YIELD ATTRIBUTES AND YIELD OF RICE (*ORYZA SATIVA* L.) AS INFLUENCED BY INTEGRATED WEED MANAGEMENT IN SYSTEM OF RICE INTENSIFICATION (SRI) UNDER CHHATTISGARH PLAINS

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Abstract : An experiment carried out to find out the yield attributes and yield of rice (*Oryza sativa* L.) as influenced by integrated weed management in system of rice intensification (SRI) under Chhattisgarh plains during *Kharif* season of 2009 at Research cum-Instructional Farm, Department of Agronomy, IGKV, Raipur (C.G.). The experiment laid out in Randomized Block Design (RBD) with three replications. Results revealed that post-emergence combined application of Fenoxaprop-p-ethyl 60 g ha^{-1}+ Ethoxysulfuron 15 g ha^{-1} at 20 and 35 DAT was statistically at par with hand weeding (twice) at 20 and 40 DAT for producing yield attributing characters like plant height, test weight, number of grain $panicle^{-1}$ etc. under system of rice intensification method of rice. Grain yield and straw yield was recorded maximum under the post-emergence application of Fenoxaprop-p-ethyl 60 g ha^{-1}+ Ethoxysulfuron 15 g ha^{-1} at 20 and 35 DAT followed by hand weeding twice. However, both were comparable. All the treatments gave significantly higher seed yield than unweeded control. The highest gross return and B:C ratio was obtained from Fenoxaprop-p-ethyl 60 g ha^{-1}+ Ethoxysulfuron 15 g ha^{-1} at 20 and 35 DAT followed by hand weeding and lowest from unweeded control.

Keyword : Weed management, yield attributes, integrated weed management, rice

INTRODUCTION

Chhattisgarh is known as rice bowl of central India. The area and productivity of rice in Chhattisgarh is 3.61 million ha and 1.5 t ha^{-1} (Anonymous, 2008-09), which is quite low as compared to many states as well as country. Weeds are the major constraints in production of rice which often pose serious problem. Weeds compete with crop plants for moisture, light, nutrients and space. The extent of yield reduction of rice due to weeds is estimated from 15-95 per cent (Gogai *et al*., 1996). Weed competition depends upon method of rice cultivation, weed species and their time of emergence etc. 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. The untimely and poor weed management adversely affects proper growth and yield of rice. Herbicide used in isolation, however, unable to obtain complete weed control because of their selective killing. Their use can be made more effective if apply in combination and/or supplemented with other weed management practices such as hand weeding or mechanical weeding or etc which are available for weed control in rice. Keeping these points in view, integrated approach of weed management was evaluated for more feasible and practicable control of mixed weed flora in SRI.

MATERIAL AND METHOD

The experiment was carried out at research cum-instructional-Farm, IGKV, Raipur (C.G.) 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. There were three replication and twelve treatments of various combinations of different herbicides (viz. post-emergence application of fenoxaprop-p-ethyl 9.3 EC @ 60 g ha^{-1} + chlorimuron-ethyl + metsulfuron-methyl 20 WP @ 4 g ha^{-1} at 20 DAT, post-emergence application of fenoxaprop-p-ethyl 9 EC @ 60 g ha^{-1} + ethoxysulfuron 15 WG @ 15 g ha^{-1} at 20 DAT, post-emergence application of fenoxaprop-p-ethyl 9.3 EC @ 60 g ha^{-1} + chlorimuron-ethyl + metsulfuron-methyl 20 WP @ 4 g ha^{-1} at 20 DAT + mechanical weeding (one way) at 35 DAT, post-emergence application of fenoxaprop-p-ethyl 9.3 EC @ 60 g ha^{-1} + ethoxysulfuron 15 WG @ 15 g ha^{-1} at 20 DAT + mechanical weeding (one way) at 35 DAT, post-emergence application of fenoxaprop-p-ethyl 9.3 EC @ 60 g ha^{-1} + ethoxysulfuron 15 WG @ 15 g ha^{-1} at 20 DAT + mechanical weeding (two way) at 35 DAT, post-emergence application of fenoxaprop-p-ethyl 9.3 EC @ 60 g ha^{-1} + chlorimuron -ethyl + metsulfuron-methyl 20 WP @ 4 g ha^{-1} at 20 DAT + mechanical weeding (two way) at 35 DAT, two purely of mechanical type (mechanical weeding performed one way and two ways), one hand weeding at 20 and 40 DAT and one unweeded control with three replications. 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^{-1} 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.

RESULT AND DISCUSSION

Yield attributes

Panicle length

The observation on panicle length revealed that it was significantly influenced by all the weed management practices of post emergence herbicides, mechanical weeding (one/two ways) either alone or combined with post emergence herbicides and hand weeding as compared to unweeded control (Table 1). All the treatments produced significantly higher length of panicle than unweeded control. Panicle length was longest (30.60 cm) in PoE followed by PoE (Fenoxaprop-p-ethyl 60 g ha^{-1}+ ethoxysulfuron 15 g ha^{-1}) followed by hand weeding, Fenoxaprop-p-ethyl 60 g ha^{-1}+ ethoxysulfuron 15 g ha^{-1} + MW (two ways) and mechanical weeding performed on two ways. These are in accordance with the findings of Singh *et al.* (2005b) and Narwal *et al.* (2002).

Number of grains panicle^{-1}

All the treatments proved significantly superior over unweeded control in increasing number of grains panicle^{-1} (Table 1) Among various treatments, highest (168.33) grains panicle^{-1} were recorded under PoE followed by PoE (Fenoxaprop-p-ethyl 60 g ha^{-1}+ ethoxysulfuron 15 g ha^{-1}), marginally followed by hand weeding. However, Fenoxaprop-p-ethyl 60 g ha^{-1}+ ethoxysulfuron 15 g ha^{-1} + MW (two ways), mechanical weeding performed two ways, Fenoxaprop-p-ethyl 60 g ha^{-1}+ CME+MSM + MW (two ways), PoE followed by PoE (Fenoxaprop-p-ethyl 60 g ha^{-1}+ CME + MSM 4 g ha^{-1}) respectively, were next in order and comparable to each other. Lowest grains panicle^{-1} was recorded under unweeded check.

Test weight

Data in respect of test weight are presented in Table 1 which revealed that variation in test weight due to various weed management practices of post emergence herbicide, mechanical weeding either alone (one/two ways) or with post emergence herbicides and hand weeding were not significant. However, maximum test weight (28.94 g) was observed under PoE followed by PoE (Fenoxaprop-p-ethyl 60 g ha^{-1}+ ethoxysulfuron 15 g ha^{-1}). The test weight of unweeded control was recorded the minimum than rest of treatment. Test weight under hand weeding, Fenoxaprop-p-ethyl 60 g ha^{-1}+ ethoxysulfuron 15 g ha^{-1} + MW (two ways) Fenoxaprop-p-ethyl 60 g ha^{-1}+ CME + MSM + MW (two ways) was also found higher than unweeded control and other treatments.

Seed yield

PoE followed by PoE (Fenoxaprop-p-ethyl 60 g ha^{-1}+ ethoxysulfuron 15 g ha^{-1}) produced highest grain yield (51.85q ha^{-1}) narrowly followed by hand weeding. Kolhe (1999) observed that post emergence application of Fenoxaprop-p-ethyl+ ethoxysulfuron was as effective as hand weeding twice. He also reported that lower yield reduction (5.3 to 12.8%) was obtained with combined application of these chemicals. This was owing to low crop-weed competition and longer weed free period under these treatments which leads to high growth and yield of rice. Similar results were also noted by Rekha *et al.* (2003), Moorthy (2002), Saba *et al.* (2003). 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.* (2005a) also reported the higher phytotoxicity of combined application of Fenoxaprop-p-ethyl + Chlorimuron-ethyl + metsufuron-methyl of rice crop. Narayan *et al.* (1999) too observed that Chlorimuron-ethyl + metsufuron-methyl registered significantly lower grain yield. The similar results of increased grain yield were too reported by Rajkhowa *et al.* (2007) and Vijayakumar *et al.* (2004). It was observed that significantly higher grain yield was also recorded under Fenoxaprop-p-ethyl 60 g ha^{-1}+ ethoxysulfuron 15 g ha^{-1} +MW (two ways), mechanical weeding performed two ways and Fenoxaprop-p-ethyl 60 g ha^{-1}+ CME+MSM + MW (two ways) as compared to rest of the treatments including unweeded control. This was might be due to the higher crop growth of rice in terms of foliage, large amount of photosynthates, which act as source and helped in developing yield attributes due to low crop-weed competition and finally the higher grain yield. The minimum grain yield was obtained from unweeded control (21.12 q ha^{-1}) due to no control measure was adopted in this plot.

Straw yield

The data on straw yield (q ha^{-1}) are given in the Table 1. All the treatments produced significantly more straw yield than unweeded control. Straw yield was the highest (66.08 q ha^{-1}) under PoE followed by PoE (Fenoxaprop-p-ethyl 60 g ha^{-1}+ ethoxysulfuron 15 g ha^{-1}), which was narrowly followed by hand weeding. However hand weeding were comparable in producing straw yield to Fenoxaprop-p-ethyl 60 g ha^{-1}+ ethoxysulfuron 15 g ha^{-1} + MW (two ways). Rest of the treatments followed the trend as that of grain yield. Similar result was noted by Bhowmick and Ghosh (2006).

Harvest index

The data on harvest index are presented in Table 1 which revealed that variation in harvest index due to various weed management practices of post emergence herbicide, mechanical weeding either alone (one/two ways) or with post emergence herbicides and hand weeding were not significant. However maximum harvest index (48.49 %) was observed under PoE followed by PoE (Fenoxaprop-p-ethyl 60 g ha^{-1}+ ethoxysulfuron 15 g ha^{-1}) (T_{10}). The harvest index of unweeded check was recorded the minimum than rest of treatment.

Economics

The lowest benefit: cost ratio was obtained from T_{12} which was unweeded control. This was due to the lowest grain yield obtained in control condition. The maximum benefit: cost ratio was obtained from the treatment PoE followed by PoE (Fenoxaprop-p-ethyl 60 g ha^{-1}+ ethoxysulfuron 15 g ha^{-1}) (1.72) followed by hand weeding and Fenoxaprop-p-ethyl 60 g ha^{-1}+ ethoxysulfuron 15 g ha^{-1} +MW (two ways) (1.52), respectively. Bali *et al.* (2006) also reported similar report. No doubt, the results of hand weeding were also better but are time consuming, expensive and laborious hence cannot be recommended at large scale.

Table 1. Grain yield, straw yield, panicle length, test weight and seed $panicle^{-1}$ as influence by integrated weed management under SRI

Treatments		Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Panicle length (cm)	Test weight (g)	Seed panicle $^{-1}$ (No)	Harvest index
T_1 :	Fenoxaprop-p-ethyl @ 60 g ha^{-1}+CME+MSM @ 4 g ha^{-1} at 20 DAT	41.16	49.82	25.13	27.80	115.43	41.12
T_2 :	Fenoxaprop-p-ethyl @ 60 g ha^{-1} + Ethoxysulfuron @ 15 g ha^{-1} at 20 DAT.	43.30	51.28	27.09	27.82	121.56	42.13
T_3 :	Fenoxaprop-p-ethyl @ 60 g ha^{-1}+ CME+MSM 4 g ha^{-1} at 20 DAT + MW (one way) at 35 DAT	45.32	51.99	27.13	27.85	121.66	43.76
T_4 :	Fenoxaprop-p-ethyl @ 60 g ha^{-1}+ Ethoxysulfuron @ 15 g ha^{-1} at 20 DAT + MW (one way) at 35 DAT	45.73	53.65	28.36	27.90	138.33	44.66
T_5 :	Fenoxaprop-p-ethyl 60 g ha^{-1} + Ethoxysulfuron 15 g ha^{-1} + MW (two way) at 20 and 35 DAT	48.30	58.93	29.30	28.45	155.66	48.16
T_6 :	Fenoxaprop-p-ethyl 60 g ha^{-1}+ CME+MSM 4 g ha^{-1} at 20 DAT + MW (two way) at 35 DAT	46.90	54.99	28.80	28.16	147.00	47.69
T_7 :	Mechanical weeding (one way) -12, 25, 35 DAT.	40.93	49.71	25.13	27.56	109.66	39.56
T_8 :	Mechanical weeding (two way) -12, 25, 35 DAT	48.11	58.82	29.26	28.42	155.66	47.87
T_9 :	PoE followed by PoE Fenoxaprop-p-ethyl + CME+MSM @ 4 g ha^{-1} at 20 and 35 DAT	45.77	54.99	28.74	28.09	146.66	47.13
T_{10} :	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	48.53
T_{11} :	Hand weeding – 20, 40 DAT	50.50	62.53	30.52	28.92	167.7	48.49
T_{12} :	Unweeded control.	21.12	41.38	23.43	27.20	86.33	33.79
CD at 5%		2.02	3.62	1.31	NS	8.99	NS

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

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