In last decades, improved varieties of seeds, fertilizers, irrigation, water and plant conservation has contributed significantly to attain the state of self sustainability. Due to present power crisis and continuously diminishing source of energy, the price of fertilizers has become very high. Absorption of nitrogen is highest amongst different primary nutritive elements such as nitrogen, phosphate and potash. Not only this, the crop utilizes only 40-50% of the total quantity of the nitrogen poured in the soil and remaining 50-60% of the nitrogen is either drained with water or mixes in atmosphere by nitrification or temporarily bounded in the soil. As compared to other nutritive elements, nitrogen found in soil is minimal. If the attention is paid towards per kg nutritive element, nitrogen is more costly. Hence, economic and careful use of each grain of nitrogen is today's requirement.

In developing country like India, supply of such a huge quantity of nitrogen from chemical fertilizers is beyond the capacity of small and marginal farmers. Hence, dependency on chemical fertilizers to meet the nitrogen requirements of the plant on chemical fertilizer is not logical. Use of alternate sources of nitrogen along with nitrogenous fertilizers is not only from economic point of view but also it is essential to maintain sustained soil fertility. In such circumstances, integrated use of bio fertilizers and concentrate in the form of nitrogen fertilizers has been recommended. Following conditions are favorable for combined action of micro organism in the soil:

- Presence of organic matter.
- Moisture.
- Air circulation
- pH value nearing neutral. These entire four requirements can be met by compost only.

What is bio fertilizer or organic manure?

Primarily 17 elements are essential for good growth of all types of plants in which nitrogen and phosphorous is very essential. This is available to the plants in 3 ways:

- **A.** Chemical fertilizers.
- **B.** Dung Manures
- **C.** Nitrogen fixing and phosphorous solublizing bacteria. These are found in soil in natural form which converts atmospheric nitrogen in ammonia and unavailable phosphorous in available phosphorous. Organic manure is product of such organism which increases the availability of nitrogen and phosphorous to the plants.

Following bio fertilizers are available:

1. Rhizobium
2. Azotobactor
3. Azospirillum
4. Phosphatica
5. Blue Green Algae

Rhizobium

This is a mixture of moist and organic material of which one gram contains more than 10 crore microorganism. This bio fertilizer can be used in pluses only. This is crop specific i.e., for different crops, different types of rhizobium bio fertilizer are used. In seed treatment by rhizobium bio fertilizer, the microorganism sticks with the seed. At the time of seed germination, these microorganisms enter the roots through root hair and forms glands on the roots. Nitrogen fixation and growth of the plant depends upon the glands formed. If the glands are more, the growth of the plants is also more.

In which crop, rhizobium is used?

For different crops, rhizobium bio fertilizers are available in different packets and used in following crops:

- Moong, Urad, Arhar, Gram, Peas, Masoor etc.
- Oil seed crops – ground nut and soya bean.
- Others: rijika, barseen and all types of beans

How to use?

10 kg of seed can be treated by 200 gram rhizobium culture. Open one packet of 200 gram rhizobium, and dissolve with 50 gram gur in 500 ml of water. Spread the seeds on a clear surface and pour the solution slowly on the seeds. Turn the seeds up and down till a uniform layer of bio-fertilizer is formed on all the seeds. Now spread the treated seeds in shade. Dry it for 10-15 minutes and sow immediately.

Benefits of the use of rhizobium culture

- Its use save 10-30 kg nitrogen
- Its use increases the yield of crop by 15-20%.
- Rhizobium bacteria also form some hormones and vitamins due to which growth of the plant and development of roots is very good.
- As the soil fertility of land is high, the crop followed by the crop in which rhizobium culture has been used gives better growth of the plant.

Azotobactor/ Azospirillum bio fertilizer

These bio fertilizers are moist powdery product of nitrogen fixing bacteria, azotobactor and azospirillum. One gram of it contains 10 crore bacteria. This bio fertilizer can be used in any crop except pluses.

Benefits of the use of Azotobactor/ Azospirillum

- Its use increases the yield of crop by 10-20% and natural taste of fruits and grains retained.
- Its use can save 20-30 kg nitrogen
- Its use results in early and healthy germination and development of roots is early and high.
- The crop uses more of fertilizers from the soil which results in more tillering.

- The bacteria of this bio fertilizer destroy the bacteria spreading diseases which prevent crops from diseases and increase disease resistant capacity of the plant.
- Use of such bio fertilizers results in higher growth of roots and stems due to which the capacity of the plant to bear fast wind, heavy rains and drought conditions.

Phosphatica Bio Fertilizer

Phosphatica bio fertilizer is moist powdery product of independent living nitrogen fixing bacteria. One gram of it also contain 10 crores bacteria. By use of this bio fertilizer, non soluble phosphorous present in the soil is converted into soluble phosphorous by the bacteria.

Normally, above type of bacteria is also found in the soil. But it is not essential that the bacteria present in the soil are efficient and active. Hence, effective microorganism is made available to the farmers through culture.

Benefits of the use of Phosphatica Bio Fertilizer

- Use of phosphatica bio fertilizer not only increase the yield by 10-20% but 30-50% phosphorous available in the soil can also be saved.
- Development of root is more so the plants become healthy.

Precautions

- Rhizobium is crop specific. Hence use it in the crop mentioned on the packet.
- Keep the bio fertilizer in dry and cold places away from sun light and heat.
- Do not mix seeds treated with bio fertilizers with any type of chemicals or chemical fertilizers.
- If the fungicides are to be used on seeds, use bavistin. If the copper and mercurial chemicals are to be used, treat the seed first with fungicides and then with double the quantity of bio fertilizer.
- Use bio fertilizer within expiry date mentioned on the packet.
- Purchase bio fertilizer from certified institutions only otherwise their bacteria may not be active.

Quantity and Method of use of Azotobactor/Azospirillum/ Phosphatic Bio Fertilizer

Quantity and Method of use of Azotobactor/Azospirillum/ Phosphatic Bio Fertilizer

SN	Method of Use	Crop	Quantity per Acre
1	Seed Treatment: Dissolve required quantity of bio fertilizer in 1.5 liter water per acre and gently pour on the seeds. Turn the seeds up and down with the hand till a uniform layer of bio fertilizer is formed on the seed. Keep the treated seed in shade and sow immediately.	Wheat, Jowar, Maize, Cotton, Sun flower, Mustard	2 kg 500 grams 200 grams

2	Root Treatment: Prepare a solution in wide mouth bottle by dissolving required quantity of bio fertilizer at the rate of 1 kg in 4 liter water. Soak the roots of the plants for 3-4 minutes in this solution and then plant the treated roots immediately in the field.	Paddy, Chili, Tomato, Cauliflower, Brinjal, Onion etc	1.5kg 2kg
3	Tuber Treatment: Prepare a solution by dissolving required quantity of bio fertilizer at the rate of 2 kg in 1.5 liter water. Soak the tuber of the plants for 5-10 minutes in this solution or spray the solution on the tuber and then sow the treated tuber immediately in the field.	For crops ripening within 6 months	2.5kg
4	Soil Treatment: Prepare a mixture of required quantity of bio fertilizer with 35-40 kg compost or fine tilth and spray in the soil at the time of last plough or before first irrigation.	For crops ripening in more than 6 months	3.5 kg
5	Blue Green Algae: Apply blue green algae at the rate of 12.5 kg per hectare after one week of planting. At least 3-4 cm water must be filled in the field at the time of its use. If any weed fungicides has been used, use blue green algae after 3-4 days of weed fungicides.		