Original Research Article

Effect of Different Levels of Phosphorus and Zinc on Growth and Yield of Green gram (*Vigna radiata* L.*) Var.* Swati Swarna

Abstract

An experiment was conducted during in *Zaid* season (March 2022-June 2022) on central research farm of Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. The experiment was laid out in randomized block design with three levels of Phosphorus and Zinc (0 %, 50 % and 100 %). The treatment combinations were replicated three times and were allocated at random in each replication. The result shows that application of different levels combination of inorganic fertilizers increased growth, yield of green gram. It was recorded from the application of P and Zinc fertilizers in treatment T_7 [P @ 100% + Zinc @ 0 %] maximum plant height 40.90, 49.12, and 60.16 cm at 30, 60 DAS and at harvest, number of branches plant^{-1} 9.35, 11.62, and 14.24 at 30, 60 DAS and at harvest, number of pods plant^{-1} 25.73, number of seeds pod^{-1} 10.54, test weight of 1000 seeds 54.66 g, grain yield 11.73 q ha^{-1} with benefit cost ratio 1: 2.33 best from T_1 [(control) P @ 0% + Zinc @ 0 %].

Key word: Green gram, Phosphorus, Zinc, Growth and Yield, etc.

Introduction

Green gram (*Vigna radiata* L.) having chromosome number 2n=24 is a self-pollinated legume crop. It is a native of India and Central Asia. It is the hardiest of all pulse crops. It can meet its nitrogen requirements by symbiotic fixation of atmospheric nitrogen. The nutrients which need attention are Phosphorus and Zinc. (Handbook of Agriculture, ICAR -2002). It is also known as mung bean, is an important pulse crop grown in India. In India, production of green gram is around 2.32 million tonnes with an area of 3.49 million ha having productivity of 665 kg ha^{-1} (Horticultural Statistics At a Glance 2021).

In Uttar Pradesh, Green gram is grown on 337 thousand ha with production of 2.47 million tonnes and the average productivity of 587 kg ha^{-1} (Ranpriya *et al.*, 2017). Green gram is one of the important pulse crops containing about 23.9 % protein, 60% carbohydrate, 1.3% fat, 3.2% minerals, 0.9% fiber, 154 mg calcium, 385 mg Phosphorus, 9.1 mg iron and

small amounts of vitamin B-complex. In recent years the importance of zinc in pulse nutrition has been well recognized. (Kumawat *et al*., 2014).

Phosphorus (P) is an essential nutrient for the growth and development of green. It plays a critical role in several physiological processes, including photosynthesis, energy transfer, root development, and cell division. Phosphorus is also involved in the formation of DNA and RNA, which are essential for the plant's growth and reproduction. A deficiency of phosphorus can result in stunted growth, poor root development, and reduced yield (Khan *et al.*, 2022).

Zinc plays important role in the correct functioning of many enzymatic systems, the synthesis of nucleic acids and auxins (plant hormones) metabolisms, protein analysis and normal crop development and growth (Mengel and Kirkby, 1982, Havlin *et al.*, 2006). This may be as a result of slower rate of translocation of Zn from roots to tops, i.e., zinc accumulation in the roots and lower Zn uptake (Stukenholtz *et al.*, 1966). Plants absorb Zn in the form of Zn. Poor growth, interveinal chlorosis and necrosis of lower leaves are the common symptoms of Zn deficiency in field crops (Muindi *et al*., 2019).

Materials and Methods

A field experiment conducted at the Soil Science Research Farm, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, during the *Zaid* season of 2022 growing green gram *Var*. Swati Swarna applied 3 levels of P and Zinc respectively 0 %, 50 %, 100 % and including RDF for black gram = 20:40:20 kg ha^{-1} and Zinc 20 kg ha^{-1} experiment is lead to observe the plant parameters like that plant height, number of branches $plant^{-1}$, number of pods $plant^{-1}$, number of seeds pod^{-1}, test weight of 1000 seeds and seed yield.

Statistical analysis

The data recorded during the investigation was subjected to statistical analysis by RBD, as per the method “Analysis of Variance (ANOVA) technique” as given by R. A. Fischer (1955). Experiment was laid out in RBD and the treatment will be replicated three times. The significant and non-significant effect was judged with the help of “F” (variance ratio) table. The significant difference between the means were tested against the critical difference of 5% level. For testing the hypothesis in ANOVA table will be used.

Result and Discussion

Plant height (cm)

A critical perusal of data pertaining in the table and fig. 1 the effect of different levels of P and Zn on plant height (cm) at different days interval of green gram was found to be significant at C.D @ 5%. The plant height of green gram was found to be maximum 40.90, 49.12 and 60.16 cm at 30, 60 DAS and at harvest in treatment T_7 (P @ 100 % + Zn @ 0 %) and minimum 35.33, 42.44 and 51.10 cm at 30, 60 DAS and at harvest in treatment T_1 [Absolute control (P @ 0 % + Zn @ 0 %)]. Similar results were reported by **Midde *et al.*, (2022) and Srivastava *et al.*, (2017).**

Number of Branches Plant^{-1}

A critical perusal of data pertaining in the table and fig. 1 the effect of different levels of P and Zn on number of branches plant^{-1} at different days interval of green gram was found to be significant at C.D @ 5%. The number of branches plant^{-1} of green gram was found to be maximum 9.35, 11.62 and 14.24 at 30, 60 DAS and at harvest in treatment T_7 (P @ 100 % + Zn @ 0 %) and minimum 7.37, 10.42 and 12.06 at 30, 60 DAS and at harvest in treatment T_1 [Absolute control (P @ 0 % + Zn @ 0 %)]. Similar results were reported by **Rathore *et al.*, (2010) and Masih *et al*., (2020).**

Number of Pods Plant^{-1}

A critical perusal of data pertaining in the table and fig. 2 the effect of different levels of P and Zn on number of pods plant^{-1} at different days interval of green gram was found to be significant at C.D @ 5%. The number of pods plant^{-1} of green gram was found to be maximum 25.73 in treatment T_7 (P @ 100 % + Zn @ 0 %) and minimum 17.43 in treatment T_1 [Absolute control (P @ 0 % + Zn @ 0 %)]. Similar results were reported by **Ranpariya *et al.*, (2017) and Rathore *et al*., (2010).**

Number of Seeds Pod^{-1}

A critical perusal of data pertaining in the table and fig. 2 the effect of different levels of P and Zn on number of seeds pod^{-1} at different days interval of green gram was found to be significant at C.D @ 5%. The number of seeds pod^{-1} of green gram was found to be maximum 10.54 in treatment T_7 (P @ 100 % + Zn @ 0 %) and minimum 7.56 in treatment T_1 [Absolute control (P @ 0 % + Zn @ 0 %)]. Similar result has been recorded by **Solanki *et al*., (2017) and Ranpariya *et al.*, (2017).**

Test weight of 1000 seeds (g)

A critical perusal of data pertaining in the table and fig. 2 the effect of different levels of P and Zn on test weight of 1000 seeds of green gram was found to be significant at C.D @ 5%. The test weight of 1000 seeds of green gram were found to be maximum 54.65 g in treatment T_7 (P @ 100 % + Zn @ 0 %) and minimum 51.34 g in treatment T_1 [Absolute control (P @ 0 % + Zn @ 0 %)]. Similar results were reported by **Masih *et al.*, (2020) and Srivastava *et al.*, (2017).**

Seed yield (q ha^{-1})

A critical perusal of data pertaining in the table and fig. 2 the effect of different levels of P and Zn on seed yield at different days interval of green gram was found to be significant at C.D @ 5%. The seed yield of green gram was found to be maximum 11.73 q ha^{-1} in treatment T_7 (P @ 100 % + Zn @ 0 %) and minimum 8.01 q ha^{-1} in treatment T_1 [Absolute control (P @ 0 % + Zn @ 0 %)]. Similar results were reported by **Roy *et al.*, (2017) and Barman *et al.*, (2015)**.

Table 1: Effect of different levels of P and Zn on plant height (cm) and number of branches plant^{-1} at different days interval of green gram.

Treatment		Plant Height (cm)			Number of Branches Plant^{-1}		
		30 DAS	60 DAS	At harvest	30 DAS	60 DAS	At harvest
T_1	Absolute control (P @ 0 % + Zn @ 0 %)	35.33	42.44	51.10	7.37	10.42	12.06
T_2	@ 0 % P (RDF) + @ 50 % Zinc	35.57	42.90	53.15	7.63	10.65	12.35
T_3	@ 0 % P (RDF) + @ 100 % Zinc	36.10	43.57	53.90	7.85	10.81	12.60
T_4	@ 50 % P (RDF) + @ 0 % Zinc	36.18	44.10	55.50	8.03	10.92	12.90
T_5	@ 50 % P (RDF) + @ 50 % Zinc	37.23	44.92	55.87	8.42	11.04	13.18
T_6	@ 50 % P (RDF) + @ 100 % Zinc	37.57	45.33	57.12	8.74	11.15	13.42
T_7	@ 100 % P (RDF) + @ 0 % Zinc	40.90	49.12	66.16	9.35	11.62	14.24
T_8	@ 100 % P (RDF) + @ 50 % Zinc	39.42	47.33	58.15	9.22	11.45	14.08
T_9	@ 100 % P (RDF) + @ 100 % Zinc	38.90	45.12	57.16	9.00	11.21	14.00
	F-Test	S	S	S	S	S	S
	S.Ed. (±)	0.003	0.05	0.001	0.47	0.84	1.28
	C.D. at 0.5%	0.006	0.11	0.002	0.97	1.72	2.60

Table 2: Effect of different levels of P and Zn on number of pods plant^{-1}, number of seeds pod^{-1}, test weight of 1000 seeds (g) and seed yield (q ha^{-1}) of green gram.

Treatment		Number of pods plant^{-1}	Number of seeds pod^{-1}	Test weight of 1000 seeds (g)	Seed yield (q ha^{-1})
T_1	Absolute control (P @ 0 % + Zn @ 0 %)	17.43	7.56	51.34	8.01
T_2	@ 0 % P (RDF) + @ 50 % Zinc	18.17	7.80	51.70	9.87
T_3	@ 0 % P (RDF) + @ 100 % Zinc	19.22	8.02	52.06	10.34
T_4	@ 50 % P (RDF) + @ 0 % Zinc	18.63	8.45	52.45	9.57
T_5	@ 50 % P (RDF) + @ 50 % Zinc	19.71	8.82	52.78	10.53
T_6	@ 50 % P (RDF) + @ 100 % Zinc	23.46	9.15	53.12	10.81
T_7	@ 100 % P (RDF) + @ 0 % Zinc	25.73	10.54	54.66	11.73
T_8	@ 100 % P (RDF) + @ 50 % Zinc	24.57	10.08	54.02	11.46
T_9	@ 100 % P (RDF) + @ 100 % Zinc	23.46	9.34	53.45	10.69
	F-Test	S	S	S	S
	S.Ed. (±)	0.360	0.71	1.10	0.147
	C.D. at 0.5%	1.056	1.45	2.25	0.432

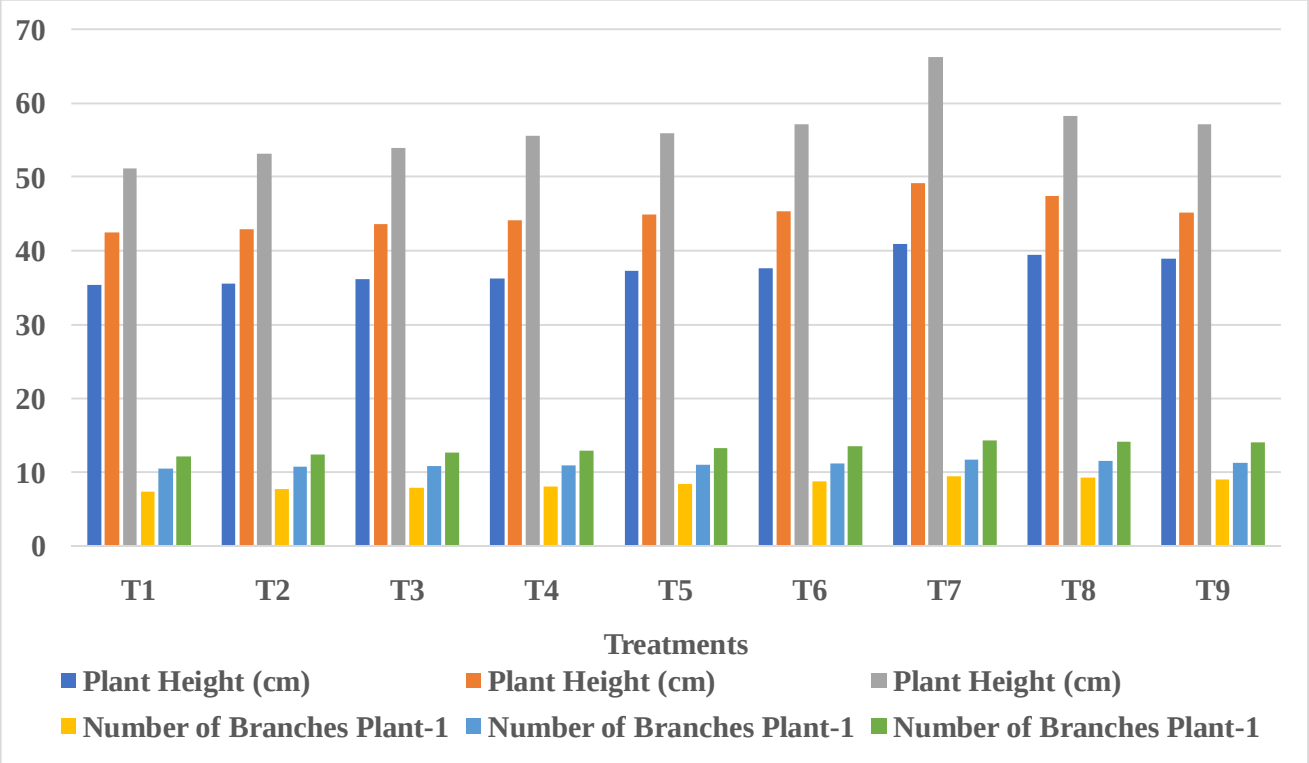

Fig. 1: Effect of different levels of P and Zn on plant height (cm) and number of branches plant^{-1} at different days interval of green gram.

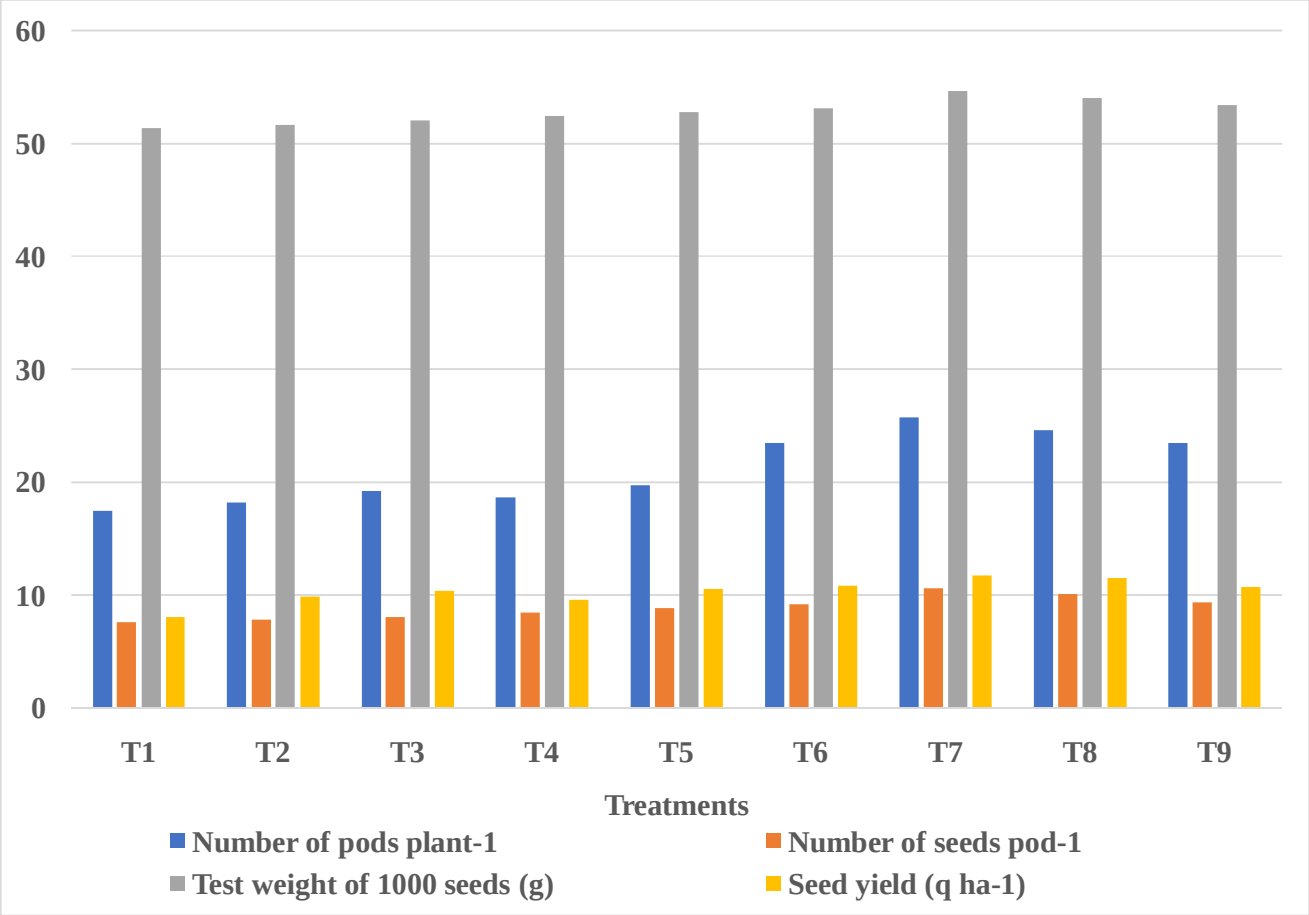

Fig. 2: Effect of different levels of P and Zn on number of pods plant^{-1}, number of seeds pod^{-1}, test weight of 1000 seeds (g) and seed yield (q ha^{-1}) of green gram.

Conclusion

It was concluded that the various level of P and Zn used from different sources fertilizers [*i.e.* Urea (46% N) + SSP (16% P_2O_5) + MOP (60% K_2O) + $ZnSO_4$ (36.5% Zn)] in the experiment gave the best result in the treatment T_7 (P @ 100 % + Zn @ 0 %) followed by treatment T_8, in the treatment T_7 growth and yield attributes parameters of green gram gave highest net profit of 69516.00 ₹ ha^{-1} with highest cost benefit ratio is 1:2.33. Therefore, it can be recommended for farmers to obtain best combination Treatment (T_7) for higher farm income and sustainable agriculture.

Reference

Anonymous (2021) Ministry of Agriculture and Farmers Welfare, Government of India.

Barman, A., Chowdhury, M. J., Mahabub, T. S., Quamruzzaman, M. and Mondul, A. (2015) Interaction effect of phosphorus and zinc on the concentration of N, P, K, S and Zn in mungbean straw and seed. *International Journal of Scientific and Research Publication*. **5**(2): 1-3.

Khan, A., Nawaz, H., Rab, A., Asim, M., Khan, I. and Munsif, F. (2022) Impact of Phosphorous and Zinc Levels on the Productivity of Green Gram (*Vigna radiate* L.). *Journal of Soil, Plant and Environment.* **1**(1): 38-49.

Kumawat, S., Khistriya, M. K., Yadav, S. L. and Kumar, M. (2014) Effect of sulphur and phosphorus on growth and yield attributes on summer green gram (*Vigna radiata* L.). *International Journal of Agricultural Science.* **10**(2): 770-773.

Masih, A., Dawson, J. and Singh, R. E. (2020) Effect of Levels of Phosphorus and Zinc on Growth and Yield of Green gram (*Vigna radiata* L.). *International Journal of Current Microbiology and Applied Sciences.* **9**(10): 3106-3112.

Midde, J., Thomas, T. and Kumar, T. (2022) Application of Phosphorus and Zinc affecting soil health after cultivation of green gram (*Vigna radiata* L.) *Var.* MD Vikas in an Inceptisol of Prayagraj. *Emergent Life Sciences Research.* **8(2)**: 158-164.

Muindi, E. M., Muindi, C. M. and Ndiso, J. (2019) Effects of Combining Farm Yard Manure, Starter Nitrogen, Phosphorus and Zinc on Growth and Yield of Green Grams. *Journal of Agriculture and Ecology Research International.* **20**(4): 1-9.

Ranpariya, V. S., Polara, K. B., Hirpara, D. V. and Bodar, k. H. (2017) Effect of potassium, zinc and FYM on content and uptake of nutrients in seed summer green gram (*Vigna radiata* L.) and post-harvest soil fertility under medium black calcareous soil. *International Journal of Chemical Studies.* **5**(5): 1055-1058.

Rathore, D. S., Purohit, H. S. and Yadav, B. L. (2010) Integrated Phosphorus management on yield and nutrient uptake of green gram (*Vigna radiata* L.) underrainfed conditions of southern Rajasthan. *Journal of Food Legumes.* **23**(2): 128- 137.

Roy, P. D., Lakshman, K., Narwal, R. P., Malik, R. S. and Saha, S. (2017) Green gram (*Vigna radiata* L.) Productivity and grain quality enrichment through zinc fertilization.

International Journal of Current Microbiological and Applied Science. **6**(6): 643-648.

Solanki, D., Swetha, P. and Solanki, M. S. (2017) Growth, yield and yield attributes of summer green gram (*Vigna radiata* L.) under medium black calcareous soils as influenced by application of sulphur and zinc levels. *International Journal Agricultural Science and Research*. **7**(4): 663-668.

Srivastava, N., Dawson, J. and Singh, R. K. (2017) studied that interaction effect of spacing, sources of nutrient and methods of zinc application on yield attributes and yields of green gram (*Vigna radiata* L.) in NEPZ. *Journal of Pharmacognosy and Phytochemistry.* **6**(4):1741-1743.