ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 11, Issue, 07, pp. 5149-5153, July, 2019

DOI: https://doi.org/10.24941/ijcr.35969.07.2019

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

EFFECT OF BIOFERTILIZERS ON YIELD AND YIELD COMPONENTS OF MAIZE (*ZEA MAYS* L.)VARIETIES ECO-92 AND AFRICAN TALL

[1,*]Shinde Madhumati Y., [2]Khade S K., [3]Patil V.A.

[1]P.G. Department of Botany, Dattajirao Kadam Arts, Science and Commerce College, Ichalkaranji, Dist. Kolhapur-416115, Maharashtra, Affiliated to Shivaji University, Kolhapur, India

[2]Padmabhushan Dr Vasantraodada Patil *(PDVP)* Mahavidyalaya, Tasgaon, Maharashtra Affiliated to Shivaji University, Kolhapur, India

[3]P.G. Department of Botany, Dattajirao Kadam Arts, Science and Commerce College, Ichalkaranji. Dist. Kolhapur-416115, Maharashtra, Affiliated to Shivaji University, Kolhapur, India

ARTICLE INFO

Article History:
Received 27th April, 2019
Received in revised form
02nd May, 2019
Accepted 16th June, 2019
Published online 25th July, 2019

Key Words:
Azotobacter,
PSB, Eco -92,
African tall,
Maize yield etc.

**Corresponding author:*
Shinde Madhumati Y.,

ABSTRACT

An attempt has been made of study the effect of different biofertilizers such as *Azotobacter* and *Phosphate Solubilizing Bacteria* (*PSB*) on yield and yield components of Maize (*Zea mays* L.) varieties viz.Eco-92 and African tall. The experiments were carried out in a randomized complete block design with three replications. The yield parameters like weight of cob, diameter of cob, length of cob, number of rows per cob, weight of grains, number of grains per cob, weight of 100 grains, grain yield Kg/ha . Result showed that, maize yield and yield components were significantly different at ($p \leq 0.05$) higher in application of biofertilizers treatments. However, treatment with combined application of *Azotobacter+PSB* biofertilizer (A+P) biofertilizers had the highest weight of cob and grain yield Kg/ha as compaired to control. Overall, *Azotobacter* and *PSB* biofertilizers improved the quality and quantity of yield.

Citation: Shinde Madhumati Y., Khade S K., Patil V.A., 2019. "Effect of biofertilizers on yield and yield components of maize (*zea mays l.*) varieties eco-92 and African tall", *International Journal of Current Research*, 11, (07), 5149-5153.

INTRODUCTION

Maize (*Zea mays* L.) being an important staple food crop after Rice and Wheat throughout the world (FAO, 2002), Maize originated from Mexico. Every part of the maize plant has economic value and cob can all be used to produce a large variety of food and non-food production (IITA 2006).Apart from the soil the fertility and productivity issues, use of chemical fertilizers are also becoming more and more difficult for the farmers due to their high costs. Large amount of chemical fertilizers and pesticides are being used for its higher yield production, but the problem is, they influence human and environmental health. To get rid off from the problems, we required to alter ways of increasing yield production by applying biofertilizers (Shevananda, 2008).Nitrogen and phosphorus are essential nutrients for plant growth and development in Maize.N_2-fixing and P-*solubilizing bacteria* are important for plant nutrition by increasing N and P uptake by the plants and playing a significant role as that like biofertilizer, so *Azotobacter* and *Phosphate solubilsing bacteria* are used in this study.

Though nitrogen and phosphorous are essential nutrient for plant growth and development in corn, biofertilizers are able to fix atmospheric nitrogen in the available form of plants (Chen, J.2006). For highest grain yield in agriculture in addition to both, the nitrogen and phosphate fertilizer are very important (Shaban.2013 a.b). Biofertilizers include mainly the nitrogen fixing, phosphate solubilizing and growth promoting microorganisms (Goel *et al*., 1999). Among biofertilizers benefitting the crop production are *Azotobacter, Azospirillium*, Blue green algae, *Azolla* (Hegade *et al*., 1999) Application of biofertilizer provides effective implementation of biological mechanisms of plant nutrition, growth promotion and protection (Bashan and Levanony, 1990; Doebereiner, 1995).In Maize the present positive effect of biofertilizers on growth, yield and yield component was revealed because of the increasing demand for food and livestock feed. The similar results are concurved in case of barley (Azimi *et al*.2013). *Azotobacter* species besides playing a role in nitrogen fixation, it has the capacity to synthesize and secrete considerable amounts of biological active substances like vitamins, gibberellins and auxins (Suhag, 2016).

Nitrogen is the most critical element of plant growth and plays a key role in many metabolic and physiological functions (Balasubramaniyan and Palaniappan, 2001) .Biological fertilizers are obviously an important part of a sustainable agricultural system, they The present study was undertaken to assess the effect of liquid biofertilizer different levels (doses) on growth and yield of two maize cultivars and to determine the optimum level suitable for improving maize production. According to Beyranvand *et al* 2013 them nitrogen and phosphate biofertilizers increase in the yield components like plant height, cob weight, and cob length, number of grain per cob and grain yield.

MATERIALS AND METHODS

To evaluate effect of biofertilizers (*Azotobacter* and *Phosphate Solubilizing Bacteria*) on yield and yield components two maize (*Zea mays* L.) varieties Eco-92 and African tall are selected.

Experimental site: The field experiment were conducted at the Experimental farm Belanki (Santoshwadi Lat. $16^0$50′42″N, Long.$74^0$51′54″ E), Dist.Sangli.

Land Preparation, experimental design: The land was ploughed twice with bullock drawn mould board plough followed by harrowing using cultivator and the entire plot was leveled with leveler. A rectangular plot having uniform fertility and even topography was selected for conducting the field experiment and individual plots were made manually as per experimental plan. Pre-sowing irrigation was given 10 days before the land preparation. The land was prepared to good tilth and leveled uniform before sowing. The two maize cultivars were considered as main plots and the three levels of biofertilizers as sub-plots.

Treatments : *Azotobacter* biofertilizer considered as 'A'.PSB biofertilizer considered as 'P' and collective application was considered as 'A+P' arranged respectively as in the form. Characters using a split plot based on a randomized complete block design with three replications.

Fertilizer applications: The treatment of bio-fertilizer levels were corresponding to (TA_1), (TA_2), (TA_3), (TP_1), (TP_2), (TP_3) and ($TA+P_1$), ($TA+P_2$), ($TA+P_3$) respectively.

Seed and Sowing: Before sowing of crop, furrows were opened at 60 cm interval with the help of hand hoe. Two seeds were dibbled at 30 cm spacing on 22nd May 2015. Advised nutrients and microbial inoculants were applied separately at the base of row and covered with soil.

Thinning: A week after emergence, seedlings were thinned to control two plants per hill. Final thinning was appeared two weeks after the emergence to maintain only one healthy seedling per hill.

Weeding: Hand weeding was done at 30 days after sowing and one time planting by chipkunte was carried at 20 days after sowing to keep all the plots systematic weed release throughout the crop growth period. Earthing up of soil was also made at 30 days after sowing to have good support and aeration to the plant roots.

Irrigation: Protective irrigation was supplied to the crop. Proper care was taken to keep away from movement of fertilizers from one plot to another during irrigation. All plots were irrigated immediately after sowing for uniform germination. Further irrigation was given at 5 days interval during crop growth. Irrigation was stopped one week earlier to harvest of the crop.

Harvesting and threshing: The crop was harvested when the cobs became green stage and plants showed physiological maturity. First, the cobs were removed from the standing crop and stover was harvested later. The harvested cobs were kept in separate gunny bags for each plot and dried in sun before shelling. After shelling the grains were dried in the sun to bring the moisture content 15% and then the final weights were recorded. Five plants were randomly selected in each net plot area for recording yield attributing parameters. The crop in the net plot was harvested and threshed separately. The stover was also bundled separately for each plot and dried thoroughly in the sun before taking the final weight. Grain and straw were sun dried and weight was recorded as per treatment and converted to yield in kg per hectare.

Measurements and data gathering: All plant growth observations were recorded treatment wise in the net plot area at monthly interval, starting from 30 days after sowing to till harvest. Five plants were tagged at random in each plot and observations were recorded. The crop in the net plot was harvested and threshed separately .10 plants were randomly selected to each plot area for recording yield attributing parameters .At harvest, the following characters were measured included: Plant height (cm), cob diameter (cm), Cob length (cm), Number of rows cob per plant, Number of rows cob, Number grains per cob, 100-grain weight (g) and Grain yield (kg ha^{-1}).

Statistical analysis: The collected data was statistically analyzed separately according to the analysis of variance (ANOVA) by and Duncan's Multiple Range Test (DMRT) used to determine the level of significance at $p \leq 0.05$ with SPSS excels software.

RESULTS

Cob length and Diameter: The Analysis of variance showed that, the effect of *Azotobacter, PSB* and interaction between them on cob length and diameters were significant. The comparison of the mean values of the cob length and diameter for interaction between different biofertilizers showed that combine treatment of *Azotobacter* and *PSB* ($TA+TP_1$), ($TA+TP_2$), ($TA+TP_3$) had the highest length and diameter as compared to control in variety Eco 92 and African tall(Table 1 and 2).

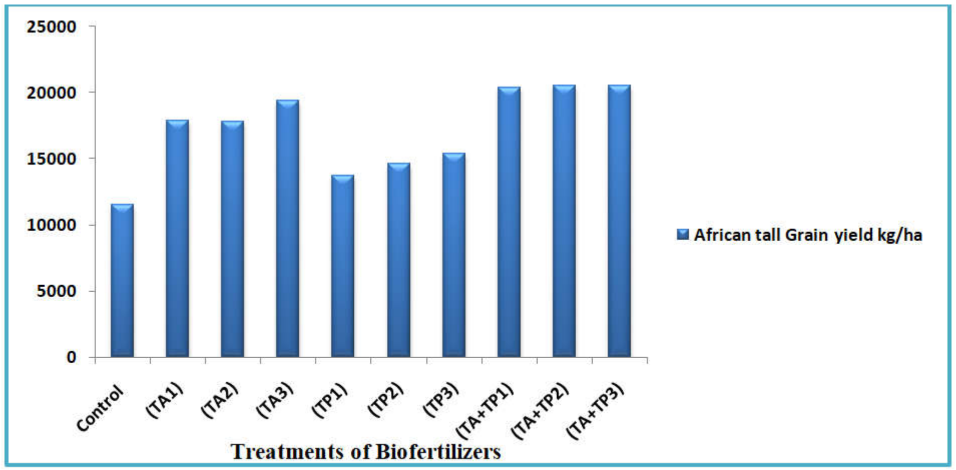
Number of row per cob: The effect of biofertilizer *Azotobacter* and *phosphate solubilizing bacteria* on number of row per cob were significant. The comparison of the mean values of African tall and in Eco 92 number of rows per cob for (TA_3), ($TA+TP_2$), ($TA+TP_3$) treatment showed that, the highest number of row per cob (16.3),(16.0) and control treatment had lowest number of row per cob (11.33),(16.33) and the differences were significant. The combined biofertilizer treatment had the highest number of row per cob as compared to control (Table 1 and 2).

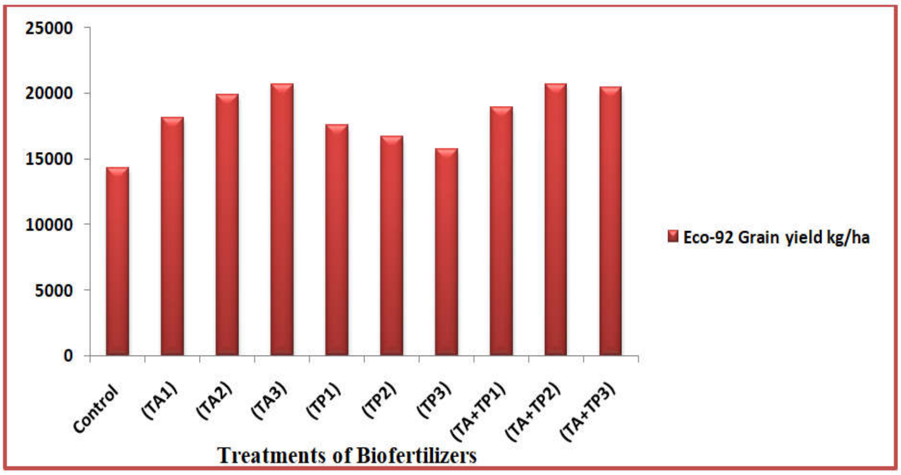
Table 1. Effect of Biofertilizers on yield and yield components of Maize (*Zea mays* L.) Variety African tall

Sr.no	Treatments	No. of cob/Plant	Diameter of cob	Length of cob	Horizontal cob lines /cob	Vertical cob lines /cob	No. of grain /cob	Cob weight	Weight of grains /ear	100 grain weight	Grain yield kg/ha
0	Control	2	3.50e	14.67e	32.00e	11.33e	320e	179.10e	107.69e	28.68e	11486e
1	(TA_1)	2	4.37b	16.00c	38.67c	15.33b	521 b	271.32b	167.59b	44.43b	17876b
2	(TA_2)	2	4.53b	16.27b	38.67c	15.33b	529b	270.18b	166.62b	45.02b	17773b
3	(TA_3)	2	4.57b	16.17b	39.33b	15.67b	541a	278.87b	182.27b	42.31c	19373a
4	(TP_1)	2	4.10d	16.00c	35.53d	13.33d	438c	223.24d	128.15d	39.03d	13669d
5	(TP_2)	2	4.17c	15.80d	34.67d	13.33e	382d	223.43d	137.30d	38.45d	14644c
6	(TP_3)	2	4.13c	16.00c	36.00d	14.00c	394d	233.87c	143.87c	44.83b	15345c
7	($TA+TP_1$)	2	4.97a	17.33a	39.67b	15.67b	550a	304.17a	190.82a	48.39a	20353a
8	($TA+TP_2$)	2	4.97a	17.33a	40.67a	16.00a	547a	301.05a	192.50a	48.05a	20527a
9	($TA+TP_3$)	2	4.93a	17.33a	40.33a	16.00a	557a	303.89a	192.30a	48.46a	20509a

Table 2. Effect of Biofertilizers on yield and yield components of Maize (Zea mays L.) Variety Eco-92

Sr.no	Treatments	No. of cob/Plant	Diameter of cob	Length of cob	Horizontal cob lines/cob	Vertical cob lines/cob	No.of grain /ear	Cob weight	Weight of grains /cob	100 grain weight	Grain yield kg/ha
0	Control	2	3.93e	15.13e	35.67e	13.33e	489e	218.49e	137.20e	19.09e	14279e
1	(TA_1)	2	4.37d	16.17b	39.00a	16.33b	615b	282.58b	169.44c	33.44c	18073c
2	(TA_2)	2	4.73c	16.17b	38.00b	16.00c	621b	279.85b	185.89b	33.94c	19828b
3	(TA_3)	2	4.77c	16.00c	39.33a	16.33b	623b	272.89c	193.86a	33.91c	20677a
4	(TP_1)	2	4.37d	16.00c	36.67c	14.67d	559d	245.18d	164.38c	30.26d	17524c
5	(TP_2)	2	4.37d	15.60d	36.00d	16.00c	536d	244.95d	156.46d	30.13d	16689c
6	(TP_3)	2	4.40d	16.03c	36.67c	16.00c	521d	245.32d	146.11e	30.48d	15691d
7	($TA+TP_1$)	2	4.83b	17.07a	40.67a	16.33a	623b	294.70a	177.29c	39.08b	18911d
8	($TA+TP_2$)	2	4.87b	17.00a	39.00a	16.33a	650a	307.04a	193.36a	39.30b	20624a
9	($TA+TP_3$)	2	5.10a	17.17a	39.67a	16.33a	668a	308.86a	191.40a	39.99a	20415a





Cob weight: Results showed that, the effect of *Azotobacter* and *Phosphate Solubilizing Bacteria* biofertilizers and interaction between them on cob weight was significant (Table 1 and 2). The comparison of the values of the cob weight for interaction between *Azotobacter* and *PSB* biofertilizers showed that, ($TA+TP_1$), ($TA+TP_2$), ($TA+TP_3$) treatment had the highest (308.8gm)cob weight and control had lowest cob weight(218.4gm)The differences were significant (Table 1 and 2).

Weight of 100 grains: The effect of *Azotobacter* and *Phosphate Solubilizing Bacteria* biofertilizers and interaction between them on cob weight were significant. The comparison of the mean values showed that, ($TA+TP_1$), ($TA+TP_2$), ($TA+TP_3$) treatments had the highest (African tall =48.46gm), (Eco 92 =39.99gm) 100 grain weight and control (African tall=28.68gm)(Eco 92 =19.09gm) had lowest 100 grain weight and differences were significant.

Grain yield: The effect of *Azotobacter, Phosphate Solubilizing Bacteria* biofertilizers and interaction between them on grain yield were significant. The comparison of the values of the grain yield for interaction between *Azotobacter* and *PSB* biofertilizers showed that, highest grain yield as compaired to control.

DISCUSSION

According to the data of table 1 and2, the effect of *Azotobacter* and *phosphate solubilsing bacteria (PSB)* biofertilizers were evaluated positively, there were an increase in plant height, ear weight, and number of grain per ear, grain yield and biomass yield. Statistical analysis was performed on the effect of nitrogen and phosphate biofertilizer treatments on plant growth, corn yield in variety African tall and Eco-92.The means were compared according to Duncan multiple range test (DMRT).Maize grain and biomass yield increasing was reported with the biofertilizer application which account important benefit to the maize producers and maize production. It may be concluded that photosynthetic capacity of plants treated with phosphors-solubilizing microorganism's increases due to increased supply of phosphors nutrition. Seed weight also increases due to better transfer of photosynthetic substances. Use of these biofertilizers as environment friendly helps to reduce the much expensive chemical fertilizers. Phosphorus and nitrogen biofertilizers could help to increase the availability of accumulated phosphate (by solubilization) efficiency of biological nitrogen fixation and increase the availability of Fe, Zn etc., through production of plant growth promoting substances. The research of various other studies has demonstrated that mixed treatments increase plant vegetative growth, resulting in increased yield in crops and legumes under farm conditions. The result showed that treatments of biofertilizers in the form of N-fixing *Azotobacter* and *phosphate solubilsing bacteria (PSB)* enhanced increase yield with positive effects on measured plant height ,number of cob, diameter of cob, cob weight, grain yield. Given the significant enhancement in growth and yield of maize taking place mainly N-fixing *Azotobacter* and *phosphate solubilsing bacteria (PSB)* under environmental condition, the mechanism for this beneficial effect could be due to more balanced nutrition and improved absorption of nitrogen and other nutrients by the corn. Interaction between N and P showed that the comparison of the values of the grain yield for interaction between *Azotobacter* and *PSB* biofertilizers showed that, highest grain yield as compaired to control and differences were significant. In the final results of this study revealed that, the application of nitrogen and *phosphate solubilsing bacteria* (*PSB*) biofertilizers increased yield and yield components of maize under environmental condition.

Conclusion

It is concluded that, the treatment of biofertilizer increase the yield and yield components more effectively than the control. The use of biofertilizer influenced the Maize variety Eco-92 and African tall positively. Biofertilizer as a source in agricultural production, decreases environmental pollution and leads to economic savings for farmers.

Acknowledgement

The authors are grateful The Director Research and Production Eco Agriseeds Pvt.Ltd. Shri Krishna nagar, Medchal, R.R.Dist.-Hyderabad-501 401 and The Mahatma Phule Krishi Vidyapeeth, (MPKV) Rahuri for providing seed and biofertilizer for this study. Thanks are also due to the principal D.K.A.S.C.College, Ichalkaranji for laboratory facilities

REFERENCES

Adebooye O.C., S.O.Ajadi and A.B.Fagbohun,2006. 'An accurate Mathematical Formula for Estimating Plant Population in a Four Dimensional Field of Sole Crop'. *Journal of Agronomy*5 (2):289-292.

Alofe, C.O., O.C.Adebooye and A.J.Isei, 1996. 'Effect of N and stand density on grain yield performance of maize in a southwest location' *Ife J.Agric*, 18:37-44.

Balasubramaniyan, P., S.P. Palaniappan, 2001. 'Nutrient management. In: Principles and practices of agronomy', *Agrobios*, India, 185-188.

Bashan,Y. and Levanony, H. 1990. 'Horizontal and vertical movement of Azospirillum brasiliense Cd in the soil and along the rhizosphere of wheat and weeds in controlled and field environments', *Journal of General Microbiology*. 138 : 3473 -3480.

Beyranvand H, Farnia A, Nakhjavan SH, Shaban M. 2013 'Response of yield and yield Components of maize (Zea mays L.) to different bio fertilizers'. *International journal of Advanced Biological and Biomedical Research.* 1 9; 1068-1077.

Chen, H., Gurmesa, G. A., Zhang, W., Zhu, X., Zheng, M.,Mao, Q., Zhang, T. and Mo, J. 2006. 'Nitrogen saturation in humid tropical forests after 6 years of nitrogen and phosphorus', *addition: Hypothesis testing, Funct. Ecol*., 30, 305–313.

FAO. 2002. 'Fertilizer and the future. IFA/FAO '*Agriculture Conference on Global food security and the role of Sustainability Fertilization*' . Rome, Italy. 16th-20th March, 2003, pp 1-2.

Geol. A.K., Laura R.D., Pathak D.V., Anuradhaand, G, Goel .A 1999. 'Use of biofertilizers: potential, constraints and future strategies review'. *International Journal of TropAgric*., 17: 1-18

Hay RKM, Gilbert R A 2001.' Variation in the harvest index of tropical maize: evaluation of recent evidence from Mexico to Malawi', *Annals of Applied Biology* 138: 103–109.

Hegde D.M., Dwivedi B.S. and Babu S.N.S. 1999 'Biofertilizers for cereal production in India', –Areview. Ind.

Hoflich et al., 1994; Hoflich and Khan, 1996. 'In final results of this study reviled that application nitrogen and phosphate biofertilizers increased yield and yield components of maize under Boroujerd environmental condition'.

Hoflich G, Wiehe, W, Kuhn G 1994. 'Plant growth stimulation with symbiotic and associative rhizosphere microorganisms', Experientia 50: 897–905

IITA (International Institute of tropical Agriculture). 2006.Maize overview. In: Research to

Khaliq A, Sanders FE 2000.' Effects of vesicular – arbuscular mycrrhizal inoculation on the yield and phosphorus uptake of field – grown barley', *Soil Biology and Biochemistry*,32: 1691–1696.

Kucey, R.M.N., H.H. Janzen and M.E. Leggett. 1989. 'Microbially mediated increases in plant-available phosphorus', *Ad. Agron*., 42: 199–228.

Nourish Africa. *www.intaresearch.org.*on(7/10/2006)

Shaban, M. 2013a. 'Application of seed equilibrium moisture curves in agro physics'. *International journal of Advanced Biological and Biomedical Research*. Volume 1, Issue 9: 885-898.

Shaban, M. 2013b. 'Biochemical aspects of protein changes in seed physiology and germination'. *International journal of Advanced Biological and Biomedical Research*. Volume 1, Issue 8: 885-898.

Shevananda. 2008. 'Influence of bio-fertilizers on the availability of nutrients (N, P and K) in soil in relation to growth and yield of Stevia rebaudiana grown in South India'. *International Journal of Applied Research in Natural Products*, Vol. 1(1), pp. 20-24.

Shivankar, S.K., Joshi, R.P. and Shivankar, R.S. 2000. 'Effect of biofertilizers and levels of nitrogen and phosphorous on yield and uptake by wheat under irrigated condition'. *J. Soils &Crops*, 10(2): 292-294.

Suhag M 2016. Potential of biofertilizers to replace chemical fertilizer Int. Adv. Res. J. Sci. Eng. Tech. 3(5):163-167

****