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## BIO-FERTILIZERS: A KEY FOR SOIL HEALTH, QUALITY AND CROP PRODUCTION

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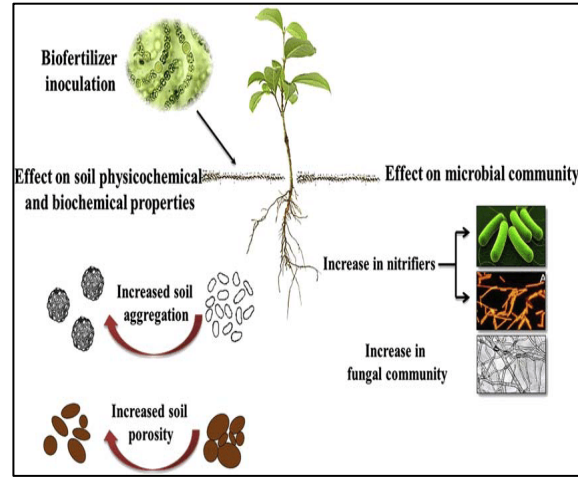
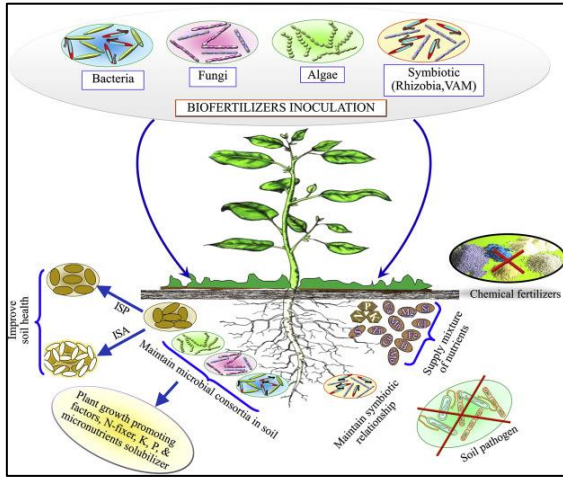
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**T**he sustainability of the agricultural sector is a clef for feeding the emerging population and economic exports of a country; therefore, the growth and survival of a nation indirectly depend on its agriculture. Though current imbalance situation between farmers and agriculture is under unclarification and remains blurred. Over the decades, every scientists, research scholars, institutes focus on soil to develop its innate fertility in order to give better yield. But conventional practices of farmer's usage over inorganic fertilizers like urea, super, MOP and other compounds to boost the fertility status triggers the natural properties of soil. But after reaching certain periods, the soil stops to give back yield even though application of more inorganic fertilizers. The main reason beyond is usage of over chemicals kills the natural micro-organism which prevails in the soil ecosystems. Biofertilizers can, directly or indirectly the soils, help in attaining food security compared to the harmful effect of chemical fertilizers in soil. This article provides insight over bio fertilizer and its key role in crop production and soil health.

Biofertilizer is the microbial inoculants that contain the culture of dormant or live cells of the effective strains of N-fixing, P-solubilizing/ mobilizing, K-solubilizing. Microorganisms at their cellular level which is often applied to seeds, soils, or compost material to accelerate the microbial activities by such organisms through their multiplication and enhance the nutrient's availability, which can be easily accessible by the plants. Very often microorganisms are not as efficient in natural surroundings as one would expect them to be and therefore artificially multiplied cultures of efficient selected microorganisms play a vital role in accelerating the microbial processes in soil. Use of bio fertilizers is one of the important components of integrated nutrient management, as they are cost effective and renewable source of plant nutrients to supplement the chemical fertilizers for sustainable agriculture. Several microorganisms and their association with crop plants are being exploited

in the production of biofertilizers. They can be grouped in different ways based on their nature and function.

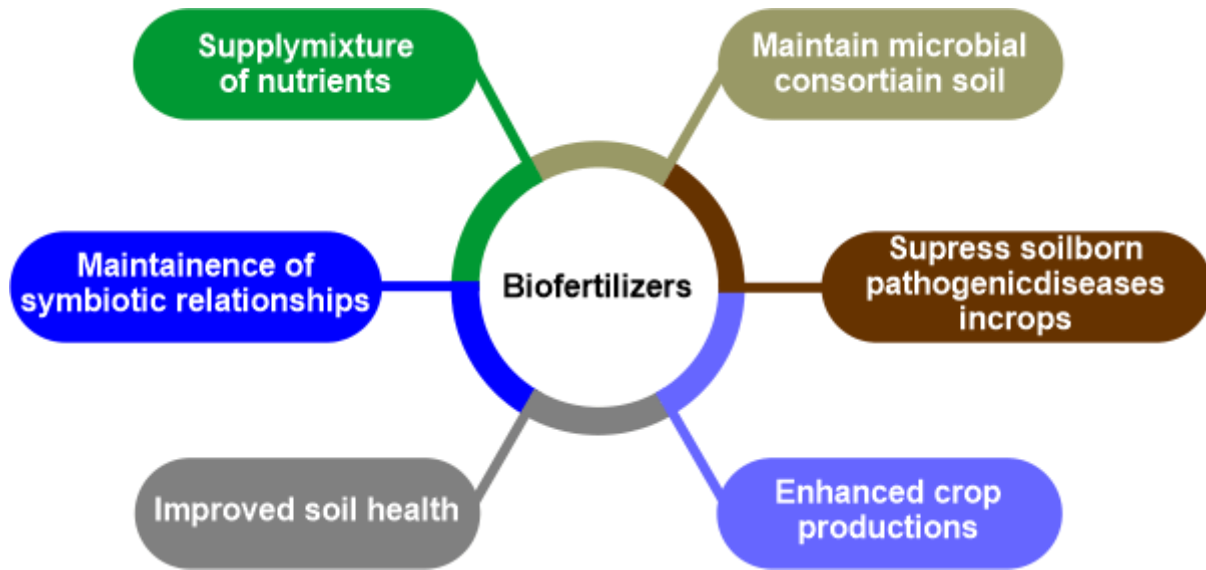
### Bio Fertilizer Inoculation and Soil Properties



### Different Groups of Biofertilizers with Example

S. No.	Groups	Examples
<b>N<sub>2</sub> fixing Biofertilizers</b>		
1.	Free-living	<i>Azotobacter</i> , <i>Beijerinckia</i> , <i>Clostridium</i> , <i>Klebsiella</i> , <i>Anabaena</i> , <i>Nostoc</i> ,
2.	Symbiotic	<i>Rhizobium</i> , <i>Frankia</i> , <i>Anabaena azollae</i>
3.	Associative Symbiotic	<i>Azospirillum</i>
<b>P Solubilizing Biofertilizers</b>		
1.	Bacteria	<i>Bacillus megaterium</i> var. <i>phosphaticum</i> , <i>Bacillus subtilis</i> , <i>Bacillus circulans</i> , <i>Pseudomonas striata</i>
2.	Fungi	<i>Penicillium sp.</i> , <i>Aspergillus awamori</i>
<b>P Mobilizing Biofertilizers</b>		
1.	Arbuscular mycorrhiza	<i>Glomus sp.</i> , <i>Gigaspora sp.</i> , <i>Acaulospora sp.</i> , <i>Scutellospora sp.</i> & <i>Sclerocystis sp.</i>
2.	Ectomycorrhiza	<i>Laccaria sp.</i> , <i>Pisolithus sp.</i> , <i>Boletus sp.</i> , <i>Amanita sp.</i>
3.	Ericoid mycorrhizae	<i>Pezizella ericae</i>
4.	Orchid mycorrhiza	<i>Rhizoctonia solani</i>
<b>Biofertilizers for Micro nutrients</b>		
1.	Silicate and Zinc solubilizers	<i>Bacillus sp.</i>
<b>Plant Growth Promoting Rhizobacteria</b>		
1.	<i>Pseudomonas</i>	<i>Pseudomonas fluorescens</i>

## Bio Fertilizer - Benefits



## Advantage

- Soil enrichment
- More suitable than synthetic fertilizers
- Non-toxic to plants
- Beneficial for soil microorganisms
- Eco-friendly
- Sustainability
- Enhanced plant development and harvest
- Boost the root region's beneficial microorganism population
- Pathogenic soil bacteria must be managed and prevented

## Methods of Application of Bio Fertilizer

### 1. Seed Treatment

- This is the most common practice of applying biofertilizers. In this method, the biofertilizers are mixed with 10% solution of jiggery. The slurry is then poured over the seeds spread on a cemented floor and mixed properly in a way that a thin layer is formed around the seeds. The treated seeds should be dried in the shade overnight and then they should be used. Generally, 750 grams of biofertilizer is required to treat the legume seeds for a one-hectare area.

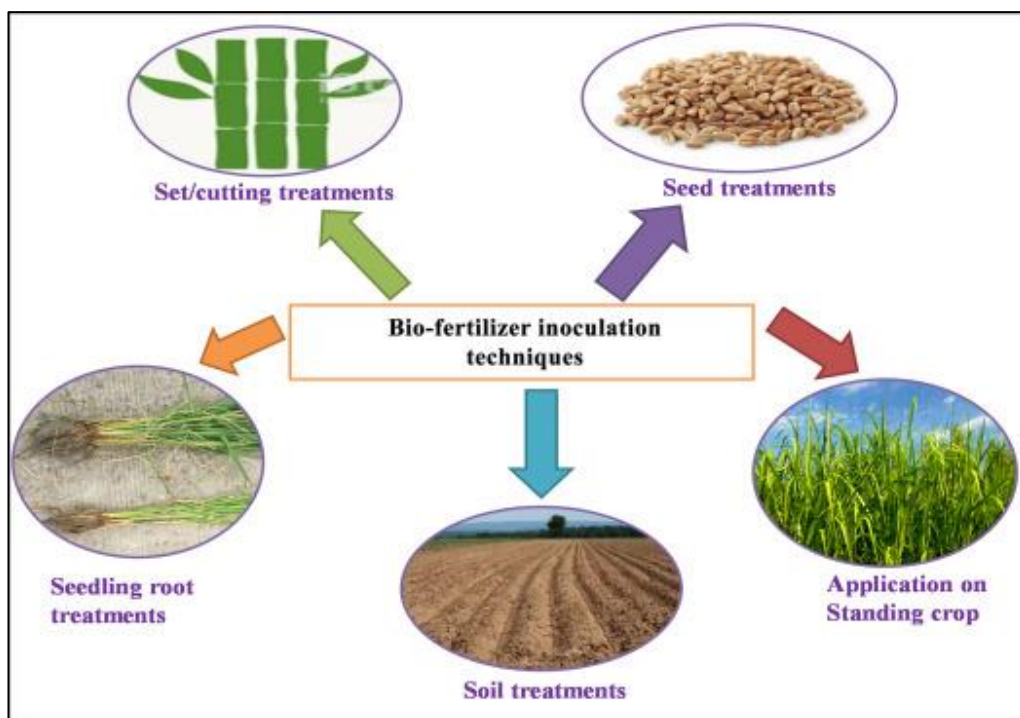
## 2. Seedling root dip

- The seedling roots of transplanted crops are treated for half an hour in a solution of biofertilizers before transplantation in the field.

## 3. Main field application / broadcast

- This method is mostly used for fruit crops, sugarcane and other crops where localized application is needed. At the time of planting of fruit trees, 20 g of biofertilizer mixed with compost is to be added in the ring of one sapling.

### Different Techniques of Bio Fertilizer Inoculation



### Conclusion

“Soils are gift of nature” - Biofertilizers have been used to boost up crop production by augmenting the plant's available nutrients through the organic matter decomposition process. In normal, biofertilizer accelerate certain microbial processes in the soil which augment the extent of availability of nutrients in a form easily assimilated by plants. Plants can easily mobilize the available form of nutrients in soil. Hence by considering the soil fertility, heath, microorganisms (Biota) in soil ecosystem, it is better to hold live cell of living entity rather than going for inorganic chemical for soil application. Several types of research

need to be conducted on different farming communities to steepen with the recommended type and quantity of biofertilizers in future.

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