

“Go Bio, Grow Better: Improving Soil Fertility Naturally”

Dr. T. Sri Chandana¹, N. Teja Kumar², Dr. K. Raghavendra Chowdary³, Dr. Y. Mounika⁴,

Dr. M. V. Niranjan Reddy⁵ B. Anil Kumar⁶

¹SMS (Extension), ²PA (STL), ³Programme Coordinator, ⁴SMS (Horticulture), ⁵SMS (Veterinary) and ⁶Young Professional-II
 (Special Project on Cotton) KrishiVigyan Kendra, Banavasi-518 360

*Corresponding author: chandanaphd39@gmail.com

Manuscript No: KN-V4-02/002

Introduction

In agriculture, the use of chemical fertilizers and pesticides is increasing day by day. This not only reduces the number of microorganisms in the soil but also deteriorates the soil's health. In this context, the method of “Integrated Nutrient Management” has been recognized as very important in our agricultural sector. Along with the use of organic manures, the use of bio-fertilizers has gained significant importance.

What are Bio-fertilizers?

Bio-fertilizers are formulations containing important, beneficial microorganisms in powder or liquid form that are applied to seeds or the soil. These beneficial microorganisms enter the root nodules or the root zone (rhizosphere), making necessary nutrients available to the plants and greatly assisting in plant growth.

Precautions when using Bio-fertilizers:

- Store bio-fertilizer packets in a cool, shady place away from direct sunlight and heat.
- The packet used by the farmer must be appropriate for the specific crop.
- Use only within the expiry date printed on the packet.
- If seeds are treated with chemicals, there must be a gap of 24-48 hours before treating with bio-fertilizers.
- Do not mix bio-fertilizers with chemical fertilizers.
- Use quality culture for effective results.
- Use the specific bio-fertilizer recommended for the crop.
- When mixed with organic manure, the mixture should be used immediately.

Benefits of using Bio-fertilizers

- Environmental pollution can be curbed.
- They make nutrients in the atmosphere and soil, which plants cannot use on their own, available to them.
- Hormones and vitamins become available to the plant, leading to faster and healthier growth.
- Soil-borne diseases can be controlled to some extent.
- Physical properties of the soil improve, and soil fertility develops.
- Farmers' expenditure on chemical fertilizers decreases, increasing the profit ratio.
- Normal yields can increase by 10-20%.

Types of Bio-fertilizers: Bio-fertilizers are classified based on their activity and usage:

1. Nitrogen-fixing bio-fertilizers.
2. Phosphorus solubilizing microorganisms.
3. Potassium mobilizers.
4. Zinc solubilizing microorganisms.
5. Organic matter decomposing microorganisms.
6. Plant Growth Promoting Rhizobacteria (PGPR) inhabiting the root zone.

1. Nitrogen-Fixing Bio-fertilizers

- **Rhizobium:**

- This should be used as a bio-fertilizer for legume crops (pulses) and oilseeds like groundnut and soy.
- Using this culture leads to the formation of pinkish root nodules. The Rhizobium in these nodules fixes atmospheric nitrogen and supplies it to the plant.
- **Method of Use:** Dissolve 10g of sugar, jaggery, or gum powder in 100ml of water, boil for 10 minutes, and cool it. Sprinkle this cooled solution on 10kg of seeds, add 200g of Rhizobium culture, mix well, dry the seeds in the shade for 10 minutes, and then sow.

- **Azotobacter:**

- This bacterium not only fixes nitrogen but also provides necessary hormones and vitamins to the plant.
- Recommended for leafy vegetables, other vegetables, and flower gardens.
- **Method of Use:** Mix 1kg of culture with 200kg of organic manure and broadcast it over one acre of land at the time of sowing.

- **Azospirillum:**

- These bacteria grow around plant roots and, where possible, enter the roots to live. As a result, a large percentage of the fixed nitrogen is directly available to the plant.
- Useful for Paddy, Sugarcane, Cotton, Chilli, Jowar, Bajra, Sunflower, Banana, etc.
- **Method of Use:** Mix 1kg of Azospirillum culture with 80-100kg of organic manure and apply it to the soil (in the seed furrows) for one acre.
- **For Seedlings:** Prepare a small bed with 70-80 litres of water. Mix 1kg of Azospirillum. Dip the roots of the seedlings in this solution for 10 minutes before planting. For sugarcane, dip the setts for 10 minutes before planting.

- **Blue-Green Algae (Cyanobacteria):**

- This is a nitrogen-fixing bio-fertilizer useful only for paddy. Farmers can grow this in small ponds or tanks and use it after transplanting paddy.
- **Method of Use:** Broadcast 4-6kg of this bio-fertilizer mixed with 40-50kg of organic manure in one acre of paddy field 3-7 days after transplanting.

- Within 15-20 days, the algae forms a thick mat. Drain the water and incorporate the algae into the soil. It also serves as organic matter.
- **Azolla - Anabaena:**
 - Azolla is a fern that floats on water in paddy fields. The leaves of this fern harbor a cyano bacterium called Anabaena, which fixes nitrogen and makes it available to the crop.
 - It supplies not just nitrogen, but also organic carbon and potassium.
 - **Method of Use:** One week after planting paddy, broadcast about 200kg of Azolla in one acre. Let it grow on the water for 15-20 days. Then drain the water; it will rot in 3-4 days and provide nutrients. It is even more effective if grown as a green manure and ploughed into the puddle.

2. Phosphorus Solubilizing Bio-fertilizers

These microorganisms produce enzymes and various acids in the soil to dissolve insoluble phosphorus and help plant roots absorb it. They also release phosphorus bound with micronutrients.

- **Phospho bacteria:**
 - Converts phosphorus present in the soil in an unavailable form into an available form. Can be used for all crops.
 - **Method of Use:** Mix 1-1.5kg of Phospho bacter with 200kg of cattle manure and apply in the furrows or soil. In paddy, apply within 3-7 days of transplanting.
- **Phospho-fungi:**
 - A bio-fertilizer more powerful than phosphor bacteria. It can be used for all crops.
 - **Method of Use:** Mix 1kg of bio-fertilizer with 100kg of organic manure and apply in the seed rows for one acre.
- **Phosphate Mobilizing Mycorrhiza:**
 - It penetrates deep into soil layers where plant roots cannot reach and supplies phosphorus along with micronutrients like Zinc, Copper, Sulphur, Manganese, Iron, and water.
 - **Method of Use:** Since there is no specific dosage, at least 5kg should be applied per acre. It is easy to use for nursery-grown crops.

3. Other Bio-fertilizers

- **Potassium Mobilizers:** Mobilize potassium in the soil that is unavailable to plants.
 - **Method of Use:** Mix 1-1.5kg with 100kg of organic manure and broadcast over one acre.
- **Zinc Solubilizers:** Make zinc elements in the soil available to plants.
- **Organic Matter Decomposers:** These are used to decompose plant waste. They decompose residues after harvest, increasing soil density and providing nutrients to plants.

References

FAO. 2019. *Biofertilizers: A Sustainable Approach for Soil Health and Crop Productivity*. Food and Agriculture Organization of the United Nations, Rome.

Bhattacharyya, P. and Jha, D.K. 2012. *Plant growth-promoting rhizobacteria (PGPR): Emergence in agriculture*. *World Journal of Microbiology and Biotechnology*, 28: 1327–1350.

- Subba Rao, N.S. 2014. Biofertilizers in Agriculture and Forestry. Oxford & IBH Publishing Co., New Delhi.*
- Yadav, A.K., Verma, J.P. and Tiwari, K.N. 2017. Effect of biofertilizers on soil fertility and crop productivity. International Journal of Agricultural Sciences, 9(2): 382–387.*