

Yield of rice-wheat cropping system as influenced by chemical and mechanical weed management in Chhattisgarh

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ABSTRACT

A field experiment was conducted during the years 2002-03 and 2003-04 at Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) to develop an effective weed management practice in rice-wheat cropping system. Pre-emergence application of oxadiargyl 0.08 kg/ha produced maximum grain yield (5.43 t/ha) of transplanted rice which was comparable to hand hoeing twice at 20 and 35 DAT (5.22 t/ha) and pre-emergence application of pretilachlor 0.75 kg/ha (5.14 t/ha) mainly due to higher weed control efficiencies associated with them than other weed management treatments. Post-emergence application of sulfosulfuron (0.025kg/ha) produced maximum grain yield of wheat which was at par with pre-emergence application of pendimethalin (1.0 kg/ha) and hand hoeing twice.

Key words : Butachlor, Oxadiargyl, Pretilachlor, Pendimethalin, Rice-wheat cropping system, Sulfosulfuron, Yield

Rice-wheat cropping systems play a significant role in food security by contributing 76% to national food grain production. This system occupies 9.7 million hectare area in India (Joshi and Tripathi 2006). In recent years, however, this cropping system is showing the sign of deterioration in productivity due to various reasons and severe weed infestation. Unchecked weeds reduce the system productivity by 20-40% (Nandal and Singh 1994, Pandey 2002). Thus timely and effective control of weeds is imperative to augment the system productivity. Chemical weed control method is the most acceptable and widely used measure for managing weeds in the country. Extensive and intensive uses of herbicides has deep impact on weed infestation. Inclusion of mechanical weed control along with chemicals may be helpful to minimize the pressure on chemical weed control alone.

Very little information is available pertaining to comparative studies on chemical and mechanical weed control in rice-wheat cropping system of Chhattisgarh. Hence, the present experiment was under taken to study the comparative performance of different promising herbicides with mechanical weed control in rice-wheat cropping system.

MATERIALS AND METHODS

A field experiment was conducted during 2002-03 and 2003-04 at Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh). The soil of experimental field was alfisol with neutral reaction (pH 7.2), low organic content

(0.40%), low available nitrogen (203 kg/ha), medium available P (9.6 kg/ha) and high available K (315 kg/ha) content. The experiment consisted of 5 treatments involving 3 herbicides viz., butachlor 1.5 kg/ha, pretilachlor 0.75 kg/ha and oxadiargyl 0.08 kg/ha, hoeing at 20 and 35 days after transplanting (DAT) and a weedy check in rice during *kharif* season in randomized block design replicated thrice. In wheat, treatments consisted of herbicides viz., pendimethalin 1.0 kg/ha as pre-emergence, sulfosulfuron 0.025 kg/ha as post-emergence, hoeing twice by wheel hoe and weedy check which were super imposed over each treatment of rice in wheat during *rabi* season.

Twenty five day old seedlings of rice cv. Mahamaya were transplanted in second week of July at a spacing of 20x10cm. Wheat cv. Sujata was sown in the first week of December in rows 20cm apart using 100 kg seed/ha during both the years. A uniform fertilizer dose of 80kg N + 50 kg P₂O₅ +30 K₂O/ha was used in both the crops. Full quantity of P and K and half dose of N were applied as basal in both the crops. Remaining N was applied in two equal splits to both crops. In rice, herbicides were applied at 3 days after transplanting while in wheat, pendimethalin and sulfosulfuron were applied at 3 and 21 days, respectively. All the herbicides were applied by using a volume spray of 600 l/ha with the help of Knapsacks prayer fitted with flat-fan nozzle. Periodical observations on weeds and crops were recorded to interpret the results.

RESULTS AND DISCUSSION

Floristic composition

The experimental field was infested with narrow and broad leaf weeds as well as sedges in weedy check plot of rice. The dominant weeds in rice were *Echinochloa colona*, *Cyperus iria*, *Caesulia axillaries*, *Ischaemum rugosum*, *Eclipta alba*, *Commelina benghalensis*, *Cynodon dactylon* and *Alternanthera* sp. The wheat crop in weedy check plot was predominantly infested with *Melilotus alba*, *Medicago denticulata*, *Chenopodium album*, *Cynodon dactylon*, *Anagallis arvensis*, *Vicia faba* and *Physalis minima*.

Weed biomass

Dry matter of weeds was significantly affected in rice by different weed management practices. During first year, pretilachlor 0.75 kg/ha and oxadiargyl 0.08 kg/ha as well as hoeing twice at 20 and 35 DAT were comparable for weed biomass and these were significantly superior over weedy check and application of butachlor 1.5kg/ha (Table 1). Dry matter of weeds was minimum (9.32 g/m²) with pretilachlor mainly due to higher weed control efficiency (74.77%) (Fig.1). But during second year, dry matter of weeds was lowest (14.29 g/m²) with oxadiargyl 0.08 kg/ha closely followed by pretilachlor 0.75 kg/ha, hoeing twice and butachlor 1.5 kg/ha in ascending order, respectively. All these treatments were significantly superior to weedy check due to their higher weed control efficiencies. Chander and Pandey (2001) also confirmed these observations.

There was no impact of treatments applied on weed dry matter accumulation in wheat but treatments applied in wheat significantly differed in dry matter production by weeds. During *rabi* season, weed biomass was minimum in both years with sulfosulfuron 0.025 kg/ha due to better control of broad leaf weeds. These results are in close conformity with the findings of Singh *et al.* (1998) and Balyan (1999). Pre-emergence application of pendimethalin 1.0 kg/ha and hoeing twice by wheel hoe were also comparable to sulfosulfuron in respect to weed biomass.

Grain yield

Pre-emergence application of oxadiargyl 0.08 kg/ha produced maximum grain yield (5.43 t/ha) of transplanted rice which was comparable to those obtained with hoeing twice at 20 and 35 DAT (5.22 t/ha), pre-emergence application of pretilachlor 0.75 kg/ha (5.14 t/ha) and butachlor 1.5 kg/ha (5.01 t/ha) All these treatments significantly produced higher grain yield over weedy check mainly due to better weed control efficiency by effective utilization of light, moisture, space and nutrients by crop (Fig. 1 and Table 2). Similar results were reported by several other workers from their studies (Rao 1995, Jacob and Syriac, 2005).

Post-emergence application of sulfosulfuron 0.025 kg/ha produced maximum wheat yield which was comparable to pre-emergence application of pendimethalin 1.0 kg/ha and hoeing by wheel hoe and these were significantly superior over weedy check (Table 2).

Table 1. Effect of weed management techniques on dry matter production of weeds in rice-wheat system

Treatment	Dry matter of weeds (g/m ²)					
	Rice			Wheat		
	2002	2003	Mean	2002-03	2003-04	Mean
Rice						
Butachlor 1.5kg/ha	18.35	19.39	18.97	28.79	30.1	29.70
Pretilachlor 0.75 kg/ha	9.32	15.18	12.25	29.93	30.20	30.07
Oxadiargyl 0.08 kg/ha	13.31	14.79	14.05	26.15	29.85	28.00
Hoeing twice by wheel hoe	11.69	18.68	15.89	27.45	31.27	29.36
Weedy check	37.07	38.71	37.89	38.64	32.80	35.72
LSD (P=0.05)	6.39	6.50	-	1.90	NS	-
Wheat						
Pendimethalin 1.0 kg/ha	-	-	-	27.09	21.13	24.11
Sulfosulfuron 0.025 kg/ha	-	-	-	23.05	18.75	20.90
Hoeing by wheel hoe	-	-	-	24.66	18.75	20.90
Unweeded control	-	-	-	45.97	61.71	53.84
LSD(P=0.05)	-	-	-	2.50	4.60	-

Table 2. Effect of weed management techniques on grain yield of crops

Treatment	Rice (t/ha)			Wheat (t/ha)		
	2002	2003	Mean	2002-03	2002-04	Mean
Rice						
Butachlor 1.5 kg/ha	5.80	4.22	5.01	3.49	2.83	3.16
Pretilachlor 0.75	6.10	4.17	5.14	3.58	2.86	3.22
Oxadiargyl 0.08	5.92	4.94	5.43	3.57	2.80	3.19
Hoeing twice by wheel hoe	5.73	4.71	5.22	3.68	2.80	3.24
Weedy check	4.17	3.77	3.97	3.47	2.7	3.12
LSD (P=0.05)	0.24	0.46	-	0.16	NS	-
Wheat						
Pendimethalin 1.0 kg/ha	-	-	-	3.62	2.88	3.25
Sulfosulfuron 0.025 kg/ha	-	-	-	4.01	3.25	3.63
Hoeing twice by wheel hoe	-	-	-	4.0	2.92	3.49
Weedy check	-	-	-	2.54	2.19	2.37
LSD(P=0.05)	-	-	-	0.96	1.64	-

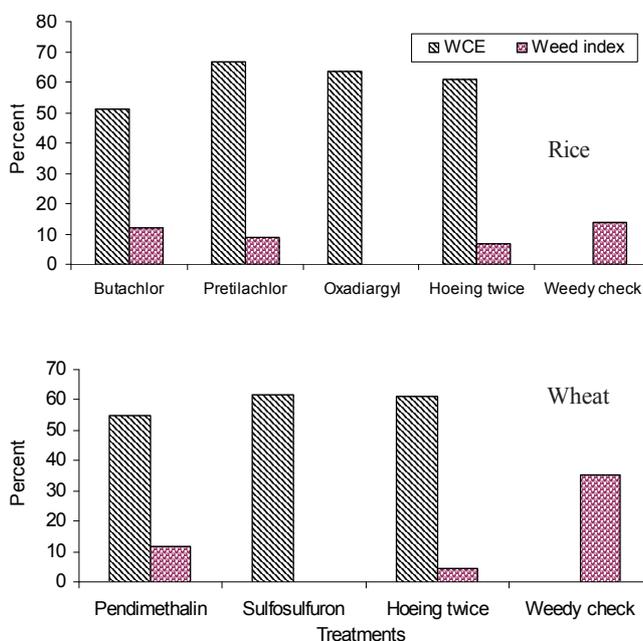


Fig. 1. Weed control efficiency (WCE) and weed index (WI) under different weed management in rice and wheat.

REFERENCES

- Balyan RS.1999. Efficacy of sulfosulfuron, tralkoxydim and metribuzin applied alone and tank mixed on weed in wheat. *Indian Journal of Weed Science* 31(1 & 2):80-83.
- Chander S and Pandey J. 2001.Effect of rice culture (*Oryza sativa*), nitrogen and weed control on nitrogen competition between scented rice and weeds. *Indian Journal of Agronomy* 46(1): 68-74.
- Joshi A and Tripathi SS. 2006. Pulses and crop diversification in India. *Indian Farmer's Digest* 39(2):23-24.
- Jacob D and Syriac Elizabeth K. 2005. Relative efficacy of different spacing and weed control methods in scented rice. *Oryza* 42(1):75-77.
- Nanda DP and Singh CM. 1994. Weed management in transplanted rice-wheat cropping system. *Indian Journal of Agronomy* 39(4):517-521.
- Pandey J. 2002. Direct and residual effects of herbicide on weed and productivity of rice-wheat cropping system. In: *Extended Summaries of Second International Agronomy Congress*: 1166-1167.
- Rao AS. 1995. Susceptibility of various weed groups as influenced by herbicide mixture and sequential application in transplanted rice *Annals of Agricultural Research* 16(2):455-459.
- Singh Vireshwar, Singh S and Malik R.K.1998. Performance of new herbicides against *Phalaris minor* in wheat. *Indian Journal of Weed Science* 30 (3 & 4): 21-123.