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Dose and time of application of imazethapyr for weed control in soybean (*Glycine max*)

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ABSTRACT

A field experiment was conducted during the rainy season of 1990 and 1991 to study the efficacy of imazethapyr at different doses (50, 100, 150 and 200 g/ha) and times of application (pre-plant incorporation, pre-emergence and early post-emergence) in controlling weeds in soybean [*Glycine max* (L.) Merr.]. Reduction in yield due to weeds in unweed check over imazethapyr 200 g/ha pre-emergence) was 76 and 63.2% during first and second years respectively. Significantly lower dry matter and weed count of all the weed species except *Aeschynomene indica* L. were obtained with imazethapyr 200 g/ha (pre-emergence) and were at par with its pre-plant incorporation, hand-weeding twice and imazethapyr 150 g/ha (pre-emergence) during both the years. Significantly higher seed and straw yields of soybean were obtained with imazethapyr 200 g/ha (pre-emergence) and were statistically at par with its early post-emergence application and hand-weeding twice.

In northern India, soybean [*Glycine max* (L.) Merr.] is grown as a rainy-season crop. As the rate of initial growth of soybean plants is slow, weeds offer serious competition to it.

Imazethapyr (imidazolinone herbicide) shows has longer persistence and broad spectrum for weed control (Dobson *et al.*, 1988). The present study was therefore undertaken to estimate the efficacy of imazethapyr at different levels and times of application for weed control in soybean.

MATERIALS AND METHODS

The field experiment was conducted at Palampur during the rainy season of 1990 and 1991. The soil of the experimental field was silty-clay loam with acidic (pH 5.8) reaction, medium in available phosphorus (17.9 kg/ha), high in potassium (306.5 kg/ha) and low in available nitrogen status (206 kg/ha). Fourteen treatment combinations due to 4 levels (50, 100, 150 and 200 g/ha) and 3 times of application (pre-plant incorporation, pre-emergence and early post-emergence) of imazethapyr with hand-weeding twice, and unweeded checks as the check were laid out in randomized block design with 3 replications. The herbicide was sprayed with power sprayer using 600 litres water/ha. Soybean variety 'Bragg' was sown on 9 June and 12 July and was harvested on 18 October and 1 November during first and second years respectively.

To study the main and interaction effects of doses and times of application of imazethapyr, data were analysed as per randomized complete block design (factorial).

RESULTS AND DISCUSSION

Weed dominance

Total weed flora was constituted by *Cyperus* spp. (59.8%) during the first year

and *Panicum dichotomiflorum* (37.9%) during the second year. This was followed by *Panicum dichotomiflorum* (21.4%) during the first year and *Echinochloa* spp. (21.%) during the second year. *Aeschynomene indica* L. population which was only 1.6% during the first year increased to 11.4% during the second year. *Ageratum conyzoides* being less than 1% during the first year increased to 9.9% during the second year because of its poor control by all the treatments and thus higher seed formation during the first year

Effect on weeds

In general weed population and dry matter of all the weed species were lower during the second year than during the first year. This may be ascribed to effective control of all the weeds by most of the treatments during first year, as the experimental site was the same during both the years.

Significantly lower dry matter and weed count of all the weed species except *Aeschynomene indica* were obtained with imazethapyr 200 g/ha (pre-emergence) and were at par with its pre-plant incorporation, hand-weeding twice and imazethapyr 150 g/ha (pre-emergence) during both the years. *Aeschynomene indica* was effectively controlled with imazethapyr 200 g/ha (early post-emergence) and was statistically at par with lower doses of 100 and 150 g/ha (early post-emergence). *Ageratum conyzoides* L., which appeared during the second year only, was effectively controlled with imazethapyr 200 g/ha irrespective of the time of application and its lower dose of 150 g/ha applied as pre-plant incorporation. The optimum moisture condition due to uniform distribution of rainfall during the initial stages of application helped in increasing the efficacy of imazethapyr and thus resulted in effective control of weeds even at lower dose (100 g/ha) during the second year.

Effect on crop

The better growth and development of the crop under competition-free environment with effective weed-control treatments reflected its influence on formation of better yield-contributing characters (Table 2). The better development of yield attributes contributed towards the higher productivity of the crop, as the yield-contributing characters had a significant correlation ($r = 0.63–0.94$) with the seed yield of soybean in the present investigation.

The yield-contributing characters, viz. plant population/m^2, number of branches/plant, number of pods/plant and number of seeds/pod increased significantly by imazethapyr 200 g/ha at all the times of application and hand-weeding twice over remaining treatments. However, these treatments were also statistically at par with imazethapyr 150 g/ha at pre-emergence in increasing these yield-contributing characters and in increasing the effective plants/m^2 when applied at any of the times of application. The 1,000-seed weight was not found significantly affected by any of the treatments. Comparative weed-free environment helped for better plant development.

Higher dry matter of weeds (Table 1) during the first year created more competition with the crop and thus resulted in 76.3% reduction in seed yield compared with 63.2% during the second year in unweeded check over the best treatment (imazethapyr 200 g/ha, pre-emergence). The data on main effects of doses of imazethapyr indicate that imazethapyr 200 g/ha resulted in significantly highest seed yield of 34.91 and 34.79 q/ha during first and second years respectively. Time of

Table 1. Effect of treatments on maximum dry-matter accumulation by different weed species

Treatment (g/ha)			Time of application	*P. dichotomiflorum*		*Echinochloa* spp.		*Cyperus* spp.		*Aeschynomene indica*		*Ageratum conyzoides*
				1990	1991	1990	1991	1990	1991	1990	1991	1991
T_1,	Imazethapyr	50	ppi	96.67	30.00	52.67	28.00	21.73	3.67	23.33	41.67	4.00
T_2,	Imazethapyr	50	pre	66.67	20.00	33.00	24.67	16.67	2.33	23.33	57.33	5.00
T_3,	Imazethapyr	50	post	126.67	65.00	22.67	23.00	8.67	5.00	11.67	11.67	4.00
T_4,	Imazethapyr	100	ppi	76.67	25.00	42.33	8.33	18.13	3.33	21.33	36.67	4.00
T_5,	Imazethapyr	100	pre-	41.67	16.67	28.33	6.67	14.67	1.33	21.67	52.00	4.00
T_6,	Imazethapyr	100	post	108.33	60.00	18.33	6.67	7.87	4.00	6.67	7.33	4.00
T_7,	Imazethapyr	150	ppi	60.00	20.00	27.00	5.00	12.40	2.67	18.00	31.67	2.67
T_8,	Imazethapyr	150	pre-	21.67	11.67	16.00	4.67	6.93	1.00	19.33	46.67	3.00
T_9,	Imazethapyr	150	post	90.00	55.00	13.00	4.00	5.33	3.00	6.33	5.00	3.00
T_{10},	Imazethapyr	200	ppi	46.67	16.67	22.33	3.00	7.20	2.33	17.33	26.67	1.67
T_{11},	Imazethapyr	200	pre-	15.00	6.67	14.67	3.00	5.00	0.83	17.33	41.33	2.00
T_{12},	Imazethapyr	200	post.	73.33	50.00	8.33	2.67	6.00	2.67	5.33	2.17	2.00
T_{13},	Hand-weedings		25, 45 DAS	21.67	26.67	13.67	4.00	4.00	8.00	10.00	11.33	6.33
T_{14},	Unweeded			154.00	83.33	105.33	195.00	115.55	10.00	26.67	45.00	4.33
	CD (P = 0.05)			8.86	10.86	4.64	5.29	2.78	1.38	2.82	5.85	1.08
	CD (P = 0.05) for doses			5.02	3.40	2.8	2.3	1.3	0.5	1.6	3.4	0.6
	CD (P = 0.05) for time of application			4.33	2.95	2.4	NS	1.1	0.4	1.4	2.9	NS
	CD (P = 0.05) for doses x times			NS	NS	4.9	NS	2.2	NS	NS	NS	NS

PPI, Pre-plant incorporation; pre, pre-emergence; post, early post-emergence; DAS, days after sowing
For comparison of main effects of doses and times of application, the means could be worked out from the above data

Table 2. Effect of weed-control treatments on yield-contributing characters of soybean

Treatment	Branches/ plant		Effective plant/m^2		Pods/ plant		Seeds/ pod		1,000-grain weight (g)	
	1990	1991	1990	1991	1990	1991	1990	1991	1990	1991
T_1	6.80	5.70	16.20	19.46	32.17	29.47	2.03	2.10	198.20	195.30
T_2	7.30	4.85	16.48	19.46	37.30	30.77	2.10	2.13	197.27	195.00
T_3	7.50	5.80	16.55	19.98	38.43	28.77	2.10	2.07	197.93	195.60
T_4	7.50	6.70	16.55	20.50	40.17	39.97	2.20	2.10	196.93	193.30
T_5	9.00	6.65	19.91	20.50	45.50	38.87	2.20	2.13	196.40	194.00
T_6	8.50	7.20	19.44	20.57	43.83	39.27	2.17	2.17	196.47	193.70
T_7	8.40	7.60	19.17	20.80	49.67	48.97	2.17	2.23	195.67	192.70
T_8	10.50	8.50	20.50	21.54	56.40	50.77	2.23	2.27	196.13	195.70
T_9	10.20	8.85	20.20	21.46	54.50	48.27	2.20	2.20	195.40	196.00
T_{10}	10.00	9.00	20.28	21.39	55.50	56.57	2.20	2.23	194.70	191.30
T_{11}	11.50	9.40	20.57	21.31	61.33	55.47	2.27	2.23	195.90	191.70
T_{12}	10.97	8.80	20.65	21.39	58.27	55.87	2.23	2.30	195.47	191.50
T_{13}	11.10	9.60	20.65	21.61	59.93	54.87	2.23	2.27	194.70	192.00
T_{14}	5.80	4.25	15.47	18.50	24.50	19.47	1.93	2.03	199.07	195.80
CD (P = 0.05)	1.13	1.93	1.80	1.61	4.24	5.96	NS	0.18	NS	NS
CD (P = 0.05) for doses	0.7	1.4	1.1	1.0	2.3	3.7	NS	0.1	NS	NS
CD (P = 0.05) for time of application	0.6	NS	0.9	NS	2.0	NS	NS	NS	NS	NS
CD (P = 0.05) for doses x times	NS	NS	NS	NS	4.0	NS	NS	NS	NS	NS

Details of treatments are mentioned in Table 1

For comparison of main effects of doses and times and application, the means could be worked out form the above data

Table 3. Effect of weed-control treatments on seed yield, straw yield and harvest index of soybean.

Treatment	Seed yield (q/ha)		Straw yield (q/ha)		Harvest Index	
	1990	1991	1990	1991	1990	1991
T_1	16.73	23.45	36.93	43.20	0.307	0.337
T_2	20.47	23.63	46.20	42.15	0.303	0.360
T_3	22.17	23.32	44.30	42.50	0.337	0.357
T_4	21.47	28.16	44.50	51.61	0.323	0.357
T_5	30.50	27.68	50.20	50.30	0.357	0.353
T_6	30.00	27.85	51.10	50.50	0.367	0.353
T_7	28.83	31.07	53.90	57.12	0.343	0.357
T_8	33.37	32.10	54.23	57.03	0.353	0.360
T_9	31.20	31.85	54.90	56.92	0.357	0.360
T_{10}	31.80	34.94	55.29	58.90	0.367	0.373
T_{11}	36.77	34.80	59.10	58.50	0.380	0.373
T_{12}	36.17	34.63	58.13	58.60	0.383	0.370
T_{13}	35.20	34.83	56.96	58.61	0.377	0.370
T_{14}	8.70	12.86	25.30	36.00	0.250	0.260
CD (P = 0.05)	4.68	1.42	5.62	3.95	0.044	0.026
CD (P = 0.05) for doses	2.78	0.84	3.5	2.4	0.03	NS
CD (P = 0.05) for time of application	2.41	NS	3.0	NS	NS	NS
CD (P = 0.05) for doses x times	NS	NS	NS	NS	NS	NS

For comparison of main effects of doses and times of application, the means could be worked out from the above data

application did not influence the seed yield significantly during the second year. However, during the first year pre-emergence application of imazethaphr (30.28 q/ha), being statistically at par with post-emergence application (29.89 q/ha), resulted in significantly higher seed yield comparted with its pre-plant incorporation (24.71 q/ha). The doses and times of application did not interact significantly in influencing the yield and yield attributes of soybean. But the analysis of all the 14 treatments including checks (Table 3) indicate that imazethapyr 200 g/ha applied at pre-emergence stage was found statistically at par with its early post-emergence application and hand-weeding twice in influencing the seed and straw yields of soybean. However, the straw yield was at par with imazethapyr 150 g/ha at all the times of application and harvest index up to 50 g/ha.

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