Indian Journal of Agronomy **50** (3) : 218–220 (September 2005)

Effect of varieties, crop geometries and weed management on nutrient uptake by soybean (*Glycine max*) and associated weeds

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Received : April 2004

ABSTRACT

A field experiment carried out during the rainy season of 2001 and 2002 on clay loam alkaline soil at Udaipur (Rajasthan) showed that soybean [*Glycine max* (L.) Merr.] variety 'JS 335' outyielded 'NRC 37' and 'JS 71-05' in terms of N and P uptake. Crop geometries (30 cm × 10 cm and 20 cm × 15 cm) did not show any significant variation for N and P uptake by crop and associated weeds. All the weed-management treatments significantly reduced removal of N and P by weeds and enhanced uptake of these nutrients by soybean compared to weedy check. Two hand-weedings at 20 and 40 days after sowing and pre-emergence application of clomazone at 1.0 kg/ha + hand-weeding at 40 days were at par and resulted in significant reduction in uptake of N and P by weeds and increase in uptake of these nutrients by soybean compared to all other methods of weed control. Seed and straw yields of soybean were also increased significantly owing to these 2 methods of weed control compared to rest of the methods.

Key words: Clomazone, Crop geometries, Fenoxaprop-p-ethyl, Hand-weeding, Nutrient Uptake, Soybean, Weed management

Slow initial growth of soybean and heavy rainfall during growing season provide congenial atmosphere for abundant population and growth of weeds. It is well known fact that weeds through competition with crop, deprive it of limited essential resources prominent amongst which are nutrients. To minimize the magnitude of nutrient drain by weeds and effective utilization of fertilizer by crop, the control of weeds is essential. Different varieties may differ in their canopy structure and growth characterisitcs, which play a pivotal role in smothering weeds and nutrient uptake by weeds and crop. Alteration in crop geometry, by way of manipulation in inter- and intra-row spacing without changing plant density may impart competing ability to crop plants with weeds with respect to nutrient uptake. Maurya *et al.* (1990) reported that herbicides cause an appreciable decrease in nutrient depletion by weeds. The present investigation was therefore undertaken to study the extent of nutrient depletion by weeds and crop under various varieties, crop geometries and weed-management practiaces and to minimize their losses by controlling weeds.

MATERIALS AND METHODS

The experiment was conducted at Udaipur (Rajasthan) during rainy (*kharif*) seasons of 2001 and 2002. The experimental soil was clay loam, alkaline (pH 7.9 and 8.0), medium in available nitrogen (285.5 and 292.4 kg N/ha), phosphorus (23.4 and 24.8 kg P_2O_5/ha) and potassium (304.4 and 317 kg K_2O/ha). The experiment consisted of 3 varieties of soybean ('NRC 37', 'JS 335' and 'JS 71-05') and 2 crop geometries (30 cm × 10 cm and 20 cm × 15 cm) in main plots; and 6 weed-management practices, viz. weedy check, 2 hand-weedings (HW) at 20 and 40 days after sowing (DAS), clomazone 1.0 kg/ha as pre-emergence (PE), clomazone 1.0 kg/ha PE+HW at 40 DAS, fenoxaprop-p-ethyl 75 g/ha as post-emergence (PoE) at 20 DAS and fenoxaprop-p-ethyl 75 g/ha POE at 20 DAS + HW at 40 DAS in sub-plots.

The experiment was laid out in split-plot design with 3 replications. A uniform dose of 20 kg N and 40 kg P_2O_5/ha was applied through urea and diammonium phosphate as basal dose in crop rows 5 cm below the seedling depth. Total rainfall in the respective seasons during the crop period was 362.7 and 253.2 mm. Life-saving irrigations were applied as and when needed. As per treatment, clomazone was applied the next day of sowing, while fenoxaprop-p-ethyl at 20 DAS. Yield data and uptake of nutrients by weeds and crop were recorded at harvest.

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RESULTS AND DISCUSSION

Important weed flora during the study period that constituted monocot weeds were *Echinochloa colonum* (L.) Link, *Cynodon dactylon* (L.) Pers. and *Cyperus rotundus* (L.), Pers., while dicot weeds were *Trianthema portulacastrum* L., *Commelina benghalensis* L., *Amaranthus spinosus* L., *Parthenium hysterophorus* L. and *Digera arvensis* L. Out of these, *Echinochloa colonum* and *Trianthema portulacastrum* were the most dominant monocot and dicot weeds respectively.

Performance of variety

Varieties did not differ significantly with respect to total weed dry matter and nitrogen and phosphorus uptake by weeds at harvest (Table 1). 'JS 335' soybean exhibited its superiority for seed and straw yields and nitrogen and phosphorus uptake by crop to 'NRC 37' and 'JS 71-05'. Variety 'JS 7105' also recorded significantly higher seed yield than 'NRC 37'. 'NRC 37' soybean was significantly superior to 'JS 71-05' for straw yield and phosphorus uptake. Varieties 'NRC 37' and 'JS 71-05' were found at par with respect to nitrogen uptake. The results are in close conformity with the findings of Nagar (2001).

Effect of crop geometry

Crop geometries in soybean did not show any significant effect on total weed dry matter, nitrogen and phosphorus uptake by weeds and crop at harvest and seed and straw yield (Table 1).

Effect of weed management

All the weed-management treatments significantly reduced total weed dry matter and N and P uptake by weeds compared with the weedy check. Two hand-weedings and clomazone + hand-weeding (HW) were found at par but superior to clomazone 1.0 kg/ha PE, fenoxaprop-p-ethyl 75 g/ha PoE and fenoxaprop-p-ethyl + HW with respect to reduction of total weed dry matter and N and P uptake by weeds. Reduction in N and P uptake by weeds was 86.6 and 87.8% due to 2 hand-weedings compared to weedy check. Corresponding reduction due to clomazone + HW was 88.8 and 87.9%. Results obtained are in close conformity with the findings of Singh *et al.* (1994).

All the weed-management treatments significantly increased seed and straw yields and N and P uptake by the crop compared to weedy check (Table 1). The pronounced effect of increased yields and nutrient uptake were observed with 2 hand-weedings and clomazone + HW and both were found at par with each other but significantly superior to rest of the treatments. The increase in yield and nutrient uptake under these treatments may be attributed to significant reduction in weed dry matter, thereby, reduction in crop–weed competition which pro-

Table 1. Effect of varieties, crop geometries and weed-management practices on total weed dry matter and nutrient uptake by weeds and crop at harvest and yields of soybean (pooled data of 2001 and 2002)

Treatment	Total weed dry matter (q/ha)	Nutrient uptake by weeds (kg/ha)		Nutrient uptake by crop (kg/ha)		Soybean yields (q/ha)	
		Nitrogen	Phosphorus	Nitrogen	Phosphorus	Seed	Straw
Variety							
'NRC 37	12.36	21.4	3.4	106.2	11.6	12.29	20.94
'JS 335'	11.86	20.3	3.2	134.1	14.6	16.09	25.84
'JS 71-05'	12.11	20.9	3.3	102.5	11.0	12.92	18.24
CD (P = 0.05)	NS	NS	NS	4.6	0.5	0.61	1.22
Crop geometry							
30 cm × 10 cm	11.93	20.5	3.2	116.3	12.7	14.02	21.96
20 cm × 15 cm	12.30	21.2	3.3	112.2	12.2	13.51	21.39
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS
Weed management							
Weedy check	30.46	51.9	8.1	70.3	7.7	8.48	14.30
2 HW at 20 and 40 DAS	3.51	5.9	0.9	143.3	15.5	17.18	26.47
Clomazone 1.0 kg/ha PE	5.61	9.5	1.6	126.2	13.7	15.20	23.67
Clomazone 1.0 kg/ha PE + HW at 40 DAS	3.47	5.8	0.9	140.4	15.2	16.90	26.08
Fenoxaprop-p-ethyl 75 g/ha PoE	22.97	41.1	6.3	90.1	9.9	10.90	17.69
Fenoxaprop-p-ethyl 75 g/ha PoE + HW at 40 DAS	6.65	11.0	1.8	115.2	12.6	13.93	21.85
CD (P = 0.05)	0.51	0.9	0.2	4.5	0.5	0.66	1.17

HW, Hand-weeding; DAS, days after sowing; PE, pre-emergence; PoE, post-emergence at 20 DAS

vided congenial environment to the crop for better expression of vegetative and reproductive potential. Results corroborate the findings of Chhokar *et al.* (1997) and Vyas and Billore (2003).

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