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Effect of levels and sources of sulphur on seed yield and quality of summer green gram

P.M. PATEL, J.S. PATEL[1], J.J. PATEL* AND H.K. PATEL
Department of Agronomy, B.A.College of Agriculture, Anand Agricultural University, ANAND (GUJARAT) INDIA

ABSTRACT

An experiment was conducted to study the effect of levels and sources of sulphur on yield and quality of green gram during *summer* season of the year 2006. The results revealed that sulphur levels significantly influenced on quality parameters, growth and yield attributes *viz.*, plant height at 40 DAS and at harvest, number of branches plant^{-1}, seed and straw yields and protein content, as well as chemical parameters such as uptake of S showed the similar trend. Application of different sulphur sources significantly increased the quality parameters, growth and yield attributes. These attributes were increased with increase in the application of gypsum. Chemical parameters *viz.*, uptake of S by seeds was also increased with the application of gypsum. Application of 30 kg S ha^{-1} from gypsum (GY) to summer green gram recorded maximum seed yield and net realization.

Key words : Sulphur sources, Sulphur levels, Green gram

INTRODUCTION

Green gram (*Vigna radiata* L. Wilczek) is commonly known as 'mung' or 'mungbean', which is the most important crop throughout South-East Asia and particularly in the Indian sub-continent. Being a leguminous crop, the pulses are an indispensable part of the diet as it contains 23.1 % protein, which is nearly two and half times more than the cereals, 0.5 to 4.33 per cent fats and 23.4 to 66.3 per cent carbohydrates (Sinha, 1978). The crop is especially recognized as an excellent source of protein. It is highly digestible and free from the flatulent effects unlike other pulses. Sulphur increase crop yield and improve produce quality. The present study was undertaken to find out the effect of levels and sources of sulphur on yield and quality of summer green gram.

Fertilizer is an important factor which increase agricultural production. It is universally accepted that chemical fertilizers are an integral part of the package of practice for raising agricultural production to higher technological plan. Adequate crop nutrition through the use of fertilizer is a proven route for increasing crop productivity. Sulphur requirement is high for the crops of Gramineae, Leguminosae and Cruciferae families. Sulphur is absorbed by plants as sulphate ion. Concentration of Sulphur in the plants ranges from 0.1 to 0.4%. Sulphur is generally called the fourth major nutrient. The effect of Sulphur has a synergistic effect on productivity of crops. Sulphur is essential for synthesis of protein, vitamins and S-containing essential amino acids *viz.*, methionine, cystine and cysteine. About 90% of plant sulphur is present in these amino acids. It is also constituent of glutathione, a compound that plays a part in plant respiration and synthesis of essential oils. Sulphur also markedly enhanced the content of P, S, protein and gum in grain and ultimately the yield. Sulphur has their role in growth and development of crop in legumes. Sulphur increases crop yields and improve produce quality, both of which are important for determining the market price. After phosphorus, sulphur nutrition has been found to be major limiting factor in green gram production. Sulphur can be applied to the soil through any of the suitable S-carriers, the choice depending on crop, local availability, price and need for other nutrients.

MATERIALS AND METHODS

An experiment was carried out at College Agronomy Farm, B.A. College of Agriculture, Anand Agricultural University, Anand, Gujarat during summer season of the year 2006. The soils of the experimental plot was well drained loamy sand with low organic carbon (0.42%) and total nitrogen (0.032 %), medium in available P_2O_5 (43.28 kg ha^{-1}) and low in available sulphur (8.2 ppm). The experiment was laid out in RBD with factorial concept with four replications and treatment comprised of three levels of sulphur (10, 20 and 30 kg S ha^{-1}) and three sulphur sources (single super phosphate, Elemental sulphur and Gypsum).

RESULTS AND DISCUSSION

The results obtained from the present investigation are present below:

*** Author for correspondence**
[1]BIDI Tobacco Research Station, Anand Agricultural University, ANAND (GUAJARAT) INDIA

Effect of sulphur level :

The results revealed that sulphur levels showed significant influence on quality parameters, growth and yield attributes *viz.*, plant height at 40 DAS and at harvest, number of branches plant^{-1}, seed weight plant^{-1}, test weight and protein content. These attributes were higher under the application of 30 kg S ha^{-1} as compared to control. Like-wise chemical parameters, such as uptake of S showed the similar trend, except S content. Moreover, plant height at 20 DAS, number of pod plant^{-1}, pod length and number of seeds pod^{-1} were non significant due to sulphur levels.

An appraisal of data (Table 1) indicated that the differences in seed yield due to different sulphur levels were significant. The yield was increased appreciably with each successive increased in the sulphur levels and significantly the highest seed (1377 kg ha^{-1}) and straw yield (2107 kg ha^{-1}) of summer green gram was registered under the treatment S_3 (30 kg S ha^{-1}). Maximum seed yield under treatment S_3 might be due to its pivotal role in regulating the metabolic and enzymatic processes including photosynthesis, respiration and legume-*Rhizobium* symbiotic nitrogen fixation which reflected in increased yield. The other reason might be due to the important role of sulphur in energy-transformation activation of enzymes and also in carbohydrate metabolism. Another reason might be due to the improved status of available S in soil to sufficient level, which consequently resulted in bold seeds and well-filled pods and in turn increased the seed yield of green gram. Higher straw yield at higher dose of sulphur was might be due to its role in protein and hormone synthesis. Sulphur is requiring for conversion of reduce nitrogen in to protein in nitrogen fixing legumes The findings on higher seed yield due to sulphur levels were also reported by Singh and Agarwal (1998) and Ghosh and sarkar (2000).

Statistical analysis of the data on protein content of seeds (Table 1) indicated that sulphur levels significantly influenced the protein content. Treatment S_3 (30 kg S ha^{-1}) produced significantly the highest protein content (24.84%) as compared to other treatments. This might be due to increase in content of Sulphur containing amino acids. The results are in agreement with Singh and Aggarwal (1998).

Effect of sulphur sources :

Application of different sulphur sources significantly increased the quality parameters, growth and yield attributes *viz.*, plant height at 40 DAS, seed weight plant^{-1}, and test weight, except plant height at harvest, number of branches plant^{-1} and protein content. These attributes were increased with increase in the application of gypsum. Chemical parameters *viz.*, uptake of S by seeds was also increased with the application of gypsum. However, non significant response of sulphur sources was observed on plant height at 20 DAS, number of pod plant^{-1}, pod length, number of seeds pod^{-1} and harvest index.

Result on seed yield indicated that application of GY (gypsum) recorded 1320 and 1970 kg ha^{-1} seed and straw yields, respectively. The increase in seed yield under treatment GY (gypsum) was to the tune of 33.33 per cent over control. Increase in seed yield might be due to the presence of readily available SO_4 sulphur in the gypsum as compared to other sources. This also might be due to

Table 1 : Effect of sulphur levels and sources on yield, yield attributing and quality characters of summer green gram

Treatment	Plant height at harvest (cm)	No. of branches/plant	No. of pods/ plant	Pod length (cm)	No. of seeds/ pods	Seed yield (kg/ha)	Straw yield (kg/ha)	Protein content (%)	S content in seed (%)	S uptake (kg/ha)
S_1	48.32	4.75	21.42	7.48	9.78	1093	1675	23.47	0.113	1.24
S_2	46.54	4.94	21.98	7.07	9.46	1225	1847	24.23	0.108	1.33
S_3	49.85	5.08	20.13	7.35	9.72	1377	2107	24.84	0.107	1.48
S. E. $\pm$	0.23	0.02	0.19	0.04	0.08	10.18	12.49	0.10	0.001	0.01
C.D. (P=0.05)	0.67	0.07	NS	NS	NS	29.55	36.24	0.29	NS	0.04
SS	48.49	4.93	21.98	7.24	9.32	1127	1785	24.07	0.103	1.15
ES	49.98	5.00	21.38	7.25	9.57	1249	1874	24.48	0.113	1.40
GY	46.23	4.85	20.18	7.41	10.07	1320	1970	23.99	0.113	1.50
S. E. $\pm$	0.23	0.02	0.19	0.04	0.08	10.18	12.49	0.10	0.001	0.01
C.D. (P=0.05)	0.67	0.07	NS	NS	NS	29.55	36.24	0.29	0.002	0.04
SL X SS	NS	Sig.	Sig.	Sig.	NS	NS	NS	NS	NS	Sig.
CV%	5.82	5.52	11.28	6.32	9.50	10.12	8.11	5.07	8.84	11.65

S_1 : 10 kg S ha^{-1} S_2 : 20 kg S ha^{-1} S_3 : 30 kg S ha^{-1}
SS : Single Super phosphate ES : Elemental Sulphur GY : Gypsum NS-Non significant

Table 2 : Economics as influenced by sulphur levels and its sources

Treatments	Yield kg ha^{-1}	Treat. cost (Rs.)	Common cost (Rs.)	Total cost (Rs.)	Gross realization (Rs./ha)	Net Realization (Rs./ha)	BCR
RDF	990	0	7937	7937	21780	13843	1.74
Sulphur levels							
S_1 (10 kg ha^{-1})	1093	1000	7937	8937	24046	15109	1.69
S_2 (20 kg ha^{-1})	1225	2000	7937	9937	26950	17013	1.71
S_3 (30 kg ha^{-1})	1377	3000	7937	10937	30294	19357	1.77
Sulphur sources							
SS (single super phosphate)	1127	398	7937	8335	24794	16459	1.97
ES (elemental sulphur)	1249	5174	7937	13111	27478	14367	1.10
GY (gypsum)	1320	428	7937	8365	29040	20675	2.47

Seed price : 22 Rs. kg^{-1}

its ability to mobilize more sulphur for the crop plant. Another reason might be due to application of gypsum attributed to the fact that addition of gypsum brought about remarkable improvement in the physico-chemical properties of soil. The increased mineralization of native as well as applied nutrients brought about a considerable increase in both macro (N, P and S) and micronutrient particularly of Fe in the soil. This also might be due to the gypsum application influenced the productivity of the crop by improving the both, the basic infrastructural frame (bearing capacity) and the leaf area (the photosynthate production efficiency as well as the pod size). It regulates these parameters, because it is part of amino acids like methionine, cystine and cystein, lipolic acid, co-enzymes (SCOAH) and vitamins (thiamine pyrophosphate). These results are in conformity with the findings of those reported by Singh and Aggarwal (1998). Increasing straw yield of green gram might be due to mobilization of adequate sulphate from the growth medium to the plant parts as a result of sulphur addition. The other reason might be due to application of gypsum may be attributed to the higher availability of nutrients due to reduce pH as a consequence of gypsum application favoured greater absorption by plants which led to higher photosynthesis, production of carbohydrates and their translocation to different parts of the plant resulting into increased seed and straw yield. Similar results were also reported by Dwivedi *et al*. (1996).

Application of sulphur through GY (gypsum) and ES (elemental sulphur) increased the sulphur content of seeds (0.113%) as compared to SS (single super phosphate).

Economics:

Data on economics as influenced due to sulphur levels and sources are presented in Table 2. The highest net realization of Rs. 19357 ha^{-1} was recorded under treatment S_3 (30 kg S ha^{-1}) with BCR value of 1.77, followed by S_2 (20 kg S ha^{-1}) treatment gave Rs. 17013/ ha net realization with BCR value of 1.71, while the lowest net gain of Rs. 15109 ha^{-1} was noticed under the treatment S_1 (10 kg S ha^{-1}) with the BCR value of 1.69.

Among the sulphur sources, the highest net realization of Rs. 20675 ha^{-1} was recorded under GY (gypsum) with BCR value of 2.47, followed by the treatment SS (Single Super Phosphate) with net realization (Rs.16459 ha^{-1}) and 1.97 BCR value. The lowest net gain of Rs. 14367 ha^{-1} was noticed under treatment ES (elemental sulphur) with the BCR value of 1.10. The per cent increased in net realization under treatment S_3 (30 kg S ha^{-1}) and GY (gypsum) as compared to RDF (control) were at the extent of 39.83 and 49.35, respectively. Higher net realization under GY (gypsum) was only due to higher seed yield (Table 3). Application of ES (elemental sulphur) recorded less net realization than GY (gypsum) due to its higher cost.

From the above findings, it is concluded that for securing maximum seed yield and higher net realization of summer green gram crop it should be fertilized with 30 kg S ha^{-1} from gypsum.

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