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EFFECT OF POTASSIUM, ZINC AND FYM ON GROWTH, QUALITY AND YIELD OF SUMMER GREEN GRAM (*VIGNARADIATAL.*) UNDER MEDIUM BLACK CALCAREOUS SOIL

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Abstract: A field experiment was conducted during summer season of 2016 at the Instructional farm, Junagadh Agriculture University, Junagadh. The application of potassium, zinc and FYM significantly increased the Growth attributes, quality and yield of green gram. The results revealed that the higher values of growth attributes and yield of green gram was obtain under the application of potassium @ 60 kg ha^{-1}, zinc sulphate @ 10 kg ha^{-1} and FYM @ 5 t ha^{-1} than other treatment. The quality parameters like as protein content and protein yield significantly increased with the application of Potassium @ 40 kg ha^{-1} and zinc sulphate @ 10 kg ha^{-1}.

Keywords: Green gram, *summer*, potassium levels, zinc levels, FYM, growth attributes, yield quality.

Introduction

Green gram (*Vigna radiate* L.) is one of the most important and extensively cultivated pulse crops. India shares about 35 - 37 % and 27 % of the total area and production of pulses, respectively in the world. Green gram commonly known as “mung” or “mung bean” is the most important crop of the South-East Asia and particularly the Indian sub-continent. This popular and ancient crop is specially recognized as an excellent source of protein. It also plays an important role in maintaining and improving the fertility of soil through its ability to fix atmospheric nitrogen in the soil by root nodules.

Green gram contains about 24.3 % protein and a good source of riboflavin and thiamine. The straw and husk yields are used as fodder for cattle. It is good green manure and erosion resisting cover crop. The grains are mainly used as Dal or to make flour. Green pods are also used as vegetables.

Potassium is one of the essential nutrient for plant growth and vital for sustaining modern high yield agriculture. Plant needs large quantities of potassium which not only improves the crop yield, but crop quality also. Hence potassium fertilization results in higher value product and therefore in a greater return to farmers. It is a prime factor for deciding the market price

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of green gram grown, which improve the income of farmers just by improving the quality of produce (Krishna, 1995)

Among the micronutrients, zinc plays vital role in plant growth and development. Zinc also catalyses the biosynthesis of indol acetic acid, acting as metal activator of the enzyme, there by ultimately increasing crop yield. Moreover, it controls the equilibrium between CO2, water and carbonic acid in plant metabolism and helps in synthesis of nucleic acids, proteins and stimulates seed formation. Its deficiency retards photosynthesis and nitrogen metabolism. The end result is lower yield; poor produce quality and sub optimal nutrient use efficiency. Mungbean also respond to zinc application (Quah 1996).

Organic manures like farm yard manures and compost have been traditionally used as input for improving soil physical, chemical and biological properties as well as maintain soil fertility which has resulted in yield stability. Guar et al. (1990) reported that organic nitrogen is slowly mineralized and about 30 percentage N, 60 to 70 percentage P2O5 and 75 percentages K2O is likely become available to the first crop and rest of the nutrients to succeeding crops.Therefore, an experiment planned to know the effect of potassium and zinc with FYM on yield and quality of green gram.

MATERIALS AND METHODS

The experiment was conducted at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during *Summer* season of 2015-16. The soil of the experimental field was clayey in texture andalkaline in reaction (pH of 8.0 and EC of 0.56dS m^{-1}). The soil was low in available nitrogen (225 kg ha^{-1}), medium in available phosphorus (36 kg ha^{-1}), medium in available potassium (185 kg ha^{-1}), medium in available sulphur (15.64ppm), medium in iron (5.26ppm), high in zinc (0.50ppm), high in manganese (16.77ppm) and high in copper (2.07ppm). The experiment comprised of total twelve treatment combinations in which three levels of potassium (0, 40 and 60 K_2O kg ha^{-1}), two levels of zinc (0 and 10 $ZnSO_4$kg ha^{-1}) and two levels of FYM (0and 5 t ha^{-1}) were laid out in Randomized Block Design having factorial concept with three replications. The fertilizer application was done with fixed doses of nitrogen at 20 kg ha^{-1} and phosphorus at 40 kg ha^{-1}. Potassium, zinc and FYM application was done according to the treatments. The nutrients of N, P, K and Zn were applied by using sources of Urea, DAP, MOP and zinc sulphate (WG 35%Zn), respectively. The Green gramvariety “Gujarat Mung- 4” was planted in third week of January with spacing of30 m × 10 m and seed rate of 25kg ha^{-1}. The crop was raised with all the standard package of practices and protection measures also timely

carried out as they required. The experimental data recorded for growth parameters, yield attributes and yield parameters were statistically analyzed for level of significance.

RESULTS AND DISCUSSION

Growth, yield attributes and yields

Effect of potassium

The data revealed that the maximum plant height (41.28 cm) was obtained with potash application of 60 kg ha-1 which was statistically at par with application of 40 kg ha-1. Maximum number of branches (6.61) per plant was recorded in 60 kg potash per hectare which was statistically at par with application of 40 kg ha^{-1}(Table 1). Potassium application increased the availability of nitrogen and phosphorus (Sahai, 2004), which resulted in better plant growth and more number of branches per plant. Number of pod per plant (14.70) and number of seed per pod (11) was obtained higher under application of potassium @ 60 kg K_2O ha^{-1}.These findings were also collaborated with Biswash *et al.* (2014) in green gram. Number of nodules per plant (18.49) and dry weight of nodules per plant (28.4 g) significantly increased with potassium application @ 60 kg K_2O ha^{-1} at harvest. Biswash *et al.* (2014) and Thesiya *et al.* (2013) also found similar results in their experiment results.

A perusal of data (Table 1) revealed that different levels of potassium exerted their significant influence on protein content, protein yield, seed index and test weight. Application of 40 kg K_2O ha^{-1} recorded significantly the higher protein content (24.75 %) and protein yield (322.5 kg ha^{-1}), which was remain statistically at par with 60 kg K_2O. These findings were also collaborated with Farhad *et al.* (2010) in green gram. Application of 60 kg K_2O ha^{-1} recorded significantly the higher seed index (7.89) and test weight (76.94), which was remain statistically at par with 40 kg K_2O.

Seed yield and straw yield affected significantly by potassium levels up to the 60 kg ha^{-1} and beyond that level the differences were remained on par (Table 1). The highest seed yield (1296kg ha^{-1}) and straw yield (1660 kg ha^{-1}) was obtained with 60 kg ha^{-1} K_2O, which might be due to better attributed to more number of pods per plant and number of seeds per pod. Buriro *et al.* (2015) also reported such favourable effect of K on seed yield of green gram.

Effect of zinc

Application of zinc @ 10 kg $ZnSO_4$ ha^{-1} resulted in significantly higher plant height (40.96 cm) and numbers of branches per plant (6.21) obtained at harvest. Number of nodules per plant (18.07) and dry weight of nodules per plant (27.57 g) significantly increased with zinc

application @ 10 kg $ZnSO_4$ ha^{-1} at harvest. The yield attributing characters *viz*, number of pod per plant and number of seed per pod were significantly influenced due application of zinc. Numbers of pod per plant (14.69) and number of seed per pod (10.96) were obtained higher under application of zinc @ 10 kg $ZnSO_4$ ha^{-1}.A similar result was reported by Sitaram *et al.* (2013) with green gram.

Quality parameters like protein content, protein yield and test weight significantly influenced by zinc application. Application of Zn @ 10 kg $ZnSO_4$ ha^{-1}resulted in significantly higher protein content (24.51 %), protein yield (306 kg ha^{-1}) and test weight (74.77 g). Usman *et al.* (2014) found that significantly maximum protein content was obtained when 10 kg ha^{-1} zinc sulphate was applied in soil.

Like wise, application of Zn @ 10 kg $ZnSO_4$ ha^{-1}resulted in significantly higher seed yield (1254 kg ha-1) and straw yield (1624 kg ha-1). Ram and Katiyar (2013) also reported such favourable effect of Zn on seed and straw yield of green gram.

Effect of FYM

Application of FYM @ 5 t ha^{-1} resulted in significantly higher plant height (41.18 cm) and numbers of branches per plant (7.02) were obtained at harvest. Number of nodules per plant (18.51) and dry weight of nodules per plant (29.24 g) were significantly increased with FYM application @ 5 t ha^{-1} at harvest. The yield attributing characters *viz*, number of pod per plant and number of seed per pod were significantly influenced due application of FYM. Numbers of pod per plant (14.88) and number of seed per pod (11.31) were obtained higher under application of FYM @ 5 t ha^{-1}.Similar result in green gram was reported by Meena *et al.* (2016).

Significantly, the highest seed yield (1271 kg ha^{-1}) and straw yield (1645 kg ha^{-1}) was achieved under treatment FYM @ 5 t ha^{-1}. A similar result was reported by Shete *et al.* (2010) with green gram.

Conclusion

It can be concluded that for obtaining higher yield components with better quality of green gram (*cv*. GM-4) should be fertilized with potassium 60 kg K_2O ha^{-1}or 40 kg K_2O ha^{-1} and zinc10 kg ha^{-1} with FYM @ 5 t ha^{-1} in medium black calcareous soils of South Saurashtra region of Gujarat.

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Table 1: Effect of potassium, zinc and FYM on growth attributes quality and yield in summer green gram

Treatments	Plant height (cm)	Number of branches per plant	No. of pods per plant	No. of seeds per pod	Number of nodules per plant	Dry weight of nodules per plant	Protein content (%)	Protein yield (kg ha^{-1})	Test Weight (g)	Seed index (100 seed weight-g)	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})
Potassium levels (kg K_2O ha^{-1})												
K_0 – 0	37.83	4.69	12.59	9.81	16.56	24.52	21.58	237.5	66.59	6.60	1081	1435
K_{40} – 40	40.41	6.18	14.26	10.78	17.83	27.73	24.75	322.5	74.94	7.47	1268	1615
K_{60} – 60	41.28	6.61	14.70	11.00	18.49	28.40	24.13	319.5	76.74	7.89	1296	1660
S. Em ±	0.67	0.22	0.57	0.31	0.51	0.55	0.89	13.35	1.59	0.28	24	37
C.D. at 5%	1.96	0.66	1.69	0.93	1.50	1.61	2.61	39.18	4.66	0.84	72	109
Zinc sulphate levels (kg $ZnSO_4$ ha^{-1})												
Z_0 – 0	38.72	5.44	13.12	10.10	17.17	26.20	22.49	280	70.74	7.15	1175	1516
Z_{10} – 10	40.96	6.21	14.59	10.96	18.08	27.57	24.51	306	74.77	7.49	1254	1624
S. Em ±	0.54	0.18	0.47	0.26	0.41	0.45	0.72	10.9	1.29	0.23	20	30
C.D. at 5%	1.60	0.54	1.38	0.76	NS	1.32	2.16	31.26	3.81	NS	58	89
FYM levels (t ha^{-1})												
F_0 – 0	38.50	4.64	12.82	9.75	16.74	24.53	23.44	278	69.17	6.99	1158	1495
F_5 – 5	41.18	7.02	14.88	11.31	18.51	29.24	23.76	300	76.34	7.65	1271	1645
S. Em ±	0.54	0.18	0.47	0.26	0.41	0.45	0.72	10.90	1.29	0.23	20	30
C.D. at 5%	1.60	0.54	1.38	0.76	1.22	1.32	NS	NS	3.81	NS	59	89
C.V. %	5.83	13.48	14.42	10.51	10.08	7.11	13.09	16	7.57	13.64	7.9	8.2