

Weed management in *kharif* rice (*Oryza sativa* L.) under System of Rice Intensification (SRI)

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India is the world's second largest rice producer and consumer next to China. Total area under rice in India is 44 million hectares with annual production of 90 million tonnes. It needed to be enhanced from the present 90 million tonnes to about 100 million tonnes by the end of eleventh plan period to meet the growing demand of rapidly increasing population (Kumar *et al.* 2008). The main reasons of low productivity and profitability are vagaries of nature, low water and fertilizer use efficiency and poor crop management practices (poor input use efficiency) including adherence of farmers to the traditional costlier practices, besides low market price of farm produce, especially in the recent past.

A field experiment was conducted during *kharif* season on rice (Cv. GR-12) in the year 2010 at Main Rice Research Station, Anand Agricultural University, Nawagam. The experimental soil was silty clay loam, low in organic carbon (0.36%), medium in available nitrogen (254.34 kg ha⁻¹), phosphorus (35.84 kg ha⁻¹) and high in available potassium (316.35 kg ha⁻¹).

The experiment was laid out in randomized block design with four replications. Ten weed control treatments were studied viz., Weedy check (W₁), Weed free (three HW at 15, 30 & 45 DATP) (W₂), two conoweedings at 10, 20 DATP (W₃), three conoweedings at 10, 20 & 30 DATP (W₄), four conoweedings at 10, 20, 30 & 40 DATP (W₅), Butachlor @ 1.5 kg ha⁻¹ at 5 DATP (W₆), Butachlor @ 1.5 kg ha⁻¹ at 5 DATP + one conoweeding at 30 DATP (W₇), Butachlor @ 1.5 kg ha⁻¹ at 5 DATP + one

HW at 30 DATP (W₈), Pyrazosulfuron @ 25 g ha⁻¹ at 10-12 DATP (W₉), Fenoxaprop-p-ethyl @ 70 g ha⁻¹ at 10-12 DATP (W₁₀). Pre-emergence and post-emergence herbicides were sprayed with Knapsack sprayer fitted with flat fan nozzle using 500 litres of water per hectare as per treatment.

The dominant weed flora found in weedy check plot of field experiment was *Echinochloa crusgalli* L. and *Cynodon dactylon* L. (grassy weeds), *Cyperus rotundus* L. and *Cyperus iria* L. (sedges) and *Eclipta alba* L. and *Amisophacelus cucuttala* L. (broad leaved). At 25 & 50 DATP, significantly the lowest weed dry bio-mass and number of total weed counts were registered under the treatment of three hand weedings carried out at 15, 30 & 45 DATP (W₂) as compared to other weed management treatments. At harvest, results indicated that lower total weed dry bio-mass was registered under treatment of three hand weedings carried out at 15, 30 & 45 DATP (W₂) and it remained at par with treatments of pre-emergence application of Butachlor @ 1.5 kg ha⁻¹ at 5 DATP + one HW at 30 DATP (W₈), four conoweeding at 10, 20, 30 & 40 DATP (W₅). Significantly higher weed dry bio-mass was recorded in weedy check (W₁) at harvest. Similar results were reported by Shekhar and Mankotia (2005).

It is clear from the data that treatment of three hand weedings carried out at 15, 30 & 45 DATP (W₂) recorded higher weed control efficiency (WCE) followed by the treatments of four conoweeding at 10, 20, 30 & 40 DATP (W₅), pre-emergence application of Butachlor @ 1.5 kg ha⁻¹ at 5 DATP + one HW at 30 DATP (W₈), post-emergence application of Pyrazosulfuron @ 25 g ha⁻¹ at 10-12

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Table 1 Effect of weed management treatments on intensity of total weeds, dry bio-mass of total weeds, weed index, weed control efficiency, grain and straw yields at different growth of *Kharif* rice grown under system of rice intensification

Treatments	Intensity of total weeds (no. m ⁻²)		Dry bio-mass of total weeds (gm ²)		WI (%)	WCE (%)	Yield (kg ha ⁻¹)	
	At 25 DATP	At 50 DATP	At 25 DATP	At 50 DATP			Grain	Straw
W ₁ - Weedy check	9.71 ^a (93.75)	13.51 ^a (181.75)	87.60 ^a	145.69 ^a	40.95	0.00	2945 ^c	3473 ^c
W ₂ - Weed free (three HW at 15, 30 & 45 DATP.)	2.17 ^a (3.75)	3.72 ^a (13.00)	5.18 ^a	39.63 ^f	0.00	76.38	4988 ^a	5491 ^a
W ₃ - Two conoweeding at 10 & 20 DATP	6.53 ^b (41.75)	9.97 ^b (98.75)	44.98 ^b	88.17 ^e	14.23	40.92	4278 ^b	4579 ^b
W ₄ - Three conoweeding at 10, 20 & 30 DATP	4.29 ^d (17.50)	7.95 ^c (62.25)	26.86 ^d	70.30 ^c	13.19	53.45	4330 ^b	4818 ^b
W ₅ - Four conoweeding at 10, 20, 30 & 40 DATP	2.82 ^f (7.00)	4.58 ^f (20.25)	9.23 ^e	48.90 ^e	6.68	71.92	4655 ^{bc}	5102 ^{bc}
W ₆ - Butachlor @ 1.5 kg ha ⁻¹ at 5 DATP	5.06 ^c (24.75)	6.57 ^d (42.25)	26.69 ^d	61.40 ^d	12.50	63.50	4364 ^b	4846 ^b
W ₇ - Butachlor @ 1.5 kg ha ⁻¹ at 5 DATP + one conoweeding at 30 DATP	4.60 ^{cd} (20.25)	5.74 ^e (32.00)	24.72 ^d	57.48 ^d	8.36	67.69	4571 ^{bc}	5013 ^{bc}
W ₈ - Butachlor @ 1.5 kg ha ⁻¹ at 5 DATP + one HW at 30 DATP	3.84 ^e (13.75)	4.92 ^f (23.25)	13.68 ^f	47.97 ^e	6.46	71.97	4665 ^{bc}	5123 ^{bc}
W ₉ - Pyrazosulfuron @ 25 g ha ⁻¹ at 10-12 DATP	4.38 ^d (18.25)	6.39 ^{de} (40.00)	20.01 ^e	57.44 ^d	6.87	66.81	4645 ^{bc}	5096 ^{bc}
W ₁₀ - Fenoxaprop-p-ethyl @ 70 g ha ⁻¹ at 10-12 DATP	6.82 ^b (45.75)	8.24 ^c (67.00)	38.30 ^c	61.62 ^d	12.33	56.83	4373 ^b	4888 ^b
S.E.m. ±	0.16	0.23	1.14	2.44	-	-	188.05	175.51
C. D. at 5 %	Sig.	Sig.	Sig.	Sig.	-	-	Sig.	Sig.
C. V. %	6.64	6.40	7.70	7.20	-	-	8.58	7.25

* Figures in parentheses are original values. All figures subjected to transformed values to square root $\sqrt{(X+1)}$. Figures indicating common letters in column do not differ significantly from each other at 5 % level of significance according to Duncan New Multiple Range Test

DATP (W_9), Butachlor @ 1.5 kg ha⁻¹ at 5 DATP + one conoweeding at 30 DATP (W_7) and Butachlor @ 1.5 kg ha⁻¹ at 5 DATP (W_6). Weed control efficiency was varied between 69.5 to 100 % in these treatments.

Significantly lower weed index was observed under treatment of three hand weeding carried out at 15, 30 & 45 DATP (W_2) followed by treatments of pre-emergence application of Butachlor @ 1.5 kg ha⁻¹ at 5 DATP + one HW at 30 DATP (W_8), four conoweeding at 10, 20, 30 & 40 DATP (W_5), post-

emergence application of Pyrazosulfuron @ 25 g ha⁻¹ at 10-12 DATP (W_9), Butachlor @ 1.5 kg ha⁻¹ at 5 DATP + one conoweeding at 30 DATP (W_7), Fenoxaprop-p-ethyl @ 70 g ha⁻¹ at 10-12 DATP (W_{10}) and Butachlor @ 1.5 kg ha⁻¹ at 5 DATP (W_6). The weedy check (W_1) recorded the maximum weed index. Halder and Patra (2007) also obtained similar results.

Significantly higher yield attributing characters viz., panicle weight, panicle length, test weight and

Table 2. Yield attributing characters of rice influenced by weed management treatments at harvest grown under system of rice intensification

Treatments	Panicle length (cm)	Panicle weight (g)	Number of grains panicle ⁻¹	Test weight (g)
W_1 - Weedy check	18.42 ^c	1.98 ^c	149.75 ^c	14.05 ^c
W_2 - Weed free (three HW at 15, 30 & 45 DATP.)	24.50 ^a	3.38 ^a	239.25 ^a	17.35 ^a
W_3 - Two conoweeding at 10 & 20 DATP	21.00 ^b	2.94 ^b	199.75 ^b	14.90 ^{bc}
W_4 - Three conoweeding at 10, 20 & 30 DATP	22.38 ^{ab}	2.83 ^b	215.75 ^{ab}	15.33 ^{abc}
W_5 - Four conoweeding at 10, 20, 30 & 40 DATP	23.28 ^{ab}	3.15 ^{ab}	226.00 ^a	17.03 ^a
W_6 - Butachlor @ 1.5 kg ha ⁻¹ at 5 DATP	22.53 ^{ab}	3.01 ^{ab}	217.50 ^{ab}	16.95 ^{ab}
W_7 - Butachlor @ 1.5 kg ha ⁻¹ at 5 DATP + one conoweeding at 30 DATP	22.63 ^{ab}	3.19 ^{ab}	219.00 ^{ab}	17.00 ^a
W_8 - Butachlor @ 1.5 kg ha ⁻¹ at 5 DATP + one HW at 30 DATP	23.45 ^{ab}	3.21 ^{ab}	226.75 ^{ab}	17.15 ^a
W_9 - Pyrazosulfuron @ 25 g ha ⁻¹ at 10-12 DATP	23.00 ^{ab}	3.17 ^{ab}	225.00 ^a	17.13 ^a
W_{10} - Fenoxaprop-p-ethyl @ 70 g ha ⁻¹ at 10-12 DATP	21.83 ^b	3.05 ^{ab}	219.00 ^{ab}	16.68 ^{ab}
S.E.m. $\pm$	0.78	0.12	7.65	0.64
C. D. at 5 %	Sig.	Sig.	Sig.	Sig.
C. V. %	6.95	8.18	7.16	7.77

* Treatments means with the letters in common are not significant according to Duncan New Multiple Range Test at 5 % level of significance

number of grain per panicle were noted under treatment of three hand weedings carried out at 15, 30 & 45 DATP (W_2), but remained at par with treatment of pre-emergence application of Butachlor @ 1.5 kg ha^{-1} at 5 DATP + one HW at 30 DATP (W_8), four conoweeding at 10, 20, 30 & 40 DATP (W_5), post-emergence application of Pyrazosulfuron @ 25 g ha^{-1} at 10-12 DATP (W_9) and Butachlor @ 1.5 kg ha^{-1} at 5 DATP + one conoweeding at 30 DATP (W_7), (Table 2). This might be due notable increase in uptake of nutrients, growth and development and thereby increase in yield attributes under weed free condition.

Significantly higher grain & straw yield of rice were recorded under treatment of three hand weedings carried out at 15, 30 & 45 DATP (W_2) which was remained at par with treatments of pre-emergence application of Butachlor @ 1.5 kg ha^{-1} at 5 DATP + one HW at 30 DATP (W_8), four conoweedings at 10, 20, 30 & 40 DATP (W_5), post-emergence application of Pyrazosulfuron @ 25 g ha^{-1} at 10-12 DATP (W_9) and Butachlor @ 1.5 kg ha^{-1} at 5 DATP + one conoweeding at 30 DATP (W_7). Significantly the lowest grain yield was recorded under weedy check (W_1) which might be due to higher infestation of weeds in the plot resulted in strong competition of weeds with the crop for moisture, light, nutrients and space. These results are in close association with the findings of Saha *et al.* (1999) and Dixit and Varshney (2008).

In view of the results obtained from this investigation, it could be conducted that higher

profitable yield of *kharif* rice grown under System of Rice Intensification could be obtained by keeping it weed free by three hand weedings carried out at 15, 30 & 45 days after transplanting (DATP). While under labour crises situations, either Pyrazosulfuron @ 25 g ha^{-1} in 500 litres of water at 10-12 DATP or Butachlor @ 1.5 kg ha^{-1} in 500 litres of water at 5 DATP coupled with one hand weeding at 30 DATP may be adopted.

REFERENCES

- Dixit, A. and Varshney, Jay G. (2008). Assessment of post-emergence herbicides in direct seeded rice. *Indian Journal of Weed Science* **40** (3&4):144-147.
- Halder, J. and Patra, A. K. (2007). Effect of chemical weed control methods on productivity on transplanted rice. *Indian Journal of Agronomy* **52** (2): 111-113.
- Kumar, J., Kumar, A. and Sharma, B. C. (2008). Effect of weed management and crop establishment methods on weed dynamics and productivity of rice. *Indian Journal of Weed Science* **41** (3&4):142-147.
- Saha, G. P.; Singh R. S. and Shrivastava, V. C. (1999). Effect of beushening and chemical weed control on productivity and profitability of rainfed lowland rice. *Oryza sativa* L. **36** (1): 92-93.
- Shekhar, J. and Mankotia, B. S. (2005). Efficacy of some new herbicides in wet seeded rice. *Indian Journal of Weed Science* **37** (1 & 2): 58-60.