

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

S. K. SHARMA AND S. R. BHUNIA

Agricultural Research Station, Rajasthan Agricultural University, Sriganaganagar 335 001

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 weeds in transplanted rice (*Oryza sativa* L.) under Ghaggar flood plains of north-west Rajasthan. Pre-emergence application of pendimethalin @ 1.5 kg a.i./ha supplemented with one hand weeding at 30 days after transplanting showed the highest weed control efficiency (80.37%) and yield attributes 248.1 (effective panicles/m², 137.0 filled grains/panicle and 29.64 g 1000-grain weight as well as grain (72.64 q/ha) and straw (8813 q/ha) yields of rice with maximum additional net return (Rs. 4056). However, butachlor and benthocarb proved at par with pendimethalin when applied alone. Two hand weeding treatments though significantly reduced the weed biomass and improved the grain yield, yet owing to higher labour cost reduced the benefit-cost ratio.

Key words: Weed management, Transplanted rice

Weeds are real menace in Ghaggar flood plains of north-west Rajasthan in rice (*Oryza sativa* L.). This problem of weeds has become aggravated due to introduction of fertilizer responsive high yielding dwarf and semidwarf varieties coupled with intensive cultural practices. Further, the rice-wheat rotation followed over last many decades has added to weed infestation problem 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

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 0.13ds/m. The treatment comprised 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) Benthicarb 1.5 kg a.i./ha, (vi) Benthicarb 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. The weed control measures were tested against, (ix) Weedy check in the randomised block design with 3 replications. Half dose of nitrogen (60 kg/ha) and full dose of phosphorus (60 kg/ha) was applied as basal and remaining half of nitrogen (60 kg/ha) was applied at active tillering stage. No potassium was applied to the crop as soil was highly rich in potassium. Thirty days old rice variety "Jaya" were transplanted at 20×15 cm spacing. Herbicides were sprayed 2 to 3 days after transplanting. Weeds were collected from an area of $1 m^2$ and their dry weight was taken. Weed control efficiency (WCE) was calculated by the formula : $WCE (\%) = \{(DWU - DWT) / DWT\} \times 100$. Where, DWU means dry matter weight of weeds in weedy check and DWT means dry matter weight of weeds in treatments.

RESULTS AND DISCUSSION

Weed flora

Monocot weeds (grasses and sedges) were dominant than dicot. Weeds sanvak (*Echinochloa crus-galli* L.) and wild rice (*Oryza sativa* var. *fatua*) were the prominent weeds and others were *Panicum repens*,

Dactyloctenium aegyptium L., *Setaria glauca* L., *Eclipta alba* L. and *Cyperus rotundus*. Besides these, presence of hydrophytes such as *Salvinia* spp., *Hydrilla* spp. and *Sagittaria saggitifolia* L. were observed in the experimental field.

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 supplemental hand weeding at 30 DAT reduced the weed bio-mass significantly (Table 1) and recorded the lowest dry weight of weeds ($33.77 g/m^2$) and the highest weed control efficiency (80.37%). Balsubramanian and Veerabadrin (1998) also recorded higher weed control efficiency with benthicarb, 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 was found particularly effective against predominant weeds like sanvak and wild rice, thus outyielding other herbicides butachlor and benthicarb applied alone (Table 1). Angaris and Sharma (1998), and Kehinde (1998) also recorded significant reduction of weed flora with benthicarb or pendimethalin over control.

Effect on yield attributes

All the weed control treatments significantly increased the effective tillers and filled grains, though were not found significant over control i.e., unweeded check (Table 1). All the weed control methods tried recorded higher 1000-grain weight over con-

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

Weed control	Weed intensity at 90 DAT (numbers of weeds/m ²)	Dry matter of weeds at 90 DAT (g/m ²)	Weed control efficiency (%)	Effective panicle/ m ²	Filled grains/ panicle	1000-grain weight (g)
Control (unweeded check)	38.16	172.87	—	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 weeding at 30 & 60	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

Table 2. Effect of weed-control measures on grain and straw yields and economics (data pooled over the years)

Weed control	Grain yield (q/ha)	Straw yield (q/ha)	Price of additional produce (Rs/ha)	Cost of treatment (Rs/ha)	Additional net return (Rs/ha)	Benefit : cost ratio (B : C)
Control (unweeded check)	57.38	69.88	—	—	—	—
1 hand weeding at 30 DAT	64.31	78.29	2593	1000	1593	2.59
2 hand weeding at 30 and 60 DAT	67.99	82.57	3967	2000	1967	1.98
Butachlor @ 1.5 kg a.i./ha	65.15	79.30	2908	1050	1858	2.78
Butachlor @ 1.5 kg a.i./ha + 1 hand weeding	67.04	81.60	3615	2050	1565	1.76
Benthiocarb @ 1.5 kg a.i./ha	65.47	79.69	3028	1050	1978	2.88
Banthiocarb @ 1.5 kg a.i./ha + 1 weeding	67.04	81.61	3616	2050	1566	1.76
Pendimethalin @ 1.5 kg	66.93	81.47	3574	1250	2324	2.86
Pendimethalin @ 1.5 kg a.i./ha + 1 hand weeding	72.64	86.13	5706	2050	3556	2.78

trol, though pendimethalin supplemented with 1 hand weeding recorded significantly higher filled grains (130.20/panicle) and effective tillers (220.90/m²) over all other treatments. The superior performance of pendimethalin could be attributed to the reduced weed crop competition in the initial stages which helped higher effective tillers, filled grains and 1000-grain weight. Even, pendimethalin alone gave at par yield contributing characters in comparison to benthicarb or butachlor supplemented with 1 hand weeding at 30 DAT, as pendimethalin was very effective against the predominant weeds sanvak and wild rice.

Effect on yield and economics

Among different weed control measures, pre-emergence application of pendimethalin supplemented with one hand weeding at 30 DAT recorded maximum grain (72.64 q/ha) and straw (86.13 q/ha) yields (Table 2) with higher net returns of Rs. 3556 (Table 2), owing to higher number of tillers per panicle, grains per panicle and 1000-grain weight. Pre-emergence application of 3 herbicides viz., benthicarb, butachlor and pendimethalin each @ 1.5 kg a.i./ha applied alone or in combination with one hand weeding at 30 DAT recorded significantly higher yields as compared to unweeded check due to higher yield contributing characters.

Moderate performance of benthicarb and butachlor vis-a-vis pendimethalin in controlling weeds was due to higher levels of variable weed infestation under Ghaggar flood plains indicating the suitability of these herbicides for lower level of weed infestation only. Pradhan and Choudhary (1989) also reported significantly higher yield of direct seeded rice with benthicarb 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 treatment alone or in combination with herbicides, though improved grain and straw yields, yet owing to higher labour cost reduced the net return and benefit : cost ratio (Table 2).

REFERENCES

- Angaris, N.N. and Sharma, V.K. 1998. Effect of seed rates, interculture and weed control methods to manage weeds in direct-seeded upland rice (*Oryza sativa*). *Indian Journal of Agronomy* 43 (3) : 431-436.
- Balasubramanian, R. and Veerabadran, V. 1998. Herbicidal weed management in lowland rice (*Oryza sativa*) nursery. *Indian Journal of Agronomy* 43 (3) : 437-440.
- Khinde, J.K. 1998. Pre-emergence control of weeds in upland rice. *International Rice Communication Newsletter* 37 : 31-32.