Int.J.Curr.Microbiol.App.Sci (2020) *9*(7): 2548-2552

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 9 Number 7 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.907.299

Post-harvest Soil Available Nutrient Status and Microbial Load as Influenced by Graded Levels of Nitrogen and Biofertilizers

Felix Mwiza Mayuni*, G. Karuna Sagar, D. Subramanyam and G. Mohan Naidu

Department of Agronomy, S. V. Agricultural College, Tirupati, Andhra Pradesh 517 502, India

**Corresponding author*

Keywords

Post-harvest Soil, Nitrogen, Biofertilizers

Article Info

Accepted:
20 June 2020
Available Online:
10 July 2020

A B S T R A C T

A field experiment was conducted in sandy clay loam soil of S.V. Agricultural College Farm, Tirupati with three levels of nitrogen *viz*., 75, 100, 125 % RDN and five biofertilizers *viz*., *Azospirillum*, phosphorus solubilizing bacteria (PSB), potassium solubilizing bacteria (KSB), zinc solubilizing bacteria (ZnS) and combined application of *Azospirillum* + PSB + KSB + ZnS each applied @ 5 kg ha^{-1} in randomized block design with factorial conceptin *kharif* maize. The experimental results revealed that significantly higher grain yield of maize and post-harvest nutrient status of soil as well as soil microbial load of bacteria, fungi and actinomycetes were recorded with 125 % RDN followed by 100 % RDN. All the above parameters at their highest with the combined application of azospirillum + PSB + KSB + ZnS each applied 5 kg ha^{-1}.

Introduction

Maize (*Zea mays* L.) is a miracle and industrial crop. It is also called as "queen of cereals" for its relative productive potential among other cereal crops. It is a C_4 plant that effectively utilize the inputs and respond well to growth resources. It is an exhaustive and nitropositive crop which needs higher quantity of nitrogen for its maximum yield potential. Nitrogen have its dominant role for growth and development as well as yield of maize. The escalating cost of chemical fertilizer has led to considerably lower net returns and continuous application of fertilizers alone in agricultural system deteriorates the soil health and negatively impacts crop productivity (Kannan *et al.*, 2013). Biofertilizers can either fix atmospheric nitrogen for plant or can mobilize unavailable phosphorus, potassium and zinc to the available pool. Low cost and ecofriendly biofertilizers have tremendous potential for supplying nutrients. *Azospirillum* is known to fix atmospheric nitrogen and increase grain yield in maize by 10-15 per cent (Patil *et al.*, 2001). Keeping in view of the above, the field experiment was conducted to identify the optimum nitrogen level along with suitable biofertilizer to *kharif* maize in sandy clay loam soil.

Materials and Methods

A field experiment was conducted in maize during *kharif*, 2019 at wetland farm of S.V. Agricultural College, Tirupati in a randomized block design with factorial concept and replicated thrice. The soil of the experimental field was sandy clay loam with available nitrogen of 251 kg ha^{-1}, available phosphorus (180 kg ha^{-1}), available potassium (234 kg ha^{-1}) and available zinc (3.21 ppm). The initial soil microbial load *viz*., bacteria (21 x 10^{6} CFU g^{-1} soil), fungi (3 x 10^{3} CFU g^{-1} soil) and actinomycetes (7 x 10^{5} CFU g^{-1} soil). The treatment consisting three levels of nitrogen *viz*., 75, 100 and 125 % recommended dose of nitrogen (RDN) and five biofertilizers *viz*., *Azospirillum*, phosphorus solubilizing bacteria (PSB), potassium solubilizing bacteria (KSB) and zinc solubilizing bacteria (ZnS) and combined application of *Azospirillum* + PSB + KSB + ZnS each 5 kg ha^{-1}. Recommended dose of nitrogen was fixed based on soil test value. All biofertilizers were applied at 5 kg ha^{-1} to soil. Rest of the package of practices were adopted as per the package of practices of Acharya N.G. Ranga Agricultural University. Post-harvest soil available nitrogen (Subbiah and Asija 1956), available phosphorus (Olsen *et al.*, 1956), available potassium (Jackson, 1973) and zinc (Tandon, 1993) were estimated. Soil microbial load of soil *viz*., bacteria, fungi and actinomycetes were estimated by serial dilution plate count technique (Pramer and Schemidt, 1965).

Results and Discussion

Grain yield of maize was significantly influenced with application of different nitrogen levels and biofertilizers as well as their interaction (Table 1). Application of 125 % RDN resulted in higher grain yield, which was at par with 100 % RDN. This might be due to better growth and yield attributes with higher dose of nitrogen. The increase in grain yield due to application of 125 % RDN was 16.44 per cent compared to 75 % RDN. Similar results were also reported by Athokpam *et al.*, (2017) and Mohammadi *et al.*, (2017). The lowest grain yield was obtained with application of 75 % RDN due to sub-optimal dose of nitrogen. The highest grain yield was obtained with combined application of *Azospirillum* + PSB + KSB + ZnS each applied 5 kg ha^{-1}, which was at par with application of *Azospirillum* and PSB alone each 5 kg ha^{-1}.

Table.1 Interaction effect of nitrogen levels and biofertilizers on grain yield of maize during *kharif*, 2019

Treatment	Recommended dose of nitrogen (%)			
Biofertilizers	75	100	125	**Mean**
Azospirillum	5376	6120	5364	5620
Phosphorus solubilizing bacteria (PSB)	4764	5568	5460	5264
Potassium solubilizing bacteria (KSB)	3912	4428	5172	4504
Zinc solubilizing bacteria (ZnS)	3228	4836	5316	4460
***Azospirillum* + PSB + KSB + ZnS**	5412	5640	5844	5632
Mean	4538	5318	5431	

SEm ± CD (P= 0.05)
Nitrogen levels (N) 133 386
Biofertilizers (B) 171 499
Interaction (N x B) 297 864

Table.2 Post-harvest available nutrient status and microbial load of soil as influenced by nitrogen levels and biofertilizers in maize during kharif, 2019

Treatment	**Post-harvest nutrient status (kg ha^{-1})**				**Soil microbial load**		
	Available nitrogen	**Available phosphorus**	**Available potassium**	**Available zinc**	**Bacteria (10^6 CFU g^{-1})**	**Fungi (10^3 CFU g^{-1})**	**Actinomycetes (10^5 CFU g^{-1})**
Factor I: Nitrogen levels							
N_1: 75 % RDN	152.7	50.6	101.2	0.42	132.5	10.6	26.5
N_2: 100 % RDN	193.2	64.1	128.1	0.61	163.9	13.0	32.3
N_3: 125 % RDN	219.3	69.1	137.5	0.80	230.5	15.4	38.5
SEm ±	1.03	0.52	0.99	0.01	4.77	0.3	0.8
CD (P= 0.05)	2.98	1.50	2.89	0.03	13.89	0.9	2.4
Factor II: Biofertilizers							
B_1: *Azospirillum*	186.5	61.7	123.3	0.60	169.9	13.4	33.6
B_2: Phosphorus solubilizing bacteria (PSB)	182.9	60.7	121.3	0.55	161.9	12.8	31.7
B_3: Potassium solubilizing bacteria(KSB)	174.3	57.8	115.6	0.52	157.0	11.9	29.8
B_4: Zinc solubilizing bacteria (ZnS)	165.7	53.6	107.1	0.60	139.7	10.9	27.2
B_5: *Azospirillum* + PSB + KSB + ZnS	232.6	72.6	144.0	0.77	249.9	16.0	40.0
SEm ±	1.32	0.67	1.28	0.01	6.16	0.4	1.1
CD (P= 0.05)	3.85	1.94	3.73	0.04	17.93	1.2	3.1
Interaction (N x B)	NS	NS	NS	NS	NS	NS	NS

These results are in line with the findings of Lakum *et al.,* (2018). Application of ZnS 5 kg ha^{-1} resulted in lower grain yield. This is possibly due to non-response of zinc solubilizing bacteria. Application of 100 % RDN along with *Azospirillum* 5 kg ha^{-1} produced significantly higher grain yield, which was at par with application of 125 % RDN or 100 % RDN with combined application of *Azospirillum* + PSB + KSB + ZnS each 5 kg ha^{-1}. It clearly indicate that performance of *Azospirillum* 5 kg ha^{-1} found to be more responsive to promote growth and development of maize because of the enhanced mineralization and biological nitrogen fixation.

Post-harvest available nutrient status and soil microbial load was significantly influenced by nitrogen levels and biofertilizers, but their interaction was non-significant (Table 2). The highest values of post-harvest available nutrient status and microbial population *viz.*, bacteria, fungi and actinomycetes were noticed with application of 125 % RDN which might be due to sufficient substrate available for growth and multiplication of microorganisms, which inturn increased the mineralization and availability of nutrients in the soil.

These results are corroborative with the findings of Abdullahi *et al.,* (2014) and Navsare (2107). Combined application of *Azospirillum* + PSB + KSB + ZnS each applied 5 kg ha^{-1} resulted in higher soil available nutrient status due to enhanced mineralization and solubility of insoluble fixed nutrients. The response of *Azospirillum* 5 kg ha^{-1}found to be more responsive than others while zinc solubilizing bacteria was found to be poor. The response of microorganisms are highly location specific. These results are in conformity with the earlier findings of Garcia *et al.,* (2017) and Khambalkar *et al.,* (2017).

References

Abdullahi, R., Shariff, H.H and Buba, A. 2014. Effect of biofertilizer and organic manure on growth and nutrient content of pearl millet. *Journal of Agricultural and Biological Science*. 9(10): 351-355.

Athokpam, H., Telem, R.S and Wani, S.H. 2017. Integrated nutrient management for sustainable maize (*Zea mays* L.) production in acidic soil of Senapati District, Manipur, India. *International Journal of Current Microbiology and Applied Sciences*. 6(7): 690-695.

Garcia, M.M., Pereira, L.C., Braccini, A.L., Angelotti, P., Suzukawa, A.K., Marteli, D.C.V., Felber, P.H., Bianchessi, P.A and Dametto, I.B. 2017. Effect of *Azospirillum brasilense* on growth and yield components of maize grown at nitrogen limiting conditions. *Revista de Ciências Agrárias*. 40(2): 353-362.

Jackson, M.C. 1973. *Soil Chemical Analysis*. Prentice Hall of India. Private limited, New Delhi, 498.

Kannan, L.R., Dhivya, M., Abinaya, D., Krishna, R.L and Krishnakumar, S. 2013. Effect of integrated nutrient management on soil fertility and productivity in maize. *Bulletin of Environment, Pharmacology and Life Sciences*. 2(8): 61-67.

Khambalkar, P. A., Narendra Singh, Verma, S.K and Shashi S.Y. 2017. Influence of integrated nutrient management on soil fertility and properties of sandy clay loam and relationship with productivity of pearl millet (*Pennisetum glaucum*) - mustard (*Brassica juncea*) cropping sequence. *International Journal of Chemical Studies*. 5(5): 1237-1243.

Lakum, Y.C., Patel, S.H and Mehta, P.V. 2018. Reducing fertilizer requirement with the use of biofertilizers in summer pearl millet. *Asian Journal of Soil Science*. 6(1): 50-66.

Mohammadi, N.K., Pankhaniya, R.M., Joshi, M.P and Patel, K.M. 2017. Influence of inorganic fertilizer, vermicompost and biofertilizer on yield and economic of sweet corn and nutrient status in soil. *International Journal of Applied Research*. 3(5): 183-186.

Navsare, R.I. 2017. Studies on effect of potassium and zinc solubilizing microorganism on mungbean. *M.Sc. (Ag.)Thesis*. Marathwada Agricultural University, Badnapur, Maharashtra.

Olsen, S.R., Cole, C.V., Watanabe, F.S and Dean, L.A. 1954. Estimation of available phosphorus in soil by extraction with sodium bicarbonate. *United States Department of Agriculture*. Circular number: 939.

Patil, R.K., Goyal, S.N., Vora, M.S and Vaishnav, P.R. 2001. Response of *kharif* maize to inoculation with *Azotobacter* and *Azospirillum* at varying levels of nitrogen. *G.A.U. Research Journal*. 27(1&2): 13-17.

Pramer, D and Schmidt, E.L. 1965. *Experimental Soil Microbiology*. Burgess Publishing Co., Minneapolis.

Subbiah, B.V and Asija, G.L. 1956. Rapid procedure for estimation of available nitrogen in soils. *Current Science*. 25: 259-260.

Tandon, H.L.S. 1993. *Methods of Analysis of Soils, Plant, water and Fertilizers*. Fertilizer Development and Consultation Organization. New Delhi. 140.

How to cite this article:

Felix Mwiza Mayuni, G. Karuna Sagar, D. Subramanyam and Mohan Naidu, G. 2020. Post-harvest Soil Available Nutrient Status and Microbial Load as Influenced by Graded Levels of Nitrogen and Biofertilizers. *Int.J.Curr.Microbiol.App.Sci.* 9(07): 2548-2552.
doi: https://doi.org/10.20546/ijcmas.2020.907.299