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Biofertilizers: A boon for Crop Productivity

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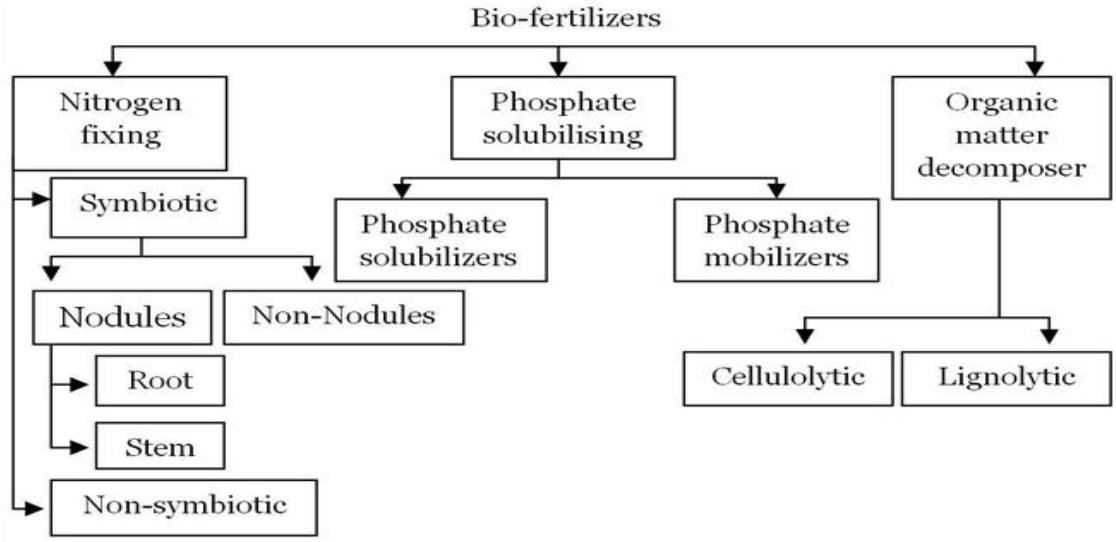
Biofertilizers

Biofertilizers are microbial inoculants that fix atmospheric nitrogen and improve soil phosphorus uptake, therefore mobilising the nutrients needed by the plants. Longer shelf lives of microbial cells that don't harm the environment are characteristics of biofertilizers.



Role of Biofertilizer to pulse crops

India is a country with a sizable population that relies heavily on agriculture, the majority of whom live in dry and semi-arid regions with little rainfall. Because to the production of pulses, these regions have an abundance of crops. In these areas, a few additional crops as well as pulses such chickpea, red gramme pea, green gramme, and black gramme are farmed. The low yield observed in these places can be attributed to reduced availability of water and nutrients. In an effort to boost yield and productivity, farmers apply a lot of chemicals and fertilisers, but in the process, they degrade the fertility and productivity of the soil. With 14% of the world's pulse imports and over 30% of the world's population, India is the world's largest producer, importer, and consumer of pulses.

Useful microbes in crop production

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

1. **Rhizobium:** Rhizobium is a commonly used and comparatively more effective biofertilizer. Legumes and Rhizobium together fix atmospheric nitrogen. Legumes associated with Rhizobium improve yield by 10–30%. It has been calculated that the microbiological activity of Rhizobium in various legume crops fix 40–250 kg N/ha/year. Nodules with a pink hue are thought to be the most efficient at fixing nitrogen, with a seasonal variation of 50 to 200 kg N/ha.

Root Nodules

2. **Phosphate-Solubilizing Microorganisms:** These microorganisms release organic acids that facilitate the absorption of phosphorus by pulse plants. Phosphorus is a crucial nutrient for plant growth and development. For pulse crops, the dual inoculation of Rhizobium and phosphobacteria is a crucial technique for providing N and P nutrients. Pulses with dual inoculations of Rhizobium and Bacillus megaterium var. phosphaticum showed a considerable increase in nodule weight, quantity, and plant height.
3. **Arbuscular Mycorrhizal Fungi:** A unique class of fungus called mycorrhiza has a symbiotic relationship with plant roots, which helps the plants absorb and translocate phosphorus. The phylum Glomeromycota, which includes ten genera of fungi—*Paraglomus, Glomus, Gigaspora, Geosiphon, Scutellospora, Diversispora, Sclerocystis, Acaulospora, Entrophospora, and Archaeospora*—forms the group that forms them.It has a significant impact on stimulating plant growth. It improves water

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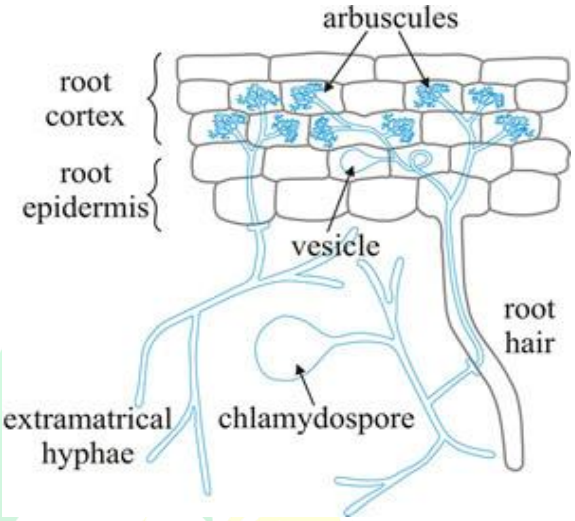
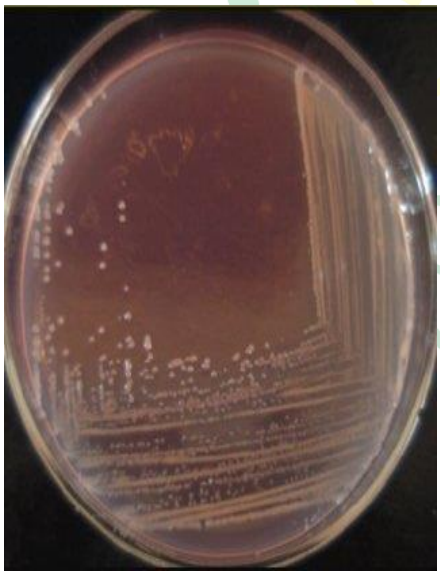
absorption, particularly in situations of water stress, and makes it easier for several macro- and micronutrients—phosphorus in



Root colonized by AMF

4. **Plant Growth-Promoting Rhizobacteria (PGPR):** By fixing nutrients and keeping them from evaporating, they have the capacity to raise the concentration of nutrients that are available in the rhizosphere. These are phytohormones and biostimulants that generate cytokinin, gibberellins, indole-acetic acid, and ethylene production inhibitors.



(A)

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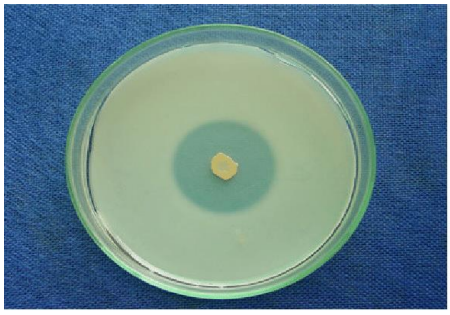

(D)

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

Ways to apply Biofertilizers: -

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

1. **Seed Treatment:** Make a slurry using 500 millilitres of water and the suggested Biofertilizer. Combine it with the seeds either on a plastic sheet or a spotlessly sealed floor. Show the seeds right away after letting them air dry in the shade.
2. **Soil Treatment:** Apply the biofertilizer to furrows prior to crop sowing, or mix it with 10 kg of soil or farmyard manure and spread it evenly over an acre of land.
3. **Seedling Treatment:** Make a biofertilizer suspension in 100 litres of water. Before transferring the seedling into the fields, let its roots soak in this suspension for forty-five minutes.

Precautions for stakeholders:

- Using organic manures and biofertilizers together has many advantages.
- The biofertilizer should not be used with other chemicals.
- Because biofertilizers are live products, they must be stored with care.
- Rhizobium is crop-specific; it should only be used for that particular crop.
- Store biofertilizer packets out of direct sunlight in a cool, dry location.

Tips to maximum benefits to Biofertilizers application: -

- Assure the availability of other nutrients, such as phosphorus.
- For optimal results, sufficient adhesive should be used while treating seeds.
- Use the proper mix of biofertilizers before the expiration date.
- The product made from biofertilizers needs to be free of contaminating microorganisms and have a good, effective strain in the right population.

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- Apply remedial techniques to troublesome soil, such as adding lime or gypsum to seed pellets or adjusting the pH of the soil with lime.

Future Perspectives of Biofertilizers in crop yield:

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. To properly classify and investigate the many activities of rhizobia, a thorough investigation utilising molecular techniques is required for the infections of V. radiation, V. Mungo, C. Cajan, Cyamopsis tetragonoloba, and V. unguiculata. At the moment, PCR-based methods are being used to analyse the endophytic occurrence of these rhizobia in cereals and improve the crops' ability to use fertiliser.
2. It is necessary to develop genetically modified organisms (GMOs) that are more effective at promoting plant development. Simultaneously, scientists must demonstrate to the global regulatory community and the general public that GMOs pose no new risks or dangers.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.
3. It is imperative to do research on the microbial persistence of biofertilizers in harsh soil conditions.
4. For optimal value, biofertilizers should be evaluated based on agronomic practises, soil, and socioeconomic factors in a variety of agricultural production systems.
5. Quality control system that ensures the manufacturing of biofertilizers, guarantees their application in the field, and investigates the advantages of plant-microbe symbiosis. Therefore, strong regulations for quality control in markets and application, as well as the "biofertilizer act," should be implemented.

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