

Bio-fertilizers - Necessity for Sustainability

Gaur, V,

SMS(Agronomy), Gujarat Vidyapith Krishi Vigyan kendra, Randheja, District- Gandhinagar, Gujarat

What is an artificial fertilizer?

- Nitrogen (N), Phosphorus (P) and Potassium (K) are the most important among 17 essential plant nutrients.
- The plant absorbs nitrogen only in the form of solid.
- Conservation of gaseous form of nitrogen into solid form is called nitrogen fixation.
- Fixation of nitrogen in chemical fertilizers in factories is called artificial nitrogen fixation (artificial fertilizers).

What is Bio Fertilizer?

- In nature there are certain microorganisms and minute plants, which can absorb gaseous nitrogen directly from atmosphere and make it available to plant in solid form. It is called natural nitrogen fixation (natural fertilizers).
- Materials containing such organisms are called biofertilizers or natural fertilizers.
- They are multiplied and introduced into root zone of crop plant to supply nitrogen, phosphorus and other nutrients.

In short they are soil microorganisms which-

- Fix and activate the nitrogen in the soil,
- Convert the unavailable P into available P, and
- Causes fast decomposition of organic matter.

Types of bio fertilizers

- A) Nitrogen fixing Bacteria
Symbiotic Bacteria- Rhizobium
Free living organisms- Azotobacter, Azospirillum, Blue green algae, Azolla
- B) Phospho-microorganisms
Phosphate solubilizing bacteria (PSB), Mycorrhiza

Rhizobium

- They enter into the roots of legume crops.
- They forms nodule on the roots of the crop.
- They take carbohydrates from the plant.

- They give the fixed N to the crop.
- The fixed N is given in the form of asparagines and glutamine.

For nitrogen fixation first of all rhizobium comes in rhizosphere then a number of changes takes place including curling of root hair, entry of rhizobium in root, nodule initiation, nodule differentiation, and nitrogen fixation.



Rhizobium nodules in Groundnut

Azotobacter and Azospirillum

- They fix about 20-30 kg N ha⁻¹.
- Both can be used for cereal crops.
- Azospirillum is mainly used for oilseed crops.
- *Acetobacter diazotopix* is used for sugarcane.

Phosphate solubilizing bacteria and Mycorrhiza

- Only 33% of the total P is soluble in water.
- It releases the acid which solubilizes phosphorus.
- It solubilizes the unavailable P and makes it available to the crop plant.
- PSB can be used in any crop. Among bacteria- *Pseudomonas* and *Bacilli* are used and among fungi- *Penicilium* and *Aspergillus* are mainly used

Azolla

- Azolla is a small aquatic fern with a branched stem and bi-lobed leaves.
- When it dies and decays in the soil, nitrogen becomes available to plant.



Bio-fertilizers - Necessity for Sustainability

- Azolla can double its body weight in 3 - 5 days.
- *Azolla pinnata* is the common species.
- It fixes the N due to presence of BGA in the lobes of its leaves.
- It contains 45% (N), 2.6% (P) and 0.9 % (K).
- It fix about 30-40 kg N ha⁻¹.
- It survives well in temperature range of 20 to 30°C and suitable with 5.5 to 7.0 pH of soil.



Azolla Pond

Blue Green Algae (BGA)

- The most common species are *Anabaena* and *Nostoc*.
- It fix about 15 to 45 kg N ha⁻¹.
- It can grow in temperature range of 25 to 45°C
- Standing water of 2-10cm in the field is prerequisite for its growth.
- It grows well in pH 7-8 and soil high in organic matter.



BGA in fields

Benefits of Bio fertilizers

- Cheap source of nutrients
Biofertilizers can be called as poor man's technology. Taking into account the amount of nutrient supplied, biofertilizers are many times cheaper than chemical fertilizers.
- Suppliers of micro nutrients
Biofertilizers not only supply nitrogen and phosphorous but also some micronutrients essential for plant growth. In this situation the application of bulky biofertilizers like blue green algae and azolla increases yield due to greater supply of micronutrients
- Supplier of organic matter
Organic matter is an inexhaustible source of nutrients and energy for plant as well as for microorganisms. *Azolla* and BGA produce an average 8-10 tone of biomass per hectare which adds to the organic matter pool of soil
- Counteracting negative impact of Chemical Fertilizers

When chemical fertilizers are excessively and continuously used for a few years, they may create acidity or alkalinity in the soil and deteriorate the quality of soil. Application of biofertilizers can avoid this problem to a great extent

- Secretion of growth hormones:
Azotobactor, blue green algae and *Azolla* have been found to synthesize growth hormones for e.g. indol acetic acid and vitamin B, which benefit the main crop.