

Biofertilizers – An Ecofriendly Way of Maintaining Soil Health

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Growing reliance on chemical fertilizers makes the nation self-sufficient in food production, but they also damage the environment and have negative effects on living things. Due to inadequate uptake of these fertilizers by plants, fertilizers enter water bodies through rainfall, which leads to eutrophication and has an impact on aquatic life, particularly microorganisms. The excessive use of chemical fertilizers in agriculture is costly and has a number of detrimental effects on soils, including reduction in soil fertility, water retention capacity, and imbalance of soil nutrients. Therefore, there was a need to develop some affordable, efficient, and environmentally friendly fertilizers that don't harm the environment. Then came the concept of using certain microorganism species that have special abilities to produce natural products and function well as an alternative to chemical fertilizers. These are called biofertilizers. 'Bio' means 'life'. Therefore, biofertilizers are living organisms that enrich the nutrient quality of the soil. It refers to the use of microbes instead of chemicals to enhance the nutrition of the soil. To put it in another way, Biofertilizers are substances containing microorganisms that aid in promoting the growth and development of plants and trees by enhancing the transfer of essential nutrients to the plants. Bio fertilizers are an important tool for sustainable agriculture because they give farmers a way to increase crop yields and soil fertility while minimizing the detrimental impacts of chemical fertilizers. Bio fertilizers contain advantageous microorganisms, such as bacteria and fungus, which can increase soil fertility, supply plants vital nutrients, and decrease their dependence on synthetic chemical fertilizers. Some of the examples of bio fertilizers include nitrogen-fixing bacteria like Rhizobium, which can fix nitrogen from the atmosphere and make it available to crops, phosphate-solubilizing bacteria, which can increase the availability of phosphates to plants, and mycorrhizal fungi, which can develop symbiotic relationships with plant roots and help in the absorption of essential nutrients. For using biofertilizers efficiently, it is crucial to

understand the soil conditions and crop requirements. Bio fertilizers should be administered according to particular standards and at the appropriate time to maximize their effects.

Types of biofertilizers

1. Nitrogen fixing bacteria:

- ✚ **Rhizobium** - Biological nitrogen fixing by bacteria occurs in the root nodules of legume plants. They belong to the genera Rhizobium, Bradyrhizobium, Azorhizobium, and Mesorhizobium collectively. Due to rhizobial symbiosis, the yield of pulse crops can be improved when rhizobial culture is inoculated in the field as well as without inoculation (Dubey, 2001). Rhizobium can enhance crop productivity by up to 20% and fix 15-20 kg N ha⁻¹.
- ✚ **Azotobacter** - These are the photoautotrophic, aerobic, free-living microorganisms. They exude chemicals including vitamin B complex, gibberellins, naphthalene, acetic acid, and others that help in roots development and better absorption of nutrients from the soil.
- ✚ **Azospirillum** - These are gram negative, free living, associative symbiotic and non-nodule forming, aerobic bacteria, occurring in the roots of dicots and monocot plants i.e. corn, sorghum, wheat etc. Azospirillum is found to be very effective in increasing 10-15% yield of cereal crops and fixes N₂ up to 20-40% kg ha⁻¹.
- ✚ **Cyanobacteria (Blue Green Algae)** – Nostoc, Anabaena, Oscillatoria, Aulosira, Lyngbya etc. are the prokaryotic organisms and phototrophic cyanobacteria in nature. They play an important role in enriching paddy field soil by fixing atmospheric nitrogen and supply vitamin B complex and growth promoting substance which makes the plant grow vigorously. They also contribute organic matter to the crop besides fixing 20-30 kg N ha⁻¹ and increase 10-15% crop yield at 10 kg ha⁻¹.
- ✚ **Azolla and Anabaena symbiosis** – Azolla is a free-floating water fern sustaining on water surface and it has a symbiotic relationship with Anabaena azollae residing on its leaves. Collectively, they fix atmospheric nitrogen in paddy field and give away organic nitrogen through water and also immediately after trampling. Azolla contributes N, P, K and organic carbon with the addition of organic matter in the soil hence improving the physical structure of the soil. They also increase 10-20% of paddy yield and also help in suppressing the weed development.

- ✚ **Phosphate Solubilizing Bacteria (PSB)**–The species involving phosphate solubilizing ability are *Pseudomonas fluorescens*, *Bacillus megatherium* var. *phosphaticum*, *Acrobacter acrogens*, *Nitrobacter spp.*, *Escherichia freundii*, *Serratia spp.*, *Pseudomonas striata*, *Bacillus polymyxa*. They also supply growth promoting hormones, which aid in the soil's ability to solubilize phosphates, increasing the yield of crops by approximately 10% to 20%.
- ✚ **Phosphate solubilizing fungi**- Some fungi also have phosphate dissolving ability e.g., *Aspergillus niger*, *Aspergillus awamori*, *Penicillium digitatum* etc.
- ✚ **Mycorrhiza**- Mycorrhizas, which are utilised as biofertilizers, are produced as a result of a symbiotic relationship between some particular fungi that inhabit plant roots and the plant roots. They take nutrients from the soil, such as manganese, phosphorus, iron, sulphur, zinc, etc., and transfer them to the plant. Crop yield is increased by 30–40% due to mycorrhizal fungus, which also promotes regular plant growth and development.

Importance of Biofertilizers

Biofertilizers are important for farmers because they provide a number of advantages over conventional chemical fertilizers. Some of the key benefits of bio fertilizers are:

- **Enhanced soil fertility** - By adding helpful microorganisms to the soil, bio fertilizers can aid in enhancing soil fertility. These microbes can contribute to better soil structure, lessen degradation of the soil, and boost nutrient availability.
- **Reduction in the use of chemical fertilizer** - Bio fertilizers can reduce farmers' dependence on chemical fertilizers, which can be costly and have detrimental effects on the soil, environment, and the health of the human.
- **Lower production cost** - Since bio fertilizers are typically less expensive than chemical fertilizers, farmers can lower their production costs by using bio fertilizers.
- **Increase in yield of crops** - Bio fertilizers can boost agricultural yields by increasing soil fertility. The advantageous microorganisms found in bio fertilizers may also supply plants essential nutrients and enhance plant development, increasing agricultural crop yields.

- **Improved Environmental sustainability** - When compared to chemical fertilizers, bio fertilizers are an eco-friendlier choice because they don't cause soil erosion, water pollution, or greenhouse gas emissions.

Conclusion

There are several kinds of bio fertilisers, and each one can offer special advantages for soil fertility and plant growth. Farmers may raise soil fertility and crop production while utilising a variety of bio fertilisers in a sustainable manner. Bio-fertilizers are a valuable tool for farmers, providing several benefits compared to chemical fertilizers. Some of the benefits include soil health, crop yields, reduction in the use of chemical fertilizers and hence attaining an eco-friendly status for supplying essential plant nutrients.

References

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