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Effect of weed management in rice (*Oryza sativa*) and its carryover effect on succeeding blackgram (*Phaseolus mungo*) crop

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ABSTRACT

An experiment was conducted during *rabi* and summer seasons of 1993-95 to study the direct and carryover effect of herbicides in rice (*Oryza sativa* L.)-blackgram (*Phaseolus mungo* L.) cropping sequence. Two pre-transplanting spray of glyphosate (1.5 kg ai/ha at each spray) with oxyflourfen (pre-emergence) 0.1 ai/ha + handweeding (40 DAT) being statistically on par with two pre-transplant spray of glyphosate 1.5 ai/ha + oxyfluorfen (pre-emergence) 0.1 ai/ha + 2,4-D sodium salt 0.75 ai/ha post-emergence (21 DAT) and 2 pre-transplanting of spray of glyphosate + 2 handweedings (20 and 40 DAT) proved significantly superior to any of these 3 treatments without glyphosate in reducing weed population and their dry weight, thus resulting in highest rice grain yield (5.6 t/ha). Carryover effect of rice herbicides on the succeeding blackgram was not significant in controlling grass and broad-leaved weeds. However, sedge population in blackgram under glyphosate was significantly lower resulting in lesser weed dry weight than that of no glyphosate and gave significantly higher blackgram seed yield (10.1 t/ha).

Key words : Weed management, Rice, Carryover effect, Blackgram

In Tamil Nadu, rice is grown in 2.7 m ha with productivity of 3.1 t/ha. In the Cauvery delta of Tamil Nadu State, a major rice growing area, rice during the rainy season (October-January) followed by a pulse (mostly blackgram) during summer season (January-April) is the prevalent cropping sequence. Blackgram after rice is grown as a catch crop without any additional input with the available soil moisture. Yield loss in rice crop due to weeds ranged from 10 to 50% (Singh and Singh, 1993). Farmers though adopt weed management in rice they seldom carry out for succeeding blackgram crop resulting in severe weed competition and low blackgram seed yield. Inadequate weed management causes 70-80% yield reduction in pulses. The information in weed control in rice is available but the knowledge regarding its carryover effect in succeeding pulse crop is lacking. Hence the present investigation was undertaken.

MATERIALS AND METHODS

The field trials were conducted at experimental farm, Faculty of Agriculture, Annamalai University on clay soil during *rabi* (rainy) seasons of 1993 and 1994 and summer seasons of 1994 and 1995 in randomized block design with 4 replications. Treatments comprised weedy check, oxyfluorfen 0.1 ai/ha + handweeding (40 DAT), oxyflourfen 0.1 ai/ha + 2, 4-D sodium salt 0.75 ai/ha and two handweedings (20 DAT and 40 DAT) each treatment in integration with glyphosate spray, thus constituting 8 weed control methods (Table 1). All the 8 treatments were applied to first crop rice and their carryover effect was observed in succeeding crop blackgram. Oxyfluorfen was applied as pre-emergence (pre) at 3 DAT and 2, 4-D sodium salt as post- emergence (post) at 21 DAT. Glyphosate was sprayed at 1.5 ai/ha as per treatment schedule, on 2 March 1993 followed by a ploughing on 20 March 1993; another spray was given on 17 September 1993 and the field was prepared on 1 October 1993 for the first sequence experiment. Accordingly for the second sequence, first spray was done on 3 August 1994 followed by a ploughing on 19 August 1994 and the final dose on 18 September 1994 for the field preparation on 3 October 1994. For spraying of herbicides, water 600 litres/ha was used. Rice 'ADT 38' was planted on 2 October 1993 and 5 October 1994 in the first and second sequences respectively. Rice crop was harvested on 9 January 1994 and 16 January 1995 in the first and second sequences respectively. Blackgarm 'ADT 3' was line sown in the available soil moisture on 10 January 1994 and 17 January 1995 respectively, in the first and second sequence experiments. The package of practices as recommended by the University was followed for raising the rice crop except weed control treatments. Blackgram crop was raised as a residual crop without any additional resource.

Weed population (number/m^2) were recorded at 50 and 60 days respectively for rice and blackgram and subjected to square root transformation using $\sqrt{x+0.5}$ for statistical analysis. The dry weed biomass at harvest, grain yield of rice and blackgram seed yield was recorded. Weed control efficiency was also calculated.

RESULTS AND DISCUSSION

Weed flora

Weed flora of the experimental field consisted *Echinocloa colonum* (13.3%), *Leptochloa chinensis* (3.4%) and *Cynodon dactylon* (16.7%) among grasses; *cyperus rotundus* (30.5%), *cyperus difformis* (80.5%) and *Fimbristilis littoralis* (3.5%) among sedges; and *Cleome viscosa* (4.6%), *Ammania baccifera* (5.7%), *Croton sparsiflorus* (6.3%) and *Chrozophora rottleri* (8.1%) among broad-leaves weeds. The intensity of *Cyperus rotundus* was higher than that of other weeds.

Effect on weeds in rice

Oxyfluorfen (3 DAT) + handweeding (40 DAT) with and without glyphosate and oxyfluorfen + 2, 4-D sodium salt (21 DAT) with glyphosate being statistically on par, decreased the grass population significantly over 2 handweedings (20 and 40 DAT) irrespective of the integration with glyphosate. Increase in grass population in handweeded

Table 1. Effect of weed management practices on rice yield, weed population and weed dry weight (pooled data)

Treatment	Grain yield (t/ha)	Weed population (No./m²)			Weed dry weight (g/m²)	Weed control efficiency
		Grasses	Sedges	Broad-leaved weeds		
W_1 - Weedy check (Pre-planting glyphosate)	3.01	(38.50) 6.20	(2.25) 1.56	(12.50) 3.56	64.2	41.8
W_2 - Weedy check (Pre-planting fallow)	2.52	(30.25) 5.54	(26.25) 5.14	(12.25) 3.53	110.4	
W_3 - W_1 + oxyfluorfen + HW	5.61	(4.00) 2.11	(0.50) 0.92	(2.00) 1.49	16.4	85.1
W_4 - W_2 + oxyfluorfen + HW	4.12	(6.50) 2.64	(20.50) 4.56	(1.50) 1.40	37.2	66.3
W_5 - W_2 + oxyfluorfen + 2, 4-D	5.58	(10.25) 3.06	(1.00) 1.18	(600) 2.41	18.0	83.6
W_6 - W_2 + oxyfluorfen + 2, 4-D	3.98	(11.00) 3.30	(18.75) 4.36	(10.25) 3.23	40.1	63.6
W_7 - W_1 + two HW	5.49	(21.50) 4.67	(0.50) 0.92	(1.25) 1.27	26.3	76.1
W_8 - W_2 + two HW	3.62	(19.67) 4.43	(12.00) 3.48	(2.00) 1.49	52.1	52.8
CD (P = 0.05)	0.46	1.01	0.80	0.94	8.69	

HW, Hand weedings
Figures in parentheses indicate actual values

plots could be ascribed to difficulty in distinguishing grasses form rice seedlings especially during early stage. Raju and Reddy (1986) reported similar findings. Significantly higher grass population was recorded in weedy check + glyphosate and statistically on par with weedy check without glyphosate thus showed the poor control of glyphosate on emerging grassy weeds.

Treatments with glyphosate significantly reduced the sedge population compared to treatments without glyphosate showing the effective control of glyphosate on sedge weeds, particularly *Cyperus rotundus* (72 % among sedge population of the initial weed flora). Two handweedings (with and without glyphosate) and oxyflourfen + handweedings (with and without glyphosate) being statistically at par, were superior to weedy check handweedings (with and without glyphosate) in decreasing the broadleaved weed population.

Significant reduction in dry weed biomass was noticed with glyphosate, irrespective of post-planting weed management practices. Weed dry weight under oxyfluorfen + handweedings (with glyphosate) and oxyfluorfen + 2, 4-D sodium salt (with glyphosate) were alike and significantly lower than that weedy check (W_1, W_2). Two handweedings with glyphosate was statistically on par with oxyfluorfen + 2, 4-D sodium salt with glyphosate in reducing weed dry weight. Significant reduction in weed dry weight in glyphosate + post-planting weed management practices (W_1, W_3 and W_7) may probably be due to the effective control of *Cyperus rotundus* by glyphosate and of annual weeds by oxyfluorfen with 2, 4-D sodium salt/handweedings (2 times). Sharma and

Table 2. Effect of weed management practices on blackgram yield, weed population and weed dry weight (Pooled data)

Treatments	Blackgram yield (q/ha)	Weed population (No/m²)						Weed dry weight (g/m²)	Weed control efficiency
		Grasses		Sedges		Broad-leaved weeds			
W_1-Weedy check (Pre-planting glyphosate)	9.81	(9.50)	3.12	(2.00)	1.54	(3.25)	1.69	31.2	65.7
W_2-Weedy check (Pre-planting fallow)	5.35	(10.25)	3.24	(16.50)	4.02	(5.75)	2.30	91.2	
W_3-W_1 + oxyfluorfen + HW	9.88	(9.00)	2.74	(1.25)	1.32	(2.25)	1.75	27.3	70.0
W_4-W_2 + oxyfluorfen + HW	5.38	(9.25)	2.76	(14.25)	3.68	(4.00)	1.63	88.0	3.5
W_5-W_2 + oxyfluorfen	10.12	(8.75)	2.87	(1.50)	0.83	(5.50)	2.42	24.2	73.4
W_6-W_2 + oxyfluorfen + 2, 4-D	5.42	(9.25)	2.88	(15.00)	3.85	(5.75)	2.43	89.4	1.9
W_7-W_1 + 2 HW	9.95	(9.50)	3.00	(2.25)	1.63	(4.75)	2.25	26.3	71.1
W_8 - W_2 + 2 HW	5.89	(9.75)	3.04	(12.50)	3.50	(5.00)	2.32	79.0	13.3
CD (P = 0.05)	0.82	NS		1.18		NS		10.4	

HW, Hand weedings, NS-Not significant
Figures in parentheses indicate actual values

Reddy (1992) reported effective control of *Cyperus rotundus* with glyphosate. This indicates that integration of glyphosate either with pre-emergence or post-emergence herbicides or handweeding may be helpful in reducing the weed biomass. Baradhan *et al.* (1995) found that oxyfluorfen 0.1 ai/ha + handweeding at 40 days reduced the weed biomass significantly in rice. Weed control efficiency showed a similar trend as that of weed biomass.

Effect on weeds In blackgram

Weed control methods adopted for rice did not significantly alter the grass and broad-leaved population in blackgram (Table 2). This may be attributed to the poor carryover effect of herbicides due to the lack of persistence after 30-40 days as reported by Srivastava *et al.* (1994). Glyphosate spray, irrespective of the other weed management practices decreased the population of sedge and dry weight of weeds in blackgram significantly. It may be noticed that, *Cyperus rotundus* occupied to the tune of 30.5% of the weed flora of the experimental field and effective control of *Cyperus rotundus* and its propagules prevented its multiplication. This might be the reason for lesser weed dry weight in blackgram crop. Effective control of *Cyperus rotundus* foliage and tubers and thus prevented further sprouting (Doll and Piedrahita, 1981) has been documented.

Effect on rice

Glyphosate + oxyfluorfen + hand weeding being statistically on par with glyphosate + 2, 4-D sodium salt and with glyphosate + 2 hand weeding (20 and 40 DAT) gave significantly maximum grain yield compared with the rest of the treatments (Table 1). Weedy check with glyphosate, increased the grain yield by 20% over weedy check without glyphosate indicating the effect of glyphosate in increasing the rice yield particularly in a *Cyperus rotundus*-dominated field, supporting the findings of Mandal and Ghorai (1986).

Effect on blackgram

Carryover effect of glyphosate registered significantly higher blackgram seed yield than no glyphosate spray (Table 2). This could be ascribed to the effective control and prevention of further sprouting of sedges with glyphosate, right from the first crop itself. Lower seed yield without glyphosate proved that herbicides had no carryover effect on the succeeding blackgram crop in controlling the weeds as supported by Zirpe *et al.* (1994).

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