

Effect of pre- and post-emergence herbicides on weed control and productivity of soybean (*Glycine max*)

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ABSTRACT

A field experiment was conducted during the rainy seasons of 2000 and 2001 on Vertisol, to study the effect of different pre- and post-emergence herbicides on 'JS 335' soybean [*Glycine max* (L.) Merr.]. Among the tested herbicides, the highest seed yield was recorded with combi product of imazamox + imazethapyr @ 75 g/ha PoE, i.e. 1,622 kg/ha, and it was significantly on a par with 2 hand-weedings (1,710 kg/ha). The highest weed-control efficiency and lowest weed biomass were recorded with 2 hand-weedings, followed by application of imazamox + imazethapyr @ 75 g/ha PoE and quizalofop ethyl @ 50 g/ha PoE. Among the pre-emergence herbicides, S-metolachlor @ 750 g/ha performed better than application of alachlor @ 2 kg/ha and lower dose of S-metolachlor @ 500 g/ha.

Key words : Weed control, Herbicides, Soybean

Soybean is extensively grown in all over Madhya Pradesh because of its wide adaptability to agro-climatic conditions and high market value of the product. Intense weed competition is one of the constraints in realizing higher soybean productivity and reduction in the yield due to weeds varies from 35 to 50%, depending on type of weeds, their intensity and time of crop-weed competition (Chandel and Saxena, 1988). Unavailability of adequate labourers during weeding peaks and difficulty in the use of mechanical weeders in heavy soil due to rains creates problem for effective control of weeds. Herbicidal weed control particularly post-emergence remains the only viable option under such a situation. An experiment was, therefore, conducted to study the effect of pre- and post-emergence herbicides on soybean.

MATERIALS AND METHODS

A field experiment was conducted during the rainy seasons of 2000 and 2001 at RAK College of Agriculture, Sehore, under All-India Co-ordinated Research Project (AICRP) on Soybean. The soil was clayey in texture and neutral in reaction. It had medium N (204 kg/ha), medium P (17.28 kg/ha) and high K (485 kg/ha) contents. Ten treatments of weed control were evaluated (Table 1) in randomized block design, replicated three times.

Soybean cv. 'JS 335' was sown on 7 July and 18 June in 2000 and 2001, respectively, using seed rate of 75 kg/ha. Seed was inoculated with *Bradyrhizobium japonicum*

and phosphorus-solubilizing bacteria both @ 5 g/kg seed. Crop was fertilized with 100 kg diammonium phosphate (18 kg N + 46 kg P₂O₅/ha). Weed-control operations were accomplished as per treatments. Weeds of experimental field were identified and their intensity was recorded.

RESULTS AND DISCUSSION

Weed intensity

Major 7 species of weeds belonging to different groups were identified. Their occurrence and intensity varied in different treatments. Intensity (%) of weeds varied due to different weedicides and hand-weeding treatments at 50 days after sowing (DAS). Maximum weed infestation was observed in weedy check and the dominant weeds were *Caesulia axillaries* Roxb. (30.34%), *Cyperus rotundus* L. (15.55%), *Digitaria sanguinalis* L. (14.21%), *Echinochloa colonum* Link. (11.8%), *Commelina benghalensis* L. (7.97), *Acalypha indica* L. (5.74%) and *Anotis monantholoni* Hook. (4.71). The contribution of other weeds was less than 10.5% to total weed infestation.

The intensity of all weeds significantly reduced by pre-emergence application of alachlor and S-metolachlor than all other treatments including weed check at early growth stage of crop (20 DAS). It may be because the pre-emergence herbicides checked the emergence of weeds, resulting in reduced intensity of weeds. Mishra and Bhan (1996) also reported similar results. At 50 DAS, the treatment 2 hand-weedings recorded significantly lowest weed

Table 1. Effect of weed-control treatments on weed intensity, weed biomass and weed-control efficiency (WCE) in soybean

Treatment	Weed intensity/m ²						Weed biomass (g/m ²)	WCE
	20 days after sowing			50 days after sowing				
	Monocot	Dicot	Total	Monocot	Dicot	Total		
Alachlor 2 kg/ha PE	6.61 (43.50)	9.45 (89.16)	11.52 (132.66)	6.39 (40.66)	10.44 (133.50)	12.11 (146.66)	7.21 (51.72)	65.49
S-metolachlor 500 g/ha PE	6.01 (35.83)	11.30 (127.50)	12.79 (163.33)	6.69 (44.66)	11.10 (123.33)	12.96 (167.00)	7.22 (52.38)	65.53
S-metolachlor 750 g/ha PE	4.67 (21.50)	9.87 (97.16)	10.91 (118.66)	5.80 (33.33)	10.75 (115.33)	12.20 (147.60)	6.89 (47.53)	68.10
Quizalofop ethyl 5 EC @ 37.5 g/ha PoE	11.81 (139.16)	12.78 (163.50)	17.39 (302.66)	5.86 (34.00)	9.22 (85.00)	10.92 (119.00)	7.70 (58.92)	61.05
Quizalofop ethyl 5 EC @ 50 g/ha PoE	11.64 (135.16)	13.11 (171.83)	17.53 (307.00)	5.09 (25.66)	9.24 (85.00)	10.53 (110.66)	5.95 (35.02)	76.72
Quizalofop tefuryl 4% @ 50 g/ha PoE	12.03 (144.50)	12.48 (155.83)	17.33 (300.33)	5.83 (34.00)	9.74 (94.66)	11.34 (128.66)	8.40 (70.28)	53.26
Imazamox 70% @ 40 g/ha PoE	12.25 (149.83)	12.30 (151.16)	17.35 (301.00)	7.21 (52.00)	7.71 (59.33)	10.54 (111.3)	7.85 (61.24)	59.56
Imazamox + imazethapyr 5% @ 75 g/ha PoE	12.47 (155.50)	12.40 (153.50)	17.50 (309.00)	4.93 (25.33)	5.39 (29.33)	7.28 (54.66)	4.12 (16.97)	88.90
2 hand-weedings at 30 and 45 DAS	12.20 (148.16)	12.89 (166.16)	17.22 (297.66)	9.63 (139.00)	2.32 (5.00)	3.35 (11.00)	2.70 (6.97)	95.43
Weedy check	11.76 (139.83)	13.13 (172.83)	17.69 (312.66)	11.96 (143.00)	13.41 (179.66)	17.98 (322.66)	12.30 (151.18)	
CL (P=0.05)	1.49	1.42	1.41	1.79	1.36	2.17	1.43	

Figures in parentheses are original values and outside are transformed ($\sqrt{x+0.05}$) values

PE, Pre-emergence; PoE, post-emergence; DAS, days after sowing

population. Chokar and Balyan (1999) reported that the critical period of weed control was 30–45 DAS in soybean.

Among post-emergence herbicides, combi product of imazamox + imazethapyr @ 75 g/ha was effective against both monocot and dicot weeds. Similar findings were reported by Nelson and Enner (1999). Other PoE herbicides were effective only against grassy weeds and less effective to control the broad-leaf weeds. Vidrine *et al.* (1995) reported similar results for quizalofop ethyl and quizalofop tefuryl.

Weed dry matter

In general the dry weight of weeds increased with the increase in weed population. Only slight variation was observed due to different species. The highest dry matter of weeds was recorded under weedy check at 60 DAS (Table 1). At this stage, the lowest weed dry matter was recorded in 2 hand-weedings because of weed removal. Out of the herbicides applied, post-emergence application of imazamox + imazethapyr @ 75 g/ha resulted in the maximum reduction in weed dry matter, followed by quizalofop ethyl @ 50 g/ha.

Weed-control efficiency

The highest weed-control efficiency (WCE) (95.43%)

was found in 2 hand-weedings, followed by application of imazamox + imazethapyr @ 75 g/ha (88.90%) as PoE. The lowest WCE was recorded with application of quizalofop tefuryl (53.26%). Singh and Chandel (1995) also reported the higher WCE with 2 hand-weedings.

Yield and yield attributes

The yield and yield attributes, viz. branches/plant, pods/plant, seeds/pod, were significantly influenced by different weed-control treatments (Table 2). The highest values of these parameters over weedy check were higher in 2 hand-weedings. Among herbicides, an application of imazamox+imazethapyr @ 75 g/ha had maximum values of these parameters, followed by quizalofop ethyl @ 50 g/ha. Higher level of these parameters could be attributed to low competition stress and clean cultivation.

The 2 hand-weedings treatment significantly enhanced the seed yield (73.66% and 20.97%) over the weedy check and application of quizalofop tefuryl @ 50 g/ha. Among the herbicides, post-emergence application of imazamox + imazethapyr @ 75 g/ha and quizalofop ethyl @ 50 g/ha enhanced the seed yield by 64.50% and 59.14% over weedy check respectively. Nelson and Renner (1999) reported that imazamox + imazethapyr gave soybean yield equal to the hand-weeded plot. Nelson *et al.* (1999) also

Table 2. Effect of weed-control treatments on yield-attributing parameters and yield of soybean

Treatment	Plant height (cm)	Branches/plant	Dry weight/plant (g)	Pods/plant	Seed index (g)	Seed yield (kg/ha)	Straw yield (kg/ha)
Alachlor 2 kg/ha PE	54.83	2.91	16.20	34.05	9.31	1526	2,452
S-metolachlor 500 g/ha PE	51.56	2.58	13.68	30.26	8.07	1371	2,219
S-metolachlor 750 g/ha PE	55.88	2.96	15.39	34.76	9.26	1524	2,457
Quizalofop ethyl 5 EC@ 37.5 g/ha PoE	54.06	2.73	14.01	30.39	9.47	1463	2,316
Quizalofop ethyl 5 EC@ 50 g/ha PoE	55.52	3.08	15.81	36.05	9.51	1552	2,526
Quizalofop tefuryl 4% @ 50 g/ha PoE	53.01	2.56	14.84	34.06	9.24	1451	2,298
Imazamox 70% @ 40 g/ha PoE	51.46	2.48	13.33	32.41	9.39	1465	2,296
Imazamox + imazethapyr 5% @ 75 g/ha PoE	57.16	3.09	18.41	38.18	9.54	1622	2,613
2 hand-weedings at 30, 45 DAS	60.15	3.33	19.75	39.75	9.83	1710	2,725
Weedy check	46.45	1.94	8.90	23.68	8.60	1041	1,667
CD (P=0.05)	4.11	0.62	2.72	3.56	1.60	225	284

observed that this combi product was effective in controlling a wide spectrum of weeds, i.e. monocot and dicots.

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