Eco. Env. & Cons. 29 (3) : 2023; pp. (1266-1268)
Copyright@ EM International
ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2023.v29i03.040

Infection potential of AM based bio-fertilizers using *Zea mays*

Nalini Singh[1]*, Mubasshra Mirza[2], Sunita Rajbhar[2], Jyoti Vishwakarma[1] and Sunita Chahar[3]

Department of Botany, N.E.S Ratnam College of Arts, Science and Commerce, Bhandup (w), Mumbai 400 078, India

(Received 23 January, 2023; Accepted 23 March, 2023)

ABSTRACT

AMF (*Arbuscular mycorrhizal* Fungi) shows symbiotic association with plants root which helps the plants for their proper growth and development by providing all the nutrients to them. AMF is also used as bio-fertilizer with suitable carrier material. In the present study, pot experiment was conducted to evaluate the infection potential of commercially available, three different carrier-based AM fertilizers using *Zea mays.* After 30 days, infection was checked by staining the roots with trypan blue (Philips and Hayman method, 1970) and spore density checked by wet sieving method (Gerdeman and Nicolson method (1963). Out of three commercial samples, commercial sample 2 showed maximum spore count (8.67±1.53/ 10 g of sample) as well as infection potential (23.67±2.52%) on *Zea mays* plant compared to other two samples of commercial bio-fertilizers. pH and NPK content of commercial AMF bio-fertilizers were also checked. The pH of the all the three samples ranged between 6.2 to 7.0. NPK content of commercial bio-fertilizer1, 2 and 3 were found to be (N-0.083%, P- 0%, K-6.3%), (N-0.12%, P- 0%, K-3.2%) and (N-0.23%, P- 0%, K-8.4%) respectively.

Key words: *Spore Density, Infection Potential, AM Spores, Commercial Bio fertilizer.*

Introduction

India is an agriculture-based country, where more than 50% of Indian population is dependent on agriculture and agriculture is the main source of income (Madhusudhan, 2015). For improving the agricultural production, chemical fertilizers are used from long ago which shows the adverse effects on other living organisms like humans, animals and plants and have also decreased the soil fertility (losses of nutrients) (Patel *et al*., 2014). Bio-fertilizers are the substances that contain living microorganisms. It can be algae fungi or bacteria or a consortia, etc. Bio-fertilizers can retain the fertility of the soil by adding the nutrients like nitrogen, phosphorus and potassium into the soil, bio-fertilizers can also help to increase the growth and productivity of the crop plants and also retain the nutrients in the fruits (Sneha *et al.,* 2018). AMF (Arbuscular Mycorrhizal Fungi) is one of the most beneficial fungi which shows the association with the plant root and provide all the essential nutrients to the plant specially the phosphorus. Therefore the Arbuscular Mycorrhizal Fungi is used as the bio-fertilizer to improve the growth and productivity of the plant. AMF can infect the plant in 4 different stages, that is hyphae, arbuscules, vesicles and by spores and enhance the formation of roots so that plant can absorb the nutrients easily (Sadhana, 2014).

Materials and Methods

Spore extraction and density: The spores were ex-

([1]Ph.D Students, [2]UG Students, [3]Head)

tracted by Gerdeman and Nicolson method (1963). 10g of commercial bio-fertilizer sample were taken and mixed properly with 100 ml of water. The mixture was passed through different sieves sizes (µm) under continuous running water and the residue were collected along with some amount of water in a beaker and filtered through Whatman filter paper and the residue was observed under stereo zoom microscope, counting of spore were done by Gaur and Adholeya (1994) method.

Experimental set-up: Maize seeds were sowed in pot containing 3kg of autoclaved soil. After the germination of seeds, 10g of commercial bio-fertilizers were added to their respective pots. Each sample had triplicate pot arrangement. After 30 days, *Zea mays* plant was uprooted and infection was checked. Root colonization of AMF was done by Philips and Hayman method, 1970.

Commercial sample analysis: Total nitrogen, Phosphorous and Potassium of commercial samples 1, 2 & 3 were determined by modified Kjeldahl method (Jackson, 1973), Ammonium molybdate spectrophotometric method (Bray's method, 1945) and Flame photometer respectively. pH of the commercial biofertilizer sample were checked by using pH meter.

Results and Disccusion

In present study, spore density/10 gm of three commercial biofertilizers (i.e. C1, C2 and C3) was analyzed as shown in Table 1. It was found that, C2 showed maximum spore density, i.e. 8.67±1.53/10g which was highest as compared to C1 and C3 i.e. 2.67±0.58/10g and 1.67±1.15/10g, respectively. To assess, the viability of AMF spores present in the biofertilizer infection potential was conducted on *Zea mays.* According to experiment, infection potential of C2 was 80%, whereas in other two samples no infection was found (Table 1).This shows that, AMF spores present in C1 and C3 were not viable. According to Singh and Chahar (2021), the viability of Arbuscular mycorrhizal fungi spore can be affected when mixed with different the carriers. In our study we found that vermiculite (C2) as a carrier was suitable for the AMF inoculum as compared to other two carriers, i.e. talc and charcoal in C1 and C3 respectively which was also noted by Kumari and Parbina (2017). The pH of the C1, C2 and C3 were 6.2, 6.8 and 7.0, respectively. It was also found that there was no phosphorous present in any of the samples. Amount of Nitrogen (N) and potassium (K) was highest in C3 (N-0.23%, K-8.4%) as compared to C1 (N- 0.083%, K- 6.3%) and C 2 (N-0.12%, K-3.2%).

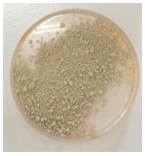
Acknowledgements

The authors thank N.E.S Ratnam college of Arts, Science and Commerce for the laboratory facilities.

Conflict of interest

The corresponding author on behalf of authors declares no potential conflict of interest.

Table 1. Spore density and Infection potential of commercial biofertilizers.

Sr. No.	Commercial AM Bio-fertilizer (carrier)	Carrier	Spore Density/10g of commercial AMF Bio-fertilizer	Infection potential % H	A	%
1	C1 (Commercial biofertilizer-1) (Talc)		2.67±0.58	-	-	0
2	C2 (Commercial biofertilizer-2) (Vermiculite)		8.67±1.53	++	++	80%
3	C3 (Commercial biofertilizer-3) (Charcoal)		1.67±1.15	-	-	0

Mean ± Std, ++ (shows infection), - (without any infection)

References

Bray, R.H. and Kurtz, L.T. 1945. Determination of total, organic, and available forms of phosphorus in soils. *Soil Science*. 59: 39-45.

Gaur, A. and Adholeya, A. 1994. Estimation of VAM Fungal spores in soil, a modified method. *Mycorrhiza News*. 6: 10-11.

Gerdemann, J.W. and Nicolson, T.H. 1963. Spores of mycorrhizal endogone species extracted from soil by wet-sieving and decanting. *Trans Br Mycol Soc*. 46: 235-244.

Jackson, M.L. 1973. *Soil Chemical Analysis*. Prentice Hall of Indian Pvt. Ltd., New Delhi.

Kumari, S. M. and Prabina, B. J. 2017. Storage life of Arbuscular mycorrhizal fungal (AMF) inoculum in Vermiculite based culture. International *Journal of Environment, Agriculture and Biotechnology*. 2(3): 1281–1287.

Madhusudhan, L. 2015. Agriculture Role on Indian Economy. *Business and Economics Journal*. 6: 176.

Patel, N. 2014. Bio fertilizer: A promising tool for sustainable farming. *Int. J. Innov. Res. Sci. Eng. Techno*. 3 (9): 15838-15842.

Phillips, J.M. and Hayman, D.S. 1970. Improved Procedures for Clearing Roots and Staining Parasitic Vesicular Arbuscular Mycorrhizal Fungi for Rapid Assessment of Infection. *Transactions of the British Mycological Society*. 55: 158-161.

Read, D.J., Koucheki, H.K. and Hodgson, J. 1976. Vesicular arbuscular mycorrhiza in natural vegetation systems. *New Phytol*. 77: 641-653

Sadhana, B. 2014. Arbuscular Mycorrhizal Fungi (AMF) as Biofertilizer- a Review. *International Journal of Current Microbiology and Applied Sciences*. 3 (4): 384-400.

Singh, N. and Chahar, S. 2021. Influence of Chitosan Solution on the viability of Arbuscular Mycorrhizal Spores. *Indian Journal of Applied Research*. 11(07): 7–9.

Sneha, S., Anitha, B., Sahair, R.A., Raghu, N., Gopenath, T.S., Chandrashekrappa, G.K. and Basalingappa, K.M. 2018. Biofertilizer for crop production and soil fertility. *Acad. J. Agric. Res*. 6 (8): 299-306.