The Pharma Innovation Journal 2022; 11(4): 1421-1424

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(4): 1421-1424

www.thepharmajournal.com
Received: 07-01-2022
Accepted: 31-03-2022

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Efficacy of sources of nitrogen and bio-fertilizers on growth and yield of maize (*Zea mays* L.)

Valluri Surendra and Shikha Singh

Abstract
A field experiment was conducted during *Kharif* 2021 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 treatments which are T1: 100% N through Urea + Azotobacter, T2: 100% N through Urea + KSB, T3: 100% N through Urea + VAM, T4: 100% N through Vermicompost + Azotobacter, T5: 100% N through Vermicompost + KSB, T6: 100% N through Vermicompost + VAM, T7: 50% N through Urea + 50% N through Vermicompost + Azotobacter, T8: 50% N through Urea + 50% N through Vermicompost + KSB and T9: 50% N through Urea + 50% N through Vermicompost + VAM are used. The results showed that application of 50% N through Urea + 50% N through Vermicompost + VAM was recorded significantly Higher Plant height (179.69 cm), No of Leaves/Plant (12.7), Plant dry weight (92.83 g/plant), Crop growth rate (13.7 g/m^2/day), No. of Cobs/plant (3.0), Cob Length (20.18), No of rows/cob (15.2), No of grains/row (30.4), Seed Index (26.33 g), Grain yield (4.37 t/ha), Stover yield (14.5 t/ha) and Harvest index (21.88%) as compared to other treatments.

Keywords: Azotobacter, KSB, VAM, yield

Introduction
Maize (*Zea mays* L.) is one of the most important cereal crop after rice and wheat and occupies a prominent in global agriculture. It ranks third after rice and wheat in India. In India it is grown for grain and for human consumption, as component in poultry and cattle feed mixture and for other industrial purpose. Maize also called as corn, is one of the most crucial and strategic crops in the world. Its origin is in Mexico (Central America). It is called as queen of cereal due to it great importance in human, animal diet and high yielding ability. It efficiently utilizes solar energy and has immense potential for higher yield, so called as "Miracle Crop". Maize plays a vital role in ensuring food security as well as nutritional security through quality protein. The nutritional composition of maize (per 100 g) is as follows protein 4 g, 30 g carbohydrate, 3.5 g dietary fiber, 1.5 g fat, 3.6 g sugar, 4 mg calcium, 0.72 mg zinc etc. It has an important role in the industry as more than 35 products of daily use are derived from maize.
VAM (Vesicular arbuscular mycorrhizae) develop both Intra and extra material hyphae that extend into P available zone and far areas away from the roots and increase the absorptive surface area of the mycorrhizae root system VAM improve the P uptake in many crop plants like maize. Similarly Phosphate Solubilizing Bacteria (PSB) converts insoluble phosphates into soluble forms through acidification, chelating, exchange reactions and production of organic acids resulted in improved growth, yield and P uptake in several crops.
Vermicompost has been recognized as a low cost and environmentally sound process for treatment of many organic wastes. Vermicompost production, the complex organic residues are biodegraded by symbiotic association between earthworms and microbes. In the process of Vermicompost, it helps to increase the density of microbes and also provides the vital macro nutrients *viz*., N, P, K, Ca, Mg and micronutrients such as Fe, Mo, Zn, Cu etc. Apart from this, it also contains plant growth promoting substances like NAA, cytokinin's, gibberellin's etc. The chemical analysis of vermicompost produced at Dharwad revealed the availability of N, P and K content at 0.8, 1.1 and 0.5 per cent, respectively (Giraddi, 1993).

Materials and Methods
The present examination was carried out during *Kharif* 2021 at Crop Research Farm,

Department of Agronomy, SHUATS, Prayagraj, UP, which is located at 25.28ºN latitude, 81.54ºE longitude and 98 m altitude above the mean sea level. The experiment laid out in Randomized Block Design which consisting of nine treatments with T1: 100% N through Urea + Azotobacter, T2: 100% N through Urea + KSB, T3: 100% N through Urea + VAM, T4: 100% N through Vermicompost + Azotobacter, T5: 100% N through Vermicompost + KSB, T6: 100% N through Vermicompost + VAM, T7: 50% N through Urea + 50% N through Vermicompost + Azotobacter, T8: 50% N through Urea + 50% N through Vermicompost + KSB and T9: 50% N through Urea + 50% N through Vermicompost + VAM seed are used. The experimental site was uniform in topography and sandy loam in texture, nearly neutral in soil reaction (P^H 7.1), low in Organic carbon (0.38%), medium available N (225 kg ha^{-1}), higher available P (19.50 kg ha^{-1}) and medium available K (213.7 kg ha^{-1}). In the period from germination to harvest several plant growth parameters were recorded at frequent intervals along with it after harvest several yield parameters were recorded those parameters are growth parameters, plant height, no. of leaves/plant and plant dry weight are recorded. The yield parameters like No. of cobs/plant, length of cob, rows/cob, grains/row, seed index (g), grain yield, stover yield and harvest index were recorded and statistically analyzed using analysis of variance (ANOVA) as applicable to Randomized Block Design (Gomez K.A. and Gomez A.A. 1984).

Results and Discussion

Growth attributes

Plant height

At Harvest maximum plant height (179.69cm) was recorded with application of 50% N through Urea + 50% N through Vermicompost + VAM which was significantly superior over all the treatments except with 50% N through Urea + 50% N through Vermicompost + KSB (177.06cm), 100% N through Vermicompost + VAM (177.10cm).

Application of Vermicompost might have favoured better root proliferation, more solubility of phosphorous which consequently favoured higher biological nitrogen fixation and uptake of nutrients and availability of all plant nutrients during the crop growth period. This resulted in the higher plant height and the results are in close in close conformity with the findings of Togas *et al*. (2017) [8]. Increased plant height may be due to the application of recommended microbial consortium of VAM. Inoculation of maize with VAM inclined to stimulate the growth of treated plants as characterized by the increase of root and shoot lengths. Similar results were reported by Patidar and Mali (2004) [5].

Number of leaves/plant

At Harvest, maximum no. of leaves/plant (12.70) was recorded with application of 50% N through Urea + 50% N through Vermicompost + VAM which was significantly superior over all the treatments except 50% N through Urea + 50% N through Vermicompost + KSB (12.1) and100% N through Vermicompost + VAM (12.2)

Plant dry weight (g/plant)

At Harvest, maximum no. of leaves/plant (92.83g) was recorded with application of 50% N through Urea + 50% N through Vermicompost + VAM which was significantly superior over all the treatments except 100% N through Vermicompost + VAM (91.55g) and 50% N through Urea + 50% N through Vermicompost + KSB (89.72g).

The increase in the total dry matter production may be due to better source and sink capacity developed due to better dry matter production with the application of nitrogen and its accumulation in assimilatory surface area and increase in the photosynthetic efficiency and thus increased the production of photosynthates reflected in better growth and ultimately in higher dry accumulation. The results were found to be similar with Kumar *et al*. (2017) [4]. The highest of biomass increase was due to biofertilizers inoculation. *VAM* has performed a significant effect on maize dry matter yield. High dry matter in those treatments is due to long plant height, high stem girth, and high root weights. These findings are in harmony with those obtained by Marngar and Dawson (2017) [6].

Yield attrubutes and Yield

Number of Cobs/plant

The maximum no. of cobs/plant was recorded with application of 50% N through Urea + 50% N through Vermicompost + VAM (3.0), which was significantly superior over all the treatments. However, the treatment 100% N through Vermicompost + VAM (2.8) were found to be statistically at par with 50% N through Urea + 50% N through Vermicompost + VAM.

Length of cob (cm)

The maximum length of the cob was recorded with application of 50% N through Urea + 50% N through Vermicompost + VAM (20.18cm), which was significantly superior over all the treatments. However, the treatments 100% N through Vermicompost + KSB (20.06cm) and 50% N through Urea + 50% N through Vermicompost + KSB (19.10cm) Were found to be statistically at par with 50% N through Urea + 50% N through Vermicompost + VAM.

No. of rows/cob

The maximum no. of grains/cob was recorded with the application of 50% N through Urea + 50% N through Vermicompost + VAM (15.2), which was significantly superior over all the treatments except with the application of 100% N through Vermicompost + VAM (14.6). Nitrogen application might have influenced into increased number of cobs and extensive root system and the greater production of metabolites and their translocation to various sinks especially the productive structures (Cobs and grains) could have helped to increase into the number of cobs per plant besides increasing the overall growth. The results were found to be similar with Fazily and Hanshul (2019) [1].

No. of grains/row

The maximum no. of grains/row was recorded with application of 50% N through Urea + 50% N through Vermicompost + VAM (30.4), which was significantly superior over all the treatments except with the application of 100% N through Vermicompost + VAM (29.3), 100% N through Vermicompost + KSB (28.90) and 50% N through Urea + 50% N through Vermicompost + KSB(28.60).

Seed index

The maximum no. of rows/cobs was recorded with application of 50% N through Urea + 50% N through Vermicompost + VAM (26.33), which was significantly

superior over all the treatments except with the application of 100% N through Vermicompost + KSB (25.70), 50% N through Urea + 50% N through Vermicompost + KSB(25.67) and 50% through Urea +50% N through Vermicompost + Azotobacter (25.53).

Application of biofertilizers proved beneficial for development of corn attributing characters mainly due to availability of nutrients in proper amount during reproductive phase of the crop. The increase in yield attributes due to application of *VAM* was caused by higher chlorophyll contents, and seed treatment which 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 of crop, which led to increase in yield attributes of Maize. These results are in agreement with the findings of Mahapatra *et al.* (2018) [2].

Grain yield (t/ha): The maximum grain yield was recorded with application of 50% N through Urea + 50% N through Vermicompost + VAM (4.37 t/ha), which was significantly superior over all treatments except with the application of 50% N through Urea + 50% N through Vermicompost + KSB (4.03 t/ha), 100% N through Vermicompost + VAM (4.10 t/ha). The higher increase in the yield has been reported to be associated with the release of macro and micro nutrients during the course of microbial decomposition. Organic matter also functions as source of energy for soil micro flora which brings about the transformation of other nutrients held in soil or applied through other means, in a form that is readily utilized by growing plants which helped in increase of seed yield. The results were in accordance with Jagadeesha *et al.* (2010) [3].

Stover yield (t/ha)

The maximum stover yield was recorded with the application of 50% N through Urea + 50% N through Vermicompost + VAM (14.5 t/ha), which was significantly superior over all treatments except with the application of 100% N through Vermicompost + VAM (13.9 t/ha), 50% N through Urea + 50% N through Vermicompost + KSB (13.4 t/ha) and 50% N through Urea + 100% N through Vermicompost + Azotobacter (12.7 t/ha).

Improved yield and growth attributes might be interpreted as the manifestation of higher nutrient uptake by the plants. Increase in dry matter production per unit area is a first step in achieving higher yield and yield attributes resulted in obtaining higher cob yield. Dry matter production at different growth stages of any crop is an important pre requisite for higher yields as it signifies photosynthetic ability of the crop. Application of *VAM* has beneficial effect on physiological process, plant metabolism and plant growth, which leads to higher yield and the results were supported by the findings of Marngar and Dawson (2017) [6] and Rathod *et al.* (2018) [7].

Harvest index (%)

The maximum harvest index was recorded highest with the application of 50% N through Urea + 50% N through Vermicompost + VAM (21.88%) which was non-significant.

Table 1: Evaluation of sources of nitrogen and Bio-fertilizer on Growth attributes of Maize

Treatments	Plant height (cm)	Leaves/plant	Dry weight (g/plant)
100% N through Urea + Azotobacter	160.90	10.2	82.24
100% N through Urea + KSB	164.48	11.1	83.79
100% N through Urea + VAM	170.69	11.5	86.87
100% N through Vermicompost + Azotobacter	168.15	10.7	85.63
100% N through Vermicompost + KSB	173.30	11.1	88.59
100% N through Vermicompost + VAM	177.10	12.2	91.55
50% N through Urea + 50% N through Vermicompost + Azotobacter	169.65	11.3	87.59
50% N through Urea + 50% N through Vermicompost + KSB	177.06	12.1	89.72
50% N through Urea + 50% N through Vermicompost + VAM	179.69	12.7	92.83
F- test	S	S	S
S. EM (±)	1.07	0.20	0.45
C. D. (P = 0.05)	3.22	0.61	1.35

Table 2: Evaluation of sources of nitrogen and Bio-fertilizer on Yield and Yield attributes of Maize

Treatments	Cobs/plant	Cob length (cm)	Grains row/cob	Grains /row	Seed index	Grain yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
100% N through Urea + Azotobacter	1.3	15.17	10.8	20.5	24	2.93	11.3	20.63
100% N through Urea + KSB	1.4	14.97	11.7	25.3	24.3	3.40	12.5	21.27
100% N through Urea + VAM	2.0	16.64	13.3	26.7	24.3	3.43	13.0	20.85
100% N through Vermicompost + Azotobacter	1.7	15.70	12.4	25.9	25.3	3.47	12.8	21.07
100% N through Vermicompost + KSB	2.3	17.23	13.8	28.9	25.7	3.63	11.7	24.26
100% N through Vermicompost + VAM	2.8	20.06	14.6	29.3	26.0	4.10	13.9	22.26
50% N through Urea + 50% N through Vermicompost	2.0	16.47	12.8	26.3	25.5	3.63	12.7	22.75
+ Azotobacter 50% N through Urea + 50% N through Vermicompost	25	19.10	14.3	28.6	25.6	4.03	13.4	23.58
+ KSB 50% N through Urea + 50% N through Vermicompost	3.0	20.18	15.2	30.4	26.3	4.37	14.5	21.88
F test	S	S	S	S	S	S	S	NS
S. EM (±)	0.13	0.37	0.38	0.66	0.49	0.22	0.48	1.10
CD (P = 0.05)	0.40	1.12	1.13	1.99	1.48	0.66	1.44	3.31

Conclusion

It is concluded that application of treatment 50% N through Urea + 50% N through Vermicompost + VAM was recorded significantly higher Grain yield (4.37 t/ha) as compared to other treatments. Since, the findings based on the research done in one season.

Acknowledgement

I express thankfulness to my advisor Dr. Shikha Singh and all the faculty members of Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj -211007, Uttar Pradesh. For providing us essential facilities to undertake the studies.

References

1. Fazily T, Hanshul CS. Effect of Organic Manures on Yield and Economics of Late Sown Wheat (*Triticum aestivum*). International Journal of Research & Review. 2019;6(1):168-171.
2. Mahapatra A, Barik AK, Mishra GC. Integrated nutrient management on baby corn (*Zea mays* L.). International Journal of Bio-resource and Stress Management. 2018;9(1):44-48.
3. Jagadeesha N, Reddy VC, Krishnamurthy N, Sheshadri T. Effect of organic manures on productivity of finger millet and redgram inter cropping system under protective irrigation. International Journal of Agricultural Sciences. 2010;6(2):453-455.
4. Kumar V, Raghuvanshi N, Singh RA. Effect of different combination of FYM and Urea on growth and yield of wheat (*Triticum aestivum* L.). Bulletin of Environment, Pharmacology and Life Sciences. 2017;6(2):395-398.
5. Patidar M, Mali AL. Effect of Farm yard manure, fertility levels and biofertilizers on growth, yield and quality of sorghum. Indian Journal of Agronomy. 2004;49(2):117-120.
6. Marngar E, Dawson J. Effect of biofertilizers, levels of nitrogen and zinc on growth and yield of hybrid maize (*Zea mays* L.). International Journal of Current Microbiology and Applied Sciences. 2017;6(9):3614-3622.
7. Rathod M, Bavalgave VG, Bhumika Tandel, Gudadhe NN. Effect of spacing and INM practices on growth, yield and economics of *rabi* sweet corn (*Zea mays* L. var. *saccharata* Sturt) under south Gujarat condition. International Journal of Chemical Studies. 2018;6(5):247-250.
8. Togas R, Yadav LR, Choudhary SL, Shisuvinahalli GV. Effect of Integrated Use of Fertilizer and Manures on Growth, Yield and Quality of Pearl millet. Int. J Curr. Microbiol. App. Sci. 2017;6(8):2510-2516.