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To Study the Requirement of Sulphur and Plant Population for Summer Green Gram (*Vigna radiata L. wilczek*) in Champhai District, Mizoram, India

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A B S T R A C T

A field experiment was conducted at KVK Instructional Farm at KVK Champhai, Mizoram during two consecutive years (2016-17 and 2017-18) to study the requirement of sulphur and plant population for summer green gram with variety HUM-2. Results revealed that green gram cultivation in Rabi among the various treatments at 30kg sulphur with 4.0 lacs plant population (P_2 & $S_{2)}$ was found better result in terms of vegetative growth, yield and yield attribute parameters and also most economic and viable as compared to other treatments.

Introduction

Green gram (*Vigna radiata* L. Wilczek) commonly known as mungbean is an excellent source of high quality protein (25%). If lives saving irrigation facilities are available mung can be grown as a late rabi crop due to availability of short duration and photo-insensitive varieties. Usually grain legumes are grown on marginal lands and poor yields in such soils are partly due to lack of proper nutrition. In the recent years the importance of sulphur in pulse nutrition has been well recognized and it enhances the activity of *Rhizobia* and helps in fixing more of atmospheric nitrogen into the soil (Tandon, 1991). So among the production factors sulphur along with appropriate plant population are very important.

Materials and Methods

The experiment was laid out at KVK Instructional Farm under KVK Champhai, Mizoram during the summer season of 2016 and 2017 with green gram. The area is situated between 93^0 00' 32" to 93^0 26' 18" E longitude and 24^0 05' 03" to 23^0 00' 04" N latitude with an altitude of 1118 m from the mean sea level. The average rainfall of Champhai District is about 1940 mm per year of which 87 per cent is received from June to September.

The average maximum and minimum temperature round the year are 34.50^0C and 5.72^0C respectively. Humidity varies from 57.83 to 85.83 percent. The soil is Colluvial soil and acidic (6.2 pH) in nature with 0.37 percent organic carbon, 190.50 kg available nitrogen, 18.42 kg available P, 212.20 kg available K, 12.08 kg available S.

Crop was grown in split plot design with three replications. The whole experiment field was divided into three equal plots, keeping 3 plant population levels. Each main plot was divided into 4 sub plots allotted to 4 sulphur levels. Crop response to treatments were measured in terms of various quantitative and qualitative indices like plant height, LAI, dry matter accumulation/m^2, and at harvest number of primary branches, number of pods/plant, number of grain/pod, test weight, grain yield, straw yield & harvest index. Economics of different treatments was also worked out.

Results and Discussion

Growth parameters

Plant height increased with the increasing level of plant population. Number of primary branches per plant was maximum under P_3 (3.33 lacs/ha) plant population. The findings are in close conformity with the results of Rana and Ahuja (1986), Panwar and Sirohi (1987). The higher leaf area index was noticed at P_1 (5.0 lacs/ha) plant population. It was followed by 4.0 and 3.33 lacs plant/ha. At different growth stages, dry matter accumulations were found the highest at 5.0 lacs plant population. It was followed by 4.0 and 3.33 lacs plant population level. A similar result has also been reported by Yadav and Warsi 1988. Numbers of nodules per plant and nodules dry weight per plant were maximum under 3.33 lacs plant population level (Shukla and Dixit, 1996)

Sulphur increased plant height significantly at all the growth stages up to 30 kg/ha. Numbers of branches per plant were maximum recorded at 45 kg sulphur/ha but the difference between 30 and 45 kg sulphur/ha was non-significant. Leaf area index and dry matter accumulation increased significantly only up to 30 kg sulphur/ha. The present result is in close agreement with the findings of Singh and Yadav (1997) on green gram. Number of nodules per plant was the highest with 45 kg sulphur/ha but the difference between 30 and 45 kg sulphur/ha was at par. Whereas, the nodules dry weight per plant was maximum with 30 kg sulphur/ha (Shinde and Saraf, 1992).

Yield attributes and yield

Plant stand per square at harvest stage was significantly higher under P_1 (5.0 lacs/ha) level of plant population. Number of pods per plant, number of grains per pod and test weight maintained its superiority under P_3 level of plant population over P_2 and P_1 level. Similar results were obtained by Bhosle and Andhale (1982) and Parihar *et al.* (1986). Maximum grain yield was associated under P_2 plant population level (Singh *et al*., 1996). It was followed by P_1 and P_3 level. Straw yield also exhibited similar trend whereas harvest index was maximum with P_3 level of plant population followed by P_2 and P_1 level.

Plant stand at harvest in per square metre was affected significantly up to 30 kg sulphur/ha. Grain yield increased significantly up to 30 kg sulphur/ha. These findings endorse the results of Bapat *et al*. (1986) and Jat and Rathore (1994). Straw yield and harvest index also exhibited similar trend.

Economics

Economic response was worked out on the basis of sulphur levels and pooled grain yield

of green gram for the two years of experimentation. The response function of sulphur was:

$Y = 14.09 + 1.47x – 0.3\ 6x^2$

Where, one unit of x = 15 kg sulphur/ha

Though the maximization of green gram grain yield can be done theoretically up to 30.60 kg sulphur/ha, the most profitable rate was 17.85 kg/ha.

The highest net profit of Rs. 24978.20/ha was obtained by the application of 30 kg sulphur/ha under P_2 (4.0 lacs plant/ha) plant population level was maintained followed by P_3S_2 (3.33 lacs plant x 30 kg sulphur/ha).

Considering overall economics, sulphur application at 30 kg /ha under P_2 plant population level was found to be the most economic combination among all the treatments under study.

P_1 = 5.0 lacs plant population
P_2 = 4.0 lacs plant population
P_3 = 3.33 lacs plant population
S_0 = control plot (0 kg sulphur/ha)
S_1 = 15 kg sulphur/ha
S_2 = 30 kg sulphur/ha
S_3 = 45 kg sulphur/ha

Table.1 Effect of sulphur and plant population on growth attributes of green gram (pooled data of 2 years)

Treatment	Plant height at harvest (cm)	Leaf-area index at harvest	Dry matter accumulation/m^2 at harvest	Number of nodules/plant	Nodules dry weight/plant
P_1	28.42	1.27	158.94	30.47	0.340
P_2	27.94	1.12	149.02	31.37	0.401
P_3	27.85	0.94	108.00	31.72	0.413
SE (d)	0.18	0.014	0.18	0.22	0.004
CD (P=0.05)	0.50	0.04	0.52	0.62	0.010
S_0	27.70	1.02	138.77	29.81	0.323
S_1	28.03	1.07	139.54	31.30	0.378
S_2	28.32	1.17	140.27	31.77	0.424
S_3	28.25	1.19	140.00	31.87	0.413
SE (d)	0.10	0.014	0.20	0.11	0.007
CD (P=0.05)	0.21	0.040	0.42	0.22	0.014

Table.2 Effect of sulphur and plant population on yield attributes and yield of green gram (pooled data of 2 years)

Treatment	Plant stand/m^2 at harvest	Number of pods/plant	No. of grains/pod	Weight of 1000-grains	Yield (q/ha)
P_1	50.56	12.75	5.41	28.47	9.34
P_2	39.65	16.55	5.97	29.84	10.37
P_3	30.15	18.07	6.15	31.54	8.88
SE (d)	0.25	0.09	0.10	0.36	0.08
CD (P=0.05)	0.65	0.23	0.27	1.00	0.20
S_0	40.00	14.45	5.08	26.50	7.74
S_1	39.77	15.40	5.64	29.53	8.60
S_2	40.81	16.64	6.32	31.86	10.80
S_3	39.92	16.67	6.31	31.92	10.94
SE (d)	0.20	0.15	0.08	0.13	0.09
CD (P=0.05)	0.42	0.31	0.17	0.28	0.19

Table.3 Economics of green gram cultivation as influenced by sulphur and plant population

Treatment	Pooled grain yield (q/ha)	Gross return (Rs/ha)	Cost of cultivation (Rs/ha)	Net return (Rs/ha)	Benefit : cost ratio
P_1	9.34	46961.60	27624.40	19337.20	1.70
P_2	10.37	48242.80	26801.50	21441.30	1.80
P_3	8.87	46105.00	26650.20	19454.80	1.73
S_0	7.75	43957.20	24020.20	19937.00	1.83
S_1	8.61	46089.60	24005.10	22084.50	1.92
S_2	10.81	48995.60	24017.40	24978.20	2.04
S_3	10.95	49337.80	24424.60	24913.80	2.02

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