Indian Journal of Agronomy **44** (2) : 210–215 (June 1999)

Integrated weed management in direct sown semi-dry rice (*Oryza sativa*) based cropping system

R. RAJENDRAN AND N. KEMPUCHETTY

Tamil Nadu Rice Research Institute, Aduthurai, Tamil Nadu 612 101

Received: September 1997

ABSTRACT

Field experiments were conducted during 1992-95 to study the weed dynamics and evolve an integrated weed management (IWM) practice in direct sown semi-dry rice (*Oryza sativa* L.)-groundnut (*Arachis hypogaea* L.)-greengram (*Phaseolus radialus* L.) cropping system. Pre-emergence (pre-em.) pretilachlor plus 0.3 kg/ha followed by (fb) hand weeding (HW) 25 days after sowing (DAS) effectively controlled the weeds in semi-dry rice. Application of pre-em. thiobencarb 2.0 kg/ha fb post-emergence (post-em.) 2, 4-D Na salt 1.0 kg/ha in semi-dry rice showed maximum carry-over effect on the control of weeds in groundnut but not on the third crop of greengram. Two hand weedings to groundnut 25 and 45 DAS recorded efficient control of weeds in the succeeding greengram.

Pre-em. pretilachlor plus 0.3 kg/ha fb hand weeding 25 DAS in semi-dry rice, pre-em. oxyfluorfen 0.125 kg/ha fb hand weeding 25 DAS in groundnut and pre-em. fluchloralin 0.75 kg/ha fb hand weeding 25 DAS in greengram resulted in efficient control of weeds recording higher total grain productivity, net return and benefit cost ratio (B : C) in the cropping system.

Key words: Carry-over effect, Weed, Cropping system

Rice occupying a prime position among food crops is grown under diversified situations. Though transplanting of rice is a traditional method, the practice of direct seeding is steadily increasing due to nonavailability of water and labour. Semi-dry rice culture i.e. dry seeding initially and bringing the rice crop under submergence after about a month, is being adopted in tail ends of Cauvery old delta and many parts of new delta. In semi-dry rice, weed problem is severe due to simultaneous emergence of crop and weed. In semi-dry rice and the following crops in the sequence, weed management plays a vital role in deciding the productivity of crops. Uncontrolled weeds reduce the rice yield up to 97% in the direct sown rice culture (Saxena and Vaishya, 1993). Hence, the present study on semi-dry rice-groundnut-greengram cropping system, integrating various weed management practices was conducted to identify the effective weed management strategy for the cropping system.

MATERIALS AND METHODS

Field experiments were conducted at Agricultural Research Station, Pattukkottai during 1992-93 and Soil and Water Management Research Institute, Thanjavur during 1994-95. The experimental sites are located in Cauvery new delta zone having identical soil type and weed flora. The experimental details are furnished in Table 1. The plots were laid out with the provision of accommodating subsequent crops in the sequence without disturbing the plot bunds. All the cultural practices recommended for semi-dry rice, groundnut and greengram other than weed management were adopted. The data on weed flora were subjected to log (X + 2) transformation. To estimate the carry-over effect of the treatments imposed in the first crop on the succeeding crops in the sequence, a statistical methodology was formulated to quantify such individual effects (Choudhury, 1989). The plot-wise differences between the crops for the parameter under study were estimated and statistical analysis was done after bringing the difference in values as positive. The pooled data collected from two years of experimentation were tabulated and presented.

RESULTS AND DISCUSSION

Weed flora of the experimental site

The experimental sites were dominated

Table 1. Experimental details

Particulars	Cropping pattern		
	Semi-dry rice	Groundnut	Greengram
Varieties	ADT-38	TMV-7	ADT-3
Design	Randomised block	Split-plot	Split-split-plot
Treatments	M_1-Pre-em. thiobencarb 2.0 kg/ha fb post-em. 2, 4-D Na salt 1.0 kg/ha	S_1-Pre-em.oxyfluorfen 0.125 kg/ha fb post-em. fluazifop-p-butyl 0.125 kg/ha 25 DAS	SS_1-Pre-em. fluchloralin 0.75 kg/ha fb HW 25 DAS
	M_2-Pre-em. thiobencarb 1.5 kg/ha fb HW 25 DAS	S_2-Pre-em. oxyfluorfen 0.125 kg/ha fb HW 25 DAS	SS_2-Two HW. 25 and 45 DAS
	M_3-Pre-em. pretilachlor plus 0.3.kg/ha fb HW 25 DAS	S_3-Intercropping with greengram plus HW 25 DAS (paired row system)	
	M_4-Post-em. bentazon 0.75 kg/ha 25 DAS fb HW 45 DAS	S_4-Two HW 25 and 45 DAS	
	M_5-Two HW 25 and 45 DAS		

One observation plot was maintained as unweeded control separately for all the crops to work out Weed Control Efficiency (WCE).

by *Echinochloa colona* (L.) Link among grasses; *Cyperus rotundus* (L.) among sedges, and *Trianthema portulacastrum* (L.) among the broad leaved weeds.

Weed control and yield of semi-dry rice and groundnut

Application of pre-em. pretilachlor plus fb hand weeding significantly reduced the dry weight of grass, sedge and broad leaved weeds resulting in the maximum WCE of 85.0% (Table 2). This treatment produced the maximum number of panicles, filled grains/panicle and grain yield. This could be due to better weed control without any injurious effect on rice (Mabbayad and Moody, 1992). The poor control of weeds and lower grain yield in post-em. bentazon fb hand weeding might be due to delayed weed control and suppression of rice growth at the early growth stage.

Pre-em. thiobencarb fb post-em. 2, 4-D Na salt applied in semi-dry rice recorded significantly lower weed dry weight and the maximum WCE (81.8%) in groundnut (Table 2). This treatment gave the maximum number of matured pods/plant, shelling percentage and pod yield. The increased groundnut yield in this treatment was due to carry-over effect of semi-dry rice treatments on control of weeds. Application of pre-em. oxyfluorfen fb hand weeding in groundnut significantly reduced the weed dry weight resulting in maximum WCE (87.0%), number of pods/plant, shelling percentage and pod yield. Integration of these two treatments in semi-dry rice and groundnut resulted in significant increase in pod yield of groundnut as reported by Pannu *et al.* (1989).

Weed control and yield of greengram

The weed control treatments adopted in semi-dry rice and groundnut did not significantly influence the weed dry weight in greengram (Table 3). Pre-em. fluchloralin fb hand weeding applied in greengram recorded the minimum weed dry weight and maximum WCE (88.2%) resulting in significantly highest yield. Integration of weed control treatments in semi-dry rice, groundnut and greengram significantly increased the grain yield of greengram. Similar effect of weed control treatments in increasing the yield of succeeding crop was reported by Saxena and Vaishya (1993).

Carry-over effect on weed

Application of pre-em. thiobencarb fb post-em. 2, 4-D Na salt in semi-dry rice exhibited significantly superior carry-over effect by recording lesser weed population in groundnut and greengram resulting in enhanced pod yield and grain yield of groundnut and greengram, respectively (Table 3). Similarly two hand weedings to groundnut recorded the minimum weed density and maximum grain yield in greengram. Integrating these two treatments exhibited maximum carry-over effect in reducing the weed population in greengram. This was in agreement with the observations of Navarez and Moody (1989).

Grain productivity and economics

Pre-em. pretilachlor plus fb hand weeding in semi-dry rice significantly increased the total grain productivity of the cropping system. Similarly, oxyfluorfen fb hand weeding in groundnut and fluchloralin fb hand weeding in greengram registered higher grain productivity. Integration of these three treatments recorded the maximum total grain productivity, net return and B : C ratio in the cropping system. Thus, the study conclusively proved that adoption of IWM viz., pre em. pretilachlor plus 0.3 kg/ha fb hand weeding 25 DAS, pre-em oxyfluorfen 0.125

Table 2. Effect of treatments on weed, yield attributes and yield of semi-dry rice, groundnut and their carry-over effect in groundnut

Treatment	Semi-dry rice							Groundnut				
	Total weed dry weight 60 DAS (g/m^2)			WCE 60 DAS (%)	Panicles/ m^2	Filled grains/ panicle	Grain yield (t/ha)	Weed dry weight 60 DAS (g/m^2)	WCE 60 DAS (%)	Matured pods/ plant	Shelling out-turn (%)	Pod yield (kg/ha)
	Grasses	Sedges	BLW									
M_1 - Thioben.fb 2,4-D	26.4	42.5	14.0	62.5	257	118	3.8	26.7	81.8	10.0	67.6	1544
M_2 - Thiobencarb fb HW	20.5	47.8	10.7	74.9	282	128	4.7	58.2	67.5	6.5	66.8	1122
M_3 - Pretilachlor plus fb HW	17.1	29.4	6.6	85.0	319	133	5.8	38.5	78.7	7.4	67.2	1362
M_4 - Bentazon fb HW	36.4	82.6	43.6	56.6	235	114	2.9	66.7	71.8	6.0	66.5	1015
M_5 - Two HW	34.7	78.2	31.2	65.6	274	125	4.5	35.0	76.1	8.3	67.1	1343
CD (P = 0.05)	2.0	1.8	2.3	–	15.0	3	0.01	6.9	–	0.6	0.3	26
S_1- Oxyfluorfen fb fluazifop-p-butyl								33.9	81.3	8.0	67.2	1340
S_2 - Oxyfluorfen fb HW								30.9	87.0	8.4	67.4	1383
S_3 - Intercropping with greengram								58.3	68.8	6.3	66.4	1055
S_4 - Two HW								56.8	67.4	8.1	67.2	1331
CD (P = 0.05)								4.7	–	0.4	0.2	23
Interaction								M_1S_2*	N.A	M_1S_2*	M_1S_2*	M_1S_2*

BLW - Broad leaved weeds
NA - Not analysed
* Interaction significant (M_1 S_2 recorded maximum values)

Table 3. Weed flora and yield of greengram, carry-over effect, grain productivity and economics of the cropping system as infuenced by weed control treatments

Treatments	Greengram (summer 1993 and 1995)				Carry-over effect						Economics	
						Semi-dry rice on geengram			Groundnut on greengram			
	Weed dry weight 40 DAS (g/m^2)	WCE 40 DAS (%)	Pods/ plant	Grain yield (kg/ha)	Semi-dry rice on grountnut weeds/m^2 60 DAS	Pod yield (kg/ha)	Weeds/ m^2, 40 DAS	Grain yield (kg/ha)	Weeds/ m^2, 40 DAS	Grain yield (kg/ha)	Total grain produc- tivity (kg/ha)	Net return (Rs/ha)
M_1 Thiobencarb fb 2, 4-D Na salt	1.8 (59.2)	81.9	29.2	531	9.4 (22.5)	1042	1.8 (58.7)	1547	1.8 (59.5)	1026	9656	19225
M_2 Thiobencarb fb HW	1.9 (78.6)	74.0	25.5	513	1.7 (45.3)	653	1.9 (75.3)	902	1.8 (68.7)	610	8491	22224
M_3 Pretilachlor plus fb HW	1.8 (65.8)	79.7	25.6	519	1.5 (45.3)	985	1.8 (58.7)	1271	1.8 (61.3)	847	10108	26620
M_4 Bentazon fb HW	1.9 (84.0)	72.6	23.4	476	1.8 (61.0)	201	2.0 (87.6)	607	1.9 (74.1)	567	6886	15721
M_5 Two HW	1.9 (74.0)	76.6	25.2	495	1.7 (47.1)	303	1.9 (77.5)	1186	1.8 (64.1)	764	8761	22878
CD (P = 0.05)	NS		0.8	7	0.18	34	NS	29	NS	56	243	
S_1 Oxyfluorfen fb fluazifop-p-butyl	1.9 (75.4)	77.5	26.0	514			1.9 (70.2)	1092	1.8 (65.7)	803	8908	21209
S_2 Oxyfluorfen fb HW	1.9 (71.3)	78.2	25.4	503			1.9 (71.2)	1113	1.8 (65.7)	824	9081	24495
S_3 Intercropping with greengram	1.9 (77.4)	71.0	24.8	490			1.9 (65.7)	1082	1.9 (73.3)	601	8145	20830
S_4 Two HW	1.8 (63.2)	81.1	27.0	531			1.9 (68.8)	1124	1.8 (60.5)	836	9018	20662
CD (P = 0.05)	NS		0.7	5			0.07	16	NS	43	137	
SS_1 Fluchloralin fb HW	1.6 (39.6)	88.2	26.8	526							8837	21438
SS_2 Two HW	2.0 (104.0)	65.7	24.8	492							8722	20832
CD (P = 0.05)	0.06		0.4	4							65	
Interaction	NS	NA	$M_1S_4SS_1$*	$M_1S_4SS_1$*			NS	NS	NS	$^{\$}M_1S_4$	*$M_3S_2SS_4$	NA

N.S. - Not significant
N.A.- Not Statistically analysed
* Interaction significant (M_1 S_4 SS_1, M_1 S_4 and M_3 S_2 SS_1 recorded maximum values)
Figures given in parentheses are original values

kg/ha fb hand weeding 25 DAS and pre-em. fluchloralin 0.75 kg/ha fb hand weeding 25 DAS in semi-dry rice, groundnut and greengram, respectively controlled the weeds effectively with maximum net return and B : C ratio in the cropping system.

REFERENCES

Choudhury, G.K. 1989. Integrated weed management in rice based cropping system. *Ph.D. thesis*, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore.

Mabbayad, M.D. and Moody, K. 1992. Herbicide seed treatment for weed control in wet seeded rice. *Tropical Pest Management* **38** (1) : 9-12.

Navarez, D.C. and Moody, K. 1989. Effects of weeding in two transplanted rice crops in sequence. *Philippines Journal of Weed Science* **16** : 64-71.

Pannu, R.K., Malik, R.K., Malik, D.S. and Singh, K.P. 1989. Effect of crop geometry, irrigation and weed control methods on groundnut and weeds. *Indian Journal of Weed Science* **20** (1) : 82-84.

Saxena, Amal and Vaishya, R.D. 1993. Effect of methods of weed control on the yield of upland drilled rice and associated weeds. *Proc. International Symposium,* Indian Society of weed Science, Hisar, November 18-20. Vol. III.