



Biofertilizer: Types of Biofertilizers and their Roles

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“Biofertilizers are substances that contain microorganisms, which when added to the soil increase its fertility and promotes plant growth.”

Biofertilizers are substance that contains microbes, which helps in promoting the growth of plants and trees by increasing the supply of essential nutrients to the plants. It comprises living organisms which include *mycorrhizal* fungi, blue-green algae, and bacteria. *Mycorrhizal* fungi preferentially withdraw minerals from organic matter for the plant whereas *cyanobacteria* are characterized by the property of nitrogen fixation.

Nitrogen fixation is defined as a process of converting di-nitrogen molecules into ammonia. For instance, some bacteria convert nitrogen to ammonia. As a result, nitrogen becomes available for plants. Dr. Norman Borlaug introduced the green revolution to enhance food production. But this also resulted in the excess use of chemical fertilizers and pesticides. This leads to alarming environmental concerns like nutrient imbalance, reduced soil microorganisms, an increase of pest and disease attacks, water and soil contamination, etc. It triggered the need for an alternate supply of plant nutrients.

Thus, **Integrated Nutrient Management** came into existence, and biofertilizers took momentum due to their benefits.

Types of Bio-fertilizers

1. Nitrogen-fixing biofertilizer
2. Phosphate solubilising (mobilising) biofertilizers
 - Biological nitrogen fixing biofertilizers consist of micro-organisms which have the ability to fix biological molecular nitrogen (N_2) either symbiotically or asymbiotically in the plants.
 - Phosphate solubilizing biofertilizers are capable of solubilizing or mobilizing the fixed insoluble phosphates of the soil.
 - However, Biofertilizers are divided into four main categories. These four types are again divided in sub-types as follows:

1. Symbiotic Nitrogen-Fixing Bacteria

Rhizobium is one of the vital symbiotic nitrogen-fixing bacteria. Here bacteria seek shelter and obtain food from plants. In return, they help by providing fixed nitrogen to the plants.

2. Loose Association of Nitrogen-Fixing Bacteria

Azospirillum is a nitrogen-fixing bacterium that lives around the roots of higher plants but do not develop an intimate relationship with plants. It is often termed as rhizosphere association

as these bacteria collect plant exudate and the same is used as food by them. This process is termed associative mutualism.

3. Symbiotic Nitrogen-Fixing Cyanobacteria

Blue-Green algae or Cyanobacteria from the symbiotic association with several plants. Liverworts, cycad roots, fern, and lichens are some of the Nitrogen-fixing cyanobacteria. Anabaena is found at the leaf cavities of the fern. It is responsible for nitrogen fixation. The fern plants decay and release the same for utilization of the rice plants. Azolla pinnate is a fern that resides in rice fields but they do not regulate the growth of the plant.

4. Free-Living Nitrogen-Fixing Bacteria

They are free-living soil bacteria that perform nitrogen fixation. They are saprotrophic anaerobes such as *Clostridium beijerinckii*, *Azotobacter*, etc.

Among all the types of biofertilizers, *Rhizobium* and *Azospirillum* are most widely used.

Phosphate supplier:

- **Bacteria:** *Bacillus megaterium*, *Phosphaticum*, *Bacillus circulans*, *Pseudomonas striata*, *Pseudomonas sp.*.
- **Fungi:** *Penicillium sp.*, *Aspergillus awamori*.

Phosphate absorber biofertilizers:

- *Arbuscular mycorrhiza:* *Glomus sp.*, *Gigaspora sp.*, *Acaulospora sp.*, *Scutellospora sp.* and *Sclerocystis sp.*, *Ectomycorrhiza:* *Laccaria sp.*, *Pisolithus sp.*, *Boletus sp.*, *Amanita sp.* *Orchid mycorrhiza:* *Rhizoctonia solani*.

Sulphur supplier:

- *Thiobacillus novellus*, *Aspergillus*

Micronutrients supplier:

- Silicate and Zinc solubilisers: *Bacillus sp.*
- Biofertilizers are important for the following reasons:
- Biofertilizers improve the soil texture and yield of plants.
- They do not allow pathogens to flourish.
- They are eco-friendly and cost-effective.
- Biofertilizers protect the environment from pollutants since they are natural fertilizers.
- They destroy many harmful substances present in the soil that can cause plant diseases.
- Biofertilizers are proved to be effective even under semi-arid conditions.

The Role of Biofertilizers in Organic Farming

The role of biofertilizers is to create a more sustainable and efficient way of doing agriculture. These products contain organic matter, thus aligning with the premise of avoiding synthetic and chemical additives for improving farming practices. Biofertilizers utilize microorganisms and materials that stimulate the natural processes in the soil. These processes affect plant growth and development. Biofertilizers indirectly improve plant growth by enhancing the biological processes through microorganisms. In contrast, fertilizers directly help crops grow by supplying extra nutrients to the soil or plant. Meanwhile, biofertilizers utilize the existing microbes in the earth to help improve a plant's nutrient uptake.

Different microorganisms offer unique effects on plant uptake. For instance, biofertilizers containing nitrogen-fixing bacteria *impact* growth by stimulating the nitrogen cycle. Plants need nitrogen for ideal growth and development. So, by increasing the abundance of nitrogen-fixing bacteria in a plant's rhizosphere, the plant would have better-growing conditions.

Despite the clear advantage of biofertilizers in organic farming, these products have some strikes against them. Among these disadvantages is biofertilizer availability. The demand for biofertilizers is high and growing, yet the product's availability cannot keep up.

The call for more advanced biofertilizers is imperative to changing agriculture in a way that is sustainable for a changing climate, growing global population, and increasing farming efficiency and sustainability. Biofertilizers thus are excellent tools for promoting organic farming. These products enhance plant growth through natural processes and organic materials, eliminating the dependence on potentially harmful synthetic and chemical substances. Impello's integrated solutions, ranging from microorganisms to other bioactive compounds, help farmers everywhere increase the quality and yield of every harvest. Consider this product line when intending to adopt biofertilizers as an initial venture into organic farming.