Biofertilizer

A biofertilizer is a substance which contains living microorganisms, when applied to seed, plant surfaces, or soil, colonizes the rhizosphere or the interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant. In nature, there are a number of useful soil micro organisms which can help plants to absorb nutrients. Their utility can be enhanced with human intervention by selecting efficient organisms, culturing them and adding them to soils directly or through seeds. The cultured micro organisms packed in some carrier material for easy application in the field are called bio-fertilisers. Thus, the critical input in Biofertilisers is the micro organisms.

Types and features of biofertilizers- Bio-fertilizer are mostly cultured and multiplied it the laboratory. However, blue green algae and azolla can be mass-multiplied in the field Based on type of microorganism, the bio-fertilizer can also be classified as follows:

a) **Bacterial biofertilizers**: e.g. Rhizobium, Azospirilium, Azotobacter, Phosphobacteria.
b) **Fungal Biofertilizers**: e.g. Mycorhiza
c) **Algal Biofertilizers**: e.g. Blue Green Algae (BGA) and Azolla.
d) **Actinimycetes Biofertilizer**: e.g. Frankia.

Characteristics Features of common Biofertilizers

I. **Rhizobium** : Rhizobium is relatively more effective and widely used biofertilizer. Rhizobium, in association wit legumes, fixes atmospheric N. The legumes and their symbiotic association with the rhizobium bacterium result in the formation of root nodules that fix atmospheric N. Successful nodulation of leguminous crop by rhizobium largely depends on the availability of a compatible stain for a particular legume. Rhizobium population in the soil is dependent on the presence of legumes crops in field. In the absence of legumes the population of rhizobium in the soil diminishes.

II. **Azospirillum** : Azospirillum is known to have a close associative symbiosis with the higher plant system. These bacteria have association with cereals like; sorghum, maize, pearl millet, finger millet, foxtail millet and other minor millets and also fodder grasses.

III. **Azotobacter** : It is a common soil bacterium. *A. chrococcum* is present widely in Indian soil. Soil organic matter is the important factor that decides the growth of this bacteria.

IV. **Blue Green Algae (BGA)** : Blue green algae are referred to as rice organisms because of their abundance in the rice field. Many species belonging to the genera, Tolypothrix, Nostic,

Schizothrix, Calothrix, Anoboenosois and Plectonema are abundant in tropical conditions. Most of the nitrogen fixation BGA are filamenters, consisting of chain of vegetative cell including specialized cells called heterocyst which function as a micronodule for synthesis and N fixing machinery.

Biofertilizers recommended for crops-

1. Rhizobium + Phosphotika at 200 gm each per 10 kg of seed as seed treatment are recommended for pulses such as pigeonpea, green gram, black gram, cowpea etc, groundnut and soybean.
2. Azotobacter + Phosphotika at 200 gm each per 10 kg of seed as seed treatment are useful for wheat, sorghum, maize, cotton, mustard etc.
3. For transplanted rice, the recommendation is to dip the roots of seedlings for 8 to 10 hours in a solution of Azospirillum + Phosphotika at 5 kg each per hectare.

Application of biofertilizers to crops

A. **Seed treatment-** Each packet (200g) of inoculant is mixed with 200 ml of rice gruel or jaggery solution. The seeds required for one hectre are mixed in the slurry so as to have uniform coating of the inoculants over the seeds and then shade dried for 30 minutes. The treated seeds should be used within 24 hous. One packet of inoculant is sufficient to treat to 10 kg seeds. Rhizobium, Azospirillum, Azotobacter and Phosphobacteria are applied as seed treatment.

B. **Seedling root dip-** This method is used for transplanted crops. Five packets (1.0 kg) of the inoculants are required for one hactare and mixed with 40 litres of water. The root portion of the seedlings is dipped in the solutions for 5 to 10 minutes and then transplanted. Azospirillum is used for seedling root dip particularly for rice.

C. **Soil treatment** 4 kg each of the recommended biofertilizers are mixed in 200 kg of compost and kept overnight. This mixture is incorporated in the soil at the time of sowing or planting.

Use of VAM Biofertilizer- Vesicular Arbuscular Mycorrhiza (VAM) The term mycorrhiza was taken from Greek language meaning 'fungus root'. term was coined by Frank in 1885

a. The inoculum should be applied 2-3 cm below the soil at the time of sowing.

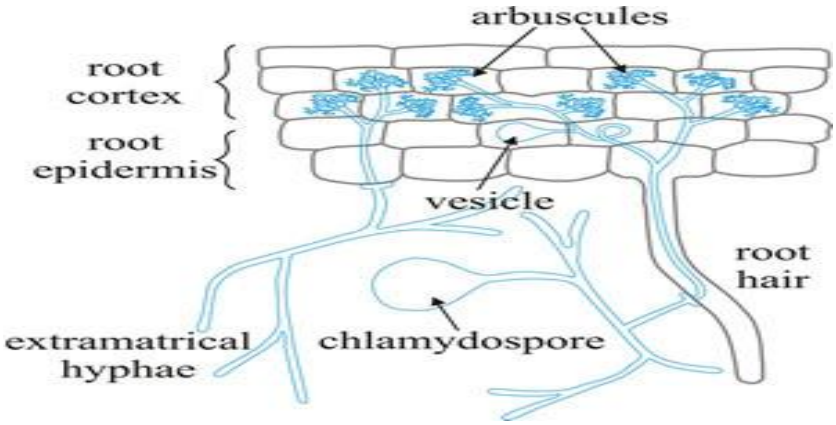
b. The seeds are sown or cuttings planted just above the VAM inoculums so that the roots may come in contact with the inoculums and cause infection.

c. Bulk inoculums of 100gm is sufficient for one meter square area.

d. Seedlings raised in the polythene bags need 5-10 g of bulk inoculums for each bag.

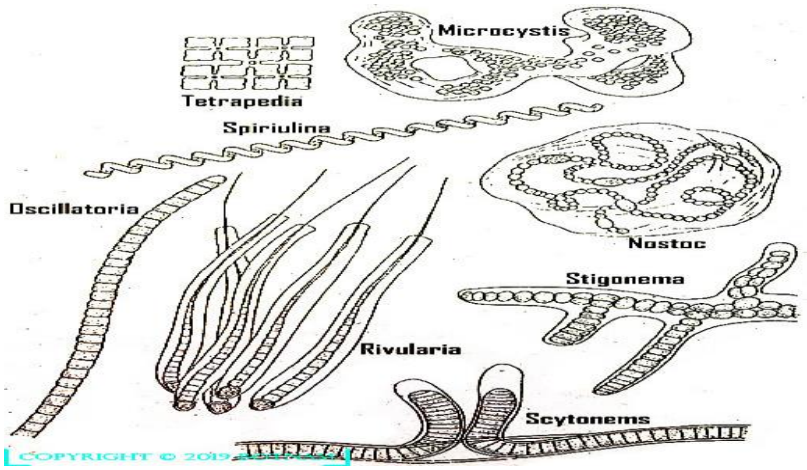
e. At the time of planting of saplings, VAM inoculums is to be applied at the rate of 20g /seedling in each spot.

f. In the existing tree, inoculums of 200g is required for each tree.



Use of Blue Green Algae (BGA)- Another group of free living nitrogen fixers are cyanobacteria. They are commonly called as Blue green algae (BGA).

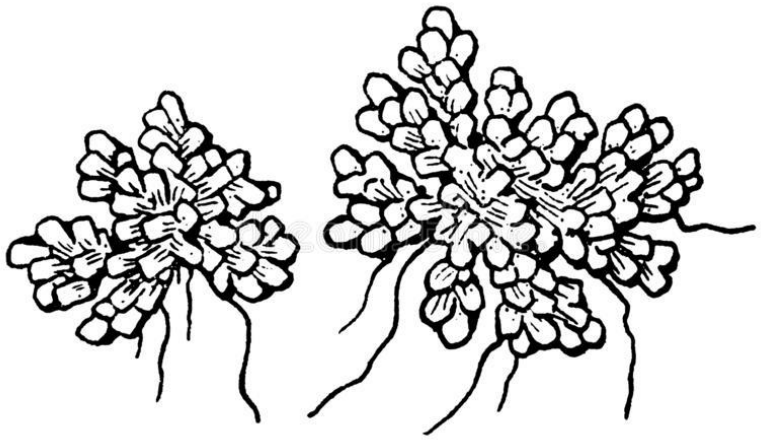
1. More than 100 species of BGA can fix nitrogen.
2. Nitrogen fixation takes place in specialized cells called 'Heterocyst' BGA very common in rice field.
3. Unlike Azotobacter BGA are not inhibited by the presence of chemical fertilizers.
4. No chemical fertilizers added, inoculation of the algae can result in 10-14% increase in crop yields.
5. They are easy to produce, usually they are mass produced in cement tanks filled with fresh water.
6. Not require any processing Quite and cheap Cost of 10kg may be Rs.30-40 only
7. Beneficial in certain crops like vegetables, cotton, sugarcane. Eg. of some algal biofertilizers are Anabena¬ Nostoc¬ Oscillatoria.



Use of Azolla- Azolla is a tiny fresh water fern common in ponds, ditches and rice fields. It has been used as a biofertilizer for a rice in all major rice growing countries including India, Thailand, Korea, Philippines, Brazil and West Africa.

The nitrogen fixing work is accomplished by the symbiotic relationship between the fern and BGA, Anabena azollae. In addition to nitrogen the decomposed Azolla also provides K, P, Zn and Fe to the crop

1. Azolla as a bio fertilizer Azolla biomass gets doubled within 5-7 days by vegetative methods.
2. Fix 40-80 kg nitrogen / ha / year.
3. Good manure for flooded rice.
4. Increase of crop yield up to 15-20% has been observed while fertilizing the rice with Azolla
5. Hybrids are growing faster
6. Tolerant to heat and cold
7. Fix 4-5% more nitrogen



Tips to get good response to biofertilizer application

1. Biofertilizer product must contain good effective strain in appropriate population and should be free from contaminating microorganisms.
2. Select right combination of biofertilizers and use before expiry date.
3. Use suggested method of application and apply at appropriate time as per the information provided on the label.
4. For seed treatment adequate adhesive should be used for better results.
5. For problematic soils use corrective methods like lime or gypsum pelleting of seeds or correction of soil pH by use of lime.
6. Ensure the supply of phosphorus and other nutrients.

Precautions to take while using biofertilizers

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a. Biofertilizer packets need to be stored in cool and dry place away from direct sunlight and heat.
b. Right combinations of biofertilizers have to be used.
c. As Rhizobium is crop specific, one should use for the specified crop only.
d. Other chemicals should not be mixed with the biofertilizers.
e. While purchasing one should ensure that each packet is provided with necessary information like name of the product, name of the crop for which intended, name and address of the manufacturer, date of manufacture, date of expiry, batch number and instructions for use.
f. The packet has to be used before its expiry, only for the specified crop and by the recommended method of application.
g. Biofertilizers are live product and require care in the storage
h. Both nitrogenous and phosphatic biofertilizers are to be used to get the best results.
i. It is important to use biofertilizers along with chemical fertilizers and organic manures. Biofertilizers are not replacement of fertilizers but can supplement plant nutrient requirements.

Benefits of biofertilizers- Bio-fertilisers are living microorganisms of bacterial, fungal and algal origin. Their mode of action differs and can be applied alone or in combination.

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1. Renewable source of nutrients
2. Sustain soil health
3. Supplement chemical fertilizers.
4. Replace 25-30% chemical fertilizers

5. Increase the grain yields by 10-40%.
6. Decompose plant residues, and stabilize C:N ratio of soil
7. Improve texture, structure and water holding capacity of soil
8. No adverse effect on plant growth and soil fertility.
9. Stimulates plant growth by secreting growth hormones.
10. Secrete fungistatic and antibiotic like substances.
11. Solubilize and mobilize nutrients
12. Eco-friendly, non-pollutants and cost effective method