*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.) During the Zaid season of 2021, a field experiment was carried out at the agricultural research farm of SHUATS, Prayagraj, to analyze the influence of nitrogen and zinc levels on the growth and yield of a Black gram. The experiment was conducted in a randomized block design (RBD) it was carried with Nine treatments, each treatment have three replications and we observed each treatment on the bases of 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 was obtained that the treatment with the application of N 25 kg/ha+ Zn 0.5% was observed 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) was acquired with application N 25 kg/ha+ Zn 0.5%, significantly superior to the rest of the treatments.

**Keywords:** Soil, Nitrogen, zinc, yield, economics.

## INTRODUCTION

India is the world's largest producer of pulses, contributing for over 25% of worldwide production. Because of their great significance in nutritional security and soil restoration, pulses have long been a staple of sustainable agriculture. They maintain the soil productive and healthy by retaining atmospheric N in the root nodules. Among the many pulses, black gram or urad

(*Vigna mungo L. Hepper*) of the leguminous family is significantly vital since it contains 60 percent carbohydrates, 24 percent protein, 1.3 percent fat, and is the richest in phosphorus among the various pulses, having 5-10 times richer than others **(Tomar et al., 2011).** "Daal-chawal (pulse-rice) or Daal-roti (pulse-wheat bread) is an essential component of the average Indian diet. In India, the crop is commonly cultivated of 1.38 Mha with an annual production of 1.46 MT, whereas its productivity was only 459 kg/ha". **(Singh *et al*., 2015)**

"Nitrogen fertilization plays an essential role in improving soil fertility and increasing crop productivity. Nitrogen fertilization increases grain yield and biomass in the crop. It contributes an 18-34% increase in soil residual N. Sole residue incorporation or combination with N fertilizer has positive effects on plant growth and production and soil physicochemical properties. Nitrogen is an essential nutrient that plants require. It increases the growth and development of all living tissues and protein content in pulses"**(Rahman *et al*., 2007)**

"Zinc is the most inadequate micronutrient in Indian soils, and it is thought to be the third most important limiting nutrient in crop yield after nitrogen and phosphorus. The increase in yield can be related to zinc's great affect on yield properties, as it is important in the metabolic activities" **(Shanti et al., 2008 & Ahmed et al., 2013). Zinc is involved in auxin formation, activation of dehydrogenase enzymes, and *stabilizing ribosomal fractions Hafeez Z 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 *Zaid* season 2021 on sandy loam soil, having nearly neutral 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 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. The appropriate dose of fertilizer was mentioned at the period of sowing in the form of Urea, DAP and MOP.

### Chemical analysis of soil

To determine the initial soil properties, composite soil samples are obtained prior to the experiment arrangement. Soil samples were taken from 0 to 15 cm depth, dried in the shade, powdered with a wooden pestle and mortar, passed through a 2 mm filter, and evaluated for organic carbon using Nelson's quick titration method (1975). Subbiah and Asija (1956) estimated available nitrogen using the alkaline permanganate method, available phosphorus using Olsen's method as outlined by Jackson (1967), available potassium using the flame photometer standard ammonium acetate solution and estimating using flame photometer (ELICO Model) as outlined by Jackson (1973), and available $ZnSO_4$ using the Atomic Absorption Spectrophotometer method as outlined by Lindsay and Norvell (1978).

### Statistical analysis

The analysis used a completely randomized block design with 3 replicates per treatment. The data were subjected to statistical analysis by adopting Fishers the analysis method of variance (ANOVA) as described by Gomez and Gomez (2010) and expressed as the mean of the replicates (Mean ± SD), with the significance of treatments responses checked at $p<0.05$. Critical difference (CD) values were calculated the 'F' test was found significant at a 5% level.

## Results and Discussion

### Plant height (cm)

There was an increase in crop age plant height was progressively increased with the advancement during the experimentation. The analysis 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). The field experiment investigating was observed the effect of nitrogen and carbon on the growth and yield performance of mungbean (*Vigna radiata* L. 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**

The number of branches/plants grown significantly from 30 to 60 DAS varied considerably as influenced by Nitrogen and Zinc. At harvest, a 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 the treatment of N 20 kg/ha+ Zn 0.5% (7.50)It might be due to the experimented 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 qualitative of mungbean cv. NM-98. "Growth (number of branches per plant and number of root nodules per plant) and yield parameters were significantly shows variation by different levels of nitrogen and phosphorus. A fertilizer mixture of 25 kg N + 75 kg ha-1 resulted in 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 from 45 to harvest, root nodules decreased. At harvest, a maximum number of nodules/plant (25.50) 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%  (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 mungbean growth and seed yield. "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)**

Das (1982) and Khanna and Gupta (2005). The Plant dry weight of Black gram was recorded at 15, 30, 45 DAS and harvest differed significantly as Influenced by Nitrogen and zinc. It might be due to the treatments, an increase in fresh and dry weight due to N, S, and their interaction could be attributed to the low soil status of available N and S 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. **At harvest, maximum plant dry weight (9.61 g/plant) 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% (9.34 g/plant)**.

**Seed yield (kg/ha)**

Treatment with the application of N 25 kg/ha + Zn 0.5% was recorded a maximum seed yield (937 kg/ha) which was significantly superior to all other treatments and statistically at par with treatment of N 20 kg/ha + Zn 0.5% (917 kg/ha). "Higher yield attributes and yield have been observed with the combined foliar spray of supplementary nutrients and zinc, which could be attributed to the important addition of zinc to secondary nutrients, likely to result in optimum solution nutrient supply for exquisite crop production and effective reformatting of nutrient uptake from source to sink **(Prasanna*et al*., 2013) Choudhary*etal*. (2014)** found higher seed yield with foliar spray of S and Zn. It might be due to the response of black grams to nitrogen fertilization".

**Straw yield (kg/ha)**

Treatment with the 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 Impact 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) | Grain yield (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 (p=0.05) | 1.048 | 0.589 | 0.980 | 0.634 | 28.611 | 198.43 | | |

**CONCLUSION**

The experiment's conclusion is carried out with different parameters that the treatment $T_8$N 25 kg/ha+ Zn 0.5% was found to be the best that recorded the highest plant height, number of branches, number of nodules, seed, stover yield. It also fetched the maximum gross return, net return and benefit-cost ratio.

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