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Growth Parameters, Biomass Production and Nutrient Uptake by Greengram as Influenced by Potash and Zinc Levels

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Abstract: ***A field experiment was conducted during kharif season at Rahuri, to study the effect of potash and zinc on greengram. Both potash and zinc affected the seed yield and yield attributes significantly. Application of potash @ 25 kg ha^{-1} and zinc @ 15 kg ha^{-1} were found optimum to obtain significantly more number of primary branches per plant, dry matter production and yield. Application of potash @37.5 kg ha^{-1} and zinc @ 15 kg ha^{-1} recorded significantly more uptake of zinc by greengram crop.***

Keywords: Greengram, zinc, potash, yield and nutrient uptake.

1. Introduction

Besides being an indispensable component of vegetarian diet, greengram plays a vital role in sustaining the long-term productivity of our soil resources. Among production inputs, fertilizer application plays a key role in enhancing the productivity levels. Pulse crops are able to fix atmospheric nitrogen; consequently the major part of N requirements is met by N fixation. Phosphorus fertilization also being given importance now a day and its recommendations for pulse crops is made in Maharashtra state. Potassium application is almost neglected resulting in imbalanced nutrients and lower crop yields. Zinc has also gained significant importance in Maharashtra agriculture due to its widespread deficiency. A significant response of applied K has been reported by Duke *et al*. (1980) and that of zinc sulphate by Singh *et al*. (2001). However, the study on combined effect of potash and zinc simultaneously has not largely been studied particularly in Maharashtra. The present experiment was therefore planned to study the effect of varying levels of potash and zinc on yield and agro-physiological parameters of green gram in clayey soils of western Maharashtra.

2. Materials and Methods

The investigation was carried out at experimental research farm of Mahatma Phule Krishi Vidyapeeth, Rahuri (M.S.), for rainy season of 2003-2004 in clayey soil. It had 178 kg ha^{-1} available nitrogen, 16.8 kg ha^{-1} available phosphorus, 448 kg ha^{-1} available potassium and 0.42 mg kg^{-1} zinc. The study was carried out in factorial randomized block design. The treatments consisted of 5 levels of potash (0, 12.5, 25.0, 37.5 and 50.0 kg ha^{-1}) and 2 levels of zinc (0 and 15 kg ha^{-1}), thus forming 10 treatment combinations replicated 3 times (Table 1). Muriate of potash and zinc sulphate were the source of potash and zinc, respectively. Full amount of potash and zinc according to treatments was applied at planting below the seed. Nitrogen @ 25 kg ha^{-1} and phosphorus @ 50 kg ha^{-1} were also applied basal at planting below the seed. FYM @ 5 t ha^{-1} was applied to all the plots during land preparation. Cultivar 'Vaibhav' of green gram was planted on 24th July whereas final picking of pods was done on 12th October. Concentration of Zn in plants in acid digest was estimated using DTPA method (Lindsay and Norvell, 1978) using atomic absorption spectrometer (AAS-1). The crop received total precipitation of 193 mm (14 rainy days) during the crop season. Other agronomical practices were performed as per the recommendations of crop treating the field homogeneous.

3. Results and Discussion

Effect of potash

Potash influenced the plant height, number of primary branches per plant and dry matter per plant significantly and application of potash @ 37.5 kg ha^{-1} registered significantly more plant height (53.73 cm), number of primary branches per plant (3.48) and dry matter per plant (14.04 g) than rest of the treatments except 25 and 50 kg K_2O ha^{-1} which were at par with it (Table 1). The significant response of potash on grain and straw yield of green gram was restricted only up to 37.5 kg ha^{-1} but application of 25 kg K_2O ha^{-1} yielded statistically identical seed and straw yield of green gram. The restricted response of potash in the present study on yield and yield attributes may be due to higher potassium status of soil. Response of potash on green gram upto 20 kg ha^{-1} has also been reported by Saxena *et al*. (1996).

N, P and K uptake of green gram was not influenced significantly due to incremental levels of potash from 0 to 50 kg ha^{-1}, but the linear increase in uptake of these nutrients was observed with increased levels of potash. Application of potash @ 50 kg ha^{-1} recorded significantly more uptake of zinc than rest of the potash levels except 37.5 kg K_2O ha^{-1}.

Effect of zinc

Significant effect of zinc was noticed on the plant height, number of primary branches per plant and dry matter per plant. Application of 15 kg Zn ha^{-1} recorded significantly the highest plant height (52.94), number of primary branches per plant (3.32) and dry matter per plant (13.20 g)(Table 1). Higher dry matter might be due to conductive influence of

zinc in improving the metabolic processes by Zn (Price *et al*., 1972 and Sarkar *et al*., 1998). Malewar *et al*. (1979) also reported the increase in dry matter yield of green gram due to Zinc application. The response of green gram crop to the application of 15 kg Zn ha^{-1} was positive and the seed and straw yield obtained in these plots were significantly more than the control without zinc application. The beneficial effects of zinc may be attributed to the marginal content of available Zn in the soil and its role in metabolic activities mainly in protein synthesis in plants as well as in N fixation. The results confirm the findings of Singh *et al*. (2001).

N, P and K uptake of green gram was not influenced significantly with application of zinc @ 15 kg ha^{-1}. Application of zinc @ 15 kg ha^{-1} recorded significantly more uptake of zinc than control without zinc application.

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Table 1: Effect of potash and zinc sulphate on morphological parameters, yield and nutrient uptake of green gram

Treatment	Plant height (cm)		Primary branches per plant	Dry matter per plant (g)	Yield (q ha^{-1})		Nutrient uptake Major nutrients (kg ha^{-1})			Micronutrient (ppm)
	45 DAS	Harvest		At harvest	Grain	Straw	N	P	K	Zn
Potash levels (kg ha^{-1})										
K_0 : 0	33.08	46.71	2.81	9.43	7.49	11.65	187.5	15.83	458.82	2.52
K_1 : 12.5	33.63	48.09	2.95	10.2	8.07	12.13	187.91	16.03	459.92	2.92
K_2 : 25.0	36.42	51.85	3.28	13.68	8.98	13.54	188.13	16.14	464.15	5.92
K_3 : 37.5	37.73	53.73	3.48	14.04	9.23	14.23	189	16.23	467.63	6.22
K_4 : 50.0	37.3	52.88	3.38	13.7	9.1	13.74	189.4	16.61	467.68	6.72
S.Em. ±	0.88	1.11	0.1	0.28	0.17	0.27	3.88	0.33	11.93	0.18
CD at 5 %	2.63	3.31	0.3	0.83	0.51	0.8	NS	NS	NS	0.55
Zinc sulphate (kg ha^{-1})										
Z_0 : 0	34.04	48.36	3.04	11.22	8.12	12.47	188.26	16.1	463.55	0.44
Z_1 : 15	37.22	52.94	3.32	13.2	9.03	13.64	189.11	16.23	463.73	9.28
S.Em. ±	0.56	0.7	0.06	0.17	0.11	0.17	2.45	0.21	7.5	0.11
CD at 5 %	1.66	2.09	0.19	0.52	0.32	0.5	NS	NS	NS	0.35