Indian Journal of Agronomy **51** (2) : 93–96 (June 2006)

Effect of integrated weed-management practices on growth and yield of wet-seeded rice (*Oryza sativa*) and their residual effect on succeeding pulse crop

E. SUBRAMANIAN, G. JAMES MARTIN AND R. BALASUBRAMANIAN

Department of Agronomy, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore 641 003

Received : March 2005

ABSTRACT

A field experiment was conducted at Agricultural College and Research Institute, Madurai during winter (*rabi*) seasons of 1998–99 and 1999–2000, to study the effect of integrated weed-management practices on weed control and yield of wet-seeded rice. Glyphosate (1.5 kg a.i./ha) was applied at pre-sowing stage alone or in combination with pre-emergence application of pretilachlor +Safener (0.4 kg a.i./ha) and early post-emergence application of butanil (3 litres/ha) along with manual weeding. It was compared with weed-free check and unweeded control. All the weed-management practices significantly reduced the weed density of grasses, sedges and broad-leaf weeds, resulting in their reduced dry weight. Pre-sowing application of glyphosate (1.5 kg a.i./ha) effectively reduced the sedges, when combined with pre-emergence application of pretilachlor + Safner (0.4 a.i./ha) followed by two hand-weedings at 25 and 45 days after sowing. These recorded lesser weed density, dry weight and higher weed-control efficiency, resulting in higher grain yield (58.73 q/ha). Bioassay showed no residual effect of the herbicides applied to rice (*Oryza sativa* L.) on the stand of succeeding crop of blackgram [*Phaseolus mungo* (L.) Wilczek].

Key words : Wet-seeded rice, Weed management, Herbicide, Growth characters, Yield

Wet-seeded rice (*Oryza sativa*) is gaining momentum in India due to high demand of labour during peak season of transplanting and availability of water for short periods. The transformation in crop-establishment technique from transplanted to wet-seeded rice cultivation has resulted in dramatic change in the type and degree of weed infestation. Weed menace is maximum in wet-seeded rice because of similarity in morphological characters of weeds and rice. Weed management is a very critical factor for successful production of wet-seeded rice, because the soil conditions favour simultaneous germination of weed seeds along with rice seeds (James Martin, 1998). It is difficult to control weeds by hand-weeding in the early stage of crop growth. Uncontrolled weed growth causes 9 per cent greater reduction in grain yield in wet-seeded rice than in transplanted rice (Moody, 1993). Though the conventional method of manual weeding is widely practised, herbicides are more efficient in timely control of weeds in wet-seeded rice. Chemical weeding preferably the use of pre-emergence herbicide is vital for effective and cost-efficient weed control in such situations, where weeds compete with the main crop right since the date of germination. Integration of chemical and manual weeding becomes essential for effective management of weeds to get good yield. Therefore pre-emergence and new post-emergence herbicides were tested alone and in combination with manual weeding to develop an effective and viable weed-management practice for wet-seeded rice.

MATERIALS AND METHODS

A field experiment was conducted during winter seasons (*rabi*) of 1998-2000 at Agricultural College and Research Institute, Madurai. The soil was sandy clay-loam, with pH 7.8 and organic carbon 0.32%. The fertility status of the soil was low, medium and high in the available N, P_2O_5 and K_2O respectively. Sprouted seeds of rice 'ADT 36' were sown @ 80 kg/ha on 25 November 1998 and 18 November 1999 by using drum seeder to maintain a row spacing of 20 cm in puddled soil. The total length of the drum seeder is 1.6 m and eight rows could be sown in single run. Recommended level of N, P and K @ 120, 38 and 38 kg/ha was followed. Nitrogen was applied in four equal splits (20 days after sowing, and active-tillering, panicle-initiation and flowering stages). Single basal dose of P and K was applied along with N in four equal splits. There were 12 treatments in randomised block design with three replications. The treatment included glyphosate (1.5 kg a.i./ha) alone and in combination with pretilachlor

+ Safener (0.4 kg a.i./ha) or butanil (3 litres/ha) followed by one or two hand-weedings at 25 and 45 days after sowing (DAS), along with weed-free check and unweeded control.

Glyphosate was applied 20 days before field preparation, whereas pretilachlor and butanil were applied at 3 and 8 DAS respectively. Observations on weed flora, weed density and dry weight were recorded and the weed control efficiency was worked out. Weed samples were taken in each plot at four randomly selected spots, using a quadrant of 0.25 m^2 area. These were oven-dried at 70°C for 48 hr and their dry weight was recorded. Data on weed density and dry weight showed high variation and hence these were subjected to logarithmic transformation of log (x + 2) before analysis. The data on crop-growth parameters and yield were also recorded. After the harvest of rice, blackgram (*Phaseolus mungo*) was sown to study the residual effect of the herbicide. Germination percentage and weed density were recorded. As the trend of data was similar in both the years, pooled data are presented.

RESULTS AND DISCUSSION

Weed flora

Weed flora of the experimental field was composite in nature, consisting of grasses such as *Echinochloa colonum* L., *E. crus-galli* L. and *Cynodon dactylon* L.; sedges such as *Cyperus rotundus* L,. *C. difformis* L. and *C. iria* L.; broad-leaf weeds such as *Eclipta alba* L. *Ammania baccifera* L., *Phyllanthus niruri* L. and *Ludwigia parviflora.*

Effect on weeds

All the weed-control treatments significantly reduced the weed density and dry weight of weeds. Pre-sowing application of glyphosate effectively checked the pre-seasonal weed growth, especially sedges in the rice fields. De Datta (1977) also reported that good weed control in rice was achieved by pre-plant application of glyphosate. The weed density and dry weight were minimum in the plots treated with glyphosate than in their control plots (Table 1). Our finding is in accordance with those of Mehta (1991) and Sankaran *et al.* (1993). The combined effect of glyphosate (1.5 kg a.i./ha) + pretilachlor with Safener (0.4 kg a.i./ha) followed by two hand-weedings (25 and 45 DAS) gave effective weed control with greater reduction in the density of grasses, sedges and broad-leaf weeds than glyphosate combined with early post-emergence application of butanil followed by two hand-

Table 1. Effect of weed-management practices on weed density, dry weight and weed-control efficiency on wet-seeded rice

Treatment	Weed density (No./m^2)				Dry weight of weeds	WCE (%)
	Grasses	Sedges	BLW	Total		
Glyphosate + pretilachlor + HW (25 DAS)	23.0 (1.40)	10.9 (1.11)	18.5 (1.31)	52.4 (1.74)	41.4 (1.64)	84.0
Glyphosate + butanil + HW (25 DAS)	26.5 (1.46)	11.5 (1.14)	23.2 (1.40)	61.2 (1.80)	45.7 (1.68)	81.3
Glyphosate + pretilachlor + 2 HW (25 & 45 DAS)	7.6 (0.98)	3.8 (0.77)	6.2 (0.91)	17.6 (1.30)	13.8 (1.20)	94.6
Glyphosate + butanil + 2 HW (25 & 45 DAS)	13.8 (1.59)	5.8 (0.89)	9.5 (1.06)	29.0 (1.50)	22.6 (1.39)	91.1
Pretilachlor + HW (25 DAS)	24.1 (1.42)	19.9 (1.34)	19.5 (1.33)	63.4 (1.82)	50.7 (1.72)	80.6
Butanil + HW (25 DAS)	29.3 (1.50)	21.9 (1.38)	22.7 (1.39)	73.9 (1.88)	55.3 (1.76)	77.4
Pretilachlor + 2 HW (25 & 45 DAS)	12.7 (1.17)	8.9 (1.04)	8.2 (0.99)	29.7 (1.51)	23.1 (1.40)	90.9
Butanil + 2 HW (25 & 45 DAS)	16.3 (1.26)	10.2 (1.09)	10.1 (1.08)	36.5 (1.59)	28.7 (1.49)	88.7
Glyphosate + HW (25 DAS)	30.5 (1.52)	17.2 (1.29)	30.1 (1.51)	77.8 (1.90)	59.3 (1.80)	76.1
Glyphosate + 2 HW (25 & 45 DAS)	15.6 (1.25)	9.9 (1.08)	12.2 (1.16)	37.7 (1.60)	30.1 (1.51)	88.5
Weed-free check	7.9 (0.99)	3.7 (0.76)	5.9 (0.90)	17.5 (1.29)	13.1 (1.18)	94.7
Unweeded control	129.6 (2.12)	80.1 (1.92)	172.2 (2.08)	326.9 (2.52)	258.9 (2.42)	
CD (P=0.05)	0.05	0.06	0.07	0.02	0.03	

Figures in parentheses are log (x + 2)–transformed values. HW, Hand-weeding, BLW, broad-leaf weeds; WCE, weed-control efficiency

Table 2. Effect of weed control on growth and yield of wet-seeded rice and their residual effect on succeeding pulse crop

Treatment	Wet-seeded rice					Blackgram				
	Plant height	Leaf-area index	Panicles/ m^2	Grain yield (q/ha)	Straw yield (q/ha)	Germination (%)	Weed density (No./m^2) Grasses	Sedges	BLW	Total
Glyphosate + pretilachlor + HW (25 DAS)	93.7	4.50	305	45.79	71.06	89.5	10.6	6.5	12.9	29.9
Glyphosate + butanil + HW (25 DAS)	93.2	4.46	297	43.85	67.88	87.1	11.1	7.8	15.0	33.8
Glyphosate + pretilachlor + 2 HW (25, 45 DAS)	98.5	4.72	362	58.73	82.40	88.2	12.5	5.0	13.2	30.6
Glyphosate + butanil + 2 HW (25, 45 DAS)	96.5	4.65	327	51.93	77.54	88.0	15.5	7.4	12.0	34.9
Pretilachlor + HW (25 DAS)	92.6	4.46	291	43.06	67.51	88.0	12.0	13.3	12.2	37.4
Butanil + HW (25 DAS)	92.3	4.40	284	41.55	64.90	86.7	10.2	14.7	15.0	39.9
Pretilachlor + 2 HW (25, 45 DAS)	96.9	4.69	341	52.73	79.70	89.0	12.6	13.8	13.9	40.2
Butanil + 2 HW (25, 45 DAS)	95.7	4.62	319	50.63	76.00	87..2	14.5	13.7	12.1	40.3
Glyphosate + HW (25 DAS)	89.7	4.41	287	38.80	59.04	87.0	10.3	10.0	12.5	32.8
Glyphosate + 2 HW (25, 45 DAS)	95.3	4.66	316	49.33	73.73	87.3	13.5	7.0	12.4	32.9
Weed-free check	98.9	4.74	367	59.38	87.84	88.5	11.7	15.3	15.3	42.2
Unweeded control	83.7	4.31	219	28.98	50.82	86.5	21.8	22.3	16.2	60.2
CD (P=0.05)	1.2	0.05	10	1.29	2.42	NS	2.8	2.8	NS	4.0

BLW, Broad-leaf weeds; HW, hand-weeding; DAS, days after sowing

weedings.

The highest weed-control efficiency (WCE) was achieved by the application of glyphosate + pretilachlor with Safener along with two manual weedings, which was comparable with weed-free check. This could be attributed to greater reduction of dry weight of weeds by the combined effect of herbicides and hand-weeding. Performance of early post emergence application of butanil on weed management ranked next to the pre-emergence application of pretilachlor with Safener.

Effect on crop growth and yield

The weed-management practices adopted in wet-seeded rice improved the growth parameters and yield by eliminating weed competition. The pre-season application of glyphoste+pretilachlor with Safener followed by two manual weedings recorded taller plant height and larger leaf area (Table 2). It was significantly on a par with that of weed-free check of three manual weedings. This finding is in agreement with that of Mabbayad and Moody (1992), who reported that the plant height was improved by the application of pretilachlor with Safener.

Among the weed-management practices, glyphosate + pretilachlor with Safener followed by two manual weedings significantly increased the number of productive tillers than the other weed-control treatments (Table 2). These weed-management practices recorded significantly higher grain yield and gave 50.7% additional grain yield compared with the unweeded check. This was achieved by better control of all the categories of weeds from pre-seasonal period to crop-weed competition period by combining herbicide and manual weeding. These results indicate that the pre-season application of glyphosate was effective in checking the weeds especially sedges; and when integrated with preemergence application of pretilalchlor with Safener followed by two manual weedings it registered higher grain and straw yields and was comparable with weed-free check.

Residual effect of herbicide

Germination percentage of blackgram was not affected by the weed-management practices (Table 2). Pre-season application of glyphosate, pre-emergence application of pretilachlor with Safener and early post-emergence application of butanil in rice did not afffect the germination of the succeeding crop of blackgram. It confirms the report of Chandra and Singh (1994) who reported that glyphosate showed no residual effect on any of the pulse crops. Weed density showed a significant difference due to various weed-management practices imposed to rice compared with the unweeded check. This might be due to higher weed density in unweeded check in the previous crop of rice. The weed density of sedges was minimum in the plots treated with glyphosate than in those of control plot, because of effective control of sedges by glyphosate in the rice field and thereby reduction in their regeneration capacity in the succeeding blackgram. However, much difference was not noticed among the weed-management practices.

REFERENCES

Chandra, S. and Singh, C.M. 1994. Residual effect of herbicides. (In): *VI Biennial Conference, Indian Society of Weed Science*, 141 pp.

De Datta, S.K. 1997. Approaches in the control and management of perennial weeds in rice. (In): *Proceedings of 6th Asian Pacific Weed Science Conference,* held at Jakarta, Indonesia, pp. 204–226.

James Martin, G. 1998. Management practices for wet seeded rice. *Short training courses on Recent Advances in Rice Production Technology,* 3–28 August 1998, TNAU, Coimbatore.

Mabbayad, M.O. and Moody, K. 1992. Herbicide seed treatment for weed control in wet seeded rice. *Tropical Pest Management* **38** : 9–12.

Mehta, H.M. 1991. Weed management in rice. *Indian Journal of Weed Science* **23**: 96–97.

Moody, K. 1993. Weed control in wet seeded rice. *Experimental Agriculture* **29**: 393–403.

Sankaran, S., Jayakumar, R. and Kempuchetty, N. 1993. *Herbicide Residues,* pp. 72–74. Gandhi Book House, Coimbatore.