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Agro-Economic Feasibility of Weed Management in Soybean Grown in Vertisols of South-Eastern Rajasthan

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ABSTRACT

Field experiment was conducted during **kharif** seasons of 2003 and 2004 to evaluate the economic feasibility of weed management practices in soybean crop in south-eastern Rajasthan. Post- emergence application of imazethapyr reduced the density and dry biomass of broad as well as narrow leaved weeds significantly as compared to pre-plant and pre-emergence and rest of post-emergence herbicides under study. The lowest weed density and biomass were recorded with two hand weedings at 30 and 45 days after sowing (DAS) followed by imazethapyr at 100 and 75 g/ha. Imazethapyr at 75 g/ha was found most agro-economic feasible by giving highest net returns (Rs.10235/ha) and incremental cost : benefit ratio (9.89).

Key words : Soil type, herbicide efficacy, cost-benefit ratio

INTRODUCTION

Soybean is one of the most promising **kharif** oil seed crop in south-eastern Rajasthan contributing about 7.54% area of total soybean acreage of the country. However, its productivity is low as compared to potential yield due to infestation of weeds. Weeds are the foremost biotic constraints in enhancing productivity of soybean and take yield toll ranging from 20 to 89% (Chhokar and Balyan,1999; Dubey, 2002) due to unpredictability of rains which makes non-workable conditions of soil for weed control during **kharif** season. Though the conventional method (hand weeding) of weed control is very much effective, but due to high wages and non-availability of labour during the critical weeding period, the use of herbicides could be more effective and time saving. Weed management in soybean had really been a challenging task. Mostly hand weedings in a very short period are not feasible. Therefore, in such situations, the only alternative is herbicidal weed control. Henceforth, a study was conducted on weed management in soybean grown in vertisols to find out agro-economic feasibility and its impact on seed yield.

MATERIALS AND METHODS

A field experiment was carried out during **kharif** seasons of 2003 and 2004 at Agricultural Research Station, Kota, Rajasthan. The soil was clay loam (Vertisols) having pH 7.95, EC 0.42 dS/m, OC 0.56%, available N, P_2O_5, K_2O 335, 24, 305 kg/ha, respectively. The treatments comprised weedy check (control), two hand weedings at 30 and 45 days after sowing (DAS), alachlor 2.0 kg/ha as pre-emergence (PE), trifluralin 1.0 kg/ha as pre-plant incorporation (PPI), imazethapyr 75 and 100 g/ha as post-emergence (POE). The experiment was laid out in randomized block design with three replications. All the herbicides were applied by manually operated knapsack sprayer fitted with flat fan nozzle using spray volume of 600 l/ha. The density and biomass of weeds were recorded at 30 and 60 DAS. Soybean variety 'JS 335' was sown in 30 cm wide rows on July 7, 2003 and July 15, 2004. The crop was fertilized with 20 kg nitrogen and 40 kg phosphorus/ha. Weed index expressing the reduction in yield due to presence of weeds in comparison with weed free situation and weed control efficiency were worked out using following formulae :

$$\text{Weed index (\%)} = \frac{\text{Yield in two hand weeded plot} - \text{Yield in treated plot}}{\text{Yield in two hand weeded plot}} \times 100$$

$$\text{Weed control efficiency (\%)} = \frac{\text{Dry matter of weeds in control plot} - \text{Dry matter of weeds in treated plot}}{\text{Dry matter of weeds in control plot}} \times 100$$

Economics was worked out on the basis of prevailing market prices. Market rate of soybean was 1150 q/ha and labour charges were Rs. 65/day.

RESULTS AND DISCUSSION

Effect on Weeds

Experimental field was infested mainly with monocot weeds (*Cynodon dactylon, Cyperus rotundus, Echinochloa crusgalli* and *E. colona*) and dicot weeds (*Celosia argentea, Digera arvensis*,*Commmelina benghalensis* and *Amaranthus viridis*). The narrow-leaved weeds dominated (60%) and the broad-leaved weeds (40%) in terms of density but the dry weight of dicots was more than the monocots. All the herbicidal treatments significantly reduced the weed density and their dry biomass over weedy check (Table 1). Significantly lowest dry weed biomass was recorded with two hand weedings. Among herbicides, imazethapyr at 75 and 100 g/ha gave significantly less weed biomass than other herbicides at both the stages. Similar observation had been made by Kushwah and Vyas (2006). At 30 days, post- emergence application of imazethapyr had more pronounced effect in reducing the density and their dry weight as compared to alachlor and trifluralin application. Imazethapyr at 100 and 75 g/ha was effective against both monocot and dicot weeds and it was at par with two hand weedings. The better performance of imazethapyr in the present study appeared to be due to better control of grassy as well as broad leaved weeds. The highest weed control efficiency (99.9 and 81.6%) was observed in two hand weedings at 30 and 60 DAS followed by the imazethapyr application.

Effect on Crop

Seed yield was significantly influenced by different weed control treatments. On pooled basis, the highest seed yield (23.62 q/ha) was recorded in two hand weedings at 30 and 45 DAS. Among the herbicides, imazethapyr 100 g/ha recorded significantly higher seed yield (20.22 q/ha) and was at par with 75 g/ha (19.30 q/ha). Application of imazethapyr 75 and 100 g/ha increased seed yield by 103.1 and 112.8% as compared to weedy check (9.5 q/ha). These results corroborate with the findings of Kushwah and Vyas (2006).

Table 1. Effect of weed management on weed density and weed dry matter in soybean (Pooled data of two years)

Treatment	Weed density* (No./m^2)		Weed dry matter (g/m^2)		Weed control efficiency (%)	
	30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS
Weedy check	13.11 (170)	14.1 (196)	292.6	415.5	-	-
Two hand weedings 30 & 45 DAS	0.7 (00)	5.1 (25)	0.00	53.7	99.9	81.6
Alachlor 2.0 kg/ha PE	8.8 (77)	8.9 (80)	83.6	158.0	71.4	46.0
Trifluralin 1.0 kg/ha PPI	7.5 (56)	7.8 (61)	64.8	124.2	77.9	57.6
Imazethapyr 75 g/ha POE	5.5 (35)	6.3 (40)	41.8	84.8	85.7	71.0
Imazethapyr 100 g/ha POE	5.3 (32)	6.1 (36)	37.3	79.0	87.3	73.0
LSD (P=0.05)	0.31 (8.7)	0.27 (12.6)	11.2	21.1	-	-

*Data subjected to $\sqrt{X+1}$ transformation and figures in parentheses are original.

Agro-Economic Feasibility

All the treatments for weed control showed better economics over the weedy check. Among the herbicides, imazethapyr 75 g/ha showed greater performance efficiency, which provided additional net returns of Rs. 10235/ha (Table 2). However, two hand weedings recorded highest additional net returns. The highest incremental cost : benefit ratio (9.89) was obtained with the application of imazethapyr 75 g/ha followed by imazethapyr 100 g/ha. Less incremental cost : benefit ratio in two hand weedings treatment was due to higher cost of manual labour as compared to herbicidal weed control. Similar results were also reported by Mandloi *et al.* (2000). Thus, herbicidal weed control using post-emergence imzathapyr at 75 g/ha may be the best alternative to control majority of weeds, obtaining higher income and boost up the productivity of soybean.

Table 2 . Agro-economic feasibility of weed management in soybean (Pooled data of two years)

Treatment	Yield (q/ha)	Weed index (%)	Cost of chemicals/ labour (Rs.)	Additional net returns (Rs.)	ICBR
Weedy check	9.50	59.78	-	-	-
Two hand weedings 30 & 45 DAS	23.62	-	3380	12858	3.8
Alachlor 2.0 kg/ha PE	16.45	30.35	960	7033	7.32
Trifluralin 1.0 kg/ha PPI	15.70	33.53	1220	5910	4.84
Imazethapyr 75 g/ha POE	19.30	18.29	1035	10235	9.89
Imazethapyr 100 g/ha POE	20.22	14.40	1380	10948	7.93
LSD (P=0.05)	1.44				

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