# Effect of Biofertilizers and Foliar Application of Zinc on Growth and Yield of Maize (*Zea mays* L.)


## ABSTRACT

A field experiment was conducted during *Kharif* 2022 at Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology And Sciences, Prayagraj, Uttar Pradesh, India. The soil of the experimental field was sandy loam in texture, slightly alkaline in soil reaction (pH 8), low level of organic carbon (0.28%), available N (219 kg/ha), P (11.6 kg/ha) and K (217.2 kg/ha). The experiment was conducted in randomized block design consisting of 10 treatments with 3 different levels of biofertilizers and different levels of zinc 0.2%, 0.4% and 0.6% (foliar application) with three replications and the treatments were allocated randomly in each replication. On the topic "Effect of Biofertilizers and foliar application of Zinc on Growth and Yield of Maize (*Zea mays* L.)",.The results showed that treatment 9 with the application of PSB (10g) + VAM (10g) + Zinc 0.6% recorded significantly higher plant height (213.08cm), higher plant dry weight (106.76g) ,maximum number of cobs/plant (2.20), higher cob length (17.63cm), maximum number of seed/cob (294.56), higher seed index (39.56g), higher seed yield (2.30t/ha), higher stover yield (8.53t/ha), higher harvest index (21.26%) compared to other treatments. The maximum gross returns (1,08772.00 INR/ha), maximum net returns (72,573.00 INR/ha) and benefit ratio (2.00) was recorded in treatment 9 with the application of PSB (10g) + VAM (10g) + Zinc 0.6% as compared to other treatments. Minimum parameters were recorded in treatment 10 control plot with RDF 120:60:40 kg/ha NPK.



**Keywords**:,*Maize, PSB (Phosphate Solubilizing Bacteria), VAM (Vesicular Arbuscular Mycorrhizae), Zinc. Growth, Yield and Economics.*

## INTRODUCTION

"Maize ( *Zea mays* L.) is a miracle crop and is also referred to as 'Queen of Cereals' due to high productiveness, easy to process, low cost than the other cereals. Among cereals maize ranks $5^{th}$ in total area and $3^{rd}$ in total production and productivity in India. At present, about 35% of the maize produce in the country is used for human consumption, 25% in poultry feed and cattle feed and 15% in food processing (corn flakes, popcorn etc.) and other industries (mainly starch, dextrose, corn syrup and corn oil etc.). Being a $C_4$ plant, it is an efficient converter of absorbed nutrients into food. Maize contains zein protein which has two essential amino acids named Tryptophan and Lysine" **(Singh *et al.*, 2010)**. Maize is a warm weather crop, while optimum temperature for the growth of maize lies within 28-32$^{o}$C and crop can be grown well in areas with annual rainfall 250 to 400 cm. It can be grown successfully in soils with pH ranging from 6.5 to 7.5. The alluvial soils of Uttar Pradesh, Bihar and Punjab are suitable for raising good maize crop. The soils with sandy loam silty loam texture are best for the crop.

"Globally maize grown in America, Asia and Africa. It is cultivated globally over an area ofabout 147.26 million hectares with a production of 724.6 million tonnes of grains with average productivity of 49.20 q/ha. India is one of the major maize cultivated country, cultivated in an area with 9.86lakh hectares. with the production of 31.51 million tonnes and productivity of 3195 kg/ha. Total maize cultivated area in Uttar Pradesh was about 0.77 million hectares with the production of1.80million tonnes and productivity of 2311 kg/ha" **(GOI, 2021)**.

Problems facing by deficiency of PSB and VAM in Indian soils are, degradation of soil physical, chemical and biological characteristics, where majority of soils are PSB deficient. PSB deficient soils reduced in uptake of phosphate and production of organic acids. However, there performance is influenced by environmental factors especially under stress condition. Bacteria's growing in alkaline soils in India during summer season are subjected to high salt, temperature and stress tolerant. This condition may result in poor growth and survival of PSB. Higher level nitrogen application reduces VAM colonization in crops. The high P concentrations in plant induced by high P fertilization in the soil is found responsible for inhibition of mycorrhizal symbiosis.

**"**Zinc deficiency in soils is prevalent worldwide both in temperate and tropical climates. In India, about 50% of the soils are deficient in the zinc and this remains the most important nutritional disorder affecting crop production. Its deficiency in plants cause, stunting (reduced height), interveinal chlorosis (yellowing of the leaves between the veins), bronzing of chlorotic leaves, small and abnormally shaped leaves or stunting and rosette of leaves" (**Alloway, 2008)**. "Zinc deficiency in the plant retards development and maturation of panicles of grain crops" (**Prasad *et al.*, 2014).** Deficit of zinc causes seed yield reductions up to 80% along with reduced grain zinc level have been observed.

"Bio- fertilizers also plays an important role because they possess many desirable soil physical, chemical and biological characteristics of the soil. PSB (Phosphate Solubilizing Bacteria) are able to change insoluble phosphorus in soil into the absorbed soluble. It facilitates sustained P supply for the growth of plants but also stimulates the efficiency of nitrogen fixation and accessibility ofother trace elements by synergizing important growth promoting substances like antibiotics and improve crop productivity by solubilizing insoluble phosphorus and providing protection to plantsagainst soil borne pathogen. Plants root associated fungus mycorrhiza exhibit symbiotic association in many vascular plants" **(Kumar *et al.*, 2012)**. "AMF symbiosis is probably more favourable in conservation and sustainable agriculture to having the potentiality of major beneficialfunctions like, increase of plant growth and nutrition by gaining more nitrogen,, phosphorus and less other nutrients, increase water uptake and water holding capacity that intimate drought tolerance, increase tolerance to other biotic stresses such as, soil salinity, heavy metal toxicity, overcome biotic stresses and offering bio protection against pathogen, improve soil quality, enhancethe plant vigor and yield" ( **Debashis *et al.*, 2022).**

"Zinc plays a very important role in plant metabolism by influencing the activities of hydrogenaseand carbonic anhydrase and stabilization of ribosomal proteins. Zinc activates the plant enzymes by cellular membranes, protein synthesis and regulation of auxin synthesis. Zinc is a micronutrientwhich enhances the grain productivity in maize and supply of zinc in the crops can be directly on the soil as fertilizers, for foliar fertilization and soil application. Application of zinc fertilizers to maize crop not only boost its production but also improves zinc content in tissues" **(Kumar *et al.*, 2019)**. Keeping all these points in view, the present investigation titled "Effect of Bio-fertilizers and foliar application of zinc on growth and yield of Maize" (*Zea mays* L.)''.

**Materials and Methods**

The experiment was conducted during *Kharif* 2022 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj, (U.P) on the topic "Effect of Biofertilizers and Zinc on growth and yield of Maize (*Zea mays* L.)", to study the response of Biofertilizers (PSB and VAM) with combination of Zinc (0.2, 0.4 and 0.6%). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 8.0), low in organic carbon (0.62 %), available N (225 kg/ha), available P (38.2 kg/ha) and available K (240.7 kg/ha). There were 10 treatments, each being replicated thrice and laid out in Randomized Block Design. The treatment combinations are treatment 1 [PSB (20g) +Zinc (0.2%)], treatment 2 [PSB (20g) + Zinc ( 0.4%)], treatment 3 [PSB (20g) +Zinc ( 0.6%)], treatment 4 [VAM (20g) + Zinc (0.2%)], treatment 5 [VAM (20g) + Zinc (0.4%)], treatment 6 [VAM (20g) + Zinc

(0.6%)], treatment 7 [PSB (10g) + VAM (10g)+ Zinc (0.2%)], treatment 8 [PSB (10g) + VAM (10g) + Zinc (0.4%)], treatment 9 [PSB (10g) + VAM (10g) + Zinc (0.6%)], treatment 10 (Control). The data recorded on different aspects of crop such as, growth parameters and yield attributes were subjected to statistical analysis by variance method **Gomez and Gomez (1976)**.

## RESULT AND DISCUSSION

### Growth parameters

### Plant height (cm)

The data revealed that, significant and higher plant height (213.08 cm) was observed in the treatment-9 [PSB (10g) + VAM (10g) + Zinc 0.6%). However, treatment 5 [VAM (20g) +Zinc (0.4%)], treatment 6 [VAM (20g) + Zinc (0.6%)], treatment 7 [PSB (10g) + VAM (10g) + Zinc (0.2%)], treatment 8 [ PSB (10g) +VAM (10g) +Zinc (0.4%)] were found to be statistically at par with treatment-9 (PSB (10g) + VAM (10g) + Zinc 0.6%) (Table 1). Significant and higher plant height was observed with application of PSB (10g) + VAM (10g) increase the availability of phosphorus that improved root development and increases uptake of nutrients which improves vegetative growth of crop. Similar result was also reported by **Singh *et al*. (2018**). Further, significant and higher plant height was recorded with application of Zinc might be due to positive effect of Zn which aids in the synthesis of growth hormones and plays a vital role in cell elongation and obtained maximum vegetative growth of plant under Zn availability. Similar result was also reported by **Rodinpuia *et al.* (2019).**

### Plant dry weight (g)

The data revealed that, significant and maximum plant dry weight (106.76g) was observed in the 9 [PSB (10g) + VAM (10g) + Zinc 0.6%). However, treatment-8 (PSB (10g) +VAM (10g) + Zinc 0.4%) were found to be statistically at par with 9 [PSB (10g) + VAM (10g) + Zinc 0.6%). (Table 1). Significant and maximum plant dry weight (g) was with application of PSB (10g) + VAM (10g) might be due to more assimilatory surface leading to higher dry matter production coupled with effective translocation and distribution of photosynthates from source to sink. Similar results are confirmed by **Rachana *et al.* (2018).** Further, significantly maximum plant dry weight (g) was with application of Zinc might be due to its influence cell division, cell elongation, auxin synthesis which played a major role in photosynthesis activity with balanced nutrients, which results in increase in plant growth. Similar results were also support with **Amutham *et al*. (2019).**

### Crop growth rate (g/m$^2$/day)

The data found that non- significant highest crop growth rate (18.47 g/m$^2$/day) was recorded in treatment 6 [VAM (20g) + Zinc (0.6%)] as compared to rest of the treatments and there was no significant difference between them (Table 1).

**Relative growth rate (g/g/day)**

The data found that non- significant and highest relative growth rate (0.067 g/g/day) was recorded with 9 [PSB (10g) + VAM (10g) + Zinc 0.6%). and treatment 7 [PSB (10g) + VAM (10g) + Zinc (0.2%)] as compared to rest of the treatments (Table 1). Relative growth rate was found that not significant with application of zinc (0.6%) might be due to low response of sunlight and photosynthesis by crop due to change is photoperiodism and synthesis of chlorophyll and stomatal action in plants.

**Yield attributes and Yield**

**Number of cobs/plant**

The data revealed that, significant and maximum number of Cobs/plant (2.20) was observed in treatment 9 [PSB (10g) + VAM (10g) + Zinc 0.6%). which was superior over all other treatments. However, treatment 8 [PSB (10g) + VAM (10g) + Zinc (0.2%)] was found to be statistically at par with treatment 9 [PSB (10g) + VAM (10g) + Zinc (0.6%)] (Table 2). Significant and maximum number of cobs/plant was with application of zinc (0.6%) might be due to higher chlorophyll contents and synthesis of metabolites, oxidation and increase in metabolic activities, resulted in formation of maximum number of cobs/plant. Similar results were also reported by **Das *et al.* (2020)** in baby corn.

**Length of cob/plant**

The data found that, significant and higher length of cob/plant (17.63cm) was observed in treatment 9 [PSB (10g) + VAM (10g) + Zinc (0.6%)] which was superior over all other treatments. However, treatment 7 [PSB (10g) + VAM (10g) + Zinc (0.2%)] treatment 8 [PSB (10g) + VAM (10g) + Zinc (0.2%)] was found to be statistically at par with treatment 9 [PSB (10g) + VAM (10g) + Zinc (0.6%)] (Table 2). Significant and higher length of cobs/plant was with application of PSB might be due to increase in nitrogen fixation and phosphorus soublizing microorganisms to enhance growth and yield of maize and have possibility substituting a part of demand of chemical fertilizer which ultimately increase cob length .This similar findings were reported by **Rina *et al.* (2020)** Further, significant and higher length of cobs/plant was with application of VAM might be due to increase in availability of essential nutrients required for promotion of meristematic and physiological activities such as root development, efficient absorption and translocation of water and nutrients, which resulted in increased in cob length. Similar result was also reported by **Rachana *et al.* (2018)**. “Another further, significant and higher length of cobs/plant was with application of Zn might be due to increase in higher chlorophyll content and this had apparently a positive effect on photosynthetic activity, synthesis of metabolites and growth –regulating substances, oxidation and metabolic activities and ultimately better growth and development which ultimately led to increase in cob length". [20] This similar findings were also reported by **Das *et al*. (2020).**

**Number of seeds/cob**

The data found that, significant and maximum number of seeds/cob (294.56) was observed in treatment 9 [PSB (10g)+ VAM (10g) + Zinc (0.6%)] which was superior over all other treatments. However, treatment 5 [VAM (20g) +Zinc (0.4%)], treatment 6 [VAM (20g) + Zinc (0.6%)], treatment 7 [PSB (10g) +VAM (10g) + Zinc (0.2%)], treatment 8 [ PSB (10g) + VAM (10g) + Zinc (0.4%)] (Table 2). Significant and maximum number of seeds/cobs was with application of VAM might be due to improved soil condition and continues supply of nutrients in adequate quantities due to mineralization and enhance solubilization of P from insoluble source. this similar finding was reported by **Prathyusha *et al*. (2017**). Further, significant and maximum number of seeds/cob was with application of PSB might be due to higher photosynthetic process which translocate various source to sink and helps in development of reproductive components. Similar result was also reported by **Rachana *et al.* (2018)**. Further, significant and maximum number of seeds/cobs was with application of Zn might be due to zinc activates various enzymes which are involved in carbohydrate metabolism and protein synthesis and pollen formation, resulted in increased seeds/cob. Similar result was also reported by **Kumar *et al.* (2019).**

**Seed index (g)**

The data found that, significant and higher seed index (39.56g) was observed in treatment 9 [PSB (10g) + VAM (10g) + Zinc (0.6%)] which was superior over all other treatments. However, treatment 7 [PSB (10g) + VAM (10g) + Zinc (0.2%)], treatment 8 [PSB (10g) +VAM (10g) + Zinc (0.2%)], was found to be statistically at par with treatment 9 [PSB (10g) + VAM (10g) + Zinc (0.6%)] (Table 2). Significant and higher seed index was with application of PSB might be due to improved soil condition and continues supply of nutrients in adequate quantities due to mineralization and enhance solubilization of P from insoluble source. this similar finding was reported by **Prathyusha *et al*. (2017**). Further, significant and higher seed index was with application of Zn might be due to activation of enzymes makes sufficient availability of macro and micro nutrients to plant during grain development to maturity stage, which resulted in increase in seed index. Similar result was also reported by **Kumar *et al.* (2019).**

**Seed yield (t/ha)**

The data found that, significant and higher seed yield (2.30t/ha) was observed in treatment 9 [PSB (10g) +VAM (10g) + Zinc (0.6%)] which was superior over all other treatments. However, treatment 6 [VAM (20g) +Zinc (0.6%)], treatment 7 [PSB (10g) + VAM (10g) + Zinc (0.2%)], treatment 8 [PSB (10g) + VAM (10g)+Zinc 0.2%). was found to be statistically at par with treatment 9 [PSB (10g) + VAM (10g) +Zinc (0.6%)] (Table 2). Significant and higher seed yield was with application of PSB might be due to increase in ability of the plants due to biofertilizers which attributed to higher biomass accumulation with effective translocation and distribution of photosynthates from source to sink, resulted in elevation of higher seed yield. Similar result was also reported by **Rachana *et al.* (2018).** Further, significant and higher seed yield was with application of zinc (0.6%) might be due to zinc is essential for several biochemical process in plant like auxin metabolism, chlorophyll production, enzyme activation which resulted in better grain development. Similar result was also reported by **Singh *et al*. (2022)** in sorghum.

**Stover yield**

The data found that, significant and higher stover yield (8.53t/ha) was observed in treatment 9 [PSB(10g) + VAM(10g) + Zinc(0.6%)] which was superior over all other treatments. However, treatment 7 [PSB (10g) +VAM (10g) + Zinc (0.2%)], treatment 8 [PSB (10g) +VAM (10g) + Zinc (0.2%)], (Table 2). Significant and higher seed yield was with application of PSB might be due to increased availability of P through solubilization of insoluble inorganic phosphate by organic acid, decomposition of phosphate rich organic compounds and production of plant growth promoting substances could explain the increase in stover yield of wheat after inoculation with P solubilizing microorganisms. Similar findings were also reported by **George *et al*. (2021).** Further, significant and higher stover yield was with application of VAM might be due to higher photosynthesis activity because of increased leaf area index which ultimately promoted dry matter production resulting in higher yield. Similar results were also reported by **Prathyusha *et al*. (2017).** Further**,** significant and higher stover yield was with application of Zn might be due to various morphological and physiological changes occurred in plants during growth and reproductive period leads to enhance translocation of photosynthates, which resulted in higher production of fodder yield. Similar results was also reported by **Das *et al.* (2020)** in baby corn.

**Harvest index (%)**

The data revealed that, significant and higher harvest index (21.26%) was observed in treatment 9 [PSB (10g) +VAM (10g) + Zinc (0.6%)] which was superior over all other treatments and there was no significance difference between them. (Table 2).

## Economics

### Cost of cultivation (INR/ha)

The maximum cost of cultivation (36,239.00 INR/ha) was found to be highest in treatment-3 (PSB 10g + Zinc 0.6%) and minimum cost of cultivation (34,879.00 INR/ha) was found to be in treatment-10 (control) as compared to other treatments (Table 3).

### Gross return (INR/ha)

The maximum gross returns (10,8772.00 INR/ha) were found to be highest in treatment-9 (PSB (10g) + VAM (10g) + Zinc 0.6%) and minimum gross returns (90,661.00 INR/ha) was found to be in treatment-10 (control) as compared to other treatments (Table 3).

### Net returns (INR/ha)

The maximum net returns (72,573.00 INR/ha) were found to be highest in treatment-9 (PSB (10g) + VAM (10g) + Zinc 0.6%) and minimum gross returns (55,782.00 INR/ha) was found to be in treatment-10 (control) as compared to other treatments (Table 3).

### Benefit cost ratio (B:C)

The maximum Benefit Cost ratio (2.00) was found to be highest in treatment-9 [PSB (10g) + VAM (10g) + Zinc 0.6%) and minimum gross returns (1.60) was found to be in treatment-10 (control) as compared to other treatment (Table 3). Higher B:C ratio was obtained with application of PSB due to enhance in growth and development of the crop by beneficial effect of phosphorus solubilizing bacteria on yield is related to the constant and increase in supply of major and minor nutrients as well as improvement in soil physio -chemical parameters which ultimately increase in maize output due to integrated use of PSB which increased due to microbial colony and made more nutrients available during crop growth and development stage, which ultimately increased benefit cost ratio. these similar findings were described by **Bhavya *et al.* (2022)**

**Table 1 Effect of Biofertilizers and foliar application of Zinc growth attributes of maize.**

| S. No. Treatment combinations | Growth attributes | | | |
|---|---|---|---|---|
| | **Plant height (80 DAS)** | **Plant dry weight (80 DAS)** | **CGR ($g/m^2$/day) (60-80DAS)** | **RGR (g/g/day) (40-60 DAS)** |
| 1. PSB (20g) + Zinc (0.2%) | 198.45 | 98.30 | 17.93 | 0.062 |
| 2. PSB (20g) + Zinc ( 0.4%) | 198.69 | 99.63 | 18.09 | 0.063 |
| 3. PSB (20g) + Zinc ( 0.6%) | 200.43 | 101.57 | 18.45 | 0.062 |
| 4. VAM (20g) + Zinc (0.2%) | 198.45 | 102.53 | 18.44 | 0.065 |
| 5. VAM (20g) + Zinc (0.4%) | 206.16 | 102.91 | 18.26 | 0.064 |
| 6. VAM (20g) + Zinc (0.6%) | 207.16 | 103.97 | 18.47 | 0.060 |
| 7. PSB (10g) +VAM (10g) + Zinc (0.2%) | 210.57 | 104.62 | 18.35 | 0.059 |
| 8. PSB (10g) +VAM (10g) + Zinc (0.4%) | 211.11 | 105.67 | 18.20 | 0.057 |
| 9. PSB (10g) +VAM (10g) + Zinc (0.6%) | 213.08 | 106.76 | 18.24 | 0.055 |
| 10. Control | 191.69 | 96.53 | 18.10 | 0.064 |
| F test | S | S | NS | NS |
| S Em (±) | 3.37 | 0.39 | 0.24 | 0.002 |
| CD (p =0.05) | 10.0 | 1.16 | - | - |

**Table 2 Effect of Biofertilizers and foliar application of Zinc on yield and yield attributes of maize.**

| S. No. Treatment combinations | Cob/plant | Length of cob/plant (cm) | No. of Seeds/ cob | Seed index (g) | Seed yield(t/ha) | Stover yield (t/ha) | Harvest Index (%) |
|---|---|---|---|---|---|---|---|
| 1. PSB (20g) +Zinc (0.2%) | 1.33 | 15.40 | 276.00 | 32.48 | 2.05 | 7.86 | 20.68 |
| 2. PSB (20g) + Zinc ( 0.4%) | 1.40 | 15.60 | 278.24 | 33.15 | 2.08 | 8.04 | 20.54 |
| 3. PSB (20g) + Zinc ( 0.6%) | 1.53 | 16.00 | 279.63 | 36.29 | 2.10 | 8.12 | 20.58 |
| 4. VAM (20g) + Zinc (0.2%) | 1.60 | 16.10 | 281.76 | 28.31 | 2.13 | 8.18 | 20.62 |
| 5. VAM (20g) + Zinc (0.4%) | 1.67 | 16.27 | 286.42 | 28.54 | 2.16 | 8.25 | 20.75 |
| 6. VAM (20g) + Zinc (0.6%) | 1.73 | 16.30 | 288.98 | 32.00 | 2.18 | 8.30 | 20.78 |
| 7. PSB (10g) +VAM (10g) + Zinc (0.2%) | 1.80 | 17.07 | 290.13 | 38.02 | 2.22 | 8.34 | 21.01 |
| 8. PSB (10g) +VAM (10g) + Zinc (0.4%) | 2.00 | 17.50 | 291.12 | 38.17 | 2.25 | 8.41 | 21.07 |
| 9. PSB (10g) +VAM (10g) + Zinc (0.6%) | 2.20 | 17.63 | 294.56 | 39.56 | 2.30 | 8.53 | 21.26 |
| 10. Control | 1.27 | 14.33 | 275.06 | 27.16 | 1.87 | 7.33 | 20.27 |
| F test | S | S | S | S | S | S | NS |
| SEm (±) | 0.10 | 0.19 | 3.29 | 0.54 | 0.04 | 0.07 | 0.34 |
| CD (p=0.05) | 0.29 | 0.57 | 9.77 | 1.62 | 0.12 | 0.20 | 1.01 |

**Table 3 Effect of Biofertilizers and Zinc on Economics of maize.**

| S. No. Treatment combinations | Cost of Cultivation (INR/ha) | Gross returns (INR/ha) | Net Return (INR/ha) | B:C ratio |
|---|---|---|---|---|
| 1. PSB (20g) + Zinc (0.2%) | 35,439.00 | 98439.00 | 63000.00 | 1.78 |
| 2. PSB (20g) + Zinc ( 0.4%) | 35,839.00 | 100203.00 | 64364.00 | 1.80 |
| 3. PSB (20g) +Zinc ( 0.6%) | 36,239.00 | 101350.00 | 65111.00 | 1.80 |
| 4. VAM (20g) + Zinc (0.2%) | 35,359.00 | 102223.00 | 66864.00 | 1.89 |
| 5. VAM (20g) + Zinc (0.4%) | 35,759.00 | 103476.00 | 67717.00 | 1.89 |
| 6. VAM (20g) + Zinc (0.6%) | 36,159.00 | 104186.00 | 68027.00 | 1.88 |
| 7. PSB (10g) +VAM (10g) + Zinc (0.2%) | 35,399.00 | 105532.00 | 70133.00 | 1.98 |
| 8. PSB (10g) + VAM (10g) + Zinc (0.4%) | 35,799.00 | 106600.00 | 70801.00 | 1.98 |
| 9. PSB (10g) + VAM (10g) + Zinc (0.6%) | 36,199.00 | 108772.00 | 72573.00 | 2.00 |
| 10. Control | 34879.00 | 90661.00 | 55782.00 | 1.60 |

## CONCLUSION

It is concluded that in maize with the different combinations of Biofertilizers PSB and VAM along with Zinc (0.6%) was observed higher seed yield and benefit cost ratio in maize.

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