1. Effect of weed-control measures on weed intensity, dry matter of weeds weed control efficiency and yield attributing characters of rice (pooled over 3 years)

Weed control measures	Weed intensity at 90 DAT (weeds/m^2)	Dry matter of weeds at 90 DAT (g/m^2) Pooled	Weed control efficiency (%)	Effective panicles/m^2	Filled grains/ panicle	1,000-grain weight (g)
Control (unweeded check)	38.16	72.87		166.3	80.4	27.23
1 hand weeding at 30 DAT	24.55	71.89	58.40	196.4	85.3	28.55
2 hand weedings at 30 and 60 DAT	21.65	45.22	73.85	221.8	132.4	28.62
Butachlor 1.5 kg a. i./ha	24.66	72.22	56.47	203.4	125.7	28.56
Butachlor 1.5 kg a. i./ha + 1 hand weeding	21.14	42.89	75.21	224.9	134.1	28.60
Benthiocarb 1.5 kg a. i./ha	24.33	57.22	66.57	207.9	127.4	28.70
Benthiocarb 1.5 kg a. i./ha + 1 hand weeding	22.11	46.22	65.44	221.8	131.4	29.01
Pendimethalin 1.5 kg a. i./ha	22.55	43.78	74.69	220.9	130.2	28.90
Pendimethalin 1.5 kg a. i./ha + 1 hand weeding	17.88	33.77	80.37	248.1	137.0	29.64
CD (P = 0.05)	3.86	7.67		7.02	4.63	NS

DAT = Days after transplanting, NS = Not significant

Hanumangarh, under Ghaggar flood plains of north-west Rajasthan. The soil of the experimental field was clay loam in texture having pH 7.6, organic carbon 0.24%, available P_2O_5 27.50 kg/ha, and K_2O 471.0 kg/ha with EC 0.13 dS/m. The treatments comprised 9 weed control measures, viz. (i) 1 hand weeding at 30 DAT (days after transplanting), (ii) 2 hand weedings at 30 and 60 DAT, (iii) butachlor 1.5 kg a.i./ha, (iv) butachlor 1.5 kg a. i./ha + 1 hand weeding at 30 DAT, (v) benthiocarb 1.5 kg a. i./ha (vi) benthiocarb 1.5 kg a. i./ha + 1 hand weeding at 30 DAT, (vii) pendimethalin 1.5 kg a. i./ha, (viii) pendimethalin 1.5 kg a. i./ha + 1 hand weeding at 30 DAT, and (ix) weed check. The weed control measures were tested in the randomized block design with 3 replications. Half dose of nitrogen (60 kg N/ha) and full dose of phosphorus (60 kg P_2O_5/ha) was applied as basal and remaining half of nitrogen (60 kg/ha) was applied at active tillering stage. Seedlings of 30 days age of rice 'Jaya' were transplanted at 20 × 15 cm spacing. Herbicides were sprayed 2 to 3 days after transplanting. Weeds control efficiency (WCE) was calculated by the formula : WCE (%) = [(DWU-DWT)]/DWT} × 100. Where DWU means dry matter weight of weeds in weedy check and DWT means dry matter weight of weeds in treatment plot.

RESULTS AND DISCUSSION

Weed flora

Monocot weeds (grasses and sedges) were dominant than dicot. Weeds *sanvak* (*Echinochloa cruss-galli* L.) and wild rice (*Oryza sativa* var. *fatua*) were the prominent weeds and others were *Panicum repens*, *Dactyloctinum aegyptium* L., *Setaria glauca* L., *Eclipta alba* L. and *Cyperus rotundus*. Besides these, presence of hydrophytes such as *Salvina* spp., *Hydrilla* spp. and *Sagitaria saggitafolia* L. were observed in the experimental field.

Table 2. Effect of weed control measures on grain and straw yields

Weed control measures	Grain yield (q/ha)				Straw yield (q/ha)			
	1994	1995	1996	Pooled	1994	1995	1996	Pooled
Control (unweeded check)	58.00	57.16	57.00	57.38	70.30	69.78	69.55	69.88
1 hand weeding at 30 DAT	65.31	66.00	61.63	64.31	79.16	80.52	75.20	78.29
2 hand weedings at 30 and 60 DAT	69.40	69.90	64.67	67.99	83.63	85.28	78.80	82.57
Butachlor @ 1.5 kg a.i./ha	66.31	66.33	62.80	65.15	80.92	76.62	79.30	
Butachlor @ 1.5 kg a.i./ha + 1 hand weeding	67.03	66.50	67.60	67.04	82.06	82.75	80.03	81.61
Pendimethalin @ 1.5 kg a.i./ha	66.03	65.93	68.83	66.93	80.00	80.43	83.97	81.47
Pendimethalin@ 1.5 kg a.i./ha + 1 hand weeding	73.76	71.76	72.40	72.64	88.50	87.55	88.33	86.12
CD (P = 0.05)	4.99	4.49	3.44	4.09	6.06	5.50	4.25	5.00

Table 3. Economics of weed-control measures included in the experiment (mean data of 3 years)

Weed control measures	Response to additional produce (q/ha)		Cost of additional produce (Rs/ha)	Cost of treatment (Rs/ha)	Additional net return (Rs/ha)	Benefit : cost ratio
	Grain	Straw				
Control (unweeded check)	6.93	8.41	2,593	1,000	1,593	2.59
1 hand weeding at 30 DAT	10.61	12.69	3,967	2,000	1,967	1.98
2 hand weedings at 30 and 60 DAT	7.77	9.42	2,908	1,050	1,858	2.78
Butachlor @ 1.5 kg a.i./ha	9.66	11.72	3,615	2,050	1,565	1.76
Butachlor @ 1.5 kg a.i./ha	8.09	9.81	3,028	1,050	1,978	2.88
Butachlor @ 1.5 kg a.i./ha + 1 hand weeding	9.66	11.73	3,616	2,050	1,566	1.76
Pendimethalin @ 1.5 kg a.i./ha	9.55	11.59	3,574	1,250	2,324	2.86
Pendimethalin @ 1.5 kg a.i./ha + 1 hand weeding	15.26	18.25	5,706	2,050	3,556	2.78

Effect on weeds

Different weed control measures significantly influenced the weed intensity and weed dry matter during all the 3 years of study (1994 to 1996). Wide spectrum of weeds reduced by pre-emergence application of pendimethalin @ 1.5 kg a. i./ha at early growth stages and removal of late emerged weeds by supplimental hand weeding at 30 DAT reduced the weed biomass significantly (Table 1) and recorded the lowest dry weight of weeds (33.77 g/m^2) and the highest weed control efficiency (80.37%). Veerabadran *et al.* (1994) and Balsubramanian and Veerabadran (1998) also recorded higher weed control efficiency with benthiocarb, butachlor and pendimethalin (62.3-73.4%) in rice.

Though all the 3 pre-emergence herbicides used in the experiment significantly reduced the weed flora against weedy check, pendimethalin found particularly effective against predominant weeds like *sanvak* and wild rice, thus outyielded other herbicides butachlor and benthiocarb applied all (Table 1). Angaris and Sharma (1998), Kehinde (1998) and Kulmi (1991) also recorded significant reduction of weed flora with benthiocarb or pendimethalin over control.

Effect on yield attributes

All the weed control treatments significantly increased the effective tillers filled grains but the increase not found significant over control, i.e. unweeded check (Table 1). All the weed control methods tried recorded higher 1,000-grain weight (Table 1). Pre-emergence application of 3 herbicides, viz. benthiocarb, butachlor and pendimethalin, each @ 1.5 kg a. i./ha applied all or in combination with 1 hand weeding at 30 DAT recorded significantly higher yields as compared to unweeded check due to higher yield contributing characteRs Kulmi (1991) also

recorded higher yield of direct seeded rice with benthiocarb or butachlor or pendimethalin over control. Moreover pendimethalin has better efficacy against weeds specially at early growth stages against prominent and predominant weeds *sanvak* and wild rice. Hand weeding treatments all or in combination with herbicides, though improved grain and straw yield, yet owing to higher labour cost reduced the net return and benefit : cost ratio (Table 3).

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