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Chemical weed control in soybean (*Glycine max*)

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ABSTRACT

A field experiment was conducted during rainy (*kharif*) season of 1995 and 1996 on alluvial soils of Agronomy Research Centre of College of Agriculture, Gwalior (M.P.). Pre-emergence application of alachlor and pendimethalin @ 1.50 kg/ha were comparable with two hand-weedings (20 and 30 DAS) in reducing the weed density and weed biomass, and increasing the weed-control efficiency as well as number of pods/plant and weight of pods. Pooled data showed that except the weed-free treatment, next in higher order was the treatment of two hand weedings, which gave maximum seed yield (12.45 q/ha) followed by alachlor @ 1.5 kg/ha. However, alachlor at 1.5 kg/ha was on a par with penedimethalin 1.5 kg a.i./ha as pre-emergence and fluchloralin 1.5 kg a.i./ha as pre-plant application.

Key words : Soybean, Alachlor, Pendimethalin, Hand-weeding

Soybean [*Glycine max* (L.) Merill] is a dual-purpose most important rainy season (*kharif*) crop to meet pulse and oil requirements of Madhya Pradesh, but the average yield in the state is quite low (10.16 q/ha) (Jain *et al.*, 1998). Soybean has a good competitive ability against weeds due to its fast-growing behaviour combined with dense canopy, permitting low crop-weed competition. However, it offers severe infestation for a large number of weeds, which reduces its yield by 18.83 to 42.37% (Kurumawanshi *et al.*, 1995). The conventional method of weed control is time consuming, expensive and laborious. It is more favourable to use chemicals due to scarcity in availability of human labour during the peak season. Therefore control of weeds by using herbicides is the only alternative to increase the yield of soybean. Keeping in view these facts, the present investigation was undertaken to study the effect of chemical weed-control measures on weed growth, yield and yield attributes in soybean.

MATERIALS AND METHODS

The field experiment was conducted during the rainy season (*kharif*) of 1995 and 1996 at the Research Farm, College of Agriculture, Gwalior (M.P.) on alluvial soils (Inceptisol) having 0.37% organic carbon, 26.79 kg available P_2O_5, 389.68 kg/ha available K_2O and pH 7.1. The

experiment was laid out in randomized block design with 14 treatments replicated thrice. The treatments consisted of fluchloralin 1 and 1.5 kg/ha as pre-plant application, pendimethalin @ 1 and 1.5 kg/ha as pre-emergence, metolachlor 0.5 and 1 kg/ha as pre-emergence, alachlor 1 and 1.5 kg/ha as pre-emergence, metolachlor granules 5% @20 kg/ha and metolachlor granules 10% @ 10 kg/ha, one hand-weeding at 20 days after sowing (DAS) and two hand-weedings (20 and 30 DAS), weed-free and weedy check (control). Soybean variety 'JS 71-05' was sown at the seed rate of 100 kg/ha in rows 30 cm apart with a basal dose of 30 kg N + 80 kg P_2O_5/ha through diammonium phosphate and urea. The crop was sown on 27 July 1995 and 24 July 1996 and harvested on 24 October 1995 and 11 October 1996 respectively. Weed biomass as well as population species-wise, crop yield and yield attributes, viz. pods/plant and weight of pods/plant, were recorded. Total precipitation during the crop season was 931.6 mm and 888.8 mm in 1995 and 1996 respectively. The distribution of rains was quite abnormal for the crop growth. During both the years there were heavy continuous downpours during flowering season, which ultimately adversely affected seed yields of two consequetive seasons.

RESULTS AND DISCUSSION

Effect on crop

All the herbicidal treatments as well as hand-weeding treatment gave higher number of pods/plant, weight of pods/plant and seed yield (q/ha) on pooled basis of 2 years over control (Table 1). However, the maximum yield-attributing traits were recorded in weed-free and two hand-weedings 20 and 30 DAS and the lowest in control in both the years. Higher levels of herbicidal treatments, viz. fluchloralin, pendimethalin and alachlor, as well as two hand-weedings were on a par among themselves in seed yield (q/ha) on pooled basis of 2 years. The maximum seed yield (q/ha) was recorded in weed-free treatment, followed by two hand-weedings (20 and 30 DAS), alachlor @ 1.5 kg/ha as pre-emergence, pendimethalin 1.5 kg/ha and fluchloralin 1.5 kg/ha. However, the lowest yield was registered under unweeded check. The higher seed yield of soybean was also recorded by Jain *et al.* (1997) in two hand-weedings as well as weed-free treatment. The higher yield under two hand-weedings may be attributed to lower dry-matter accumulation by weeds and decrease in their population, which in turn increased the yield attributes and ultimately pushed the yield ahead. The two hand-weedings 20 and 30 DAS also recorded the maximum weed-control efficiency, closely followed by alachlor @ 1 and 1.5 kg/ha, pendimethalin and fluchloralin (Table 2), whereas unweeded control recorded the lowest. The superiority of hand-weeding twice 20 and 30 DAS may be attributed to better weed control and better aeration to crop.

Effect on weeds

Most dominant weeds of the experimental field during both the years were *Cyperus iria*, *Digera arvensis* (L.) Aschers, *Cynodon dactylon* L., *Phyllanthus niruri* L., *Echinochloa crusgalli* (L.) Beauv. and

Table 1. Effect of weed-control treatments on yield-contributing characters, additional monetary return, additional cost of cultivation, net return and benefit : cost ratio (pooled data of 2 years)

Treatment	Dose (kg/ha)	Time of application	Pods/ plant	Weight of pods (g)/ plant	Seed yield (q/ha)	Additional return from yield over control (Rs/ha)	Additional cost of cultivation due to weed-control methods and application	Net return due to weed control (Rs/ha)	Benefit : cost ratio
Fluchloralin	1.0	PPI	45.40	10.80	8.73	6,984	1,000	5,984	1.81
Fluchloralin	1.50	PPI	47.10	11.15	10.69	8,552	1,050	7,502	3.22
Pendimethalin	1.00	Pre-em.	53.35	11.98	8.63	6,904	1,450	5,454	1.19
Pendimethalin	1.50	Pre-em.	53.32	12.52	10.59	8,472	1,850	6,622	1.78
Metolachlor	0.50	Pre-em.	44.12	9.73	8.04	6,432	650	5,782	1.94
Metolachlor	1.00	Pre-em.	48.91	10.40	9.16	7,328	1,300	6,028	1.66
Alachlor	1.00	Pre-em.	53.98	12.50	10.47	8,376	550	7,826	4.01
Alachlor	1.50	Pre-em.	55.30	13.15	11.81	9,128	750	8,378	4.95
Hand-weeding	-	20 DAS	37.77	8.05	9.11	7,288	950	6,338	2.23
Hand-weeding	-	20, 30 DAS	51.70	12.42	12.45	9,440	1,900	7,540	2.24
Metolachlor 5G	20	Pre-em.	44.67	10.70	8.40	6,720	800	5,920	1.94
Metolachlor 10G	10	Pre-em.	44.90	10.30	8.63	6,904	400	6,504	4.34
Weed free	--	--	67.25	14.56	12.69	10,152	2,700	7,452	1.84
Weedy check	--	--	33.41	6.95	6.46	3,658	-	-	-
CD (P = 0.05)	--	--	3.64	1.46	2.19				

Selling price ; Grain Rs 800/q; rest of herbicides: fluchloralin 410/ litre; pendimethalin 460/litre; metolachlor 450/litre; alachlor 280/litre; metolachlor 5G Rs 50/kg; metolachlor 10G Rs 30/kg .

Table 2. Effect of weed-control treatments on weed population, weed-dry matter, weed-control efficiency, weed index and species-wise population of weeds at 90 DAS (pooled data of 2 years)

Treatment	Weed population/ m^2 at 90 DAS	Weed-dry matter (kg/m^2 at 90 DAS)	Weed-control efficiency (%)	Weed index (%)	*Cyperus iria*	*Digera arvensis*	*Cynodon dactylon*	*Phyllanthus niruri*	*Echinochloa crus-galli*	*Commelina benghalensis*
Fluchloralin 1 kg/ha PPA	43.13	0.68	54.02	25.06	18.82	7.76	7.26	12.31	12.25	8.26
Fluchloralin 1.5 kg/ha PPA	39.60	0.60	60.14	14.51	20.00	4.95	4.85	11.65	10.10	5.50
Pendimethalin 1.0 kg ha pre-em.	35.47	0.55	63.40	25.99	18.79	8.00	4.25	10.60	6.84	3.77
Pendimethalin 1.5 kg/ha pre-em.	31.27	0.53	64.38	15.50	19.92	3.50	4.60	10.60	7.30	5.11
Metolachlor 0.50 kg/ha pre-em.	46.20	1.04	28.54	27.47	16.75	8.00	5.78	17.31	9.28	8.60
Metolalchlor 1.0 kg/ha pre-em.	46.02	1.05	27.51	18.67	14.15	7.20	7.71	12.76	14.60	8.50
Alachlor 1.0 kg/ha pre-em.	29.70	0.39	72.99	16.57	19.10	7.10	5.15	9.50	6.10	4.65
Alachlor 1.5 kg/ha pre-em.	28.23	0.50	66.99	7.67	17.65	5.61	4.65	5.61	5.30	4.96
Hand-weeding 20 DAS	53.16	0.85	45.08	27.65	13.00	13.50	5.15	13.25	10.70	7.88
Hand-weeding 20 and 30 DAS	27.36	0.37	74.40	2.96	8.00	2.69	2.72	5.30	4.35	3.05
Metolachlor (G) 5G 20 kg/ha	45.25	0.97	33.66	32.56	14.26	5.85	5.55	12.90	11.50	6.50
Metolachlor (G) 10 G 10 kg/ha	46.03	0.88	39.71	30.70	12.40	4.78	5.63	12.01	14.82	6.14
Weed free	-	-	91.06	-	4.11	3.31	2.01	3.40	2.00	3.65
Weedy check	58.48	1.47	-	47.29	30.50	11.51	9.65	21.59	10.70	11.30
CD (P = 0.05)	6.00	0.26	-	-	4.43	3.23	4.74	4.92	3.70	2.41

DAS=Days after sowing

Commelina benghalensis L. (Table 2).

Among the herbicide treatments, alachlor and pendimethalin were at par with weed free and two hand-weedings (Table 2). Two hand-weedings reduced weed population more than the remaining treatments except weed free. The maximum weed population was recorded in weedy check (control), which was significantly compared with all the treatments.

Weed index indicates the percentage reduction in seed yield compared with weed-free situation. The treatments containing weeds showed significantly higher values of weed index, which was highest in no-weeding check during both the years.

Economic viability

All the treatments for weed control showed better economics over the weedy check (control). Among the treatments, alachlor 1.5 kg/ha showed greater performance efficiency, which maintained additional net return of Rs 8,378/ha followed by alachlor @ 1 kg/ha, 2 hand-weedings and weed-free treatment (Table 1). Depending on the limitation of fund, decisions should be based on higher benefit : cost ratio, i.e. alachlor 1.50 kg/ha, metolachlor (10 G) 10 kg/ha and fluchloralin 1.50 kg/ha. Chandrakar and Urkurkar (1990) also reported similar results.

REFERENCES

Chadrakar, B.L. and Urkurkar, J.S. 1990. Efficacy and economics of weed control in soybean (*Glycine max* L.) under vertisols of Chhattisgarh region. *Indian Journal of Weed Science* **25** : 32-35.

Jain, K.K., Agarwal, K.K., Sharma, R.S. and Kashyap, M.L. 1997. Studies on weed management in soybean (*Glycine max* (L.) Merrill). *World Weeds* **4** (3&4) : 185-190.

Jain, K.K., Tiwari, J.P. and Sahu, T.R. 1998. Energy and nutrient utilization in soybean weed ecosystem under different methods of sowing and herbicidal treatments. *Journal of Oilseeds Research* **15** (1) : 86-92.

Kurumawanshi, S.M., Sharma, R.S. and Sahu, T.R. 1995. Studies on economic viability of weed control with herbicides in soybean (*Glycine max* (L.) Merrill). *Indian Journal of Weed Science* **27** (3&4) : 110-113.