Effect of Biofertilizers and foliar application of zinc on growth and yield of Groundnut (*Arachis hypogea. L*)

Abstract

A field experiment was conducted during Zaid 2022 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36 %), available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). The experiment was laid out in Randomized Block Design with ten treatments each replicated thrice on the basis of one year experimentation. The results showed that application of PSB 20g/kg seed + 0.75% $ZnSO_4$ was recorded significantly higher plant height (97.37 cm), Number of nodules/plant (112.60), Plant dry weight (18.41 g/plant), Pods/plant (31.2), Seeds/pod (2.20), Test weight (38.46 g), Pod yield (3.00 t/ha), Seed yield (2.46 t/ha), Haulm yield (4.94 t/ha), Harvest index (49.83 %), Shelling percentage (82.13 %), gross returns (Rs.98,508.00/ha), net return (Rs.71,388.00/ha) and benefit cost ratio (2.63).

Key words: Rhizobium, PSB, Zinc sulphate, Groundnut.

INTRODUCTION

The peanut (*Arachis hypogaea*), also known as the groundnut, goober (US), **(Domonoske 2014)** pindar (US) or monkey nut (UK), is a Legume crop grown mainly for its edible seeds. It is widely grown in the tropics and subtropics, being important to both small and large commercial producers. It is classified as both a grain legume and, due to its high oil content, an oil crop. World annual production of shelled peanuts was 44 million tonnes in 2016, led by China with 38% of the world total. Atypically among legume crop plants, peanut pods develop underground rather than above ground. With this characteristic in mind, the botanist Carl Linnaeus gave peanuts the specific epithet *hypogaea*, which means "under the earth". The peanut belongs to the botanical family Fabaceae, commonly known as the legume, bean, or pea family. Like most other legumes, peanuts harbor symbiotic nitrogen- fixing bacteria in root nodules. The capacity to fix nitrogen means peanuts require less nitrogen-containing fertilizer and improve Soil fertility, making them valuable in crop rotation

Zinc is required in various metabolic processes as catalysts. Zinc also increases the content of protein, calorific value, amino acid and fat in oilseed crop Balanced fertilization helps to improve the quality of the produce. Zinc entered into the constituents of enzyme system that regulate initial metabolic reactions in the plants body. Zinc catalyses the process of oxidation in plant cells and is vital for the transformation of carbohydrates. It regulates the consumption of sugars and increases the source of energy for the production of chlorophyll. Zinc also aids in the formation of auxin and synthesis of protein.

Bio-fertilizer are known to play a number of vital roles in soil fertility, crop productivity and production in agriculture as they are eco- friendly but cannot at any cost replaces chemical fertilizers that are indispensable for getting maximum crop yields. They supplement chemical fertilizers for meeting the integrated nutrient demand of the crops. Application of bio-fertilizers results in increased mineral and water uptake, root development, vegetative growth and nitrogen fixation. Bio-fertilizers offer an economically attractive and ecologically sound means of reducing external inputs and improving quality and quantity of crop. They contain microorganisms which are capable of mobilizing nutrient elements from unavailable form to available form through different biological processes **(Hadiyal *et al.* 2017).** Azotobacter inoculants when applied to many non-leguminous crop plants, promote seed germination and initial vigor of plants by producing growth promoting substance **(Kalita *et al.* 2019).**

MATERIAL AND METHODS:

The experiment was conducted to know the effect of different doses of bio-fertilizers and foliar application of zinc on growth and yield attributes of Groundnut cv. K1812 was carried out at Crop Research Farm of Sam Higginbottom University, Prayagraj, Uttar Pradesh during 2022. The experiment was laid out in a RBD consisting of Ten treatments including Control with 3 replications, with the treatment combinations T_1: Rhizobium 20g/kg seeds + 0.25% $ZnSO_4$,

T_2: Rhizobium 20g/kg seeds + 0.50% $ZnSO_4$,

T_3: Rhizobium 20g/kg seeds + 0.75% $ZnSO_4$,

T_4: PSB 20g/kg seed + 0.25% $ZnSO_4$,

T_5: PSB 20g/kg seed + 0.50% $ZnSO_4$,

T_6: PSB 20g/kg seed + 0.75% $ZnSO_4$,

T_7: Rhizobium 10g/kg seeds + PSB 10g/kg seeds + 0.25% $ZnSO_4$,

T_8: Rhizobium 10g/kg seeds + PSB 10g/kg seed + 0.50% $ZnSO_4$,

T_9: Rhizobium 10g/kg seeds + PSB 10g/kg seeds + 0.75% $ZnSO_4$,

T_{10}: Control.

RESULTS AND DISCUSSION:

PARAMETERS:

PRE-HARVEST:

The perusal of data indicate that plant height measured at final stage (i.e., 60 DAS) was not influenced markedly by the application of different levels of phosphorous, though numerical increase in plant height was recorded in dose dependent manner. At 60 DAS, significantly higher plant height (53.55 cm) was recorded with the treatment PSB 20g/kg seed + 0.75% $ZnSO_4$. However, the treatments PSB 20g/kg seed + 0.50% $ZnSO_4$ (53.45 cm), PSB 20g/kg seed + 0.25% $ZnSO_4$ (52.75 cm) and Rhizobium 20g/kg seeds + 0.75% $ZnSO_4$ (52.25 cm) and Rhizobium 10g/kg seeds + PSB 10g/kg seeds + 0.75% $ZnSO_4$ (53.35 cm) were found to be statistically at par with PSB 20g/kg seed + 0.75% $ZnSO_4$ and there was significant difference among the treatments. However, highest Number of nodules/plants (112.60) was recorded with the application of PSB 20g/kg seed + 0.75% $ZnSO_4$. At 60 DAS, there was significant difference among the treatments. However, highest dry weight (28.47 gm) was recorded in treatment T6.

POST - HARVEST:

Significantly Maximum Number of Pods/plant (31.2), Seeds per Pod (2.20) and test weight (38.46 gm) were recorded with the treatment of application of PSB 20g/kg seed + 0.75% $ZnSO_4$ over all the treatments.

DISCUSSIONS:

Muhammad (2011) Maximum plant height (88.00cm) was observed in the inoculated plants, while less plant height (56.13cm) was recorded for uninoculated plants. The reason for this might be the adequate amount of nitrogen, fixed by the Rhizobia. More number of leaves per plant may also be positively contributed to more plant height in the inoculated plants. The mean values for cultivars also show significant effect for plant height. Maximum plant height (80.43 cm) was achieved by cv. Chakori, while minimum plant height (64.04 cm) was observed in cv. KS-1. Comparing means for cultivars for plant height, it is evident that variation observed in plant height was probably due to the difference in the degree of adaptation to the environment of experimental site. Rhizobium inoculation treatments also gave superior results to the un-inoculated ones in plant height; stem dry weight, number of nodules/plant and nodule dry weight. Potdar *et al.* (2019) concluded that application of 60 kg P_2O_5 ha^{-1}, FYM 5 t ha^{-1}, and PSB + VAM 20 g/kg seed inoculum increased the number of pods/plants. (281,20), seeds/pods (10.95), test weight (4.35 g), seed yield 1956 kg/ha, Indian mustard (*Brassica juncea* L.) vs oil yield of each control (40.2%). Kalita *et al.* (2019) in their experiment reported that seed inoculation with *Azotobacter* and *PSB* 40 g kg^{-1} seed + 75% NPK in toria (*Brassica campestris L.)* recorded maximum grain yield (11.15 qha^{-1}) due to the siliquae $plant^{-1}$ (164.76), root growth (2.30 g $plant^{-1}$), seeds $siliquae^{-1}$(10.97) and seed weight (4.82 g).

CONCLUSION:

It is concluded that application of PSB 20g/kg seed + 0.75% $ZnSO_4$ was recorded significantly higher seed yield (2.46 t/ha), and benefit cost ratio (2.63) as compared to other treatments. Since, the finding based on the research done in one season.

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Table 1: Effect of biofertilizers and foliar application of Zinc on growth of Groundnut.

Treatments	Plant Height (cm)	No. of Nodules	Dry weight (g)	Pods/plant(No)	seed/pod(No)	Test weight (g)`
T1	50.25	108.18	24.03	26.0	1.73	30.24
T2	51.70	109.39	25.22	26.2	1.73	30.24
T3	52.25	109.80	26.12	27.1	1.80	31.46
T4	52.75	110.18	26.32	28.2	1.87	32.69
T5	53.45	111.38	28.00	30.3	2.00	37.00
T6	53.55	112.60	28.47	31.2	2.20	38.46
T7	52.95	110.43	26.75	28.2	1.87	32.69
T8	52.75	110.74	26.98	28.5	1.93	33.74
T9	53.35	111.29	27.14	29.0	2.00	34.96
T10 (Control)	48.30	105.70	23.08	24.1	1.73	30.24
F – Test	S	S	S	S	S	S
SEm(±)	0.72	1.218	0.365	0.43	0.03	0.53
CD (p=0.05)	2.15	3.61	1.056	1.29	0.09	1.58