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Liquid Biofertilizers: An Overview

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Conventional agriculture plays a significant role in providing the food for growing human population, which has also led to growing reliance on pesticides and chemical Fertilizers. Indiscriminate and unbalanced use of chemical fertilizers, especially urea, along with chemical pesticides and lack of organic manure supply has led to considerable reduction in the health of soil. The exploitation of phosphorus and nitrogen fertilizers causes air and ground water pollution by eutrophication of water bodies. This circumstance leads to the introduction of harmless inputs like biofertilizers. Biofertilizers play important role in maintaining long term soil fertility and sustainability by fixation of atmospheric dinitrogen (N=N), convert insoluble P into available form or mobilizing fixed macro and micro nutrients for plants, there by increases their efficiency and availability. Biofertilizers keep the soil environment rich in all kinds of macro- and micro-nutrients via fixation of nitrogen, phosphate and potassium, mineralization or solubilisation, production of antibiotics, release of plant growth regulating substances and biodegradation of organic matter in the soil. Biofertilizers have tremendous potential for supplying nutrient especially for nitrogen and Phosphorus. They are eco-friendly and low cost inputs and can reduce chemical fertilizer dose by 25-50%.

Liquid bio-fertilizers are inoculants especially in liquid formulation which not only contain desired micro-organisms and their nutrients but also contain special protectants and amendments which promote cell survival in a package and after application to seed or soil. Additives used in liquid inoculants, improve quality of inoculants increasing the population density and shelf life. The liquid inoculants have efficient amount of population of *Rhizobium* sp., *Azotobactor* sp., *Azospirillum sp*. and phosphorus solubilizing bacteria up to the level of 10^8 cells per ml. Liquid bio-fertilizers are capable of fixing, solubilizing or mobilizing plant nutrients and retain their biological activity. The appropriate application of liquid bio-fertilizers improves the soil quality and yield as compared to carrier based bio-fertilizers. Liquid formulation of bio-fertilizers plays a vital role in increasing the shelf life of micro-organisms. The liquid Bio-fertilizers (LBF) are suspensions having useful microorganisms, which fix atmospheric nitrogen and solubilise insoluble phosphates and make it available for the plants. LBFs are sold to farmers under the brand name "Anubhav liquid Bio-fertilizers" by the University. nubhav LBF is based on native cultures of bacteria viz., *Azotobacter chroococcum*, *Azospirillum lipoferum* and *Bacillus coagulans*.

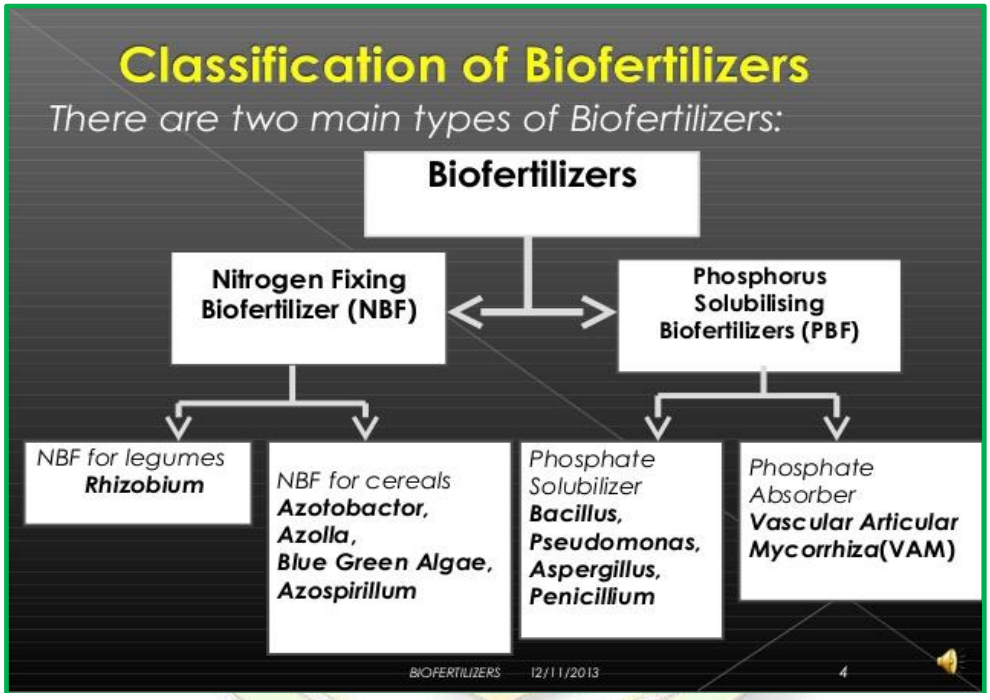
Liquid Bio-fertilizers have a distinct advantage in terms of cost saving on chemical fertilizers in addition to yield advantage. Chemical fertilizers otherwise may have negative

effects on soil as well as human health, change the soil chemistry and these soils no longer support plant growth in the long run. The earlier products of bio-fertilizers were carrier (solid) based where lignite is usually added as a carrier material. Lignite is hazardous to the production workers. Also, the shelf life of carrier based bio-fertilizers is only 6 months and is difficult to transport. LBFs on the other hand have a shelf life of minimum one year, with no health hazards to production workers and are easy to transport. Additionally, LBF can be used in drip irrigation and as a component of organic farming.

Objective of applying of liquid bio-fertilizer

- To increase the number and biological activity of useful micro- organism.
- To increase crop productivity and crop production also improve soil texture, soil fertility and other environmental problems.

Classification of biofertilizers



Rhizobium- Rhizobium is **a genus of Gram-negative soil bacteria that fix nitrogen**. Rhizobium species form an endosymbiotic nitrogen-fixing association with roots of (primarily) legumes and other flowering plants. Liquid form of rhizobium packed in 100ml, 250ml, 500ml, 1Ltr, 5Ltr bottle to increases the soil fertility. 5-10 ml / kg seed amount of rhizobium required for seed treatment.

Phosphate Solubilizing Bio fertilizer (PSB)

Phosphate Solubilizing Bio fertilizer (PSB) produce organic acids which help in dissolving soil phosphorus as well as applied phosphatic fertilizer in soil and make easy uptake by crop plants. In addition PSB also produce growth regulators which are beneficial to crop growth and strength. PSB can solubilize native soil phosphorus to the extent of two bags of SSP in case of high/medium phosphorus soils. The response further increases when organic contents of soil are improved through application of compost.

Azotobacter- Azotobacter species are **free-living, nitrogen-fixing bacteria**; in contrast to Rhizobium species, they normally fix molecular nitrogen from the atmosphere without symbiotic relations with plants, although some Azotobacter species are associated with plants. Liquid form of Azotobacter packed in 250ml, 100ml, 500ml, 1 Liter bottle to increases the soil fertility. 5-10 ml / kg seed amount of Azotobacter required for seed treatment.

Inoculation of Liquid Biofertilizers

1. Seed treatment with liquid biofertilizers

Take a plastic bag filled with 2 kg or more seeds. The bag should be air tightly packed. Then bag should be squeezed for 2 minutes or more until all the seeds are uniformly wetted. Then bag is opened, inflated again and shaked gently**.** Stop shaking after each seeds get a uniform layer of culture coating. The bag is opened and the seeds are dried under the shade for 20- 30 minutes. For large amount of seeds coating can be done in a bucket and inoculant can be mixed directly with hand. Seed Treatment with Rhizobium, Azotobacter, Azospirillum, along with PSM can be done.

2. Seedling Root dipping

For application of Azospirillum/ /PSM on paddy transplanting/ vegetable crops this method is used. The required quantity of Azospirillum/ /PSM has to be mixed with 5-10 litres of water. Then roots of seedlings has to be dipped for a minimum of half-an-hour before transplantation.

3. Soil application

Mix PSM with 400 to 600 kg of Cow dung FYM along with ½ bag of rock phosphate if available. Use 200ml of PSM per acre. The mixture of PSM, cow dung and rock phosphate have to be kept under any tree or under shade for over night and maintain 50% moisture. Use the mixture as soil application in rows or during leveling of soil.

Benefits of Liquid Biofertilizers

- Longer shelf life 12-24 month.
- NO contamination.
- Easy to identification by typical fermented smell.
- Better survival on seeds and soil.
- Easy to apply.
- High commercial revenues.
- Low effect of high temperature.

Role of liquid biofertilizers

- Supplement of chemical fertilizers for meeting the integrated nutrients demand for the crop.
- Increase in water uptake, root development, vegetative growth and nitrogen fixation.
- Increased crop yield by 15-25% as it add 20-200kg N/ha under optimum soil condition.
- Promote substance like vitamine-B complex ,indole acetic acid and gibberellic acids etc (e.g. Rhizobium, BGA, Azotobactor sp.)
- Phosphate solubilizing or mobilizing biofertilizers convert the insoluble soil phosphate into soluble forms and under optimum conditions they can solubilize/mobilize about 30-50 kg Phosphorus per ha.
- Cheaper, pollution free and used as renewable energy sources.