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Effect of seed rate and weed-control methods on yield of soybean (*Glycine max*) under rainfed condition

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ABSTRACT

A field experiment was conducted during the rainy (*kharif*) season of 1996 and 1997 to study the effect of seed rate and weed-control treatments on the weed growth and yield of soybean [*Glycine max* (L.) Merr.]. Higher seed rate (150 kg/ha) significantly reduced the weed population and dry weight of weeds compared with the lower seed rates (125 and 100 kg/ha) and enhanced the soybean yield. Two hand-weedings and metolachlor granules (5%) @ 2 kg/ha were equally effective in reducing weed population and dry weight of weeds. Hand-weeding recorded the maximum seed yield and was significantly superior to all other treatments.

Key words : Soybean, Seed rate, Weedicides, Yield

Weed–crop competition has long been recognised as one of the major causes of low productivity in soybean. Use of many herbicides provides effective weed control in different crops. These facts necessitated to develop integrated weed-control practices, involving variable seed rates, manual methods and use of herbicides to find out the cheaper and effective weed-control method for soybean cultivation under rainfed conditions.

MATERIALS AND METHODS

A field experiment was conducted during rainy season of 1996 and 1997 at Zonal Agricultural Research Station, Morena, on sandy loam soil, having pH 7.4. The soil had organic carbon 0.26%, available P_2O_5 24.5 kg/ha and available K_2O 360 kg/ha as main plots. Treatments consisted of 3 seed rates (100, 125 and 150 kg/ha) and 4 weed-control treatments [weedy check, pre-emergence application of Metolachlor granules (5%) @ 2 kg/ha, Alachlor granules (10%) @ 2 kg/ha and 2 hand-weedings at 20 and 40 days after sowing] as subplots, replicated 3 times in factorial design. Soybean 'JS 71-05' was sown at row spacing of 30 cm on 3 and 11 July in 1996 and 1997 respectively. A uniform dose of 20 kg N + 80 kg P_2O_5 + 30 kg K_2O/ha was applied basal. The crop was

harvested on 5 and 16 October during 1996 and 1997 and respectively. Weed-control operations were done as per treatments. Weeds of the experimental field were identified and their intensity was recorded. The weed-control efficiency was calculated (Mani *et al.*, 1973). The economics was worked out considering the cost of seed to be Rs 1,200/q, Alachlor granules @ Rs 30/ kg and Metolachlor granules @ Rs 25/kg. The other expenditure was common to all the treatments. The prevailing selling rate of soybean was Rs 1,000/q.

RESULTS AND DISCUSSION

Prominent species in the experimental field consisted of *Cyperus rotundus, Eragrostis major* and *Panicum colonum* among narrow-leaved weeds; and *Digera arvensis, Commelina benghalensis, Euphorbia hirta* and *Portulaca oleracea* among broad-leaved weeds. Density of broad-leaved weeds was more than that of narrow-leaved weeds.

Seed rate

The weed population and dry weight of weeds were significantly reduced due to the effect of seed rate (Table 1). In the first year, higher seed rate (150 kg/ha) was found significantly superior in reducing weed population than lower seed rates (125 and 100 kg/ha). During the second year, seed rates of 150 kg and 125 kg/ha were at par in reducing the weed population significantly from 100 kg/ha, and similar was the trend for dry weight of weeds during both the years. On an average, the reduction in weed density was 13.7% and 33.6% and in dry weight of weeds 24.4%

Table 1. Weed parameters as influenced by seed rate and weed-control methods in soybean crop

Treatment	Weed population/m²			Weed dry matter (q/ha)			WCE (%)		
	A	B	Mean	A	B	Mean	A	B	Mean
Seed rate (kg/ha)									
100	158.00	215.00	186.75	2.23	3.10	2.66	56.50	55.92	56.21
125	131.00	156.50	143.75	1.76	2.35	2.05	65.60	66.52	66.06
150	115.00	133.00	124.00	1.29	1.82	1.55	74.80	74.07	74.43
Weed-control method									
Weedy check	432.30	534.20	483.25	5.13	7.02	6.07			
Alachlor granules (10%) @2 kg/ha) (PE)	57.80	73.60	65.70	1.05	1.38	1.21	79.50	80.34	79.92
Metolachlor granules 5% @ 2 kg/ha (PE)	43.70	58.20	50.95	0.72	1.12	0.92	85.90	84.04	84.97
Hand-weeding twice at 20 and DAS	4.40	7.30	5.85	0.14	0.17	0.15	97.20	97.57	97.38
CD (P = 0.05)	39.00	48.15		0.50	0.47				

A, 1996; B, 1997; WCE, weed-control efficency

Table 2. Yield-attributing characters, yield and economic returns of soybean as influenced by seed rates and weed-control methods

Treatment	Plant stand/m²		Pods/ plant		Branches/ plant		Seed weight/ plant (g)		1,000-seed weight (g)		Seed yield (q/ha)			Net profit (Rs/ha)*	Benefit : cost ratio*
	A	B	A	B	A	B	A	B	A	B	A	B	Pooled		
Seed rate (kg/ha)															
100	22.3	19.4	27.8	25.5	6.5	5.6	4.49	5.88	117.5	116.5	11.81	10.41	11.11	4,259	1.29
125	28.4	26.6	29.4	28.2	6.8	6.2	4.62	4.67	122.2	118.0	13.46	11.78	12.62	5,299	1.40
75	34.0	31.0	26.8	26.4	6.0	5.9	4.41	4.56	119.9	115.7	14.38	12.88	13.63	5,914	1.46
CD (P = 0.05)	2.0	0.56	NS	NS	NS	NS	NS	NS	NS	NS	1.16	0.67	0.78		
Weed-control method															
Weedy check	24.2	17.8	18.8	15.8	3.2	3.0	3.41	3.42	108.8	104.6	08.34	07.30	07.82	2,159	0.95
Alachlor (10%) granules 2 kg/ha	28.7	25.3	28.7	27.0	7.25	6.0	4.62	4.70	120.0	118.2	14.05	11.78	12.91	6,089	1.63
Metolachlor (5%) granules 2 kg/ha	29.5	26.7	30.2	30.5	7.5	6.8	4.75	4.93	125.2	121.5	14.40	12.39	13.39	6,294	1.63
Hand-weeding twice at 20 and 40 DAS	30.6	29.3	34.4	33.5	9.1	7.8	5.24	5.14	128.2	124.3	16.04	14.93	15.43	7,304	1:65
CD (P = 0.05)	3.7	6.3	5.7	4.1	1.7	1.4	0.92	0.79	011.3	008.7	00.89	01.75	00.89		

A, 1996; B, 1997; *Average of 2 years

and 41.7% due to higher seed rate of 150 kg/ha from its lower seed rate of 125 and 100 kg/ha respectively. This might be due to the fact that higher plant population caused smothering effect and suppressed weed emergence and establishment. Singh *et al.* (1996) also reported similar results in groundnut.

The yield attributes (branches/plant, 1,000-seed weight, pods/plant and seed weight/plant) were not influenced significantly by seed rates. It might be due to inter-plant competition for essential nutrients with increased plant density. The yield of soybean was significantly increased under 150 kg/ha during both the years except that in the first year it was at par with 125 kg/ha seed rate (Table 2). On an average, the yield was 8 and 22.7% higher at 150 kg/ha seed rate than that at 125 and 100 kg/ha seed rates respectively. This increase in yield might have been due to the number of more plants (Table 2) and less competition of weeds over lower seed rates (Table 1). However, the yield attributes remained unaffected due to increased competition within the plants at higher seed rate.

Weed-control treatments

All the treatments significantly reduced weed population and dry weight of weeds compared with the control (Table 1). Significantly lowest weed population and dry weight of weeds were obtained under hand-weeding twice. Pre-emergence application of Metolachlor @ 2 kg/ha (granules) caused on an average 89 and 84.8% reduction in weed population and dry-matter production of weeds respectively from the weedy check. These findings are in close agreement with those of Singh and Chandel (1995).

Hand-weeding twice being statistically at par with Metolachlor @ 2 kg/ha (granules) increased all the yield-contributing characters significantly over the weedy check. However, the latter was statistically at par with Alachlor. Significantly highest yield of 16.04 and 14.83 q/ha was obtained with 2 hand-weedings during 1996 and 1997 respectively. Pre-emergence application of Metolachlor 2 kg/ha and Alachlor 2 kg/ha being statistically at par were significantly superior to weed check in increasing the seed yield of soybean. These findings are in close agreement with those of Chandel *et al.* (1995). Higher yields under these treatments was due to satisfactory control of weeds, providing less competition of weeds with plant for nutrients, water, space and light which ultimately resulted in better development of yield attributes.

Economics of different treatments showed that the highest mean net profit was obtained with 2 hand-weedings, followed by pre-emergence application of metolachlor. Dwivedi *et al.* (1991) also reported that use of metolachlor is as efficient as cultural method of weed control where labour is costly and manual weeding is not possible. The highest benefit : cost ratio of 1.65 was under 2 hand-weedings, followed by 1.63 ratio under weedicides.

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