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Effect of weed management and sulphur on nutrient content and uptake by weeds and soybean

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ABSTRACT

A field experiment was undertaken to study the effect of weed management and sulphur nutrition on nutrient content and uptake by weeds and soybean during *kharif* 2009. The results revealed that application of two hoeing and weedings and imazethapyr 100 g/ha+ H&W at 40 DAS recorded maximum seed yield (1475 and 1395 kg/ha, respectively). Two H&W significantly reduced the weed growth and nutrient uptake by weeds, there by increased the nutrient (N, P and S) uptake by crop. Application of 40 kg S /ha significantly recorded the highest seed yield. This also increased N, P and S content and their uptake by soybean and weeds.

Key words: Chlorimuron ethy1, Imazethapyr, Hoeing, Sulphur nutrition, Weed management, Weeding.

Soybean [*Glycine max* (L.) Merrill] is a crop of multiple qualities as it is both a pulse and oilseed crop. It is third largest oilseed crop of India after rapeseed-mustard and groundnut. Inspite of its high yield potential (4.5 tonnes/ha) its productivity is much less in india (0.95 ton/ha) than the world average of 2.3 tonnes/ha (FAI, 2006). Being a *Kharif* season crop, it suffers from severe infestation of weeds and rob it of essential nutrients, space and moisture, causing substantial loss in yield (33-55 %) depending on the weed flora and density of weeds (Kewat, *et al.*2000). The effective and economical weed control may not be possible through mechanical means due to heavy and continuous rains in *kharif*. Hence, use of herbicides offers an alternate method to manage weeds in such situation. The sowing time for soybean in rainy seasons is very short and farmers give first preference to sow the crop rather than to use soil applied herbicides for weed control. Under such situation post-emergence herbicides remain the only viable option needs to be explored as an effective and economical method of weed control.

It is well known fact that weeds through competition with crop deprive crops of limited essential recourses, prominent among which are nutrients. More over weeds grow faster than the crop plants and absorbed the nutrient earlier resulting into lack of nutrients in general and sulphur in particular for the growth of plants. Thus, control of weeds at appropriate time increase the nutrient use efficiency. Under such situations use of post-emergence herbicides in conjunction with sulphur nutrition needs to be explored as an effective and economical method for obtaining better yield of soybean.

A field experiment was conducted during *kharif* 2009 at Instructional Farm, Rajasthan College of Agriculture, Udaipur. The soil of the experimental field was clay loam in texture having pH 8.2, organic carbon 0.75%, available N, P, K (277.0, 20.10, 286.0 kg/ha, respectively) and S 8.7 ppm. The experiment was laid-out in a factorial randomized block design comprising six weed control treatments (weedy check, two hoeing and weeding at 20 and 40 days after sowing (DAS), Chlorimuron ethyl 9 g/ha at 15 DAS, imazethapyr 100 g/ha at 15 DAS, Chlorimuron ethyl 9 g/ha at 15 DAS + one hoeing & weeding at 40 DAS, Imazethapyr 100 g/ha at 15 DAS and Imazethapyr 100 g/ha at 15 DAS + one hoeing & weeding at 40 DAS) and three Sulphur levels (0, 20 and 40 kg S/ha) thereby making 18 treatment combinations and replicated thrice. Soybean variety "JS-335" was sown on 3rd July, 2009 at 30 cm x 10 cm plant geometry. The crop was fertilized with an uniform dose of 40 kg N and 40 kg P_2O_5 through Urea and DAP, respectively and sulphur as per treatment was applied at the time of sowing. Herbicides were applied in 500 litres of water /ha with the help of knapsack sprayer fitted with flat- fan nozzle. Observation on weed count at 50 DAS was recorded by using a quadrate measuring 50 cm x 50 cm at two randomly selected spots in each plot and converted into one square meter area

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and these data were subjected to square root transformation "x + 0.5 before analysis. The weeds taken for weed density at 50 DAS were dried in oven to obtain weed dry matter, while at harvest all the weeds of the net plot were harvested and categorized before drying and weighing.

Importance weed flora during the study period that constituted monocot weeds were *Ecinochloa colona (L.) Link (53%), Cynodon dactylon (L.) Pers. (2.5%,) Cyperus rotundus (L.) (3.75%)while* dicot weeds were *Trianathema portulacastrum (L.) (8.25%), Commelina enghalensis (L.) (6.0%), Amaranthus spinosus (L) (8.5%), Digera arvensis Forsk (11.0%)* and *Parthaniun hysterophorus L (7.0%).* Over all the experiment was dominated by density of monocot weeds specially *Ecinochloa colona (L.)* Link. All the weed control treatments significantly reduced weedy density and their dry matter at 50 DAS (Table 1). Two hoeing and weeding recorded the minimum density of weeds as well their dry matter at 50 DAS compared to weedy check, wherein the density of total weeds recorded the maximum. The reduction in density of weeds under two hoeing and weeding was 58.24 per cent compared to weedy check. Alike weed density, dry matter of weeds at 50 DAS was also recorded minimum under this treatment (234.0 Kg/ha) compared to weedy check (3055 Kg/ ha). The per cent reduction in total weed dry matter due to two hoeing and weeding at 20 and 40 DAS and imazethapyr 100 g/ha along with one hoeing and weeding 40 DAS was 92.3 and91.5 respectively, compared to weedy check. The superiority of both these treatments was because of the fact that these treatments effectively controlled the early as well as late flush of weeds. Among different levels of sulphur, application of 40 kg sulphur/ha significantly increase dry matter of weeds by 23.6 per cent compared to control. The effect of sulphur on weed dry matter seems to be in over all influence of its role in growth and development of weed as that of crops.

All the weed management treatment significantly increased plant dry weight at harvest and seed yield compared with weedy check (Table 1). The pronounced effect of increased plant dry matter and seed yield was observed with two hoeing and weeding and it was found statistically on par with imazethapyr 100 g/h in conjuction with one hoeing and weeding at 40 DAS. The per cent increase in yield due to two hoeing and weeding was 213.16 compared to weedy check. The increase in plant dry matter and seed yield may be attributed to significant reduction in weed density and their dry matter, thereby reduction in crop weed competition. Application of 40 kg sulphur/ha gave significantly higher plant dry matter and grain yield compared to its lower doses. The increase in seed yield due to sulphur application could be ascribed to its role in improving the mineral nutrition of the crop. The results corroborate with the findings of Singh *et al.* (2006)

All the weed management treatments significantly affected the total uptake of N, P and S by the crop (Table 2). The highest N, P and S uptake by the crop (128.09, 13.53 and 8.99 kg/ha) was recorded with two hoeing and weeding followed by imazethapyr 100 g/ha in conjuction with one hoeing (121.42, 12.66 and 8.46 kg N, P and S /ha). This is possibly due to the fact that higher weed control efficiency under these treatments resulted in more favourable environment for growth and development of crop plant. All the treatment of sulphur nutrition was found significant in enhancing N, P and S content both in seed and haulm. The trend of nutrient uptake is seemed to similar that of grain and haulm yield which is due to the fact that nutrient uptake is the function of yield and nutrient content.

All the weed control treatment significantly minimized the nutrient removal by weeds compared to weedy check (Table 3). The minimum removal of total N (15.84 kg/

TABLE 1: Effect of weed management and sulphur on growth, yield and economics in soybean and weed dynamics

Treatment	Plant dry weight at harvest (g/ plant)	Plant height at 60 (cm) DAS	Seed Yield (Kg/ha)	Net return (Rs/ ha)	B/C ratio	Total weed density/m^2 at 50 DAS*	Total weed dry matter (Kg/ha) at 50 DAS
Weed Management							
weedy check	15.24	63.4	471	161	1.01	20.74 (434)	3055
Two H & W	33.05	56.3	1475	15566	1.84	8.66 (78)	234
Chlorimuron ethyl 9 g/ ha	24.37	60.7	815	7412	1.63	18 (331)	1707
Chlorimuron ethyl 9 g/ ha+ H & W	30.00	57.0	1148	11196	1.72	9.68 (96)	304
Imazethapyr 100 g ha	29.65	57.1	970	9550	1.73	12.33 (154)	311
Imazethapyr 100 g/ ha+ H & W	31.65	56.3	1395	15601	1.93	9.13 (84)	259
SEm±	0.89	1.9	40	-	-	0.66	43
CD (P=0.05)	2.57	NS	117	-	-	1.88	123
Sulphur (kg/ha)							
0	22.75	53.8	948	7828	1.51	12.18 (171)	863
20	27.01	57.9	1039	9759	1.63	13.35 (200)	1006
40	32.20	63.7	1150	12156	1.79	13.73 (217)	1067
SEm±	0.63	1.4	28	-	-	0.46	30
CD (P=0.05)	1.81	3.9	82	-	-	NS	87

H & W = Hoeing and weeding * Transfer data () original value

TABLE 2: Effect of weed management and sulphur on nutrient content and uptake by soybean

Treatment	Nutrient content (%)						Nutrient uptake (kg/ ha)								
	Nitrogen		Phosphorus		Sulphur		Nitrogen			Phosphorus			Sulphur		
	Seed	Haulm	Seed	Haulm	Seed	Haulm	Seed	Haulm	Total	Seed	Haulm	Total	Seed	Haulm	Total
Weed Management															
weedy check	6.045	1.550	0.616	0.183	0.331	0.186	28.55	11.76	40.31	2.93	1.38	4.32	1.57	1.42	2.99
Two H & W	6.450	1.650	0.660	0.188	0.349	0.193	95.14	32.95	128.09	9.79	3.74	13.53	5.16	3.83	8.99
Chlorimuron ethyl 9 g/ ha	6.270	1.610	0.627	0.186	0.333	0.186	51.21	19.79	70.99	5.13	2.28	7.41	2.72	2.28	5.00
Chlorimuron ethyl 9 g ha^{1} + H & W	6.320	1.650	0.623	0.187	0.336	0.187	72.59	26.70	99.29	7.27	3.00	10.27	3.87	3.00	6.86
Imazethapyr 100 g/ ha	6.300	1.640	0.630	0.187	0.336	0.189	61.44	21.98	83.41	6.13	2.49	8.62	3.27	2.52	5.79
Imazethapyr 100 g/ ha+ H & W	6.450	1.650	0.653	0.186	0.346	0.190	89.75	31.67	121.42	9.14	3.52	12.66	4.84	3.62	8.46
SEm±	0.095	0.026	0.011	0.010	0.005	0.003	2.38	1.06	2.71	0.31	0.10	0.35	0.16	0.09	0.19
CD (P=0.05)	NS	NS	NS	NS	NS	NS	6.84	3.04	7.80	0.90	0.29	1.02	0.46	0.27	0.55
Sulphur (kg/ha)															
0	6.161	1.510	0.608	0.184	0.327	0.181	58.66	19.55	78.21	5.80	2.39	8.18	3.13	2.36	5.49
20	6.303	1.616	0.630	0.186	0.342	0.189	65.91	23.67	89.58	6.62	2.71	9.33	3.58	2.77	6.35
40	6.453	1.749	0.671	0.188	0.346	0.195	74.77	29.20	103.98	7.78	3.11	10.89	4.00	3.21	7.21
SEm±	0.067	0.018	0.008	0.001	0.003	0.002	1.68	0.75	1.92	0.22	0.07	0.25	0.11	0.07	0.14
CD (P=0.05)	0.193	0.053	0.022	0.003	0.001	0.006	4.84	2.15	5.52	0.64	0.21	0.72	0.33	0.19	0.39

H & W = Hoeing and weeding

TABLE 3: Effect of weed management and sulphur on nutrient content and uptake by weeds at harvest

Treatment	Nutrient content (%)						Nutrient uptake (kg/ha)								
	Nitrogen		Phosphorus		Sulphur		Nitrogen			Phosphorus			Sulphur		
	Monocot	Dicot	Monocot	Dicot	Monocot	Dicot	Monocot	Dicot	Total	Monocot	Dicot	Total	Monocot	Dicot	Total
Weed Management															
weedy check	1.743	2.108	0.260	0.290	0.066	0.163	46.38	33.46	79.84	6.90	4.61	11.51	1.77	2.59	4.35
Two H & W	1.753	2.175	0.275	0.305	0.070	0.172	9.16	6.67	15.84	1.44	0.94	2.38	0.37	0.53	0.90
Chlorimuron ethyl 9 g/ ha	1.743	2.113	0.261	0.292	0.067	0.160	28.94	15.66	44.60	4.35	2.16	6.51	1.11	1.19	2.30
Chlorimuron ethyl 9 g/ ha+ H & W	1.733	2.121	0.263	0.301	0.067	0.164	11.30	8.90	20.20	1.71	1.26	2.98	0.45	0.69	1.13
Imazethapyr 100 g/ ha	1.749	2.151	0.273	0.292	0.068	0.165	14.06	9.98	24.03	2.20	1.35	3.54	0.55	0.76	1.31
Imazethapyr 100 g/ ha+ H & W	1.751	2.163	0.275	0.604	0.069	0.170	10.54	7.98	18.52	1.66	1.13	2.78	0.41	0.63	1.04
SEm±	0.009	0.021	0.005	0.005	0.001	0.003	0.75	0.51	1.02	0.13	0.09	0.17	0.04	0.04	0.07
CD (P=0.05)	NS	NS	NS	NS	NS	NS	2.15	1.48	2.94	0.38	0.27	0.51	0.10	0.13	0.20
Sulphur (kg/ha)															
0	1.734	2.108	0.256	0.293	0.060	0.157	18.81	12.97	31.78	2.73	1.77	4.51	0.64	0.95	1.59
20	1.745	2.138	0.267	0.295	0.069	0.165	20.38	13.75	34.13	3.09	1.88	4.97	0.79	1.06	1.84
40	1.758	2.171	0.280	0.305	0.075	0.175	20.99	14.61	35.60	3.30	2.07	5.37	0.90	1.18	2.08
SEm±	0.006	0.015	0.003	0.003	0.001	0.002	0.53	0.36	0.72	0.09	0.06	0.12	0.03	0.03	0.05
CD (P=0.05)	0.018	0.043	0.001	0.009	0.002	0.006	1.52	1.04	2.08	0.27	0.19	0.36	0.07	0.09	0.14

H & W = Hoeing and weeding

ha), P (2.38 kg/ ha) and S (0.90 kg/ ha) by weeds were observed under two hoeing and weeding which was followed by imazethapyr 100 g/ha in conjuction with one hoeing and weeding at 40 DAS. The uptake of N, P and S by the weeds was estimated as 66.45, 72.71 and 59.26 per cent, respectively of the total removal (weeds +crop) in weedy check and only 11.0, 14.96 and 9.10 per cent in two hoeing and weeding and 13.23, 18.0 and 10.95 in imazethapyr 100 g/ha + one hoeing and weeding. Thus, saving of 55.45, 57.75 and 50.16 % N, P and S could be obtained by adoption of two hoeing and weeding and the respective saving of these nutrient under imazethapyr 100 g/ha + one hoeing was 53.22, 54.71 and 48.3 per cent. It is apparent from Table 2&3 that whenever the removal of nutrients by weeds was more, corresponding uptake by the crop was less and vicesersa.

The maximum net return of Rs 15601 was obtained with imazethapyr 100 g/ha in conjuction with one hoeing and weeding followed by Rs 15566 as obtained under two hoeing and weeding. B/c ratio also follows the same tends as that of net returns. Net return and B/C ratio are mainly governed by crop yield as well as cost of cultivation. Hence, inspite of higher yield under two hoeing and weeding it could not rank first with respect to net returns and B/C ratio because of large power was engaged in performing this operation.

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