AGRI MAGAZINE
(International E-Magazine for Agricultural Articles)
Volume: 03, Issue: 03 (March, 2026)
Available online at http://www.agrimagazine.in
©Agri Magazine, ISSN: 3048-8656

Biofertilizer: A Summary

*Prakarsh Singh[1], Preeti Varma[2], Kaushik Bajpai[1] and Niranjan[1]
[1]Department of Agronomy, School of Advanced Agriculture Sciences & Technology, C.S.J.M. University, Kanpur, Uttar Pradesh-208024, India
[2]Department of Genetics & Plant Breeding, Post Graduate College, Ghazipur, Uttar Pradesh-233001, India
*Corresponding Author's email: prakarshsinghrajput@gmail.com

The growing human population is currently posing a significant challenge to the global agriculture industry. According to estimates, there will be 9.5 million people on the planet. Billion by 2050, necessitating a significant quantity of food supplies. The production rate of a number of crops has drastically decreased due to changes in the global climate and a rise in various abiotic and biotic stressors. Additionally, the usage of artificial fertilizers is gradually deteriorating the soil's natural health, fertility, and several physico-chemical parameters. Chemical fertilizers have a detrimental effect on the environment and cause a variety of health issues for people. Therefore, it is critical to create sustainable and environmentally friendly technologies that can reduce the use of chemicals fertilizers.

Need of Biofertilizer

Biofertilizers are necessary since the careless application of synthetic fertilizers has contaminated soil, contaminated water basins, killed microorganisms, and beneficial insects, lowering soil fertility and increasing the crop's susceptibility to illnesses. There is a lot more demand than there is supply. Feedstock and fossil fuel depletion (energy crisis) and rising fertilizer prices. The growing disparity between nitrogen loss and supply is the cause of declining soil fertility. In addition to the aforementioned facts, using biofertilizers over chemical fertilizers over the long term is more cost-effective, environmentally friendly, productive, and accessible to small and marginal farmers (Venkataraman & Shanmugasundaram, 1992).

Biofertilizers for the particular crops

Biofertilizers	Functions	Crops
Rhizobium (symbiotic)	200–300 kg N/ha/year is fixed. Yields an increase of 10–30%. Preserve the fertility of the land.	Gram, Pea, Pulse, Wheat, Maize, and Jwar
Azotobacter	Provides 20–40 kg N/ha annually. Encourage the use of growth factors including vitamins, IAA, gibberellic acids. Yield increase of 10–15%.	Papaya, mustard, banana, and sunflower
Azospirillum	Boost the absorption of water and minerals. Plant hormone production. Boost the growth of roots Boost the productivity of crops.	Rice, Sugarcane,Millet
Azola	Used as a Green Manuare	Rice
Pseudomonas	Manufacturing of plant hormones and siderophores. Fixes phosphate and boosts output	Potato, Radish

Using Fungi as Biofertilizers

It has been established that root-associated fungi are widely used as biofertilizers because they release soil nutrients for plant uptake and utilization. The arbuscular mycorrhizal fungi (AMF) are the most prevalent and extensively researched root-associated fungi. Over 80% of land plant species have symbiotic relationships with these fungi, which are still connected to the root. These aid in the plants' uptake of water and minerals such as P, N, S, Cu, and Zn. AMF are excellent for producing fewer transportable nutrients like phosphate and nitrogen in the form of ammonium because of their radical mycelium, which is known to enter soil pores and reach deep into the soil.

Biofertilizers and vermicompost

Vermicompost, which is well-known for boosting plant output and aiding in development and growth of several plant species. These earthworm-produced composts are full of nutrients that plants need to grow. Tiger worms (Eisenia fetida) are the most common worm species used for vermicomposting, while other species such as red wigglers, earthworms, or white worms are also utilized Vermicomposting is the primary usage for Eisenia fetida. Worms are raised on a variety of waste materials, and the compost they produce is utilized to enhance the growth and development of plants. When these worms are added to the soil, it has been discovered that they are very helpful in breaking down the complex organic substances into simpler forms. This makes the nutrients easier for the growing plants to absorb and utilize.

Nano Biofertilizer

These days, biofertilizer formulations based on nanoparticles have been created. Typical characteristics of they are effective plant developers and growth promoters thanks to nanoparticles. Nanoscale polymers are used to coat biofertilizer, which consists of nutrients and microbes that encourage plant development. The formulation is known as a "**Nano-biofertilizer,**" and the process is called nanoencapsulation. Nanoparticles can be made from lipids, polymers, dendrimers, emulsions, ceramics, silicates, magnetic materials, semiconductor quantum dots, and certain metal oxides. The slow and steady release of nutrients to plants is facilitated by the nanomaterials (chitosan, zeolite, and polymers) utilized for coating in the creation of nano-biofertilizers. Therefore, nano biofertilizers are the biofertilizer of the future and are regarded as new environmentally beneficial methods for sustainable farming practices.

Using Trichoderma as a Biofertilizer

The fungus genus Trichoderma is employed in agriculture and serves a variety of purposes, such as promoting the plant's development and offers defense against infections as well as resilience to biotic and abiotic stress. It is a free-living fungus that interacts with plant surfaces, roots, and soil. By establishing a colony in the root system, this endophyte symbiotic organism builds a direct relationship with the plant. Numerous Trichoderma species are employed in various agricultural fields and are highly valuable economically. It is one of the most used microbial inoculants to boost plant development and protect plants against disease.

Conclusion

Biofertilizers play an important role in making agriculture more sustainable and environmentally safe. The continuous use of chemical fertilizers has reduced soil fertility, harmed beneficial microorganisms, and caused environmental pollution. In contrast, biofertilizers improve soil health naturally by enhancing nutrient availability and supporting plant growth. Microbial inoculants such as Rhizobium, Azotobacter, Azospirillum, mycorrhizal fungi, and Trichoderma help in nitrogen fixation, nutrient solubilization, and protection against plant diseases. Vermicompost and nano-biofertilizers further strengthen sustainable nutrient management practices. Adopting biofertilizers can reduce production costs, improve crop yield, and maintain ecological balance. Therefore, their integration into modern farming systems is essential for long-term soil fertility and food security.

References

1. Arora S, Dan S. Biofertilizers for sustainable agriculture. Kisan World, 2003; 31: 35-37.
2. Bandara M, Sutharsan S, Srikrishnah S. Effect of Inorganic Bio Fertilizer on Growth and Yield Of Allium cepa L. Published online, 2019.
3. Green RE, Cornell SJ, Scharlemann JPW, Balmford A. Farming and the fate of wild nature. Science, 2005; 307: 550-555.
4. Glaser B, Lehr vi, Biochar effects on phosphorus availability in agriculture soils: A meta-analysis. Sci. Rep., 2019; 9: 9338.
5. Santoyo G, Orozco-Mosqueda MC, Govindappa M. Mechanisms of biocontrol and plant growth promoting activity in soil bacterial species of Bacillus and Pseudomonas: a review. Biocontr. Sci. Technol, 2012; 22: 855-872.
6. Lee K E, Adhikari A, Kang SM, You Y H, Joo GJ, Kim JH, et al., Isolation and characterization of the high silicate and phosphate solubilizing novel strain Enterobacter ludwigii GAK2 that promotes growth in rice plants. Agronom., 2019; 9: 144. doi: 10.3390/agronomy9030144
7. Zularisam AW, Siti Zahirah Z, Zakaria I, Syukri MM, Anwar A, Sakinah M. Production of Biofertilizer from Vermicomposting Process of Municipal Sewage Sludge. J Appl. Sci., 2010; 10: 580-584.
8. Dr. Ruchi Sood. Nano-Biofertilizers For Sustainable Agriculture. Just agriculture, 2021; 1(12): 2021.
9. Kumari, R., Singh, D.P. Nano-biofertilizer: An Emerging Eco-friendly Approach for Sustainable Agriculture. Proc. Natl. Acad. Sci., India, Sect. B Biol. Sci., 2020; 90: 733–741. https://doi.org/10.1007/s40011-019-01133-6
10. Martinez-Medina A., Pozo M.J., Cammue B.P., Vos C.M. Below ground defence strategies in plants: the plant– Trichoderma dialogue. In. Vos C, Kazan K (eds) Belowground defense strategies in plants. Springer International Publishing, Cham; 2016a: 301–327.
11. Contreras-Cornejo H.A., Ortiz-Castro R., Lopez-Bucio J. Promotion of plant growth and the induction of systemic defence by VERMA & PANDEY, Curr. Agri. Res., Vol. 10(3) 193-206 (2022) 206 Trichoderma: physiology, genetics and gene expression. In: Mukherjee P, Horwitz B.A, Singh U.S, Mukherjee M, Schmoll M (eds) Trichoderma: biology and applications. CAB International, Wallingford, 2013: 175–196.