

## Role of Biofertilizers in Agriculture

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### SUMMARY

Biofertilizers are essential for the healthy growth of crops and healthy food production. For the world's ever increasing population soil management strategies today are mainly dependent on inorganic chemical based fertilizers which cause serious threat to human health and the environment. Bio fertilizers have been identified as an alternative for increasing soil fertility and crop production in sustainable agriculture. Bio fertilizers can be an important component of integrated nutrient management. Micro organisms that are commonly used as biofertilizers include nitrogen fixers, potassium and phosphate solublizer's growth promoting rhizobacteria (PGPR), endo and ecto mycorrhizal fungi, cyanobacteria and other useful microscopic organisms. These potential biological fertilizers would play a key role in productivity and sustainability of soil and also protecting the environment as ecofriendly and cost effective inputs for the farmers.

### INTRODUCTION

As per as the India concern, the population is increasing day by day very rapidly this rise in population causing big threat to the food security. Therefore, it is essential that agricultural productivity should be enhanced significantly within the next few decades to meet the large demand of food by emerging population. Now a days by keeping view of high yield farmers are, too much dependence on chemical fertilizers for more crop productions but this uncontrolled use of chemical fertilizers can damages both environmental ecology and human health with great severity. Exploitation of microbes as biofertilizers is considered to some extent an alternative to chemical fertilizers in agricultural sector due to their extensive potentiality in enhancing crop production and food safety. A bio fertilizer is substances which contain living micro organisms which when applied to seeds, plant surface, or in soil it quickly colonize the rhizosphere or interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant. Bio fertilizers add nutrients through the natural process of nitrogen fixation, solubilization of phosphorus and stimulating plant growth through the synthesis of the growth promoting substances. The benefits of using biofertilizers includes cheap source of nutrients, excellent suppliers of micro chemicals and micronutrients, suppliers of organic matter, secretion of growth hormones, and counteracting negative impact of chemical fertilizers (Gaur 2010). Different microbes are vital components of soil and they play a crucial role in various biotic activities of the soil ecosystem which make the soil dynamic for nutrient mobilization and sustainable for crop production (Ahemad and Kibret 2014)

### Classification of Biofertilizers

#### A. Nitrogen fixing biofertilizers:

- 1.Free living- *Azotobactor*, *Clostridium*, *Anabena nostae* etc
- 2.Symbiotic- *Rhizobium*, *Anabena azollae*
- 3.Associative symbiotic - *Azospirillum*

#### B. P- Solublizing biofertilizers

- 1.Bacteria- *Bacillus subtilis* and *Pseudomonas striata*

2. Fungi- *Penicillium spp* and *Aspergillus awamori*

**C. P- mobilizing biofertilizers**

1. Arbuscular mycorrhiza- *Glomus spp*, *Scutellospora spp*

2. Ecto mycorrhiza- *Laccaria spp*, *Pisolithus spp*, *Boletus spp* ect

**D. Potassium solublizing bacteria- *Bacillus spp* and *Aspergillus spp***

**E. Potassium mobilizing bacteria- *Bacillus spp***

**F. Plant Growth Promoting Rhizobacteria – *Pseudomonas fluorescens***

**1. Rhizobium:**

It is a soil habitat bacterium which colonizes in the legume root and fixes atmospheric nitrogen symbiotically. The morphology and physiology of rhizobium varies from free living condition to the bacteroid nodules. They have seven genera's and are highly specific to form nodules in the legumes, referred as a cross inoculation groups. Examples of different genera: *R. leguminosarum*, *R. phaseoli*, *R. trifolli*, *R. melioli*, *R. lupini*, *R. japonicum* ect. Rhizobium fixes about 50- 100 kg nitrogen per ha.

**2. Azotobacter-**

It is free living bacteria mostly found in neutral to alkaline soils. Fixes the atmospheric nitrogen by converting into ammonia. It produces abundant slimes which helps in soil aggregations.

**3. Azospirillum-**

Proliferates under both aerobic and anaerobic condition. This biofertilizer having some additional benefits such as PGR like IAA production, disease resistance and drought tolerance. It fixes 20-40 kg N/ha.

**4. Azolla:**

It is free floating water fern used as biofertilizer for wet land paddy. It fixes atmospheric nitrogen in association with nitrogen fixing blue green algae *Anabaena azollae*. It is known contributes 40-50 kg nitrogen/ ha

**5. Phosphate solublizing biofertilizers:**

This group of biofertilizers is capable of hydrolyzing organic and inorganic phosphorus from soluble compounds. *Bacillus* and *Pseudomonas* are among most powerful bacteria which includes in this group.

**6. Phosphate mobilizing biofertilizers (*Mycorrhiza*)**

A symbiotic generally mutualistic association between a fungus and roots of a vascular plant. The fungus colonizes the host plants roots either intracellularly or externally. This association provides fungus with access to carbohydrates. In return, the plants gain the benefits of the mycelium higher absorption capacity for water and mineral. Plant roots alone may be incapable of taking up phosphate ions that are demineralized in soil with a basic pH. The mycelium of the mycorrhizal fungus can make them available to the plants they colonize.

**7. Potassium solublizing biofertilizers (KSB)**

Potassium in the soil occurs mostly as silicate minerals which are inaccessible to plants. These minerals are made available only when they are slowly weathered or solubilized. Potassium solubilizing microorganisms solubilize silicates by producing organic acids which cause the decomposition of silicon's and helps in the removal of metal ions thereby making them available to plants.

**8. Potassium mobilizing biofertilizers (KMB):**

These work by mobilizing the inaccessible form of potassium in the soil. Some phosphate solubilizing biofertilizers such as *Bacillus spp* and *Aspergillus spp* has been found to mobilize potassium and also solubilize phosphorus

**9. Silicates and zinc solublizing biofertilizers:**

Micro organisms are capable of degrading silicates and aluminum silicates. *Bacillus spp* can be used as bio fertilizers for solubilization because these organisms solubilize the zinc present in the soil and make it available to the plants.

#### 10. Plant Growth Promoting Rhizobacteria (PGPR)

Species of *Pseudomonas* and *Bacillus* can produce phytohormones or growth promoters. They produce indol acetic acid, cytokinins, gibberellins and inhibitors of ethylene production.

### Methods of Application of Biofertilizers

#### 1. Seed treatment:

200 gm of bio fertilizers is suspended in the 300-400 ml of water and mixed gently with 10 kg of seeds using adhesives like gum or jiggery solution. The seeds are then spread on clean sheet cloths under shed to dry and immediately used for sowing.

#### 2. Seedling root dip:

This method is used for transplanted crops. For paddy crop a bed is made in the field and filled with the water then recommended biofertilizers are mixed in this water and roots of seedling are dipped for 8-10 hrs and this seedlings are used for transplanting

#### 3. Soil treatment:

4 kg each of the recommended biofertilizers is mixed in 200 kg of compost and kept overnight. Then this mixture incorporated at the time of sowing or planting

#### Advantages of biofertilizers

1. They are eco friendly as well as cost effective
2. They leads to enrichment of soil and quality of the soil improves with the time
3. Though they do not show immediate result but the results show overtime are spectacular
4. They reduces overall cost of cultivation
5. They help in increasing the crop yield by 10 – 15%
6. They reduces the need for traditional fertilizers
7. They also useful in production of plant hormones
8. They help to make plant nutrients more available to the plants

#### Precaution to be taken in use of biofertilizers

1. Never apply bio fertilizers with fungicides
2. Never expose bio fertilizers to sunlight directly
3. It should be stored at room temperature not below 0<sup>o</sup> C and 35<sup>o</sup>
4. Do not keep used solution overnight

### CONCLUSION

Bio fertilizers have great role in increasing the crop production. They improve the soil health status and provide different growth promoting hormones and phytochromes to the plants. Also do not leave the residual effects like that of the chemical fertilizers. Hence the use of biofertilizers could be the proper option for sustainable agriculture.

### REFERENCES

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