Evaluation of growth, yield and protein content of summer green gram (Vigna radiata L.) under different levels of sulphur

AK Jain, AK Singh, Pavan Shukla, VK Singh, Uday Kumar, Beerendra Singh and Subodh Kumar

Abstract
This study was conducted at the farmer’s field during summer season 2018 under supervision of V.K.S. College of Agriculture Dumraon-Bihar to evaluate the growth, yield and protein content of summer Green Gram (Vigna radiata L.) under different levels of sulphur. The experiment was conducted in randomized block design with nine treatments as levels of sulphur 0, 5, 10, 15, 20, 25, 30, 35 and 40 Kg per ha along with recommended dose of fertilizer in the crop with three replications. Grain yield (1040 kg/ha) was found significantly higher under 30 kg per ha sulphur (Y). Protein content in seed increased significantly with increasing levels of sulphur up to 30 kg.

Keywords: Growth, yield, protein content and sulphur levels

Introduction
Green gram is one of the most important pulse crops. It is mostly grown in Kharif season and in some part of India spring/summer crop is also cultivated, whereas irrigation facility is available. However, the productivity of green gram is very low due to unbalance use of fertilizer. Leguminous crops like green gram have a high sulphur (Singh and Sharma, 2016) requirement due to their many functions in plant growth. Green gram is utilized in many food products. The sprouted seeds are consumed as salad which is rich in vitamins, particularly ascorbic acid, niacin, riboflavin and thiamine. Green gram grain is having easily and high digestible protein content. Sulphur plays an important role in growth and development of crops. It plays an important role in the formation of S-containing amino acids like cystine (27% S), cysteine (26% S), methionine (21% S), which act as building blocks in the synthesis of proteins. It has role to play in increasing chlorophyll formation and aiding photosynthesis. Sulphur also plays a role in the activation of enzymes, nucleic acids and forms a part of biotin and thiamine. In recent years, an increased frequency of sulphur deficiency has been observed in crops and S may become a factor limiting yield and quality of crops. Green gram, one of the important pulse crops, is sensitive to the deficiencies of sulphur. So far, inadequate information is available regarding the effect of S on green gram in Zone III B of Bihar condition. This study was, therefore conducted to evaluate the effect of S on the growth, yield and quality of green gram.

Materials and Methods
Field experiment was conducted at the farmer’s field. It is situated at 25.51°N latitude and 84.15°E longitude. The present investigation was carried out at Karuaj, Bihar, during summer season of the year 2018. Variety of green gram is used in experiment SML-668 which was released and notified in India and evaluated at Indian Institute of Pulses Research, Kanpur. This is a short duration variety and matured only 65-70 days. The soil of the experimental field was loam in texture having pH 7.1, organic C 0.46%, available N 195 kg ha⁻¹, available phosphorus 17.8 (Kg/ha), available K 140 kg ha⁻¹ and available S 12.52 kg ha⁻¹. The experiment was conducted in Randomized Block Design with nine treatments as levels of sulphur 0, 5, 10, 15, 20, 25, 30, 35 and 40 Kg per ha along with recommended dose of fertilizer in the crop and three replications. A basal dose of 20 kg N and 60 kg P₂O₅ ha⁻¹ for green gram was applied uniformly in all the plots. Full dose of P was applied at the time of sowing. Sulphur was applied as per treatments at the time of sowing. Green gram was sown on April 10, 2018 and harvested on June, 18 2018. Grain and straw yields of the crop were recorded at maturity. The growth and yield attributes were recorded at harvest. Treatment wise full dose of S through elemental sulphur as basal dressing.
At harvest seed and straw yield were recorded. In order to determine protein in seeds Kjeldahl’s digestion and distillation procedure was followed to determine nitrogen in seeds. Then the protein content of the seed was determined by multiplying the nitrogen content of seed by 6.25. N (Kjeldahl method), P & S (Spectrophotometer), K (flame photometer) in the soil determine by these methods.

**Results and Discussion**

### Growth, Yield attributes

The plant height was significantly influenced by the application of sulphur along with recommended dose of fertilizers at all stages of crop. The highest plant height of 36.53 cm was recorded in the treatment that received 30 kg sulphur ha⁻¹ along with recommended dose of fertilizers (T₅) at maturity. However, it was found to be at par with application of sulphur @25 kg ha⁻¹ with recommended dose of fertilizers (35.77). The lowest plant height of 32.13 cm was observed in RDF without Sulphur (T₁). This might be due to known role of sulphur in stimulation of cell division, photosynthetic process as well as formation of chlorophyll. It also promotes the root nodules in legumes, which cause the more sulphur available during vegetative growth period and development of plant occurs. These results are in accordance with those of Yadav (2004) [⁶], Srivastava et al. (2006) [⁷] and Arun Raj et al. (2018) [¹²] with respect to plant height in green gram.

**Number of pods per plant**

Significantly higher pods per plant was found under 30 kg per ha and at par with 25 & 35 Kg per ha sulphur. This might be due to more availability of sulphur during these vegetative and reproductive stages of the crop. Sulphur is a part of amino acid (Cystine), which helps in chlorophyll formation, photosynthetic process and activation of enzymes (Mitra et al., 2006) [⁸] and Arun Raj et al. (2018) [¹²].

**Number of seeds per pod**

The number of seeds per pod showed significant difference with application of sulphur at different level along with recommended dose of fertilizer. The higher number of seeds per pod was recorded in the treatment that received 30 kg of sulphur ha⁻¹ along with recommended dose of fertilizer (7.0) and it was followed by the application of 25 kg sulphur ha⁻¹ along with recommended dose of fertilizer (6.70), as compared to without sulphur (5.07). This might be due to activation of enzymes by application sulphur Kumar and Singh (2017) [¹⁰].

### Grain yield (kg ha⁻¹), Stover Yield (kg ha⁻¹) and Protein Content

The significantly higher grain yield of green gram was recorded in the treatment that received application of sulphur 30 kg ha⁻¹ along with recommended dose of fertilizer (1040 kg ha⁻¹) over rest of the treatments. However, it was at par with treatment that received application of sulphur @ 25 & 35 kg ha⁻¹ along with recommended dose of fertilizer (1031.67 & 991.33 kg ha⁻¹) and lowest in recommended dose of fertilizer without use of sulphur (683.00 kg ha⁻¹). This might be due to the pronounced role of sulphur in stimulation of cell division, photosynthetic process as well as formation of chlorophyll. It also promotes the root nodules in legumes, which cause the more sulphur available during vegetative growth period and development of plant occurs as well as highest harvest index and test weight were found under T₅. Similar type of observations was also reported by Singh et al. (1999) [¹⁴] and Sharma and Singh (1997) [⁴] and also results corroborated with the findings of Das (2017) [¹¹] in green gram. Stover yield was found non-significant. Sarkar and Pal (2003) [⁵] also reported test weight and seed yield increased significantly with increasing rates of S and were higher under irrigated conditions. Bansal (1991) [¹] also noticed response of sulphur in green gram in reference to yield and yield attributes. Significantly higher protein was observed in 30 kg per ha sulphur applied along with RDF (T₅) in Table 1. similar result also reported by Ram & Katiyar (2018) [¹³] due to increase amino acid content by the application of sulphur.

Table 1: Effect of Sulphur on Growth, Yield attributes Yield and Protein Content of Green Gram

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Plant height (cm)</th>
<th>No. of pods per Plant</th>
<th>No. of Seeds Per Pod</th>
<th>Grain Yield (kg/ha)</th>
<th>Stover Yield (kg/ha)</th>
<th>Test weight (gm)</th>
<th>Harvest Index</th>
<th>Protein Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁-RDF Without S</td>
<td>32.13</td>
<td>9.13</td>
<td>5.07</td>
<td>683.00</td>
<td>1688.33</td>
<td>3.43</td>
<td>28.59</td>
<td>17.80</td>
</tr>
<tr>
<td>T₂-T₁+5 Kg S</td>
<td>33.33</td>
<td>11.53</td>
<td>5.77</td>
<td>928.00</td>
<td>1742.67</td>
<td>4.27</td>
<td>34.74</td>
<td>18.38</td>
</tr>
<tr>
<td>T₃-T₁+10 Kg S</td>
<td>34.07</td>
<td>12.17</td>
<td>6.10</td>
<td>984.67</td>
<td>1730.33</td>
<td>4.33</td>
<td>36.27</td>
<td>19.90</td>
</tr>
<tr>
<td>T₄-T₁+15 KgS</td>
<td>34.73</td>
<td>12.50</td>
<td>6.37</td>
<td>997.67</td>
<td>1676.67</td>
<td>4.37</td>
<td>37.32</td>
<td>20.93</td>
</tr>
<tr>
<td>T₅-T₁+20 KgS</td>
<td>34.97</td>
<td>13.23</td>
<td>6.63</td>
<td>1002.33</td>
<td>1702.67</td>
<td>4.57</td>
<td>37.06</td>
<td>21.70</td>
</tr>
<tr>
<td>T₆-T₁+25KgS</td>
<td>35.77</td>
<td>13.60</td>
<td>6.70</td>
<td>1031.67</td>
<td>1664.33</td>
<td>4.73</td>
<td>38.28</td>
<td>22.37</td>
</tr>
<tr>
<td>T₇-T₁+30KgS</td>
<td>36.53</td>
<td>13.90</td>
<td>7.00</td>
<td>1040.00</td>
<td>1651.00</td>
<td>5.20</td>
<td>38.65</td>
<td>23.07</td>
</tr>
<tr>
<td>T₈-T₁+35KgS</td>
<td>35.27</td>
<td>13.43</td>
<td>6.37</td>
<td>991.33</td>
<td>1707.67</td>
<td>4.70</td>
<td>36.71</td>
<td>22.07</td>
</tr>
<tr>
<td>T₉-T₁+40KgS</td>
<td>34.30</td>
<td>13.37</td>
<td>6.30</td>
<td>986.00</td>
<td>1722.00</td>
<td>4.67</td>
<td>36.36</td>
<td>21.80</td>
</tr>
<tr>
<td>SEM±</td>
<td>0.33</td>
<td>0.17</td>
<td>0.17</td>
<td>43.45</td>
<td>30.59</td>
<td>0.15</td>
<td>1.13</td>
<td>0.38</td>
</tr>
<tr>
<td>CD</td>
<td>0.99</td>
<td>0.50</td>
<td>0.52</td>
<td>131.37</td>
<td>N/A</td>
<td>0.44</td>
<td>3.42</td>
<td>1.16</td>
</tr>
</tbody>
</table>

Note: RDF- 20 Kg/ha Nitrogen +60 kg/ha Phosphorus

### References

3. Singh U, Yadav DS. Studies on S and Zn nutrition on moong (Phaseolus radiatus) in relation to growth

Note: RDF- 20 Kg/ha Nitrogen +60 kg/ha Phosphorus