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Effect of Herbicides on Weed Control and Yield of Soybean

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Soybean suffers from heavy weed competition, especially in the early growth stages. The reduction in soybean yields due to weed infestation varies from 20-77% depending on type of soil, season and intensity of weed infestation (Kurchania *et al.*, 2001). Hence, early herbicidal control seems to be a must in this crop for harvesting acceptable yields. Spraying of pre-emergence herbicides helps to minimize the crop-weed competition during such critical stages resulting in higher crop yields.

Use of post-emergence herbicides helps the farmers to have a wide choice of application time i. e. from 10-30 DAS. According to Venkatakrishnan (1992), alachlor applied at 2.0 kg a. i. ha^{-1} with one hand weeding recorded highest grain yield in soybean and comparable with fluchloralin at 1.0 kg a. i. ha^{-1} with one hand weeding. However, continuous use of one herbicide will lead to resistance for particular weed. To overcome this situation, testing of new formulations will help the farmers to use different herbicides. Evaluation of suitable herbicides and effective dose to be applied will help the farmers to create a wide spectrum of herbicide usage for control of weeds in soybean. Hence, this experiment was conducted to study the effect of different herbicides on weed control and grain yield of soybean.

A field experiment was conducted during **kharif** seasons of 2001 and 2002 at Tamil Nadu Agricultural University, Coimbatore on sandy loam soil (pH 7.2) containing 220 kg N ha^{-1}, 13.2 kg P_2O_5 ha^{-1} and 670 kg K_2O ha^{-1}. Field experiment conducted during **kharif** 2001 comprised 10 treatments viz., alachlor at 2000 g a. i. ha^{-1} (check), lactofen at 120 g a. i. ha^{-1} as PoE, kloben at 6 g a. i. ha^{-1} as PoE, kloben at 9 g a. i. ha^{-1} as PoE, clomozone+ pendimethalin (375+750 g ha^{-1}) 2.0 l ha^{-1} as PE, clomozone 1000 g a. i. ha^{-1} as PE, pendimethalin at 1000 g a. i. ha^{-1} as PE, imazethapyr at 100 g a. i. ha^{-1} as PoE, two hand weedings at 30 and 45 DAS (check) and weedy check.

The experiment conducted during **kharif** 2002 consisted of 10 treatments viz., alachlor at 2000 g a. i. ha^{-1} (check), two hand weedings at 30 and 45

Table 1. Effect of treatments on weeds and growth and yield of soybean (**kharif** 2001)

Treatment	Dose (g a. i. ha^{-1})	Weed density (No. m^{-2})			WDMP (g m^{-2})	Plant population ('000 ha^{-1})	100-seed weight (g)	Grain yield (kg ha^{-1})
		Grasses	Sedges	BLW				
Alachlor (PE)	2000	8	9	13	14.3	303.7	10.37	1536
Lactofen (PoE)	120	74	12	12	84.4	212.7	9.97	1094
Kloben (PoE)	6	59	5	32	86.0	211.7	9.90	1002
Kloben (PoE)	9	59	5	24	83.1	195.0	9.83	935
Clomozone+ Pendimethalin (PE)	375 + 750	8	6	12	13.5	303.9	10.4	1556
Clomozone (PE)	1000	11	6	14	13.2	300.0	10.37	1497
Pendimethalin (PE)	1000	10	10	16	17.4	302.2	10.23	1504
Imazethapyr (PoE)	100	19	6	30	26.1	295.4	10.23	1318
Hand weedings (30 & 45 DAS)	-	6	12	12	10.8	302.8	10.1	1533
Weedy check	-	78	17	116	147.0	92.86	9.23	583
LSD (P=0.05)		8.5	3.8	6.4	5.34	7.35	0.29	171

DAS (check), targa super (quizalofop ethyl) at 50 g a. i. ha^{-1} as PoE, kloben (chlorimuron ethyl) at 9 g a. i. ha^{-1} as PoE, alachlor at 2000 g a. i. ha^{-1}+hand weeding at 30 DAS, clomozone 1000 g a. i. ha^{-1} as PE, pendimethalin at 1000 g a. i. ha^{-1} as PE, imazethapyr at 100 g a. i. ha^{-1} as PoE, clomozone+ hand weeding at 30 DAS and weedy check. These treatments were tested in randomized block design with three replications. The pre-emergence herbicides were sprayed on 3 DAS and post-emergence herbicides on 15 DAS. Soybean seeds were inoculated with *Bradyrhizobium japonicum* culture at 500 g. Basal application of recommended dose of NPK (20 : 80 : 40 kg ha^{-1}) was applied. Two manual weedings at 30 and 45 DAS were done. Observations pertaining to the weed growth, dry matter production and crop growth and yield parameters were recorded.

The experimental field was infested with various weed species, consisting of both dicot and monocot weeds. Most common species in weedy plots were : *Cyperus rotundus, Trianthema portulacastrum, Amaranthus viridis, Eleusine indica* and *Chloris barbata.* Results showed that during **kharif** 2001, among the different herbicides pre-emergence application of clomozone+ pendimethalin (375+750 g ha^{-1}) at 2.0 l ha^{-1} resulted in effective control of all types of grasses, sedges and broad-leaved weeds throughout the vegetative period of the crop. Among the post-emergence herbicides, imazethapyr at 100 g a. i. ha^{-1} performed better than lactofen and kloben, resulting in moderate control over all types of weed flora (Table 1). However, lactofen and kloben showed an effective control over sedges dominant being *C. rotundus* and broad-leaved weeds (*T. portulacastrum*) and absolutely least effective on grasses.

Among the different herbicides, clomozone+ pendimethalin (375+750 g ha^{-1}), clomozone and pendimethalin each treated at 1000 g ha^{-1} recorded a total weed density of 27, 30 and 36 m^{-2} and WDMP of 13.5, 13.2 and 17.4 g m^{-2}. The total weed density and WDMP recorded at 60 DAS in weedy check treatment was 210 m^{-2} and 147 g m^{-2}, respectively.

During **kharif** 2002, the weed density and weed dry matter production recorded after pre-emergence herbicidal spray revealed that clomozone and pendimethalin each at rates of 1000 g a. i. ha^{-1} effectively controlled all types of weeds and were comparable with the application of alachlor at 2000 g a. i. ha^{-1}. Among the post-emergence herbicides, imazethapyr at 100 g a. i. ha^{-1} performed better than kloben resulting in moderate control over all types of weed flora (Table 2). Chandel and Saxena (2001) tested various post-emergence herbicides and concluded that imazethapyr at 100 g a. i. ha^{-1} was found effective in controlling weeds of soybean recording higher WCE and seed yield. However, kloben showed an effective control over sedges dominant being *C. rotundus* and broad-leaved weeds like *T. portulacastrum* and absolutely least effective on grasses resulting in a weed shift towards grass weeds.

The total weed density and WDMP recorded at 60 DAS during **kharif** 2002 were lower in all the treated plots compared to weedy check, which had the highest weed density (177 m^{-2}) and WDMP (138.9 g m^{-2}). Clomozone and pendimethalin treated plots recorded weed density of 26.31 and 18.0 m^{-2} and WDMP of 12.1 and 14.3 g m^{-2}. Panneerselvam and Lourduraj (2000) reported that WCE was higher with alachlor at 1.0 kg a. i. ha^{-1} followed by pendimethalin at 0.75 kg a. i. ha^{-1}.

During **kharif** 2001, the lower weed population in plots treated with clomozone+pendimethalin (375+750 g ha^{-1}), clomozone and pendimethalin each at 1000 g ha^{-1} resulted in higher grain yield of soybean recording 1556, 1497 and 1504 kg ha^{-1} as compared to pre-emergence application of alachlor (1536 kg ha^{-1}) and two hand weedings (1533 kg ha^{-1}) (Table 1). During **kharif** 2002, the grain yield recorded was 1254, 1226 and 1214 kg ha^{-1} through pre-emergence application of clomozone at 1000 g a. i. ha^{-1}+1 hand weeding, clomozone at 1 kg a. i.

Table 2. Effect of treatments on weeds and growth and yield of soybean (**kharif** 2002)

Treatment	Dose (g a. i. ha^{-1})	Weed density (No. m^{-2})			WDMP (g m^{-2})	Plant population ('000 ha^{-1})	100-seed weight (g)	Grain yield (kg ha^{-1})
		Grasses	Sedges	BLW				
Alachlor (PE)	2000	1	13	2	14.3	303.74	10.3	1171
Targa super (PoE)	50	14	85	41	88.7	157.84	9.3	543
Kloben (PoE)	9	105	1	1	86.5	141.25	9.3	547
Alachlor (PE)+ 1 HW (30 DAS)	2000	1	16	2	14.2	307.18	10.5	1216
Clomozone (PE)	1000	1	6	16	11.0	307.80	10.8	1226
Pendimethalin (PE)	1000	3	17	5	11.2	307.76	10.7	1214
Imazethapyr (PoE)	100	32	13	21	18.2	296.32	10.2	986
Clomozone (PE)+ HW (30 DAS)	1000	1	7	14	11.0	305.72	10.8	1254
Hand weedings (30 & 45 DAS)	-	16	18	7	12.1	300.66	10.3	1169
Weedy check	-	82	24	36	130	90.85	9.3	530
LSD (P=0.05)		7.3	8.6	6.7	2.52	11.03	0.33	68.2

ha^{-1} and pendimethalin at 1000 g a. i. ha^{-1} which were significantly higher than alachlor treated and hand weeded plots (Table 2).

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