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EFFECT OF SULPHUR ON GROWTH AND YIELD OF GREENGRAM [*Vignaradiata*]

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Abstract: The field experiment was conducted at Agriculture Farm of Adhiparasakthi Agricultural College, Vellore, Tamil Nadu to evaluate the effect of sulphur on growth and yield of greengram [*Vignaradiata*] variety VBN 3 during January-April 2015. The experiment was conducted in RBD with six treatments replicated four times. The treatment includes recommended dose of fertilizer (T_2), T_2 + 10kg sulphurha^{-1} (T_3), T_2 + 20kg sulphurha^{-1}(T_4), T_2 + 30kg sulphurha^{-1}(T_5) and T_2 + 40 kg sulphur ha^{-1}(T_6) were compared with control (T_1). The biometric observation *viz.,* growth attributes like plant height(cm), number of leaves per plant, number of branches per plant, total dry matter production and yield attributes like number of pods per plant, number of seeds per pod, thousand seed weight (g),grain yield (kg ha^{-1})were recorded. Among the different treatment application of 30 kg sulphur along with recommended dose of fertilizer (T_5) produced significantly higher plant height (30.95cm), number of leaves per plant (18.73), number of branches per plant (7.09), total dry matter production (11.1) and number of pods per plant (10.75), number of seeds per pod (11.91), thousand seed weight (43.55g) higher grain yield of 750 kg ha^{-1}compared to other treatments. The per cent increase of grain yield under treatment T_5 over T_1 was 49.32 per cent. It was on pair with the treatment that application of 30 kg sulphur ha^{-1} along with recommended dose of fertilizer with plant height (30.84cm), number of leaves per plant (17.95), number of branches per plant (6.62), total dry matter production (10.34) and number of pods per plant (10.0), number of seeds per pod (10.73), thousand seed weight (42.19g), grain yield (680 kg ha^{-1}).The economic analysis indicated that application of 30 kg sulphur ha^{-1}along with recommended dose of NPK (T_5) registered the maximum net return (Rs. 18,875 ha^{-1}).

Keywords: Green gram, Sulphur, Growth, Yield attributed, Yield, High profit.

INTRODUCTION

India is the largest producer and consumer of pulses in the world accounting for 29 per cent of world area and 19 per cent of world's production. At present the total area under pulses is 25.39 million hectares, with a production of 16.10 million tonnes (Anonymous, 2008). It is estimated that country population will reach nearly 1350 million by 2020 A.D. The country would then need 30.3 million tonnes of pulses to meet the requirement. In fact, there has been stagnation in the production and productivity of pulses over the past two decades. The per capita availability of pulses has declined from 64 g per capita per day (1951-56) to less than

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35 g per capita per day (Asthana, 1998), as against the FAO/WHO‟S recommendation of 80g. The important grain legumes grown in India are chickpea, pigeon pea, Greengram, Blackgram, cowpea, lentil and peas etc. Among these grain legumes, Blackgram (*Vignamungo* L), an ancient and well known leguminous crop of Asia, is popular because of its nutritional quality (protein).Green gram is a highly priced pulse, rich in protein (24per cent) and phosphoric acid. Besides being cooked for consumption with roti and rice, it is also used in making dhal. In India, Green gram is grown on 2.70 million hectare area with a production of 0.94 million tonnes. In Tamil Nadu, it is grown on an area of 3.41 lakhs hectares with a production of 1.21 lakhs tonnes. In Vellore district the area under green gram is 2157 hectare with the production of 878 metric tonnes and the productivity is 407 kg ha^{-1}. (Anonymous, 2011).However, the yield potential of this crop is very low and plagued with a number of diseases and pests. The production of pulse crop in our country including Green gram is not enough to meet the domestic demand of the population. There is scope to enhance the productivity of Green gram by proper agronomic practices and fertilizers. Application of nutrient for increasing and exploiting genetic potential of the crop is considered as an efficient and economic method of supplementing the nutrient requirement. Application of sulphur will enhance the nutrient availability and in turn increases the productivity. Application of major nutrients NPK & sulphur was found to be advantageous and increases the productivity. The research work carried out on different application of sulphur in addition to nutrients in greengram is lacking in India, and still meager in north east zone of Tamil Nadu. Keeping the above points in view, the experiment was planned with the following objectives.

Material and methods

A field experiment was conducted at Agriculture Farm of Adhiparasakthi Agricultural College, Vellore, Tamil Nadu to study the “Effect of sulphur on growth and yield of green gram” (*Vignaradiata* L.) during *rabi* 2014-2015 under irrigated condition. The experimental plot situated at 12° 46' 0" N latitude, 79° 25' 0" E longitude and at an altitude of 138 m above mean sea level. The research place comes under North Eastern Zone of Tamil Nadu. The experiment consisted of six treatments. The treatment details are as follows, T_1 - Absolute control (without any fertilizer), T_2 - Recommended dose of fertilizer (25:50:25 kg of NPK ha^{-1}), T_3 - T_2 + 10 kg ha^{-1} sulphur, T_4 - T_2 + 20 kg ha^{-1}sulphur, T_5 - T_2 + 30 kg ha^{-1}sulphur, T_6 - T_2 + 40 kg ha^{-1}sulphur.

The experiment was carried out using VBN 3 variety of green gram and the package of practices as recommended by crop production unit of TNAU was followed. Sulphur applied as treatment wise at 30^{th} and 45^{th} days after sowing coinciding with flowering and pod filling stage. Fertilizers *viz.,* Sulphur is applied in the form of gypsum 10kg, 20kg, 30kg and 40kg, were applied. Gypsum contains 18.6 per centsulphur.

Results and discussion

Growth parameters

Plant height (cm)

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 52.4 cm was recorded in the treatment that received 40 kg sulphur ha^{-1}along with recommended dose of fertilizers (T_6). However, it was found to be on par with application of sulphur @30 kg ha^{-1} with recommended dose of fertilizers (50.8 cm). The lowest plant height of 21.5 cm was observed in control (T_1). 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 (2005) and Srivastava *et al.* (2006) with respect to plant height in green gram.

Number of trifoliate leaves per plant

Number of trifoliate leaves per plant was appreciably influenced by application of sulphur at various level. Among the various treatments, 40 kg of sulphur ha^{-1} along with recommended dose of fertilizers (T_6) has recorded maximum number of leaves per plant (34.5) which was statistically on par with the treatment that received 30 kg of sulphur ha^{-1} along with recommended dose of fertilizers (33.7). The minimum number of leaves per plant (17.6) was recorded in control (T_1). The increase in number of leaves is attributed to the increased root and shoot growth in early phase which resulted in more number of leaves (Netti Kantaiah, 2008).

Number of branches per plant

Significant variation in number of branches was observed with application of sulphur along with recommended dose of fertilizer at various level. The application of sulphur @ 40 kg ha^{-1} with recommended dose of fertilizers recorded maximum number of branches per plant (8.67) which was statistically on par with the treatment that received sulphur @ 30 kg ha^{-1} with recommended dose of fertilizers (8.47). The number of branches per plant (5.36) was

less in control (T_1) (Table .1). Application of sulphur showed a profound influence on the number of branches per plant. 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) and Srivastava *et al.* (2006) with respect to plant height in green gram.

Total dry matter production (TDMP) (g / plant)

Significant variation in the dry matter production was observed among various treatments that received different level of sulphur. The highest dry matter production of 27.63 g plant^{-1} was recorded in the treatment that received sulphur @ 40 kg ha^{-1} with recommended dose of fertilizers which was found to be on par with the treatment that received sulphur @ 30 kg ha^{-1} along with recommended dose of fertilizers (26.97 g plant^{-1}). The lowest dry matter production of 14.25 g plant^{-1} was observed in control (Fig. 1). This might be due to the continuous and slow release of nutrients which could have led to increased leaf area, number of leaves and in turn in higher DMP. This finding was in confirmation with the results of Sangeetha *et al.* (2010) and Meshram *et al.* (2015).

Effect of sulphur on yield and yield components of greengram

The data on effect of application of recommended dose of fertilizer and sulphur combinations on number of pods per plant, number of seeds per pod, pod length (cm), thousand seed weight (g) and grain yield (kg ha-1) are presented in Table 3 and fig 6.

Number of pods per plant

Significant variation in number of pods per plant was observed with application of different level of sulphur along with recommended dose of fertilizers. The observation on number of pods per plant revealed a two fold increase in the treatment that sulphur @ 40 kg ha^{-1} with recommended dose of fertilizers (34.5 per plant) when compared to control (15.6 per plant). This treatment was found to be on par with the treatment that received sulphur @ 30 kg ha^{-1} along with recommended dose of fertilizers (33.56 per plant). 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)

Number of seeds per pod

The higher 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 40 kg of sulphurha^{-1}along with recommended dose of fertilizer (12.4) and it was followed by the application of 30 kg sulphurha^{-1}along with recommended dose of fertilizer (12.1), as compared to absolute control (7.4). This might be due to activation of enzymes by application sulphur (Mitra *et al.,* 2006)

Pod length (cm)

The application of sulphur 40 kg ha along with recommended dose of fertilizer was recorded significantly higher pod length (8.5 cm) over the rest of treatment. However, it was on pair with the treatment that received 30 kg of sulphur along with recommended dose of fertilizer (8.1 cm). The lowest pod length of 5.9 cm was observed in absolute control (T_1). This might be ascribed to application of sulphur, resulting in higher pod length.

Thousand seed weight (g)

Significant variation in thousand seed weight was observed with application of different level of sulphur along with recommended dose of fertilizers. The highest thousand seed weight was recorded in the treatment that received application of sulphur @ 40 kg ha^{-1} with recommended dose of fertilizers (37.2 g). However, it was on pair with the treatment that received 30 kg of sulphur per ha along with recommended dose of fertilizer (36.9 g) over absolute control (15.6 g). This might be due to application of sulphur (part of amino acid), which helps in chlorophyll formation, photosynthetic process, activation of enzymes and grain formation (Singh and Yadav2004).

Grain yield (kg ha^{-1})

The higher grain yield of green gram was recorded in the treatment that received application of sulphur 40 kg ha^{-1} along with recommended dose of fertilizer (816 kg ha^{-1}) over rest of the treatments. However, it was on pair with treatment that received application of sulphur @ 30 kg ha^{-1}along with recommended dose of fertilizer (804 kg ha^{-1}) as compared to absolute control (816 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. It resulted in higher plant height and number of branches per plant (Table 1) and ultimately helped in realization of higher grain yield (Kadam *et al.,* 2006) in green gram.

Conclusion

Based on the results of the above study, it is concluded that application of sulphur@ 30 kg ha^{-1} along with recommended dose of 25:50:25 kg of N, P_2O_5 & K_2O can be recommended to get profitably higher yield besides improving the quality of green gram. Over all, from the experimental results, it could be enlightened that application of sulphur@ 30 kg ha^{-1} along with recommended dose of fertilizers (25:50:25 kg of N, P_2O_5 & K_2O) could be considered as a better option for achieving higher productivity and profitability of green gram.

Table 1: Effect of sulphur on growth parameters of green gram

Treatments	Plant height (cm)	No. of trifoliate leaves	Number of branches/plant	Total dry matter production (g / plant)
T_1 - Absolute control	21.52	17.6	5.36	14.25
T_2 - RDF	33.54	24.7	6.54	19.67
T_3 - T_2 + 10 kg ha^{-1}Sulphur	41.25	28.6	7.12	21.54
T_4 - T_2 + 20 kg ha-1 Sulphur	47.36	30.2	7.65	24.45
T_5 - T_2 + 30 kg ha^{-1}Sulphur	50.82	33.7	8.47	26.97
T_6 - T_2 + 40 kg ha^{-1}Sulphur	52.41	34.5	8.67	27.63
SEd	0.892	0.473	0.132	0.251
CD (0.05 %)	1.83	0.97	0.276	0.52

Table 2: Effect of sulphur on yield attributes and yield of greengram

Treatments	Number of pods per plant	Number of seeds per pod	Pod length (cm)	1000 seed weight (g)	Grain yield (kg/ha)
T_1 - Absolute control	15.65	7.44	5.9	15.65	480
T_2 - RDF	19.65	9.85	6.45	29.54	561
T_3 - T_2 + 10 kg ha^{-1}Sulphur	27.58	10.96	7.10	31.42	680
T_4 - T_2 + 20 kg ha^{-1}Sulphur	31.45	11.65	7.67	33.25	760
T_5 - T_2 + 30 kg ha^{-1}Sulphur	33.56	12.16	8.17	36.96	804
T_6 - T_2 + 40 kg ha^{-1}Sulphur	34.52	12.41	8.56	37.25	816
SEd	0.502	0.12	0.219	0.164	8.1312
CD (0.05 %)	1.03	0.26	0.45	0.34	16.6

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