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 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

"Peanut (Arachis hypogaea), also known as peanut, goober (US), (Domonoske 2014), pinder (US), or monkey nut (UK), is a leguminous crop grown primarily for its edible seed". Widely cultivated in the tropics and subtropics, it is important for small and large commercial growers. Due to their high oil content, they are classified as both cereal legumes and oil crops. Covering 55.71 million hectares worldwide throughout the year, India ranks first in peanut planting area, producing 1.02 million tons with a productivity of 1831 kg per hectare in 2020-2021 It is the second largest producer in the world (agricoop.nic.In). Atypical for legumes, peanut pods tend to develop underground rather than above ground. With this characteristic in mind, the botanist Linnaeus gave peanuts the specific epithet hypogaea, meaning "under the earth." It belongs to the leguminosae of the botanical family. Like most other legumes, peanuts harbor symbiotic nitrogen-fixing bacteria in their root nodules. The ability to fix nitrogen means peanuts require less nitrogen fertilizer and improve soil fertility, making them valuable for crop rotation. Zinc is required as a catalyst for various metabolic processes. Zinc also increases the protein, energy, amino acid and fat content of oilseeds. Balanced fertilization helps improve product quality. Zinc has become a component of the enzyme system that regulates early metabolic reactions in plants. Zinc catalyzes oxidative processes in plant cells and is important for carbohydrate conversion. It regulates sugar consumption and increases the energy source for chlorophyll production. Zinc also aids in auxin formation and protein synthesis.

Biofertilizers play many important roles in soil fertility, crop productivity and agricultural production because they are environmentally friendly and do not replace chemical fertilizers which are essential for maximizing crop yields. is well known. They complement chemical fertilizers to meet the integrated nutrient needs of plants. The application of organic fertilizers results in increased mineral and water uptake, root development, vegetative growth and nitrogen fixation. Organic fertilizers offer an economically attractive and ecologically sensible way to reduce external inputs and improve yield quality and quantity. They include microorganisms that can mobilize nutrients from inaccessible to utilizable forms through a variety of biological processes (Hadiyal *et al.* 2017). "Azotobacter inoculum, when applied to many non-leguminous crops, promotes seed germination and early plant vigor by producing growth-promoting substances" (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 (2010) "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 (Farm yard manure) 5 t ha^{-1}, and PSB + VAM (Vesicular Arbuscular Mycorrhiza) 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 q/ha^{-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.

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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