Indian Journal of Weed Science 43 (3&4) : 217-221, 2011 **Short Communication**

Effect of different weed management practices on weed density and weed dry matter production in system of rice intensification (SRI)

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ABSTRACT

The twelve different weed management practices were laid out in randomized block design with three replications. Rice variety "*MTU-1010*" was grown as a test crop. Rice was transplanted with a spacing of 20 x 20 cm and fertilized with 90, 60 and 40 kg/N, P and K/ha, respectively. At later period of growth, maximum panicle length, number of seeds/panicle, WCE, weed density, dry matter accumulation under post-emergence *fb* post-emergence application of fenoxaprop-p-ethy (60 g/ha) + ethoxysulfuron (15 g/ha) favoured significant enhancement in seed yield which was at par with hand weeding. Application of post-emergence *fb* post-emergence application of fenoxaprop-p-ethyl (60 g/ha) + ethoxysulfuron (15 g/ha) gave higher net return (Rs 3,4249.72/ha) and benefit: cost ratio (1.72)

Key words: Herbicides, Weed control, SRI, Mechanical weeding.

System of rice intensification (SRI) is a methodology, which increases the productivity of irrigated rice by changing the management of plant, soil, water and nutrients. The main features of this system are transplanting of young seedlings (10-14 days old) singly in a square with wide spacing using organic fertilizer (10 t/ha FYM). Weed problems are generally of lower magnitude in traditional method because of puddling, transplanting and continuous submergence of water. But in SRI fields, weeds infestation is higher as compared to traditional transplanting system due to wetting and drying of field. Timely unavailability of laboures made weed management more difficult and costlier. Keeping these points in view, different weed management practices were evaluated for effectively and economically control of mixed weed flora in SRI.

The experiment was carried out at research cum-instructional Farm, IGKV, Raipur (Chhatisgarh) during *kharif* season (July to November) of 2009. The experiment was conducted in randomized block design (RBD). There were three replication and twelve treatments of various combinations of different herbicides (Table 1).

Rice variety "*MTU-1010*" was grown as a test crop. Rice seedlings of 14 days old were transplanted with a spacing of 20 x 20 cm. The crop was fertilized with 90, 60 and 40 kg N, P and K/ha applied through urea, single super phosphate and muriate of potash, respectively. The whole amount of P and K was applied as basal dressing, while nitrogen was applied in three splits *viz.,* 30 kg N/ha as basal and remaining 60 kg/N in two equal splits at maximum tillering and panicle initiation stage. Organic manures as green manuring crop was grown and incorporated in soil at flowering stage. Rice was harvested in the second week of November, 2009.

The weed species namely *Echinochloa colona, Alternanthera triandra, Cyperus iria* and *Fimbristylis miliacea* contributed the bulk of weed flora in experiment field and dominated throughout the crop growth period.

Weed density and dry matter production of weed

Weed management practices had remarkable effect on total weed density throughout the crop growth period. At 15 DAT (before hand weeding and application of post emergence herbicide), lowest density and dry weight of weeds were found under the treatment where two way mechanical weeding was performed followed by one way mechanical weeding. Both the treatments were significantly lower than the rest of the treatments. Thus, density and dry weight of weeds significantly reduced at 15 DAT. The cono weeder was operated at 12 DAT in either one or two ways direction helped removal and incorporation of weeds in the field (Table 1). Rajkhowa (2007) reported that mechanical weeding significantly deceased the density of weeds in transplanted rice.

At 30 and 45 DAT, the minimum density and dry weight of weeds was under the treatment where two ways mechanical weeding (MW) was performed followed by one way mechanical weeding and hand weeding twice, fenoxaprop-p-ethyl 60 g/ha + ethoxysulfuron 15 g/ha + MW (two ways) and was significantly lower than the rest of the treatments (Table 2).

At 60 DAT and at harvest the lower weed density was observed in treatment PoE *fb* PoE (fenoxaprop-p-ethyl 60 g/ha + ethoxysulfuron 15 g/ha) where hand weeding twice was next in order. Similarly, the lower dry weight of weed was observed in treatment PoE *fb* PoE (fenoxaprop-p-ethyl 60 g/ha + ethoxysulfuron 15 g/ha) followed by hand weeding twice and fenoxaprop-p-ethyl 60 g/ha + ethoxysulfuron 15 g/ha + MW (two ways). Infestation of weeds increased with time under unweeded control up to harvest.

Mechanical weeding produced the minimum density and dry weight of weeds at early growth stages. The effective control of weed through weeder was also reported by Nair *et al.* (2002). Hiromi *et al.* (2001) noted that mechanical weeding become difficult due to increased occurrence of weeds at interhill spaces in later stages of rice. In general, combined application of fenoxaprop + ethoxysulfuron proved to be superior over the combined application of chlorimuron-ethyl + metsufuron-methyl +fenoxaprop-p-ethyl might be due to higher phytotoxicity to rice crop than the former combination. Singh *et al.* (2005) also reported the higher phytotoxicity of combined application of chlorimuron-ethyl + metsufuron-methyl + fenoxaprop-p-ethyl to rice crop.

Weed control efficiency (WCE)

At harvest, the maximum WCE was observed with PoE *fb* PoE (fenoxaprop-p-ethyl 60 g/ha + ethoxysulfuron 15 g/ha). Similar results were noted by Moorthy and Saha 2002 and Rekha *et al*. (2003).

Yield attributes and seed yield

All the treatments produced significantly higher yield attributing characters such as panicle length and number of seeds per panicle than unweeded control and were maximum in PoE *fb* PoE (fenoxaprop-p-ethyl 60 g/ha + ethoxysulfuron 15 g/ha) which narrowly followed by hand weeding, fenoxaprop-p-ethyl 60 g/ha + ethoxysulfuron 15 g/ha + MW (two ways) and mechanical weeding performed on two ways. (Table 3) These are in accordance with the findings of Singh *et al*. (2005b) and Nair *et al*. (2002). However, different weed control measures could not influenced test weight significantly.

Practices comprised of post emergence herbicides, mechanical weeding (one/two ways) either alone or with post emergence herbicides and hand weeding proved to be significantly superior over unweeded control in enhancing seed yield of rice (Table 4). The highest seed yield was observed under PoE *fb* PoE fenoxaprop-p-ethyl 60 g/ha + ethoxysulfuron 15g/ha and narrowly followed by hand weeding. This was owing to high growth and yield attributes as well as low crop-weed competition and longer weed free period under these treatments. Fischer *et al.* (1993) found that longer weed free period favoured significantly increase in yield attributes and yield of rice. It was observed by Kolhe (1999) that post emergence application of fenoxaprop-p-ethyl + ethoxysulfuron was as effective as hand weeding twice. Rekha *et al.* (2003) also reported that application of ethoxysulfuron produced the highest seed yield due to effective control of weeds favouring increased yield attributes.

The cono weeder was found to increase the seed yield. This might be due to the fact that cono weeding incorporated the weeds in the soil and minimized the weeds besides increasing the soil aeration and root pruning (Uphoff, 1999). Rajendran *et al.* (2007) reported that mechanical weeding plus soil stirring by cono weeder significantly increased the seed yield. Similar increased seed yield with cono weeder was reported by Thiyagarajan *et al.* (2002). Application of post emergence herbicide fenoxyprop-p-ethyl + ethoxysulfuron resulted in the highest seed yield (Bhattacharya *et al.* 2001). The minimum seed yield was obtained from unweeded control (21.12 q/ha) due to no control measure was adopted in this plot. Similar trend as that of seed yield was also recorded for straw yield.

Weed index

The maximum weed index (loss of yield as compared to PoE *fb* PoE fenoxaprop-p-ethyl 60 g/ha + ethoxysulfuron 15 g/ha) was observed under unweeded control (Table 4). Weed index was found to be the minimum under hand weeding narrowly followed by fenoxaprop-p-ethyl 60 g/ha + ethoxysulfuron 15 g/ha + MW (two ways), mechanical weeding performed two ways, fenoxaprop-p-ethyl 60 g/ha + CME+MSM + MW (two ways) and PoE *fb* PoE fenoxaprop-p-ethyl 60 g/ha + CME+MSM 4 g/ha, in order, than other treatments. Similar result was found by Rekha *et al*. (2003).

Economics

The maximum total cost of cultivation (Rs. 21442.90/ha) was recorded under mechanical weeding and followed by hand weeding (Rs. 21238.90/ha) and one way mechanical weeding (20524.90/ha). Among the herbicides, maximum gross return, net returns and benefit: cost ratio were obtained from PoE *fb* PoE fenoxaprop-p-ethyl 60 g/a + ethoxysulfuron 15 g/ha (Table 5). Hand weeding and fenoxaprop-p-ethyl 60 g/ha + ethoxysulfuron 15 g/ha + MW (two ways) were also found equally good. Unweeded control resulted in the lowest net return of only Rs. 5607.70/ha. The lowest benefit: cost ratio was obtained from unweeded control.

Table 1. Total weed density (no./m^2) and weed control efficiency (WCE) as influenced by integrated weed management under system of rice intensification

Treatments	Total weed density (no./m^2)					WCE (%) at harvest
	15 DAT	30 DAT	45 DAT	60 DAT	At harvest	
Fenoxaprop-p-ethyl 60 g/ha + CME+MSM 4 g/ha at 20 DAT	9.3	6.4	9.3	12.4	19.3	52.05
Fenoxaprop-p-ethyl 60 g/ha + ethoxysulfuron 15 g/ha at 20 DAT.	9.7	6.1	8.9	10.4	15.7	58.11
Fenoxaprop-p-ethyl 60 g/ha + CME+MSM 4 g/ha at 20 DAT + MW (one way) at 35 DAT	9.8	5.8	5.6	8.0	15.0	59.09
Fenoxaprop-p-ethyl 60 g/ha + ethoxysulfuron 15 g/ha at 20 DAT + MW (one way) at 35 DAT	9.4	5.6	4.2	7.1	13.4	59.81
Fenoxaprop-p-ethyl 60 g/ha + ethoxysul furon 15 g/ha + MW (Two way) at 20 and 35 DAT	9.3	6.0	2.3	4.1	8.7	70.93
Fenoxaprop-p-ethyl 60 g/ha + CME+MSM 4 g/ha at 20 DAT + MW (two way) at 35 DAT	9.7	6.0	2.7	5.1	11.1	63.97
Mechanical weeding (one way) -12, 25, 35 DAT.	6.1	3.1	4.9	12.8	22.8	46.37
Mechanical weeding (two way) -12, 25, 35 DAT	5.9	3.0	1.5	4.4	9.2	66.72
PoE followed by PoE fenox aprop- p ethyl + CME+MSM 4 g/ha at 20 and 35 DAT	10.0	6.1	4.9	6.2	12.2	61.93
PoE followed by PoE fenoxaprop-p-ethyl + ethoxysulfuron 15 g/ha at 20 and 35 DAT	9.6	6.0	3.1	3.4	6.9	74.77
Hand weeding 20, 40 DAT	9.6	3.9	2.0	3.7	7.9	72.07
Unweeded control.	9.8	14.5	18.9	22.0	33.1	-
LSD P=0.05%	2.0	0.9	0.9	2.2	2.5	-

CME + MSM = Chlorimuron ethyl + metsulfuron methyl: DAT =Days after transplanting: PoE =Post emergence: MW = Mechanical weeding

Table 2. Total dry matter accumulation of weeds (g/m^2) as influenced by integrated weed management under system of rice intensification.

Treatments	Dry matter accumulation (g/m^2)				
	15 DAT	30 DAT	45 DAT	60 DAT	At harvest
Fenoxaprop-p-ethyl 60 g/ha +CME+MSM 4 g/ha at 20 DAT	1.61	3.22	8.01	18.26	132.85
Fenoxaprop-p-ethyl 60 g/ha + ethoxysulfuron 15 g/ ha at 20 DAT.	1.51	3.14	7.70	14.68	116.05
Fenoxaprop-p-ethyl 60 g/ha + CME+MSM 4 g/ha at 20 DAT + MW (one way) at 35 DAT	1.52	2.94	7.13	14.00	113.35
Fenoxaprop-p-ethyl 60 g/ha + ethoxysulfuron 15 g/ ha at 20 DAT + MW (one way) at 35 DAT	1.58	2.66	4.43	12.73	111.36
Fenoxaprop-p-ethyl 60 g/ha + ethoxysulfuron 15 g/ ha + MW (Two way) at 20 and 35 DAT	1.58	2.96	3.66	8.14	80.07
Fenoxaprop_p_ethyl 60 g/ha + CME+MSM 4 g/ha at 20 DAT + MW (two way) at 35 DAT	1.52	2.86	3.97	10.82	99.83
Mechanical weeding (one way) -12, 25, 35 DAT.	0.96	1.50	4.98	20.07	148.59
Mechanical weeding (two way) -12, 25, 35 DAT	0.90	1.36	3.04	9.78	92.20
PoE followed by PoE fenoxaprop - p ethyl + CME+MSM 4 g/ha at 20 and 35 DAT	1.57	3.02	5.48	11.77	105.48
PoE followed by PoE fenoxapro p-p-ethyl + ethoxysulfuron 15 g/ha at 20 and 35 DAT	1.61	2.93	4.19	6.49	69.91
Hand weeding 20, 40 DAT	1.50	1.88	3.14	7.54	77.39
Unweeded control.	1.63	8.12	20.20	46.79	277.05
LSD P=0.05%	0.19	0.40	0.72	1.94	12.24

CME + MSM = Chlorimuron ethyl + metsulfuron methyl: DAT =Days after transplanting: PoE =Post emergence: MW = Mechanical weeding

Table 3. Panicle length, grain/panicle and test weight as influenced by integrated weed management under SRI

Treatments	Panicle length(cm)	Test weight (g)	Grain panicle (No)
Fenoxaprop-p-ethyl @ 60 g/ha +CME+MSM @ 4 g/ha at 20 DAT	25.13	27.80	115.43
Fenoxaprop-p-ethyl @ 60 g/ha + Ethoxysulfuron @ 15 g/ha at 20 DAT.	27.09	27.82	121.56
Fenoxaprop-p-ethyl @ 60 g/ha + CME+MSM 4 g/ha at 20 DAT + MW (one way) at 35 DAT	27.13	27.85	121.66
Fenoxaprop-p-ethyl @ 60 g/ha + Ethoxysulfuron @ 15 g/ha at 20 DAT + MW (one way) at 35 DAT	28.36	27.90	138.33
Fenoxaprop-p-ethyl 60 g/ha + Ethoxysulfuron 15 g/ha + MW (two way) at 20 and 35 DAT	29.30	28.45	155.66
Fenoxaprop-p-ethyl 60 g/ha + CME+MSM 4 g/ha at 20 DAT + MW (two way) at 35 DAT	28.80	28.16	147.00
Mechanical weeding (one way) -12, 25, 35 DAT.	25.13	27.56	109.66
Mechanical weeding (two way) -12, 25, 35 DAT	29.26	28.42	155.66
PoE followed by PoE Fenoxaprop-p-ethyl + CME+MSM @ 4 g/ha at 20 and 35 DAT	28.74	28.09	146.66
PoE followed by PoE Fenoxaprop-p-ethyl + Ethoxysulfuron 15g/ha at 20 and 35 DAT	30.60	28.94	168.33
Hand weeding 20, 40 DAT	30.52	28.92	167.7
Unweeded control.	23.43	27.20	86.33
LSD P=0.05%	1.31	NS	8.99

Table 4. Seed yield straw yield, harvest index, weed index as influence by integrated weed management under SRI

Treatments	Grain yield (q/ha)	Straw yield (q/ha)	Panicle length (cm)	Test weight (g)	Seed/ panicle (No)	Weed index
Fenoxaprop-p-ethyl 60 g/ha +CME+MSM 4 g/ha at 20 DAT	41.16	49.82	25.13	27.80	115.43	20.62
Fenoxaprop-p-ethyl 60 g/ha + Ethoxysulfuron 15 g/ha at 20 DAT.	43.30	51.28	27.09	27.82	121.56	16.49
Fenoxaprop-p-ethyl 60 g/ha + CME+MSM 4 g/ha at 20 DAT + MW (one way) at 35 DAT	45.32	51.99	27.13	27.85	121.66	12.59
Fenoxaprop-p-ethyl 60 g/ha + Ethoxysulfuron 15 g/ha at 20 DAT + MW (one way) at 35 DAT	45.73	53.65	28.36	27.90	138.33	11.80
Fenoxaprop-p-ethyl 60 g/ha + Ethoxysulfuron 15 g/ha + MW (two way) at 20 and 35 DAT	48.30	58.93	29.30	28.45	155.66	6.85
Fenoxaprop-p-ethyl 60 g/ha + CME+MSM 4 g/ha at 20 DAT + MW (two way) at 35 DAT	46.90	54.99	28.80	28.16	147.00	9.55
Mechanical weeding (one way) -12, 25, 35 DAT.	40.93	49.71	25.13	27.56	109.66	21.06
Mechanical weeding (two way) -12, 25, 35 DAT	48.11	58.82	29.26	28.42	155.66	7.21
PoE followed by PoE Fenoxaprop-p-ethyl + CME+MSM 4 g/ha at 20 and 35 DAT	45.77	54.99	28.74	28.09	146.66	11.73
PoE followed by PoE Fenoxaprop-p-ethyl + Ethoxysulfuron 15g ha^{-1} at 20 and 35 DAT	51.85	66.08	30.60	28.94	168.33	-
Hand weeding 20, 40 DAT	50.50	62.53	30.52	28.92	167.7	2.60
Unweeded control.	21.12	41.38	23.43	27.20	86.33	59.27
LSD P=0.05%	2.02	3.62	1.31	NS	8.99	

CME + MSM = Chlorimuron ethyl +Metsulfuron methyl: DAT =Days after transplanting: PoE =Post emergence: MW = Mechanical weeding

Table 5. Economics of integrated weed management in system of rice intensification (SRI)

Treatment	Total cost of cultivation (Rs/ha)	Gross return (Rs/ha)		Net return (Rs/ha)	Benefit : cost ratio
		Grain yield	Straw yield		
Fenoxaprop-p-ethyl 60 g/ha +CME+MSM 4 g/ha at 20 DAT	18333.09	40336.80	2491.00	24494.71	1.34
Fenoxaprop-p-ethyl 60 g/ha + Ethoxysulfuron 15 g/ha at 20 DAT	18568.9	42434.00	2564.00	26429.1	1.42
Fenoxaprop-p-ethyl 60 g/ha + CME+MSM 4 g/ha at 20 DAT + MW (one way) at 35 DAT	19353.09	44413.60	2599.50	27660.01	1.43
Fenoxaprop-p-ethyl 60 g/ha + Ethoxysulfuron 15 g/ha at 20 DAT + MW (one w ay) at 35 DAT	19533.09	44815.40	2682.50	27964.81	1.43
Fenoxaprop-p-ethyl 60 g/ha + Ethoxysulfuron 15 g/ha + MW (two way) at 20 and 35 DAT	19941.09	47334.00	2946.50	30339.41	1.52
Fenoxaprop-p-ethyl 60 g/ha+ CME+MSM 4 g/ha at 20 DAT + MW (two way) at 35 DAT	19731.09	45962.00	2749.50	28980.41	1.47
Mechanical weeding (one way) -12, 25, 35 DAT.	20524.9	40111.40	2485.50	22072	1.08
Mechanical weeding (two way) -12, 25, 35 DAT	21442.9	47147.80	2941.50	28646.4	1.34
PoE followed by PoE Fenoxaprop-p-ethyl + CME+MSM 4 g/ha at 20 and 35 DAT	19447.28	44854.60	2749.50	28156.82	1.45
PoE followed by PoE Fenoxaprop-p-ethyl + Ethoxysulfuron 15g /ha at 20 and 35 DAT	19867.28	50813.00	3304.00	34249.72	1.72
Hand weeding 20, 40 DAT	21238.90	49490.00	3126.50	32193.6	1.58
Unweeded control.	17158.9	20697.60	2069.00	5607.7	0.33

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