

## Biocapsule Biofertilizers: Boon to Agriculture

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### SUMMARY

The Indian Institute of Spices Research (IISR), Kozhikode, Kerala, one of the institute of ICAR (Indian Council of Agricultural Research) has developed the technology in bio-fertilizer production by successfully encapsulating plant growth nutrients in tiny capsules. This technology having advantages of reduced cost and easy handling and transport, no harmful by-products, less requirement of inorganic and inert material, storage at normal temperature and more importantly, enhanced shelf life. Also, as these microbial strains are retained in the dormant stage, there is no issue of their viable loss in room temperatures as is the case with many liquid-based bio formulations.

### INTRODUCTION

Bio-fertilizers are carrier medium rich in live microorganisms. When applied to seed, soil or living plants, it increases soil nutrients or makes them biologically available. In present-day agriculture, bio-fertilizers are of great economic importance because they partially replace chemical inputs and play a vital role in enhancing soil and environmental quality. Different formulations of bio-fertilizers like liquid, peat, granules, and freeze-dried powders are available in plenty in the market and their success depends on the crop, environment, ease-of-use, cost and availability. But a perfect bio-fertilizer formulation does not exist till date and each type has its own limitations. Nevertheless, a promising advancement has been the development of this technique that allows encapsulating the required nutrition in a capsule and delivering them to the crop.

### Bio-Fertilizer

A bio-fertilizer is simply a substance which contains living microorganisms which when applied to the soil; a seed or plant surface colonizes the rhizosphere and promotes growth by increasing the supply or availability of nutrients to the host plant. A bio-fertilizer is a modernized form of organic fertilizer into which beneficial microorganisms have been incorporated. They are most commonly referred to as selected strains of beneficial soil microorganisms cultured in the laboratory and packed in suitable carriers.

### Types of Bio-Fertilizers

Bio-fertilizers are classified into different types depending on the type or group of microorganisms they contain. Table 1 shows the classification of bio-fertilizers on the bases of the different types of microorganisms used. The different types of bio-fertilizers include:

**Table 1: Different Microorganisms used in Bio-fertilizer Production**

Groups	Examples
<b>Nitrogen fixing bio-fertilizers</b>	
Free-living	<i>Azotobacter, Bejerinkia, Clostridium, Klebsiella, Anabaena, Nostoc</i>
Symbiotic	<i>Rhizobium, Frankia, Anabaena, Azollae</i>
Associative symbiotic	<i>Azospirillum</i>
<b>Phosphate solubilizing bio-fertilizer</b>	
Bacteria	<i>Bacillus megaterium var, Phosphaticum, Bacillus subtilis, Bacillus circulans</i>
Fungi	<i>Penicillum Spp. Aspergillus awamori</i>
<b>Phosphate mobilizing bio-fertilizers</b>	
<i>Arbuscular Mycorrhiza</i>	<i>Glomus Spp., Gigaspora Spp., Acaulospora Spp. Scutellospora Spp. and Sclerocystis Spp.</i>
<b>Bio-fertilizers for micronutrients</b>	

Groups	Examples
<i>Bacillus Spp</i>	Silicate and zinc solubilizers
<b>Plant growth promoting Rhizobacteria</b>	
<i>Pseudomonas</i>	<i>Pseudomonas fluorescens</i>

Source: Ritika and Uptal (2014)

### Biocapsule Bio-Fertilizer

The world's first biocapsule technology, a novel method for delivery of beneficial organisms has been developed by ICAR – Indian Institute of Spices Research, Kozhikode. A patent has been filed for the same (Application No.3594/CHE/2013 dt 13/08/2013). The production technique does not need any sophisticated equipment or special conditions. This is significant because the investment cost to manufacture these capsules is low. “The encapsulation technique appears to be significant because it can be used to deliver all kinds agriculturally important microorganisms like nitrogen fixers, nutrient solubilizers/ rhizobacteria, *Trichoderma*, etc to any crop.

### Method of Biocapsule application as per Biofertilizers

(Note: Information collected on the basis of online market Survey, 2020)

#### 1. Nitrogen Fixing Capsule (*Acetobacter*)

It contains an associative atmospheric nitrogen fixing bacteria (*Acetobacter diazotrophicus*). This bacterium produces several plant growth promoting hormones and can solubilize fixed phosphorous & zinc compounds mainly use for Sugarcane crop.

##### Dosage / acre:

- Capsule for 1 acre of land through drip or drenching
- 1 Capsule for 200 liters of water for spray

#### 2. Rhizobium Capsules

This contains bacteria *Rhizobium sp.* In symbiotic association with leguminous crops the bacteria fixes large quantity of atmospheric nitrogen and makes it available for plants

##### Dosage / acre:

- 1 Capsule for 1 acre of land through drip or drenching
- 1 Capsule for 200 liters of water for spray

#### 3. Phosphate Solubilizing Capsules

This contains several soil borne bacteria, particularly those belonging to the genera *Bacillus megaterium*. This bacterium can solubilize inorganic phosphate in the soil by releasing organic acids and make it available to plants. It produces plant growth promoting substances like IAA, GA, amino acids and vitamins.

##### Dosage / acre:

- 1 Capsule for 1 acre of land through drip or drenching
- 1 Capsule for 200 liters of water for spray

#### 4. NPK Capsule

Target crops: All crops

This is a blend of various beneficial bacteria like nitrogen fixers (*Azotobacter* and *Azospirillum*), phosphate solubilizers and potash mobilizers. It helps in fixing of nitrogen, solubilizes and mobilizes phosphorus and potassium respectively and increases crop yield.

##### Dosage / acre:

- 1 Capsule for 1 acre of land through drip or drenching
- 1 Capsule for 200 liters of water for spray

## 5. Potassium Mobilizing Capsules

Target Crops - Vegetables

This contains potash mobilizing bacteria *Fratureuria aurantia*. This bacterium produces organic acids and enzymes that help solubilize the fixed potassium into exchangeable form and make it assimilate by plants.

### Dosage / acre:

- 1 Capsule for 1 acre of land through drip or drenching
- 1 Capsule for 200 liters of water for spray

### Advantages of Biocapsule Biofertilizers

1. Applicable to all kinds of PGPR/ microbes.
2. Enhances nutrient mobilization and use efficiency, growth and yield and provides protection against diseases at a negligible cost.
3. Ecologically safe technology (no harmful byproducts, less amount of inorganic and inert material) with reduced cost of production.
4. Easy transportation.
5. Reduces the manpower requirement due to longevity of product.
6. Does not require any refrigerated condition for storage, hence save energy.

## CONCLUSION

The invention of PGPR formulation as biocapsule is an easy and reliable technology of storing and delivering of bioagents in hard gelatin capsule termed as biocapsule. This eliminates the need for farmers to carry the sacks of Biofertilizers. Different formulations of bio-fertilizers like liquid, peat, granules, and freeze-dried powders are available in plenty in the market and their success depends on the crop, environment, ease-of- use, cost and availability

## REFERENCES

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