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Use of Bio-fertilizers for Improving Crop Production and Soil fertility in Indian Agriculture

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Introduction

Bio fertilizers or microbial inoculants are defined as the preparations containing living or latent cells of useful microorganisms when used for seed treatment or for soil, lead to biological nitrogen fixation (BNF), phosphorous solubilizing and sulphur mobilizers or moralization of organic matter etc. thus improve the soil fertility and increase the crop productivity. Biofertilizers are beneficial soil microorganisms plays an important role in improving soil fertility and crop productivity due to their capability to fix atmosphere nitrogen, solubility insoluble phosphate and decompose farm wastes thus resulting in release of plant nutrients.

Nitrogen fixing biofertilizers

1. Rhizobium: is symbiotic, aerobic, N-fixing soil bacteria. They are capable to fixing nitrogen (N2) present in the air to ammonium ions that can be utilized by the host plants. Native rhizobium population is less 100 cells/g of soil. Rhizobium culture is recommended as seed treatment for legume crops. Ingredients: 125 g country sugar (Jaggery) and 1.25 Litre of water or 500 g Gum Arabica can be added as an alternative to country sugar.

2. Azotobacter: is a non-symbiotic, aerobic, free living, N- fixing soil bacterium. Found in aerable soils but its population rarely exceeds 102-103/G soil. It synthesizes growth promoting substances, produces group B vitamins, gibberellins and cytokinin like substances and seed germination of several crops (cereals and horticultural crops) improves

a) Application: Seed treatment, seedling treatment or Soil application.

3. Azospirillum (Associative): is a spiral shaped N-fixing bacteria, is widely distributed in soils and grass roots. It can fix 20-50 kg N/ ha in association with roots. It produces plant growth hormones such as IAA, GA, Cytokinin and Vitamins.

4. Acetobacter: is a rod shaped, aerobic, N-fixing bacteria. *Acteobacter diazotrophicus* is an N-fixing bacteria found in roots, stems and leaves of sugarcane with the potential to fix upto 200 kg N/ha. It is capable of growing at pH. It also solubilises various insoluble forms of phosphorous.

5. Blue green algae (BGA): BGA are photosynthetic, unicellular aerobic, N-fixing alage. They are used as biofertilizer for wetland rice and can provide 25-30 kg N/ha to 50 kg N/ ha/year. Improves soil structure by producing polysaccharides. The optical pH for BGA growth in culture media range from 7.5 to 10. Fresh BGA establish early in paddy fields and grow faster than dry BGA. Fresh BGA @ 30-60 kg/ha, Dry BGA @ 5-10 kg/ha.

6. Azolla: azolla is nothing but a water fern. It is not directly involved in N fixation. However, N fixation is carried out by the cyanobacterium a BGA. Anabaena azollae that lie in the leaf cavities of azolla. Common species: *A. pinnata, A caroliniana, A microphylla*. Azolla is also known as accumulate significant amounts of K. One crop of azolla can provide 20-40 kg N/ha to rice crop in about 20-25 days. Fresh azolla can be inoculated @ 3-4 tonnes/ ha (3-4 Kg/10 M2). It can be used either as a conventional green manure before planting rice grown or grown as a dual crop along with rice or then incorporated in the soil while rice is still growing.

Phosphate Solubilizers

'P' solubilizing microbes helps in the solubilization of native phosphorous from phosphate rock and other sparingly soluble forms of 'P' by secreting organic acids. Commercial 'P' solubilizers are ***Bacillus megaterium*** var ***phosphatase***.

- Seed treatment: Slurry is prepared using 200 g of biofertilizer in 200-500 ml of water and then poured slowly over 10-25 kg seeds. Seeds are mixed evenly, dried in shade and sown immediately.
- Soil treatment: a mixture of 5-8 kg of biofertilizer with 100-150 kg soils or compost is prepared and applied by surface broadcast over one hectare either at sowing or 24 hours earlier.
- Seedling treatment: a suspension of 1-2 kg biofertilizer is prepared in 10-15 litres of water. The roots of seedlings from 10-15 kg of seeds are dipped into this suspension for 20-30 minutes and transplanted soon after.
- Crops: sugarcane, potato, vegetables.

Phosphatic Mobilizers

The most prominent among nutrient mobilizer in the soil are the soil fungi i.e., mycorrhizae. They are 2 types.

1. Ectomycorrhizae: these form a compact sheath of hyphae over the surface of roots of a limited number of plants such as Pinus and Eucalyptus.

2. Endomycorrhizae: these fungi penetrate the roots of the host plants and grow between the cortical cells to produce storage 'vesicles' between the cells and multi-branched 'arbuscules' within the cells. Hence, they are called as Vesicular Arbuscular Mycorrhizae (VAM).

3. VAM: found everywhere and present in most soils and naturally infect most plants. VAM enhanced accumulation of plant nutrients mainly P, Zn, Cu and S. Application: 4-5 g of VAM inoculum is placed 3-5 cm below the seed or the lower proportion of bare root cuttings followed by normal plant cultivation practices.

a. Seedlings: 6 kg of inoculants is mixed with soil sufficient for 25 m2 and covered with a thin layer of soil.

b. Root treatment: with a slurry of 250 g inoculants in 1 litre of cow dung slurry can give at the time of transplanting.

Benefits of Biofertilizers

- Beneficial effect of legume bacteria in enhancing soil fertility.
- Biofertilizers can add 20-50 kg N/ha by fixation of atmospheric nitrogen and solubilize 20-30 kg P_2O_5 per hectare.
- Associative and free-living microorganisms are believed to contribute to sustainability or flooded rice production system.
- Biofertilizers when used continuously along with the fertilizers, reduce depletion of soil nutrients and provide long term sustainability to the farming system.
- Biofertilizers improve the soil physical properties, OC soil tilth and soil health.
- They are cheaper and pollution free and their production is based on renewable energy sources.
- Biofertilizers also enhance nutrient utilization efficiency and grain quality.

- Some of the biofertilizers are known to liberate growth promoting substances and vitamins and they not only help to maintain soil fertility but also involve in plant growth, suppress incidence of pathogens and disease control.
- They have potential to increase yield by 10-30 % in different crops.

Limitations and Constraints

- Rhizobium: Fixation only with legumes
- Azotobacter: Demands high organic matter.
- BGA: Effective only in submerged rice and demands bright sunlight.
- Azolla: Survival difficult at high temperature and great demand for Phosphorous.
- Faulty promotional approach based on tall claims and criticism of fertilizers.
- Unawareness of extension workers and farmers about the benefits of bio fertilizers.
- Inconsistent crop response due to adverse soil/ climatic conditions and lack of appropriate and efficient strains.
- Use of sub-standard inoculants and faulty inoculation techniques.
- Inadequate marketing/distribution network.

References

Rajanna, G.A., Paramesha, V and Bhasker, S. (2017) Agronomy at a glimpse. Jain Brother. ISBN: 978- 81-8360-243-3.

Praveen Kumar Jaga and Bharat Kumar (2016) Soil Fertility Fertilizers and Agrochemicals: Daya Publishing House, ISBN: 935130955X, 9789351309550