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Biofertilizers: A Green Approach to Boosting Pulses Crop Productivity

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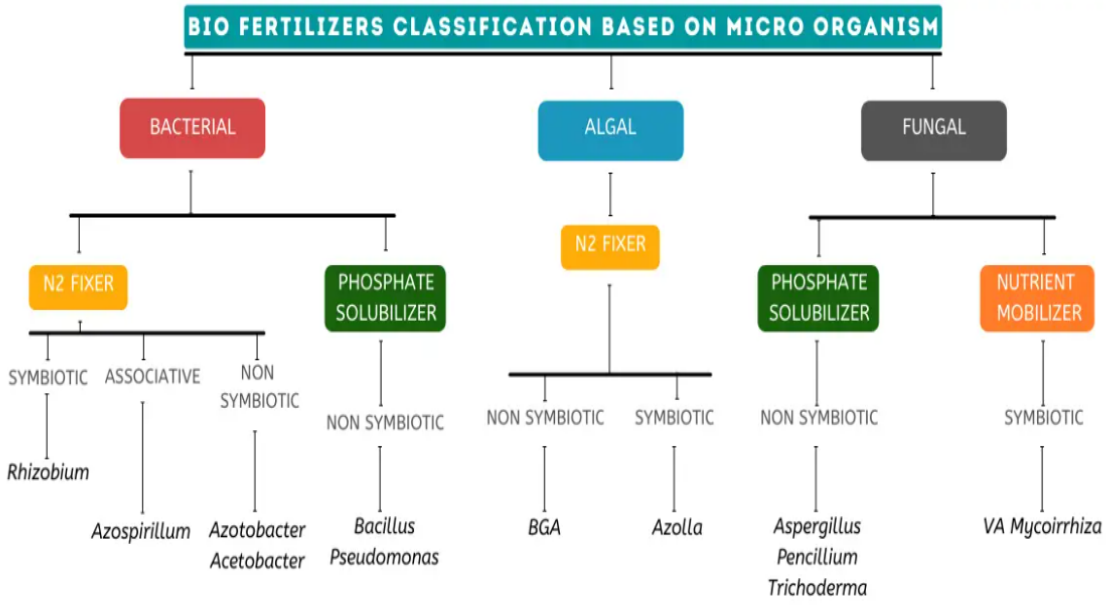
Biofertilizers

Biofertilizers are microbial inoculation which can mobilize nutritive elements required for the plants by fixing atmospheric nitrogen, solubilizing and enhancing uptake of soil phosphorus. Biofertilizers include longer shelf life of microbial cells causing no adverse effects on the ecosystem.



Contribution of Biofertilizer to pulse crops

India is such a country were large population depending on agriculture and most of them in arid and semi-arid areas where rainfall is limited. Due to this cultivation of pulses crops are abundant in these areas. Pulses like chickpea, red gram pea, green gram, black gram and few other crops are grown in these regions. Due to less water availability and less nutrient available yield among these areas are low. Farmer use large number of fertilizers and chemical to increase productivity and yield while side by side they are damaging their soil fertility and

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productivity. India is the largest producer, importer, and consumer of pulses in the world, accounting for nearly 30% of the world's population, India imports 14% of pulses from the world.

Beneficial microbes in pulse production

- Rhizobium
- Phosphate-Solubilizing Microorganisms
- Vesicular Arbuscular Mycorrhiza (VAM)
- Plant Growth Promoting Rhizobacteria (PGPR)

1. Rhizobium

Rhizobium is relatively more effective and widely used biofertilizer. Rhizobium association with legumes, fixes atmospheric nitrogen. Rhizobium legumes association yield increase by 10-30%. It has been estimated that 40- 250 kg N/ha/year is fixed by different legumes crop by their microbial activities of Rhizobium. Pink-colored nodules are considered most effective in N-fixation varying from 50 to 200 kg N/ha per season .

Nodules in pulses

2. Phosphate-Solubilizing Microorganisms

These bacteria secrete organic acids that break down insoluble phosphorus compounds, making it easier for the pulse plants to absorb phosphorus, an essential nutrient for their growth and development. The dual inoculation of Rhizobium and phosphobacteria is an important practice for N and P nutrients for pulse crops. The dual inoculation of phosphobacterium (*Bacillus megaterium var. phosphaticum*) and Rhizobium significantly increased the plant height, nodule number, and nodule weight of pulses.

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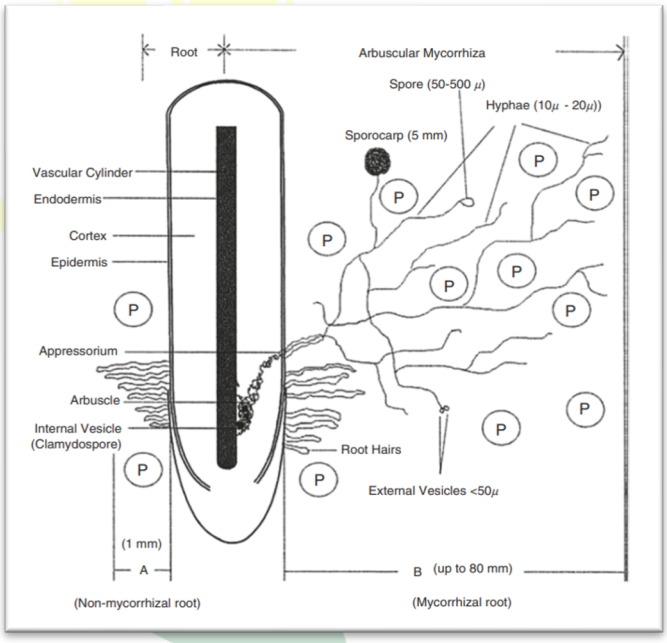
3. Arbuscular Mycorrhizal Fungi

Mycorrhiza is a symbiotic association of a special group of fungi with the roots of plants and that benefits the translocation and uptake of phosphorous in plants. They are formed by the group of fungi that are usually present in all soils from the phylum *Glomeromycota,* including ten genera: *Paraglomus, Glomus, Gigaspora, Geosiphon, Scutellospora, Diversispora, Sclerocystis, Acaulospora, Entrophospora, and Archaeospora.* It play a great role in inducing plant growth. It facilitates better water absorption especially during water stress conditions and facilitates efficient absorption of various macro and micronutrients, primarily phosphorus. Its Inoculation improves water relation of the plants.



Root colonized by AMF

4. Plant Growth-Promoting Rhizobacteria (PGPR)

They have ability to increase the availability of nutrient concentration in rhizosphere by fixing nutrients, thus preventing them from leaching out. These are Bio stimulants and the phytohormones as they produce indole-acetic-acid, cytokinin, gibberellins and inhibitors of ethylene production.

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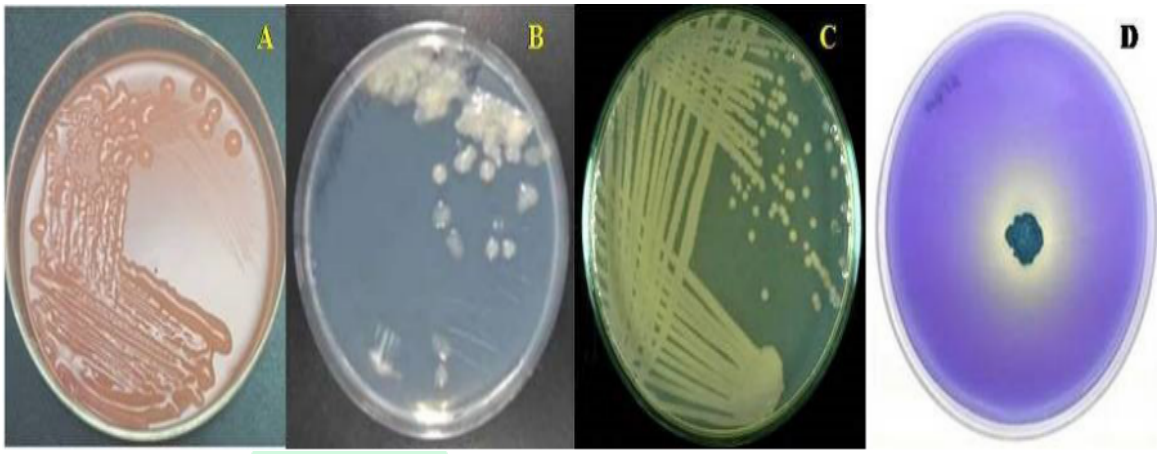

Microorganisms of biofertilizers: A. *Rhizobium sp.*, B. *Azotobacter sp.*, C. *Pseudomonas sp.* and D. Phosphate solubilizing bacteria

Mode of Application of Biofertilizers: -

Biofertilizers can be applied by any one of the following modes of application –

1. **Seed Treatment:** Prepare a slurry of recommended Biofertilizer in 500 ml water. Mix it with the seeds on clean, cemented floor or on a plastic sheet, Allow the seeds to air dry in shade and show the seeds immediately.
2. **Soil Treatment:** Mix the biofertilizer with 10 kg of soil/farmyard manure and broadcast it equally in one acre of field or apply the biofertilizer to furrows before sowing of the crop.
3. **Seedling Treatment:** Prepare a suspension of biofertilizer in 100 liters of water. Dip the roots of the seedling in this suspension for 45 minutes before transplanting into the fields.

What precautions one should take for using Biofertilizers?

1. It is highly beneficial to use biofertilizers along with organic manures.
2. Other chemicals should not be mixed with the Biofertilizer.
3. Biofertilizers are live product and require care in storage.
4. Rhizobium is crop specific; one should use for the specified crop only.
5. Biofertilizers packets need to store in cool and dry place away from direct sunlight.

Tips to get good response to Biofertilizers application: -

1. Ensure the supply of phosphorus and other nutrients.
2. For seed treatment adequate adhesive should be used for better results.

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3. Select right combination of Biofertilizers and use Before expiry date.
4. Biofertilizers product must contain good effective strain in appropriate population and should be free from contaminating microorganism.
5. For problematic soil use corrective methods like lime or gypsum pelleting of seed or correction of soil pH by use of lime.

Future Perspectives of Biofertilizers in Pulse Production:

Application of different biofertilizers as an essential factor of pulse cultivation is the new promising area nowadays. These Inoculants are already being successfully utilized in India and few developing countries for pulse production and are expected to grow with time.

1. Comprehensive study on rhizobia infecting *V. radiation, V. Mungo, C. Cajan, Cyamopsis tetragonoloba, and V. unguiculata* using molecular techniques for proper classification and exploration of its multiple functions is needed. Currently PCR- based techniques deciphered the endophytic occurrence of these rhizobia in cereals and increase fertilizer use efficiency in these crops.
2. Invention of genetically modified organisms (GMO's) more efficacious in stimulating plant growth is required . Concurrently scientists will need to establish to both the public and regulatory agencies worldwide the GMO's do not present any new hazards or risk.
3. It is necessary to have requisite extension program to educate farmers and village level workers about the long -term benefits of biofertilizers. The ill effects of prolonged use of synthetic fertilizers should also be acknowledged to people side by side.
4. Investigation into the microbial persistence of biofertilizers in stressful soil environments is to be mandatory.
5. Assessment of biofertilizers on the basis of agronomic practices, soil, and socio-economic aspects under diverse agriculture production system is desired for proper utility.
6. Quality control system for the production of biofertilizers ad their use in the field guarantee ad explores the benefits of plant – microorganism symbiosis. Hence "biofertilizer act" and strict regulation for quality control in markets and application should be established.

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