RESIDUAL EFFECT OF SULPHUR APPLICATION TO MAIZE ON SUBSEQUENT GREEN GRAM IN HAPLUSTALF

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ABSTRACT

Field experiments were conducted with green gram as test crop at two locations in Thondamuthur block of Coimbatore district to evaluate the residual effect of S application to maize on crop growth, nutrient uptake, yield and S use efficiency of subsequent green gram. The main crop was treated with 4 levels of S (0, 15, 30 and 45 kg ha\(^{-1}\)) while the residual crop green gram received no S. In both locations Maximum increase in yield parameters and yield were observed in S 45 kg ha\(^{-1}\) however it was on par with S30 kg ha\(^{-1}\). S uptake recorded maximum at S30 kg ha\(^{-1}\) than S 45 kg ha\(^{-1}\) while a phenomenal increase in N, P, K uptake were recorded in both the locations. Application of 30 kg S ha\(^{-1}\) in the form of SSP was found to be optimum dose for maize and to get better residual effect on green gram.

INTRODUCTION

The importance of sulphur for plant growth has been recognized for long to improve quality production of the crop. However its wide spread deficiency in soils and consequent losses on crop productivity have been reported during the last three decades due to the continuous use of S free fertilizers and intensive cultivation with high yielding varieties (Sakal \textit{et al.}, 2000). Sulphur helps in plant growth and metabolism especially by improving the activities of proteolytic enzymes, and is a constituent of important amino acids namely cystine, cysteine and methionine. It promotes nodulation in legumes, which enhance biological nitrogen fixation.

Green gram is one of the important leguminous crops in India. There is a wide gap between potential and actual yield obtained by farmers. This gap in field needs to be bridged up. The sulphur applied to main crop leaves residual effect to succeeding crops. The amount of residual S varies with soil type, crop yield levels, cropping intensity, irrigation source and use of organic residues in different cropping systems. The positive influence of residual effect of S on growth, uptake of nutrients and yield of many crops was reported by many authors, e.g., Mathew and Kurian (2003) in sugarcane ratoon crop, Sreemannarayana and Srinivasaraju (1995) in sunflower- green gram cropping sequence and Jena \textit{et al.} (2006) in groundnut - rice cropping sequence. The information available on residual effect of S on pulses is meager. With this view, experiments were undertaken to get better insight in to the residual effect of S on growth, yield and nutrients uptake of green gram.

MATERIAL AND METHODS

Field experiments were conducted on sandy clay loam soil (Udic Haplustalf) at two locations viz., Nathegoundenpudur (L1) and Mathuvarayapuram (LII) with Co.6 variety of green gram as a residual crop, grown after the harvest of main crop of maize, which received S application at 0, 15, 30 and 45 kg ha\(^{-1}\) along with recommended dose of N, P and K at the rate of 135, 62.5 and 50 kg ha\(^{-1}\) respectively. Green gram received 25 kg N, 50 kg P ha\(^{-1}\) with no S application. The treatments were replicated 5 times in RBD. The soils of experimental fields had pH 8.1 and 8.2, EC 0.45 and 0.31 with low in organic carbon content (each 0.45%), low available S (9.92 and 10.08 ppm) and low

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available N (232,200 kg ha\(^{-1}\)), medium available P (20.5, 17.0 kg ha\(^{-1}\)) and high available K (395, 330 kg ha\(^{-1}\)) in LI and LII, respectively.

At both locations, the number of pods plant\(^{-1}\), Number of grains pod\(^{-1}\), 1000 grain weight, yield of grain and stover were recorded treatment wise. The grain and stover sample collected at harvest were dried at 70°C, powdered in Willey mill and digested to analyze the nutrient composition. The N in plant sample were determined by microkjeldhal method (Humphries, 1956), P by vanadomolydate method and K by flame photometry by using diacid extract. Available S in soil samples was determined by turbidimetric method (Williams and Steinberg, 1959) after extracting with 0.15% CaCl\(_2\). The uptake of nutrients by green gram grain and stover at harvest were computed by multiplying the nutrient content with dry weight of grain and stover of green gram.

**Sulphur Use Efficiency (kg grain / kg S) =**

\[
\frac{\text{Grain yield with S} - \text{Grain yield without S}}{\text{S added}}
\]

**Apparent Sulphur Recovery (%) =**

\[
\frac{\text{S uptake with S} - \text{S uptake without S}}{\text{S added}} \times 100
\]

**Value Cost Ratio =**

\[
\frac{\text{Increase in grain yield in kg ha}^{-1} \times \text{price of 1 kg grain}}{\text{price of 1 kg SSP x S added (kg ha}^{-1})}
\]

### RESULTS AND DISCUSSION

The results of the field experiments conducted with residual crop of green gram are presented below. The available S in the residual soil ranged from 8.5 to 24.0 and from 7.8 to 21.4 mg kg\(^{-1}\) (Table1) with concomitant increase with S application at 0, 15, 30 and 45 kg ha\(^{-1}\) in main crop of maize.
1. **Yield Parameters**: The residual effect of S significantly affected the yield parameters viz., number of pods plant\(^{-1}\), number of grains pod\(^{-1}\) and 1000 grain weight (Table 1). The increase in the yield attributes under the influence of S application was due to the important role of S in energy transformation, activation of enzymes and in carbohydrate metabolism. The results are in close conformity with the findings of Umesh Singh and Yadev (2000) in green gram and Misra (2003) in mustard.

2. **Yield**: The grain and straw yield of green gram were favorably influenced by the residual S (Table 1). The highest grain and stover yield (1062, 1865 kg ha\(^{-1}\) (LI) and 763, 1672 kg ha\(^{-1}\) (LII)) were recorded in residual S @ 45 kg ha\(^{-1}\). However it was statistically on par with residual S @ 30 kg ha\(^{-1}\) (1045,1853 kg ha\(^{-1}\) (LI) and 755,1671 kg ha\(^{-1}\) (LII)). While control recorded the lowest yield in both locations. Jena et al. (2006) and Pattnayak et al. (2002) suggested that 30 kg S ha\(^{-1}\) as the optimum dose to get more yield in residual crop in groundnut- rice and rice- peanut cropping system, respectively, which was in line with the present findings.

Higher seed yield of green gram with S application may be attributed to cumulative effect of increased yield attributes such as No of pods plant\(^{-1}\), seeds pod\(^{-1}\) and 1000 grain weight. This was further confirmed by Jat and Rathore (1994) in green gram. An increase in grain yield of 1.2, 4.3, 5.9% and 2.9, 7.7, 8.8 % were recorded by 15, 30, 45 kg S ha\(^{-1}\) in L1 and LII, respectively.

3. **Nutrients Uptake**: As the level of S increased from 0 - 45 kg ha\(^{-1}\) there was a
significant and linear increase in uptake of S with highest value at S @ 30 kg ha\(^{-1}\) at both locations (Table 2). However, there was no significant difference between 30 and 45 kg S ha\(^{-1}\). Sulphur uptake values @ 30 kg ha\(^{-1}\) were 3.38, 2.53 over S uptake values of 3.14, 2.27 in control at L1 and LII respectively. Sulphur uptake by stover was higher as compared to S uptake by grains. The residual value of S significantly increased the S uptake by grain and stover due to increase S availability from applied S with a concomitant increase in crop yield and increased S concentration in plant and dry matter yield.

These results corroborated with the earlier findings of Sakal et al. (2000) and Sakthikumaran (2001). The linear increase in the uptake of N, P and K by green gram grain and stover was evident by the effect of residual S. The highest SUE, ASR and VCR were found to be observed high in the treatment which received residual S @ 30 kg ha\(^{-1}\).

Based on SUE, ASR and VCR, application of 30 kg S ha\(^{-1}\) in the form of SSP was found to be optimum dose for maize and to get better residual effect on green gram.

**REFERENCES**


