



Increase of wheat yield in rice-wheat system by weed management

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ABSTRACT

Sulfosulfuron at 33.3 g/ha recorded significantly lower weed intensity and biomass, higher weed control efficiency, which was at par with hand weeding 30 DAS and superior to isoproturon and 2,4 D sodium salt. The maximum nutrient removal by wheat crop and response over weedy check towards grain yield of wheat (129.6%) were with weed free treatment followed by sulfosulfuron at 33.3 g/ha and minimum in 2,4-D of sodium salt at 0.80 kg/ha. The maximum net return and B: C ratio by wheat cultivation (₹ 31,475/ha and 1:1.80) was obtained with sulfosulfuron at 33.3 g/ha at par with weed free and weeding at 30 DAS than others treatments.

Key words: 2,4-D, Isoproturon, Sodium salt, Sulfosulfuron, Weed intensity

Rice-wheat is one of the most predominant cropping systems occupying 10.5 m ha area, especially in North India. Weed infestation in wheat is more serious problem under this system. Crop weed competition during the crop growth results 20 to 95% reduction in grain yield, which also depends on the weed intensity and type of weed flora (Kumar *et al.* 1998). The broad leaved weeds, *viz.* *Cannabis* spp. and *Chenopodium* spp. were found as major weeds in eastern part of Bihar. Manual weeding is expensive, energy and time consuming as well as difficult in early stage of crop growth. Herbicides were found effective against control of large number of weeds which increased the crop yield. For efficient and economic management of weeds in wheat, isoproturon and 2,4-D has been found to be the most suitable herbicides for last two decades in India (Singh *et al.* 2001). But continuous use of single herbicide may cause shifting in weed flora or resistance problems. So, keeping these facts in view, the present study was undertaken to study the effect of different herbicides on weeds and economics of wheat.

MATERIALS AND METHODS

A field experiment was conducted during two consecutive *Rabi* seasons of 2011-12 and 2012-13 at Research Farm of Bhola Paswan Shastri Agricultural College Purnea, Bihar Agricultural University, (Sabour) Bhagalpur, Bihar. The land was situated at 25° 48' N latitude and 87° 30' E longitude and an altitude of 102 metres above MSL in inceptisole. The soil of experimental site was sandy loam in texture, neutral in pH (6.7), low in organic carbon (0.44%)

and available nitrogen (180kg /ha), medium in phosphorus (30 kg/ha), medium in available K (275 kg/ha), medium in available S (19.1 kg/ ha), medium in available Mn (6.8 ppm), low in available Zn (0.2 ppm), high in available Fe (114.4 ppm), medium in available Cu (2.6ppm) and low in available B (0.1 ppm) status. Six treatment comprising weedy check, weed free, one hand weeding (30 DAS), isoproturon at 0.75 kg/ha (pre-emergence), sulfosulfuron at 33.3 g/ha (post-emergence), 2,4-D sodium salt at 0.80 kg/ha (post-emergence) were laid out in randomized block design (RBD) having four replications. The recommended dose of fertilizers 100: 50: 25 kg NPK /ha were applied by urea, DAP and murate of potash. The full dose of phosphorus, potash and half dose of nitrogen was applied as basal. Remaining N was applied in two equal splits *i.e.* at tillering and booting stages. Irrigation was applied at critical stage of wheat production. Wheat variety 'HD 2985' was sown on Nov 28, 2011 and Nov 30, 2012 using 100 kg/ha seed rate with 23 cm of row spacing apart. The experiment was conducted in fixed plots without disturbing the layout. The weed density (species wise) and dry weight were measured in each plots from randomly selected places (1.0 m²) at 50 DAS and 80 DAS.

Weed control efficiency (WCE) was calculated on the basis of dry weight by the commonly used method and formula.

The grain, straw and weed samples were collected and dried in oven at 65±5 °C. Thereafter, these were ground, digested and analysed nitrogen by Kjeldhal method with titration of absorbed ammonia by sulphuric acid. Phosphorus content was estimated by yellow colour developed by Vandomolybedate and read-

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ing by spectrophotometer and potassium concentration was estimated by flame photometer. The percentage of nutrient content was multiplied with biomass of weed or crop yield for calculating of nutrient uptake. The cost of cultivation was calculated by taking in to account of prevailing price of inputs.

RESULTS AND DISCUSSION

The major weed flora found in experimental plots were: *Phalaris minor* Retz. in grassy weeds with *Cannabis sativa* L. , *Chenopodium album* L. and *Fumaria parviflora* L. among broad-leaved weeds. The other minor weeds were *Anagallis arvensis* L. and *Solanum nigrum* L. etc.

The maximum reduction in weeds was recorded with weed free treatment and minimum in weedy check (Table 1). Among different herbicides, sulfosulfuron at 33.3 g/ha significantly reduced number of weeds and weed biomass (111.3 weeds/m² and 58.5 g/m²) as compared to isoproturon and 2,4-D sodium salt. However, this treatment was statistically at par with hand weeding 30 DAS. This may due to broad spectrum action of sulfosulfuron on both grassy and broad-leaved weeds (Singh *et al.* 1997, Walia *et al.* 2000, Tiwari and Vaishya 2004). The maximum weed control efficiency was found in weed free treatment which was at par with sulfosulfuron at 33.3 g/ha and minimum in control plots.

Cannabis sativa L., *Chenopodium album* L. and *Fumaria parviflora* L. were major weeds which reduced yield of wheat in this area. Weed free followed by sulfosufuron at 33.3 g/ha as post-emergence at 30 DAS caused maximum reduction per cent of these weed species. Sulfosulfuron at 33.3 g/ha found significantly superior in controlling major weeds than isoproturon at 0.75 kg/ha at pre-emergence and 2,4-

D of sodium salt at 0.80 kg/ha as post- emergence. The highest nutrient uptake (N, P and K; 36.8, 20.5 and 35.4 kg/ha, respectively) by weeds was noticed in weedy check, which was harmful for wheat crops during cultivation and indicated very high competition between crop and weeds for nutrients. Among different herbicides, sulfosulfuron treatment recorded significantly lower nutrient removal (N, P and K 10.7, 5.1 and 10.5 kg/ha, respectively) by weeds and it was found statistically similar with hand weeding at 30 DAS and superior to other chemical used in the experiments. Kumar *et al.* (1998) and Yadav *et al.* (1986) also found the similar results.

All the weed control measures significantly increased grain and straw yield over weedy check (Table 2). The weed free treatment obtained grain yield at par with sulfosulfuron and hand weeding at 30 DAS. Among different herbicides, sulfosulfuron at 33.3 g/ha recorded significantly higher grain yield (2.75 t/ha) than isoproturon and 2,4-D sodium salts. Kushwaha and Singh (2000) and Walia *et al.* (2000) also found the maximum grain yield of wheat with two hand weeding. The yield attributing characters (length of spikelet, no. of spikelet's/spike, no. of grain/spike and 1000 grain wt) of wheat followed the similar trends to grain yield. The maximum response of grain yield of wheat (129.6%) was obtained with weed free treatment followed by sulfosulfuron at 33.3 g/ha as post-emergence at 30 DAS and minimum in 2,4-D sodium salt at 0.80 kg/ha as post-emergence treatment. The maximum macronutrient (N, P and K uptake) by wheat (55.5, 11.1 and 47.0 kg/ha, respectively) were obtained with weed free and it was found at par with sulfosulfuron 33.3 g/ha at post-emergence 30 DAS and one hand weeding at 30 DAS than others treatments. The maximum net return and B:C ratio by wheat

Table 1. Effect of weed management on weed growth and nutrient removal by weeds (mean of two years)

Treatment	No of weeds/m ²	Weeds dry weight (g/m ²)	Weed control efficiency (%)	Weed species (% decrease)				Nutrient uptake by weeds (kg/ha)		
				<i>Cannabis sativa</i>	<i>Chenopodium album</i>	<i>Fumaria parviflora</i>	Others	N	P	K
One HW at 30 DAS	118.8	59.5	68.5	84.0	86.0	69.0	80.0	10.2	5.6	11.0
Isoproturon 0.75 kg/ha as PE	150.0	80.8	57.2	77.0	69.0	69.0	71.0	15.1	7.3	14.9
Sulfosulfuron 33.3 g/ha as POE at 30 DAS	111.3	58.5	69.0	81.4	81.7	76.4	70.0	10.7	5.1	10.5
2,4-D sodium salt 0.80 kg/ha as POE at 30 DAS	181.3	97.8	48.2	63.0	68.0	68.0	65.0	18.1	9.1	17.9
Weedy check	390.0	188.8	0.0	-	-	-	-	36.8	20.5	35.4
Weed free	0.0	0.0	100.0	100.0	100.0	100.0	100.0	0.0	0.0	0.0
LSD (P=0.05)	28.5	14.6	3.7	-	-	-	-	3.1	1.6	2.9

DAS = Days after sowing, HW = Hand weeding, PE = Pre-emergence, POE = Post-emergence

Table 2. Effect of weed management on yield, nutrient uptake and economics of wheat (mean of two years)

Treatment	Effective tiller /m ²	Plant height at maturity (cm)	No of spiklets/spike	No of grain /spike	1000 grain wt (g)	Grain yield (t/ha)	Response over weedy check	Nutrient Uptake by crop (kg/ha)			Economics	
								N	P	K	Net returns (x10 ³ /ha)	B:C ratio
One HW at 30 DAS	25.9	91.8	16.1	29.4	42.3	2.59	107.2	50.0	10.2	44.3	28.73	1.64
Isoproturon 0.70 kg/ha as PE	24.1	90.8	15.3	30.2	41.9	2.41	92.8	46.9	9.8	43.5	26.59	1.58
Sulfosulfuron 33.3 g/ha as POE at 30 DAS	27.2	95.0	16.1	30.5	42.9	2.75	117.6	52.5	10.9	47.2	31.47	1.80
2,4-D sodium salt 0.80 kg/ha as POE at 30 DAS	22.8	90.5	15.1	30.6	41.2	2.28	82.4	44.3	9.4	41.2	24.28	1.44
Weedy check	12.5	77.6	9.6	21.4	37.1	1.25	-	24.1	4.8	20.1	6.15	0.37
Weed free	28.7	99.3	16.2	30.8	43.3	2.87	129.6	55.2	11.1	47.0	30.65	1.49
LSD (P=0.05)	3.3	10.4	2.3	4.0	3.5	0.31	-	6.1	1.3	6.5	5.82	0.33

DAS = Days after sowing, HW = Hand weeding, PE = Pre-emergence, POE = Post-emergence

cultivation (31,475/ha and 1:1.80) was obtained with sulfosulfuron 33.3 g/ha but at par with weed free and one hand weeding at 30 DAS. The minimum net return and B:C ratio was obtained with 2,4-D sodium salt.

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