

PERFORMANCE OF COMBINATION OF HERBICIDES ON GROWTH FACTORS, YIELD AND ENERGETICS OF TRANSPLANTED RICE (*ORYZA SATIVA* L.)

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Abstract: A field experiment was carried out during *Kharif* 2013-2014 at the Instructional-Cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The soil of the experimental field was sandy loam in texture. The soil was neutral in pH low in low in nitrogen, medium in phosphorus and potassium content. The experiment was laid out in randomized block design, comprising three replications and twelve treatments. The results revealed that hand weeding at 25 and 45 DAT registered maximum growth characters of rice like dry matter, number of tillers hill^{-1} , yield and energetics. It was followed by treatments bispyribac-Na + (chlorimuron-ethyl + metsulfuron-methyl) @ 20 + 4 g ha^{-1} at 25 DAT (T_5) and bispyribac-Na + ethoxysulfuron @ 25 + 18.75 g ha^{-1} at 25 DAT (T_4) and minimum was observed under weedy check (T_{12}).

Keywords: Ethoxysulfuron, Number of tillers, Transplanted rice, Grain yield, Energetics

INTRODUCTION

Weeds are one of the major constraints responsible for low yield of rice in India. Moist conditions of the hydromorphic ecosystems encourage rapid establishment of weeds and permit rapid weed growth. All the three types of weeds viz. narrow leaved, broad leaved and sedges compete with rice crop for resources. Based on nature and intensity of weed infestation, yield of transplanted rice was reduced by 47 percent failure of the crop (Balaswamy, 1999). In order to realize maximum benefit of applied monetary inputs, two to three hand weeding were most effective against all types of weeds in this crop (Halder and Patra 2007). However, continuous rains during cropping season, scarcity and high wages of labor during weeding peaks particularly at early crop-weed competition make this operation difficult and uneconomic. Therefore, application of herbicide mixtures may be useful, particularly in absence of an effective broad spectrum herbicide in rice to control highly diverse weed flora (Rao and Singh 1997). The present study was undertaken to evaluate the performance of combination of herbicides on growth factors, yield and energetics of transplanted rice.

MATERIAL AND METHOD

A field experiment was conducted at Instructional Cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during *kharif* season of 2013. The soil of experimental field was *inceptisols*, low in nitrogen, medium in phosphorus and potassium contents with neutral pH. The experiment was laid out in Randomized Block Design, comprising three replications and twelve treatments which included bispyribac-Na 25 g ha^{-1} at 25 DAT, pretilachlor 1000 g ha^{-1} at 3 DAT,

pyrazosulfuron-ethyl 20 g ha^{-1} at 3 DAT, bispyribac-Na + ethoxysulfuron @ 25 + 18.75 g ha^{-1} at 25 DAT, bispyribac + (chlorimuron-ethyl + metsulfuron-methyl) @ 20 + 4 g ha^{-1} at 25 DAT, azimsulfuron @ 35 g ha^{-1} at 23 DAT, pretilachlor fb ethoxysulfuron @ 750 / 18.75 g ha^{-1} at 3 fb 25 DAT, pretilachlor fb (chlorimuron-ethyl + metsulfuron – methyl) @ 750 / 4 g ha^{-1} at 3 fb 25 DAT, pyrazosulfuron-ethyl fb manual weeding @ 20 g ha^{-1} at 3 fb 25 DAT, pretilachlor (6%) + bensulfuron (0.6%) 6.6% Gr 660 g ha^{-1} at 4 DAT, hand weeding at 25 and 45 DAT and weedy check. Medium duration rice cultivar MTU-1010 was taken as a test crop. Transplanting was done on 16th July, 2013 with a spacing of 20 cm x 10cm and fertilizer dose was 100, 60 and 40 kg ha^{-1} of N, P_2O_5 and K_2O respectively. Full dose of phosphorus and potash along with one third of nitrogen was applied as basal. Rest of nitrogen was applied in two splits at tillering and panicle initiation. Harvesting was done on 5th November. Observations of weed density and dry weight were taken at harvest by placing a quadrat of 0.5 m x 0.5 m randomly at five places in each plot.

Sterility percentage

The number of filled and unfilled spikelets per panicle was counted from five panicles selected randomly for measurement of panicle length and sterility percentage was computed with the following formula:

$$\text{Sterility percentage} = \frac{\text{Number of unfilled spikelets panicle}^{-1}}{\text{Total number of spikelets panicle}^{-1}} \times 100$$

Energetics

Energy inputs were calculated and estimated in Mega Joule (MJ) ha^{-1} with reference to the standard values prescribed by Mittal *et al.* (1985). The standard energy coefficient for seed and straw of rice was

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multiplied with their respective yields and summed up to obtain for rice was calculated by adding the respective values of rice crop. Energy use efficiency, energy output-input ratio were calculated as per the following formula:

Total produce (q)

Energy use efficiency

= (q MJ-1 x 10-3) Energy input (MJ x 10-3)

Energy Output – Input Ratio =

Energy output

Energy input

RESULT AND DISCUSSION

Effect on crop

All the herbicide combinations had significantly higher values of crop growth and yield contributing characters over the weedy check. Among the herbicide treatments, highest number of tillers hill⁻¹ (13.60 at 60 DAT and 13.73 at harvest), dry matter of plant g hill⁻¹ (20.63 at 60 DAT and 35.29 at harvest) and yield were recorded with application of bispyribac-Na + (chlorimuron-ethyl+ metsulfuron-methyl) @ 20 + 4 g ha⁻¹ at 25 DAT (T₅) and was closely followed by bispyribac-Na+ ethoxysulfuron @ 25 + 18.75 g ha⁻¹ at 25 DAT (T₄) and minimum sterility percent (6.19) were observed. On the contrary, hand weeding at 25 and 45 DAT produced significantly higher number of tillers⁻¹ (15.91 at 60 DAT and 14.58 at harvest), dry matter of plant g hill⁻¹ (22.90 at 60 DAT and 38.37 at harvest) and minimum sterility percent (4.95) at harvest over weedy check and most of the herbicidal treatments. Grain and straw yield of transplanted rice varied significantly due to weed control treatments. Significantly maximum grain and straw yield (52 q

ha⁻¹ and 63.06 q ha⁻¹ respectively) was obtained with hand weeding at 25 and 45 DAT over rest of the treatments. Among the herbicides, application of bispyribac-Na + (chlorimuron-ethyl+ metsulfuron-methyl) @ 20 + 4 g ha⁻¹ at 25 DAT (T₅) recorded maximum grain and straw yield (50.60 and 62.18 q ha⁻¹) which was obvious due to its higher values of yield attributes and minimum sterility percent as compared to rest of the treatments. However, this treatment was at par with treatment bispyribac-Na+ ethoxysulfuron @ 25 + 18.75 g ha⁻¹ at 25 DAT (T₄). These findings are in close proximity with that of Bali *et al.* (2006) (Table 1).

Energetics

The highest energy input was registered under hand weeding at 25 and 45 DAT (T₁) (12.81) followed by pyrazosulfuron-ethyl fb manual weeding @ 20 g ha⁻¹ (T₉) (12.59). The highest energy output (155.26) and net energy output (121.00) was observed under hand weeding at 25 and 45 DAT (T₁) followed by bispyribac-Na + (chlorimuron-ethyl + metsulfuron-methyl) @ 20 + 4 g ha⁻¹ (T₅) and bispyribac-Na + ethoxysulfuron @ 25 + 18.75 g ha⁻¹ (T₄). The maximum energy use efficiency and energy output: input ratio was recorded under bispyribac-Na + (chlorimuron-ethyl + metsulfuron-methyl) @ 20 + 4 g ha⁻¹ at 25 DAT (T₅) (9.09 q MJ x 10⁻³ and 12.26) followed by hand weeding at 25 and 45 DAT (T₁₁) and bispyribac-Na + ethoxysulfuron @ 25 + 18.75 g ha⁻¹ (T₄). The highest energy output, energy use efficiency and energy output : input ratio was mainly due to higher grain and straw yield. Similar findings have been also reported by Azad *et al.* (1990) (Table 2).

Table 1. Effect of herbicide combination on growth parameters, sterility and yield of transplanted rice

Treatments	No. of tillers hill ⁻¹		Dry matter of plant (g hill ⁻¹)		Sterility (%)	Grain yield (q ha ⁻¹)	Straw yield (q ha ⁻¹)
	60 DAT	At harvest	60 DAT	At harvest			
Bispyribac -Na @ 25 g ha ⁻¹	11.66	11.91	17.78	33.09	7.45	48.60	60.51
Pretilachlor @ 1000 g ha ⁻¹	9.35	9.80	15.93	25.25	10.15	41.90	52.62
Pyrazosulfuron-ethyl @ 20g ha ⁻¹	9.67	10.00	16.65	26.43	9.34	42.50	54.25
Bispyribac-Na +Ethoxysulfuron @ 25 + 18.75 g ha ⁻¹	12.82	12.86	19.26	33.91	6.76	50.00	61.47
Bispyribac-Na + (chlorimuron-ethyl + metsulfuron-methyl) @ 20 + 4 g ha ⁻¹	13.60	13.73	20.63	35.29	6.19	50.60	62.18
Azimsulfuron @ 35 g ha ⁻¹	11.20	11.57	17.43	29.60	7.79	45.20	57.57
Pretilachlor fb Ethoxysulfuron @ 750 /18.75 g ha ⁻¹	10.51	10.85	17.25	29.32	8.28	44.60	56.00
Pretilachlor fb (chlorimuron-ethyl + metsulfuron-methyl) @ 750/ 4 g ha ⁻¹	10.93	11.25	17.31	29.48	7.95	45.00	56.99
Pyrazosulfuron-ethyl @ 20 g ha ⁻¹ fb manual weeding	12.43	12.59	18.24	33.39	7.21	49.80	61.31
Pretilachlor(6%) + bensulfuron (0.6%) 6.6% GR@ 660 g ha ⁻¹	10.26	10.47	16.81	27.47	8.94	43.20	55.98
Hand weeding at 25 and 45 DAT	15.91	14.58	22.90	38.37	4.95	52.00	63.06
Weedy check	7.60	7.68	12.49	23.90	19.30	21.87	40.76
SEm	0.88	1.04	1.26	2.48	0.62	2.17	2.37
LSD (P= 0.05)	2.58	3.06	3.69	7.27	1.81	6.35	6.94

Table 2. Effect of herbicide combination on energetics of transplanted rice

Treatments	Energy input (MJ x10 ⁻³ ha ⁻¹)	Energy output (MJ x10 ⁻³ ha ⁻¹)	Net Energy output (MJ x10 ⁻³ ha ⁻¹)	Energy use efficiency (q MJ x10 ⁻³ ha ⁻¹)	Energy output input ratio
Bispyribac -Na @ 25 g ha ⁻¹	12.41	147.08	134.67	8.79	11.85
Pretilachlor @ 1000 g ha ⁻¹	12.52	127.37	114.85	7.55	10.17
Pyrazosulfuron-ethyl @ 20g ha ⁻¹	12.40	130.29	117.89	7.80	10.51
Bispyribac-Na +Ethoxysulfuron @ 25 + 18.75 g ha ⁻¹	12.41	150.34	137.93	8.98	12.11
Bispyribac-Na + (chlorimuron-ethyl + metsulfuron-methyl) @ 20 + 4 g ha ⁻¹	12.41	152.11	139.70	9.09	12.26
Azimsulfuron @ 35 g ha ⁻¹	12.41	138.41	126.00	8.28	11.15
Pretilachlor fb Ethoxysulfuron @ 750 /18.75 g ha ⁻¹	12.53	135.56	123.03	8.03	10.82
Pretilachlor fb (chlorimuron-ethyl + metsulfuron-methyl) @ 750/ 4 g ha ⁻¹	12.52	137.39	124.87	8.15	10.97
Pyrazosulfuron-ethyl @ 20 g ha ⁻¹ fb manual weeding	12.59	149.84	137.25	8.83	11.90
Pretilachlor(6%) + bensulfuron (0.6%) 6.6% GR@ 660 g ha ⁻¹	12.48	133.48	121.00	7.95	10.70
Hand weeding at 25 and 45 DAT	12.81	155.26	142.45	8.98	12.12
Weedy check	12.37	83.10	70.73	5.06	6.72

CONCLUSION

It may be concluded from the investigation that hand weeding at 25 and 45 DAT registered maximum growth characters of rice like number of tillers hill⁻¹, dry matter accumulation, grain and straw yield, higher energy out: input ratio, energy output and energy use efficiency with minimum sterility percent. It was followed by treatments bispyribac-Na + (chlorimuron-ethyl + metsulfuron-methyl) @ 20 + 4 g ha⁻¹ (T₅) and bispyribac-Na + ethoxysulfuron @ 25 + 18.75 g ha⁻¹ (T₄).

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