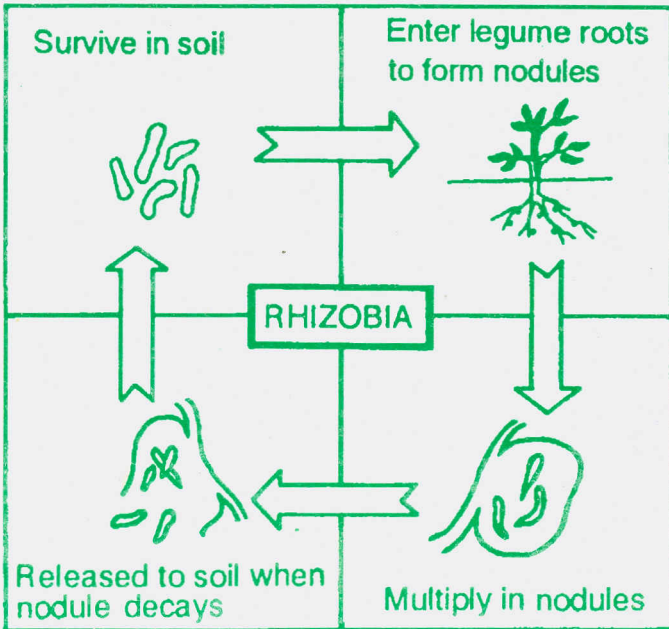


Use of Bio-Fertilizers



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INTRODUCTION :

The side effects of indiscriminate use of chemical fertilizers in agriculture can be summarised as disturbances in the soil reaction, development of nutrient imbalances in plants, increased susceptibility to pests and diseases, reduction in legume root nodulation and plant mycorrhizal associations, decrease in soil life and environmental hazards such as water pollution and soil humus reduction.

The realization of such detrimental effects of chemical fertilizers when used continuously in large quantities in the absence of organic components has triggered interest regarding the alternatives to supply the plant nutrients in an integrated manner giving rise to Integrated Plant Nutrient System [IPNS] in which, bio-fertilizers play a major role.

Plant nutrients

Nitrogen is the key nutrient for plant growth constituting between 1-5 per cent of plant dry matter as compared to 0.1-0.5 per cent for Phosphorous. Nitrogen is the major component of protein and the compound which direct and control the metabolic activity. The function of the nitrogen is to make plant green and succulent making large cells with thinner cell walls, promoting vegetative growth and determining the yield. Nitrogen is the major constituent of protein, amino acids, nucleic acids and chlorophyll. The atmosphere contains 4 trillions mt of nitrogen which is estimated as 78 per cent of it's volume and 75.5 per cent by weight. However, the ironical behavior of nature is that thugh the plants live in the atmosphere of nitrogen, they cannot use it.

Why use bio-fertilizers?

The industrial processes of nitrogen fixation (INF) involving production of ammonia expensive which involves imports of raw materials. They are heavily reliant on fossil fuel utilising a vast proportion of our energy supplies. Due to constantly depleting petroleum based products, feed stock, the cost of chemical fertilizer is increasing day by day. The energy requirement of 1kg. fertilizer is 11.2 kwh for nitrogen, 1.1 kwh for phosphorous and 1kwh for potash. Other problems associated with chemical fertilizers is the subsidy burden which has risen from Rs. 375/- crores in 1981-82 to an estimated figure of 11000 crores in 1996-97.

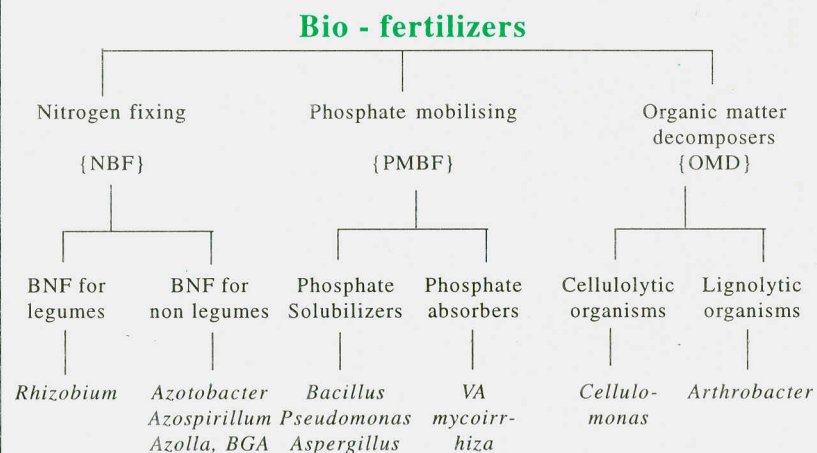
Biological; Nitrogen Fixation (BNF) :

It is the conversion of elemental nitrogen to organic combinations or to a form which is readily utilisable in the biological processes by nitrogen fixing microorganisms like free living bacteria, associative bacteria, blue green algae (BGA) and certain micro-organisms in a symbiotic association with plants. These organisms are collectively called "Diazotrophs".

Classification of bio-fertilizers

Bio-fertilizers may be broadly classified into three groups;

- ◆ Nitrogenous bio-fertilizers
- ◆ Phosphatic bio-fertilizers.
- ◆ Organic matter decomposers



Common microorganisms as Bio-fertilizers :

Name of the Bio-fertilizer	Contribution	Beneficiaries
1) Nitrogen <i>Rhizobium</i> {Symbiotic}	a) Fixes 50-30kg N/ha. b) Leaves residual nitrogen c) Increase yield by 10-30% d) Maitains soil fertility	Pulse legumes : Cowpea, Green-gram, Black gram, Pea, Gram Oil legumes : Groundnut, Soya Fodder legumes : Berseem, lucern Fodder legumes : Subabul, Shisan, Wheat, Jowar, bajra, maize
2) Azotobacter	a) Supplies 20-40mg N/g of carbon source. b) Promotion of growth	Mustard, sunflower, banana

	substances like vitamin, B Group, IAA and Gibberellic acid.	sugarcane, grapes, papaya, water melon, tomato, lily, lady finger, coconut, spices, fruit, flower, plantation crops, forest sp
	c) 10-15% increase in yield, d) Maintains soil fertility e) Biological control of plant diseases, suppresses plant pathogens	
3. Azospirillum	a) Fixes 20-40 kg Nitrogen b) Results in increase mineral and water uptake. c) Root development d) Vegetative growth and crop yield.	Rice, sugarcane, finger millet, wheat, sorghum bajra etc. ;
4. Blue Green Algae {bga}	a) 20-30 kg N/ha in submerged rice fields. b) Production of growth substances like auxins, IAA, gibberellic acid	Rice
5. Azolla	a) Fixes 40-80 kg N/ha b) Used as green manure because of large bio-mass	Rice

Methods of application :

There are four types of methods for application of bio-fertilizers:

- ◆ Seed treatment
- ◆ Seedling treatment
- ◆ Set treatment
- ◆ Soil treatment

A) Seed treatment :

For inoculation of cereals like rice, wheat, sorghum, maize etc.; and oilseeds like groundnut, sunflower, mustard, safflower, pulses like cowpea, green gram, black gram, soybean etc., seed treatment of bio-fertilizer is recommended. One packet {200g} is sufficient to treat 10-12 kg seed. On this basis the dose of bio-fertilizer per acre can be worked out, based on the seed rate.

Method :

- ✿ Keep the seeds required for sowing one acre in a heap on a clean cemented floor or gunny bag.
- ✿ Prepare culture suspension by mixing 1 packet {200g} bio-fertilizer in approx. 400 ml water {1:2}
- ✿ Sprinkle the culture suspension on the heap of the seeds and mix by hand so that thin coating is uniformly applied to the seeds.

- ✿ Spread the seeds under shade for sometime for drying and then sow.
- ✿ In place of water, rice glue {Kanji} can also be used for better results.

B) Set treatment :

This method is recommended generally for treating the sets of sugarcane, cut pieces of potato and the base of banana suckers.

Method :

- ☐ Prepare culture suspension by mixing 1 kg {5 packets} of bio-fertilizer in 40-50 litres of water.
- ☐ The cut pieces of planting material required for sowing one acre are kept immersed in the suspension for 30 minutes.
- ☐ Bring out the cut pieces and dry them in shade for some time before planting.
- ☐ After planting, the field is irrigated within 24 hours.

For set treatment, the ratio of bio-fertilizer to water is approximately 1:50.

C) Seedling treatment :

This method is recommended for crops like paddy, tobacco, tomato, chilly, onion, cabbage, cauliflower etc.;

Method :

- ☐ Prepare the suspension by mixing 1kg {5 packets} bio-fertilizer culture in 10-15 litres of water.
- ☐ Get the seedlings required for one acre and make small bundles of seedlings.
- ☐ Dip the root portion of these seedlings in this suspension for 15-30 minutes and transplant immediately.
- ☐ Generally, the ratio of inoculant and water is 1:10 {Approx} i.e. 1 kg. bio-fertilizer in 10 litres of water.
- ☐ For vegetables like chilly, tomato, cabbage, cauliflower, 1 packet of bio-fertilizer is sufficient for 0.1 ha {10000m²} land.

For flower and ornamental Plants :

These bio-fertilizers can also be used for flowers and ornamental plants like roses, jasmine, chrysanthemum, marigold, dahlias etc. Regarding the method of application, it is generally done by root dip method or by the cutting method.

For root dip method :

Dissolve one packet of bio-fertilizer {200 g} in 2 litres of water which is sufficient to treat 200-300 plants. Similarly, one packet in 2 litres is sufficient to treat 200-300 sets under cutting method.

Soil application :

This method vary crop to crop depending on it's duration. Generally, for a short duration {less than 6 months} crop, 10-15 packets {each of 200g} are mixed with 40-60 kg of well decomposed cattle manure or with 40-60 kg soil for one acre of land. The mixture of bio-fertilizer and cattle manure/soil sprinkled with water is then broadcasted into soil at the time of sowing or at the time of irrigation in standing crop. For long duration crop {perennial crop} 20-30 packets of bio-fertilizer {each containing 200g} are mixed with 80-120 kg. cattle manure or soil per acre.

Application in standing crop :

Perennial plants are pruned once in a year. After pruning, the soil in the bed is dug up with a fork with due care to avoid any damage to the roots.

Apply a mixture of bio-fertilizer and FYM/soil by incorporating it into the soil followed by irrigation.

Summary of Methods

Sl.	Method of application	Crops	Dose/ packets/Acre	Water	Ratio BF water	Soil/
1.	Seed application	All crops sown through seeds	200g bio-fert	400 ml	1:2	***
2.	Set treatment	sets of sugarcane, base of banana.	1 or 2 kg	50 or 100 litres	1:50	***
3.	Seedling method	Rice, tomato, chilly, cabbage cauliflower & flower crops	1kg	10 litres	1:10	****
4.	Soil application	All crops	2 kg	for wetting	***	40-50kg

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