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EFFECT OF LEVELS AND SOURCES OF SULPHUR ON GROWTH, YIELD AND QUALITY OF GUAR (*CYAMOPSIS TETRAGONOLOBA*) UNDER RAINFED CONDITIONS

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ABSTRACT

A field experiment was conducted to investigate the effect of levels and sources of Sulphur on growth, yield and quality of guar. Application of sulphur @ 20 and 40 kg ha^{-1} appreciably enhanced. However 20 kg S ha^{-1} was enough economically, most viable for maximum net return (Rs. 5773 ha^{-1}) and 40 kg S ha^{-1} was best for highest seed protein (32.27%). Application of sulphur 20 kg ha^{-1} through 50 % gypsum + 50 % elemental-S gave the maximum seed yield (11.40 q ha^{-1}) and net return (Rs. 7161 ha^{-1}) but the seed protein was highest significantly (33.87%) at 40 kg S ha^{-1} with the same combination.

Figure : 00 References : 12 Table : 01

KEY WORDS : *Cyamopsis tetragonaloba,* Guar.

Introduction

The deficiency of sulphur in soils is increasing due to increased use of S- free fertilizers, high analysis fertilizers and high input oriented intensive agriculture. In northern Madhya Pradesh, deficiency of sulphur is recorded in the coarse texture alluvial soil having low organic matter. The sulphur balance was negative all over Madhya Pradesh[1]. The negative balance of S was the highest in Gird zone (-8.8 kg ha^{-1}). The removal of S in the state during 1998-99 was 7.1 kg ha, however the addition through fertilizer was 4.1 kg/ha thus the negative balance of 3.0 kg ha must have now been increased much more. Keeping in view the importance and efficiency of variable sources of sulphur in increasing cluster bean productivity in Gird zone on sustainable bases, the present work was taken up.

Materials and Methods

An experiment was conducted at the Research Farm, college of Agriculture Gwalior (M.P.) during Kharif 2002 on S deficient (available S,9 mg kg^{-1}) sandy loam soil. The initial soil of experimented area was tested at pH 7.8, EC 1.2 dsm^{-1}, organic carbon 6.2g kg^{-1} with available N, P_2O_5 and K_2O 140, 17 and 260 kg/ha respectively, The rainfall received during July to October was 337.5 mm. The treatments comprised three suphur levels (0,20 and 40 $kgha^{-1}$ and five sources of sulphur (100 S by gypsum, 100% by elemental S, 20% by gypsum+ 80% by elemental-S, 50% by gypsum+ 50% by elemental S and 100% S by single super phosphate). Treatments were laid out in factorial randomized block design with four replications Guar var, HG 365 was sown (drilled) @ 16 kg seed ha^{-1} in rows 45 cm. apart on 6 August 2002. A basal dose of $N_{20}P_{60}K_{70}$ was applied uniformly in all the treatments. The required quantity of sulphur was drilled in rows in 5-7 cm deep before sowing. The crop was grown totally under rainfed condition; the crop was harvested on 30 November 2002.

Results and Discussion

Growth and yield components : Increasing levels of sulphur upto S_{40} did not deviate branches and green leaves/plant significantly, however plant height crop biomass grains/pos and grain weight/ plant were increased significantly only upto 20 kg S ha^{-1} while other characters *viz.* biomass/plant, clusters and pods/plant, pod length and 100 grain weight were increased significantly with the

TABLE -1: Plant growth and yield attributes, yield, protein and net return of cluster bean -

Treatments	Plant height (cm) at 90 DAS	Branches/ plant at 90 DAS	No. of pods/ plant	Pod length (cm)	No. of grains/ pod	Test weight of 100 seeds (g)	Grain weight/ plant (g)	Grain yield (q ha^{-1})	Seed Protein (%)	Netreturn (Rs. ha^{-1})	Benefit : cost ratio
Levels of Sulphur (Kg/ha)											
0	62.26	6.63	33.05	4.70	7.39	3.31	22.99	6.58	29.68	2145	1.36
20	65.36	6.87	44.62	4.86	7.84	3.37	25.88	9.77	31.04	5773	1.83
40	65.50	6.93	46.93	5.04	7.64	3.43	25.71	9.65	32.27	4775	1.67
S.E.(m)±	0.31	0.23	0.45	0.05	0.04	0.01	0.75	0.21	0.28	-	-
C.D. (at 5%)	0.90	NS	1.31	0.15	0.11	0.03	2.16	0.61	0.81	-	-
Sources of Sulphur											
Gypsum	64.15	7.04	40.16	4.82	7.48	3.34	27.23	8.70	30.28	4366	1.61
Elemental-S	63.71	6.84	37.13	4.75	7.40	3.33	24.04	8.22	30.73	3426	1.51
Gpsum+ Elem.-S (20:80)	64.17	6.79	41.29	4.79	7.45	3.38	24.41	9.17	31.38	4672	1.70
Gypsum+ Elem.-S(50:50)	66.20	7.21	46.40	5.28	7.78	3.46	27.63	9.67	31.63	5261	1.77
S.S.P.	63.45	6.16	41.85	4.69	7.41	3.34	20.99	7.57	30.62	2931	1.44
S.E.(m)±	0.4	0.29	0.59	0.07	0.05	0.02	0.97	0.27	0.36	-	-
C.D. (at 5%)	01.46	NS	1.69	0.20	0.15	0.07	2.78	0.79	1.04	-	-

increase in S level upto 40 kg ha^{-1} (Table-1), The probable reason may be attributed to the key role played by sulphur in plant metabolism, as being the constituent of some S containing amino acids such as cysteine and methionine. Application of sulphur had increased the concentration of sulphur in plant, which might have assisted in increasing the concentration of sulphur in plant and in increasing the chlorophyll content, ultimately influenced the utilization of sunlight, which could have increased the photosynthetic activity. Thus, the growth parameters were influenced due to sulphur application, the significant increase in number of leaves per plant and numbers of branches per plant were reported[3, 7].

Amongst the sources of sulphur 50 % gtoksyn + ekenubtal S increased all the growth and yield components, except significantly ever all the remaining S sources. The increase in growth and yield components might be due to continuous availability of sulphur in the form of sulphates (SO_4) at the early stage of growth from gypsum, which is calcium sulphate, and at the later stage from the elemental sulphur after microbial oxidation process.

Biomass per plant and per hectare was significantly affected due to sulphur application up to 40 kg/ha^{-1}. This was due to additive effect of number of branches per plant, number of leaves per plant, number of pods per plant etc. The increase in biomass sulphur can be explained as the chlorophyll synthesis is greatly affected by the sulphur content in plant, thus helps in increasing the photosynthetic activity,

The test weight of 100-seeds was significantly enhanced with the sulphur application upto 40 kg/ha^{-1}. Even sulphur application upto 20 kg/ha^{-1} significantly influenced the test weight in comparison to control (0 kg S ha^{-1}). This may be due to more accumulation of carbohydrates and protein within seed with an increased in sulphur application. The significant increase in test weight was also reported [3, 9].

Grain yield quality and net return

The significant increase in seed yield was noticed with increasing rates of sulphur only upto 20 kgha^{-1} seed yield was increased by 48.50 per cent on application of 20 kg S ha^{-1} in comparison to 0 kg S ha^{-1} (control). The probable reason could be assigned to the increasing trend of growth and yield attributes particularly number of braches per plant, number of clusters per plant, number of pods per plant, umer of seeds per pod, pod length and 100-seed weight, cumulatively initiated the additive effect of all these parameters to have a significante increase in seed yield (q ha^{-1}). The findings are in conformity with the previous results[4,11].

When different modes (sources) of sulphur applications were compared, application of 50% sulphur through gypsum + 50% sulphur through elemental sulphur, at sowing, proved to be the most effective in increasing seed yield of guar in comparison to other sources, This was due to additive effect of number of clusters per plant, number of pods per plant, number of seeds per pod and pod length. The significant increase in the seed yield with the same source of sulphur was also obtained at Bikaner and Bawal Research station.

Protein coutent in guar grain at 40 kg S ha^{-1} was higher by 1.03 and 2.49 per cent over 20 kg S ha^{-1} and no sulphur application. This might be due to the effect that sulphur fertilization promotes the development of roots and root-nodules of legume crops. Sulphur is also essential for the conversion of fixed-N from the atmospheric-N by legume root-nodules into protein nitrogen[5]. Further, sulphur is also required for the synthesis of sulphur containing amino acids *i.e.* cysteine, cystine and methionine, and ultimately for protein synthesis[12]. Consequently, protein content increased owing to the application of sulphur than no sulphur application. Similar observations were also reported[4].

The net return from guar was highest (57773/ha) with B:C ratio 1.83 when only 20 kg S/ ha was applied. Similarly it was highest upto Rs. 5261/ha with B:C ratio 1.77 when gypsum and elemental S was applied in 50:50 ratio.

The treatment interactions exerted significant influence upon seed yield but not upon seed protein (Table-3). Application of sulphur @ 20 kg/ha through 50 % gypsum + 50 % elemental S gave the maximum seed yield (11.40 q/ha) and net return (Rs. 7161/ha), but the seed protein was highest non-significantly (3.87%) at 40 kg S/ha with the same combination. This shows that under the existing nutrient status of the experimental soil, there is no need to apply higher dose of sulphur upto 40 kg/ha.

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