Madras Agric. J. 78, (5-8): 188-190 (1991) https://doi.org/10.29321/MAJ.10.A01841

EFFECT OF LEVELS OF SULPHUR ON THE YIELD AND COMPOSITION OF SOYBEAN, (*Glycin* max (L) Merr.) GREEN GRAM (*Vigna radiatus* L.), BLACK GRAM (*Vigna mungo* L.) AND COWPEA (*Vigna sinensis* L).

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ABSTARCT

Field experiment conducted on soybean, greengram, blackgram and cowpea with four levels of sulphur vis; 0,20,40 and 80 kg S/ha in alluvial soils at College of Agriculture Gwalior, indicated a significant increase in the yield. The magnitude of increase in the yield was higher for soybean and cowpea. An increase in the concentration and uptake of N,P,K and S was noticed. A significant negative relationship between N:S ratio and yield suggests that a wider N:S ratio will drastically reduce the crop yield.

Key words: Sulphur-yield, composition.

Tandon (1984) emphasised that most of the attention is devoted to N,P and K only. This is because their deficiencies are wide spread and crop removals are high. In the tropics little is known about the use of sulphur (Kanwar 1984). Higher use of nitrogen and phosphorus in comparison with sulphur will result in widening ratios of N:S and P:S. This imbalance affects the efficiency of fertilizers, impairs the quality of crop produce, and accelerates the removal of sulphate from the soil. India is one of the major pulse growing countries of the world and pulses-greengram, black gram and lobia are most popular among the cultivators, soybean is getting popularity among the Madhya Pradesh farmers. Serveral workers (Sharma and Bradford 1973; Bansal *et al*., 1983) reported increase in the yield of soybean by sulphur fertilization. But there is very little information regarding the effect of sulphur on other legumes, therefore the present investigation was undertaken with a view to find out the effect of gypsum as a sulphur source on the yield and nutrient content of different legumes.

MATERIALS AND METHODS

A field experiment was conducted on sandy clay loam soil (62.1% sand, 18.2% silt and 17.2% clay) showing available N (Alkaline permanganate extractable), P (Olsens extractable), K (normal neutral ammonium acetate extractable) and S (KH_2PO_4 500 ppm P extractable) 100, 7.2, 150 and 6 ppm respectively. The pH, conductivity and organic carbon % were 7.28, 0.28 and 0.43 respectively. Four levels of sulphur, viz; 0,20,40 and 90 kgS/ha through gypsum were applied to soybean, green, black gram and lobia (cowpea) crops on 3.0 x 2.4 sq. m. net plot size at University research farm, College of Agriculture, Gwalior. Randomised block design was employed with three replications. Forty kilogram each of P_2O_5 and K_2O per ha were applied through diammonium phosphate and muriate of potash respectively, 20 kg/ha nitrogen was applied through diammonium phosphate and urea. All the crops were sown on 24th July 1980, greengram, black gram and cowpea were harvested on 22nd October 1980 and soybean was harvested on 7th November 1980. Standard procedures were followed for the analysis of soil and plant material.

RESULTS AND DISCUSSION

Increasing levels of sulphur increased the seed yield of the crops (Table 1). The highest yield was noticed with the application of 80 kg S, which was significantly superior over control. The differences amongst 40 and 80 kg S were

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Table 1. Effect of different levels of S on the yield (q/ha) of legumes

Crops/levels of S (Kg/ha)	0	20	40	80	Mean
Soybean	16.29	17.88	22.32	23.12	19.90
Green gram	10.50	11.68	12.95	13.00	12.03
Black gram	14.16	15.20	17.43	18.78	16.39
Cowpea	22.06	24.52	26.12	26.50	24.80

S.Em ±0.61
CD at 5% 1.77

not significant. The increase in the yield of soybean, black gram and cowpea were higher than greengram. Differential response amongst crops despite similar levels of sulphur can be ascribed to differences in requirement. There is ample evidences to indicate that application of sulphur increases yield of crops (Tandon, 1984). Kamat *et al.* (1981) also obtained increase in the yield of green gram due to the application of sulphur.

These results clearly indicate that the soil of the experimental plot which contained 6.0 ppm of KH_2PO_4, 500 ppm P extractable S required S application for maximum production of legumes. Bansal *et al.* (1979) also reported the critical limit of KH_2PO_4 500 ppm P extractable S as below 10 ppm and found 9.3 ppm KH_2PO_4 500 ppm P extractable S as the critical limit below which S deficiency could be observed.

Effect of S on the nutrient content

Application of sulphur significantly increased the S content of seed (Table 2) and the maximum was under 80 kg S. The higher sulphur content in soybean seed indicates that the requirement of sulphur was more as compared to other crops. Dev *et al.* (1979) also reported the increase in the content due to S application. There was a significant increase in the nitrogen content due to the application of sulphur in all the crops. Nitrogen and sulphur are required for

Table 2. Effect of different levels of sulphur on the nutrient content and uptake in legumes

Treatment	level of sulphur kg/ha	Nutrient content				Uptake (kg/ha)			
		% N	% P	% K	% S	N	P	K	S
L1	0	4.9	0.33	1.6	0.27	80	5.4	25.3	3.8
	20	5.2	0.36	1.7	0.29	93	6.5	29.5	6.1
	40	5.4	0.38	1.9	0.31	121	8.6	41.3	8.0
	80	5.5	0.41	2.0	0.31	126	9.4	45.1	8.7
L2	0	3.4	0.27	1.3	0.21	35	2.8	13.8	1.7
	20	3.5	0.29	1.5	0.23	41	3.4	17.3	2.8
	40	3.6	0.30	1.6	0.21	27	3.9	20.4	3.4
	80	3.8	0.33	1.8	0.26	49	4.3	23.4	3.8
L3	0	3.5	0.33	1.2	0.22	50	4.6	17.0	2.3
	20	3.7	0.35	1.4	0.26	56	5.4	20.4	4.1
	40	3.8	0.39	1.4	0.28	65	6.7	24.4	5.1
	80	3.8	0.36	1.6	0.30	71	6.8	30.0	5.7
L4	0	3.0	0.32	1.3	0.20	65	7.1	28.2	3.3
	20	3.2	0.35	1.4	0.22	77	8.6	34.3	5.4
	40	3.3	0.39	1.5	0.24	85	10.3	39.3	6.4
	80	3.4	0.39	1.8	0.23	89	10.3	46.4	7.0
S.Em ±		0.023	0.001	0.036	0.003	2.5	0.22	1.2	0.15
CD at 5%		0.068	0.003	0.108	0.009	7.4	0.65	3.5	0.50

L1 : Soybean L2 : Greengram L3 : Blackgram L4 : Cowpea

the formation of protein. In order to maintain the balance of N and S in plants, uptake of one nutrient will certainly effect the uptake of another one. Stewart and Whitfield (1965) reported that addition of sulphur produced plants with high percentages of both nitrogen and sulphur. Shinde *et al.* (1982) also obtained increase in the nitrogen content of seed due to the application of S.

An increase in the phosphorus content was noticed with the application of sulphur and the highest concentration in case of soybean and greengram was found with the highest level of S. On the other hand the highest P content in black gram and cowpea was found with 60 kg S. The results suggest that the application of S had a favourable effect on the availability and uptake of phosphorus. Similar results were reported by Singh *et al.* (1979). There was a significant increase in K concentration of different legumes with the increasing levels of sulphur. The increase was more pronounced with higher level of sulphur. In general the content was found to be higher in soybean as compared to other legumes.

Uptake of nutrients:

The uptake of N,P,K and S increased with the increasing levels of sulphur. The uptake of S by the crops in the present study is comparatively less than that reported by Kanwar (1984). The uptake of other nutrients was observed to be higher with the application of 80 kg S/ha.

Relationship between Nitrogen sulphur ratio and yield:

The significant negative relationship between two parameters indicates that if the ratio increases beyond a certain limit, the yield will decrease. Dijkshoorn *et al.* (1960) suggested 17:1 as the critical ratio. The critical ratio in the present study may be considered to be nearly 16.5:1 for legumes, which appears to be quite close to that reported by Motiramani and Pal (1971) for beans Bansal *et al.* (1983) also proposed 16.2:1 as the critical N:S ratio for soybeans.

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