Original Research Article

Effect of Nitrogen and Zinc levels on growth and yield of Black gram (*Vigna mungo L.*)

Abstract

To study the retaliation performance of Nitrogen and Zinc on growth, yield and yield attributes of black gram (*Vigna mungo* L.) A field experiment was carried out during *zaid* season of 2021 at the crop research farm of SHUATS, Prayagraj to study ~~about~~ the ~~Effect~~ effect of nitrogen and zinc levels on the growth and yield of ~~Black~~ black gram. The experiment was laid out in a randomized complete block design (RCBD) with ~~Nine~~ nine treatments~~–~~, each replicated thrice on the bases of ~~one~~ one-year experimentation. In view of this experiment, three Nitrogen levels, *i.e.*N1 - (15 kg/ha), N2 – (20 kg/ha) and N3 – (25 kg/ha) and Zinc levels, i.e., Zn1 – (0.25 %), Zn2 – (0.5 %), Zn3 – (0.75 %) .The results obtained that the treatment with the application of N 25 kg/ha+ Zn 0.5% was recorded significantly maximum plant height (41.50 cm), number of nodules per plant (25.50), number of branches per plant (7.65)~~–~~, plant dry weight (9.61 g/plant), pods per plant (37.55), seeds per pod (6.83), test weight (39.23 g), grain yield (937 kg/ha), stover yield (2418 kg/ha). Maximum net return (Rs42008.92/ha) and B:C ratio (2.22) were recorded with treatment of N 25 kg/ha+ Zn 0.5%. This study concluded that the maximum grain yield (937 kg/ha) ~~were~~ was obtained with the application of N 25 kg/ha+ Zn 0.5% which was significantly superior over the rest of the treatments.

Keywords: Soil, Nitrogen~~–~~, zinc, yield, economics.

INTRODUCTION

India is the largest producer of pulses, accounting for about 25 per~~-~~cent of the global share. On account of their vital role in nutritional security and soil ameliorative properties, pulses have been an integral part of sustainable agriculture ~~since~~ for ages. They trap atmospheric N in the

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root nodules and keep the soil productive and healthy. Among various pulses, black gram or urd (*Vigna mungo* L. Hepper) belonging to family leguminous is of immense importance as it contains, 60% carbohydrates, 24% protein, 1.3% fat and is the richest among the various pulses in phosphorus being 5-10 times richer than others **(Tomar *et al*., 2011**). The combination of Daal-chawal (pulse-rice) or Daal-roti (pulse-wheat bread) is an important ingredient in the average Indian diet. In India, it is cultivated in an area of 1.38 Mha with an annual production of 1.46 MT but the productivity of the crop is only 459 kg/ha **(Singh *et al*., 2015).**

Nitrogen fertilization plays an important role in improving soil fertility and increasing crop productivity. Nitrogen fertilization increases grain yield and biomass in crop. It contributes 18-34% increase in soil residual N. Sole residue incorporation or in combination with N fertilizer ~~have~~ has positive effects on plant growth and production as well as on soil ~~physico~~Physico-chemical properties. Nitrogen is an important nutrient which is required by plants. It increases the growth and development of all living tissues and protein content in pulses**(Rahman *et al*., 2007).**

The most deficient micronutrient in Indian soils is zinc~~, in fact, zinc~~ Zinc is regarded as the third most important limiting nutrient in crop production after nitrogen and phosphorus. Zinc is involved in auxin formation, activation of dehydrogenase enzymes; stabilization of ribosomal fractions **Hafeez Z *et al.* (2013)**. The increased in yield might be due to positive effect of zinc on yield attributes as it plays an important role in metabolic process **(Shanti *et al*., 2008 and Ahmed *et al*., 2013).**

MATERIALS & METHODS

The experiment was conducted during the *Kharif* season 2021, at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj (U.P.) which is located at 25^0 30' 42''N latitude, 81^0 60' 56" E longitude and 98 m altitude above the mean sea level. ~~during~~ During *Zaid* season 2021 on sandy loam soil, having nearly neutral ~~in~~ soil reaction (pH 7.7), organic carbon (0.44), available nitrogen (171.48 kg/ha K), available phosphorus (27 kg/ha), and available potassium (291.2 kg/ha). The climate of the region is semi~~-~~arid subtropical. Treatments comprised of T_1– 15 kg/ha N + 0.25% Zn, T_2 – 15 kg/ha N + 0.50 % Zn, T_3 – 15

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kg/ha N + 0.75% Zn, T_4 – 20 kg/ha N + 0.25% Zn, T_5 - 20 kg/ha N + 0.50 % Zn, T_6 – 15 kg/ha N + 0.75% Zn, T_7 – 25 kg/ha N + 0.25% Zn, T_8– 25 kg/ha N + 0.50 % Zn and T_9 – 25 kg/ha N + 0.75% Zn. These were replicated thrice in Randomized Block Design. The recommended dose of fertilizer is 20-40-20 kg/ha NPK. ~~Recommended~~ The recommended dose of fertilizer was applied at the time of sowing in the form of Urea, DAP, and MOP.

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Chemical analysis of soil

Composite soil samples are collected before layout of the experiment to determine the initial soil properties. The soil samples are collected from 0-15 cm depth and were dried under shade, powdered with wooden pestle and mortar, passed through a 2 mm sieve, and ~~were~~ analyzed for organic carbon by rapid titration method by Nelson (1975). Available nitrogen was estimated by alkaline permanganate method by Subbiah and Asija (1956), available phosphorus by Olsen's method as outlined by Jackson (1967), available potassium was determined by using the flame photometer normal ammonium acetate solution and estimating by using flame photometer (ELICO Model) as outlined by Jackson (1973) and available $ZnSO_4$ was estimated by Atomic Absorption Spectrophotometer method as outlined by Lindsay and Norvell (1978).

Statistical analysis

The data recorded were different characteristics were subjected to statistical analysis by adopting Fishers the method of analysis of variance (ANOVA) as described by Gomez and Gomez (2010). ~~Critical difference (CD)~~Least significant difference (LSD) values were calculated the 'F' test was found significant at 5% level of significance.

Results and Discussion

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Plant height ~~(cm)~~

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There was an ~~increasing~~ increase in crop age plant height was progressively increased with the advancement during the experimentation. The analysis ~~on~~ of plant height was

significantly higher in all the different growth intervals with the levels of nitrogen and zinc. At harvest, maximum plant height (41.50 cm) was recorded with the application of N 25 kg/ha+ Zn 0.5% which was significantly superior over all other treatments and statistically at par with treatment of N 20 kg/ha+ Zn 0.5% (40.82 cm). It might be due to the field experiment to investigate the effect of nitrogen and carbon on the growth and yield performance of mungbean (*Vigna radiata* L. ~~wilczek~~Wilczek). He found that the plant height of mungbean cv. Mubarik was found to be increased with nitrogen at 40 kg ha-1. **Hamid (1988).**

Number of branches per plant

There was a steady increase in the number of branches /plants from 30 to 60 DAS differed significantly as ~~influenced~~ Influenced by Nitrogen and Zinc. At harvest, the maximum number of branches per plant (7.65) was recorded with the application of N 25 kg/ha+ Zn 0.5% which was significantly superior over all other treatments and statistically at par with treatment of N 20 kg/ha+ Zn 0.5% (7.50). It might be due to the conducted an experiment to determine the effect of varying levels of nitrogen (0, 25 and 50 kg ha^{-1}) and phosphorus (0, 50, 75, and 100 kg ha-1) on the yield and quality of mungbean cv. NM-98. Growth (number of branches per plant and number of root nodules per plant) and yield components were significantly affected by varying levels of nitrogen and phosphorus. A fertilizer combination of 25 kg N + 75 kg ha^{-1} resulted with a maximum seed yield (1112.96 kg ha-1). **Malik *et al.* (2003).**

Number of nodules per plant

There was a steady increase in root nodules from 15 to 45 DAS and a 45 to at harvest root nodules decrease. At harvest, maximum number of nodules/plant (25.50) was recorded with application of N 25 kg/ha+ Zn 0.5% which was significantly superior over all other treatments and statistically at par with treatment of N 20 kg/ha+ Zn 0.5% (24.95). It might be due to the effect of nitrogen (0, 20, 40 and 60 kg ha-1) and P (0, 25, 50 and 75 kg ha^{-1}) on the growth and seed yield of mungbean. They observed that the number of nodules- per plant was increased with the increasing rates of N up to 40 kg ha^{-1} followed by a decrease with further increase in N. **Srinivas *et al.*, (2002).**

Plant dry weight ~~(cm)~~

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The Plant dry weight of Black gram recorded at 15, 30, 45 DAS and at harvest differed significantly as ~~influenced~~ Influenced by Nitrogen and zinc. At harvest, maximum plant dry weight (9.61 g/plant) was recorded with application of N 25 kg/ha + Zn 0.5% which was significantly superior over all other treatments and statistically at par with treatment of N 20 kg/ha+ Zn 0.5% (9.34 g/plant). It might be due to the treatments, an ~~Increase~~ increase in fresh and dry weight due to N, S, and their interaction could be attributed to low soil status of available N and S ~~of~~ and due to the stimulating effect of applied nitrogen and Sulphur in the synthesis of chloroplast, resulting in enhanced photosynthesis which might have led to an increase in fresh and dry weight. Similar findings have also been reported by **Das, (1982)** and **Khanna and Gupta (2005)**.

Seed yield ~~(kg/ha)~~

Treatment with application of N 25 kg/ha + Zn 0.5% was recorded maximum seed yield (937 kg/ha) which was significantly superior over all other treatments and statistically at par with treatment of N 20 kg/ha + Zn 0.5% (917 kg/ha). It might be due to the response of black gram to nitrogen fertilization. Higher yield attributes and yield were noticed with the combined foliar spray of secondary nutrients and zinc which might be attributed due to added advantage of zinc to secondary nutrients leading to optimum availability of nutrients for luxurious crop growth and efficient partitioning of assimilates from source to sink **(Prasanna*et al*., 201** and~~3)~~ **Choudhary *etal*. (~~2~~2014)** found higher seed yield with foliar spray of S and Zn.

Straw yield ~~(kg/ha)~~

Treatment with application of N 25 kg/ha+ Zn 0.5% was recorded maximum straw yield (2418 kg/ha) which was significantly superior over all other treatments and statistically at par with treatment of N 20 kg/ha+ Zn 0.5% (2219 kg/ha).

Table 1 Effect of nitrogen and zinc on growth attributes, yield and economics of Black gram

Treatments	Growth attributes				Yield		Economics	
	Plant height (cm)	Branches per plant	Nodules per plant	Dry weight (g/plant)	Grainyield (kg/ha)	Stoveryield (kg/ha)	Net return (INR/ha)	B:C ratio
N 15kg/ha+Zn 0.25%	36.67	6.62	21.17	7.36	736	1736	29204.39	1.56
N 15kg/ha+Zn 0.5%	40.10	7.48	23.06	8.47	852	2008	36614.39	1.95
N 15kg/ha+Zn 0.75%	33.73	6.52	18.32	7.31	559	1559	17439.39	0.92
N 20kg/ha+Zn 0.25%	37.89	6.74	22.07	7.47	766	1833	31089.14	1.66
N 20kg/ha+Zn 0.5%	40.82	7.50	24.95	9.34	917	2269	40774.14	2.16
N 20kg/ha+Zn 0.75%	35.03	6.58	18.99	7.67	632	1766	22119.14	1.16
N 25kg/ha+Zn 0.25%	39.01	6.51	22.06	7.59	811	1921	33948.92	1.80
N 25kg/ha+Zn 0.5%	41.50	7.65	25.50	9.61	937	2418	42008.92	2.22
N 25kg/ha+Zn 0.75%	36.50	6.73	19.49	7.42	683	1850	25368.92	1.33
SEm(±)	0.352	0.198	0.329	0.213	9.629	66.786		
~~CD~~ LSD (p=0.05)	1.048	0.589	0.980	0.634	28.611	198.43		

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CONCLUSION

It is concluded that the treatment T_8N 25 kg/ha+ Zn 0.5% was found to be the best that recorded highest plant height, number of branches, number of nodules, seed yield, and stover yield. It also fetched the maximum gross return, net return, and the ~~benefit~~ benefit-cost ratio.

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