# Biofertilizer: An overview

## B. Sc. Microbiology

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**Prepared By:**

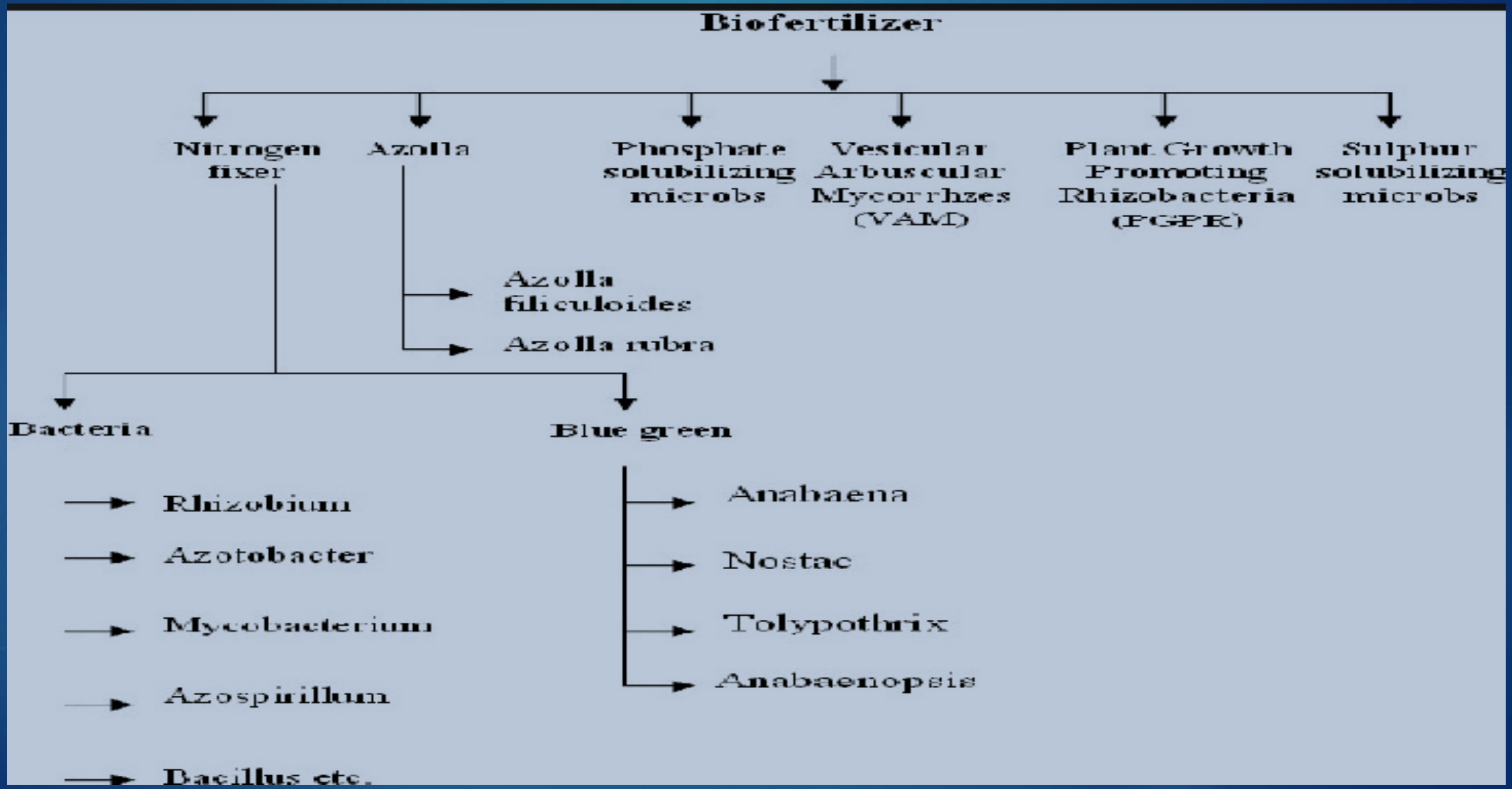
**Jaya Philip**

**Head, Department of Microbiology,**

**Patna Women's College**

**- jayaphilipmicrobio@gmail.com**

# TYPES OF BIOFERTILIZERS



| Name of bio-fertilizer | Contribution | Beneficiaries |
|---|---|---|
| A) Nitrogen<br>1) *Rhizobium* { Symbiotic} | a) Fixes 50-30 kg N/ha<br>b) Leaves residual nitrogen<br>c) Increase yield by 10 –30%<br>d) Maintains soil fertility | **Pulses legumes:** Cowpea, Green gram, Black gram, Pea, Gram<br>**Oil legumes:** Groundnut, Soyabean<br>**Fodderlegumes:** Berseem, lucerne<br>**Fodderlegumes:**Subabul,Shisan,Wheat, Jowar,Bajra, Maize |
| 2) Azotobacter | a) Supplies 20-40mg N/g of carbon source<br>b) Promotion of growth substances like vitamins, B Group, IAA and Gibberellic acid<br>c)10-15% increase in yield<br>d)Maintains soil fertility<br>e)Biological control ofplant disease, suppresses plant pathogens | Mustard, sunflower, banana, sugarcane, grapes,papaya,watermelon, tomato, chilly ladyfinger,coconut,spices,flower,plantation crops, forest sp. |
| 3. Azospirillum | a) Fixes 20-40 kg Nitrogen<br>b) Results in increase mineral and water uptake.<br>c) Root development<br>d) Vegetative growth and crop yield. | Rice, sugarcane, fingermillet, wheat, sorghum bajra etc.; |
| 4. Blue Green Algae {bga} | a) 20-30 kg N/ha in submerged rice fields.<br>b) Production of growth substances like auxins, IAA, giberellic acid | Rice |
| 5. Azolla | a) Fixes 40-80 kg N/ha<br>b) Used as green manure because of large bio-mass | Rice |

# BENEFITS OF BIOFERTILIZERS

*Makes availability of nutrients.
*Make the root rhizosphere more lively.
*Growth Promoting Substances are produced.
*More root proliferation.
*Better germination.
*Improve quality and quantity of produce.
*Improve fertilizer use efficiency.
*More biotic and abiotic stress tolerance.
*Improve soil health.
*Residual Effect.
*Make the system more sustainable.

# PRODUCTION

FOR FREE LIVING ORGANISMS:

Small quantity of inoculum of BGA and azolla can be obtained from laboratories and they can be multiplied in the farmers' field for subsequent application.

BGA inoculum is multiplied in iron trays of 2m*2m*0.25m size. Each tray is filled with 20kg soil and 400gms superphosphate. BGA inoculum is sprinkled on it standing water of 5-10cm is maintained. A thick algal scum is formed within a week. Then, water is drained out and soil is allowed to dry. Then the flakes are ready for application.

Same procedure is followed in case of azolla except that it is multiplied in 4m*2m nursery beds. Moreover azolla can be used as a green manure crop.

# METHOD OF APPLICATION

**BGA(Rice)**
Soil Application @4kg algal culture/ac at 7DAT
**Azolla(Rice)**
As Green Manure (4t/ac) at planting
As Dual Crop/inter crop (400-500kg/ac) at 7DAT
**Rhizobium (all legumes)**
1.Treatment Seed
2.Soil Application
**Azotobacter and Azospirillum (all non legumes)**
1.seed treatment
2.Seed material treatments (potato/sugarcane/sweet potato etc.)
3.Seedling Root dipping (vegetables/flowers those are transplanted)
4.Soil application

**PSM (all legumes and non-legumes)**

1.seed treatment
2.Seed material treatment(potato/sugarcane/sweetpotato etc.)
3.Seedling Root dipping (vegetables/flowers those are transplanted)
4.Soil application

**VAM (Vescicular Arbuscular Mycorrhiza)**

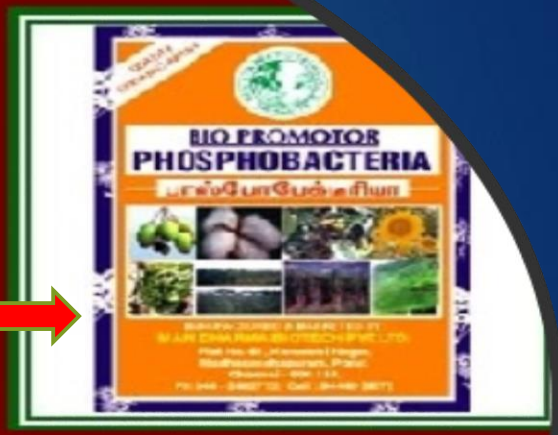
1.Inoculation of seedlings on the seedbed
2.Inoculation of potted soil

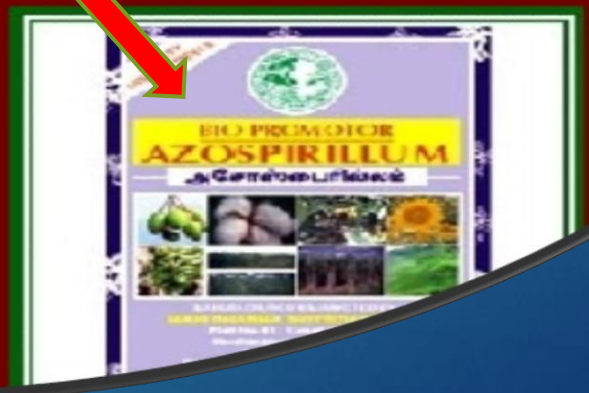
**Waste Decomposers**

1.Compost pit decomposition
2.Field(in situ) decomposition

# SOME OF BIO-FERTILIZERS IN THE MARKET





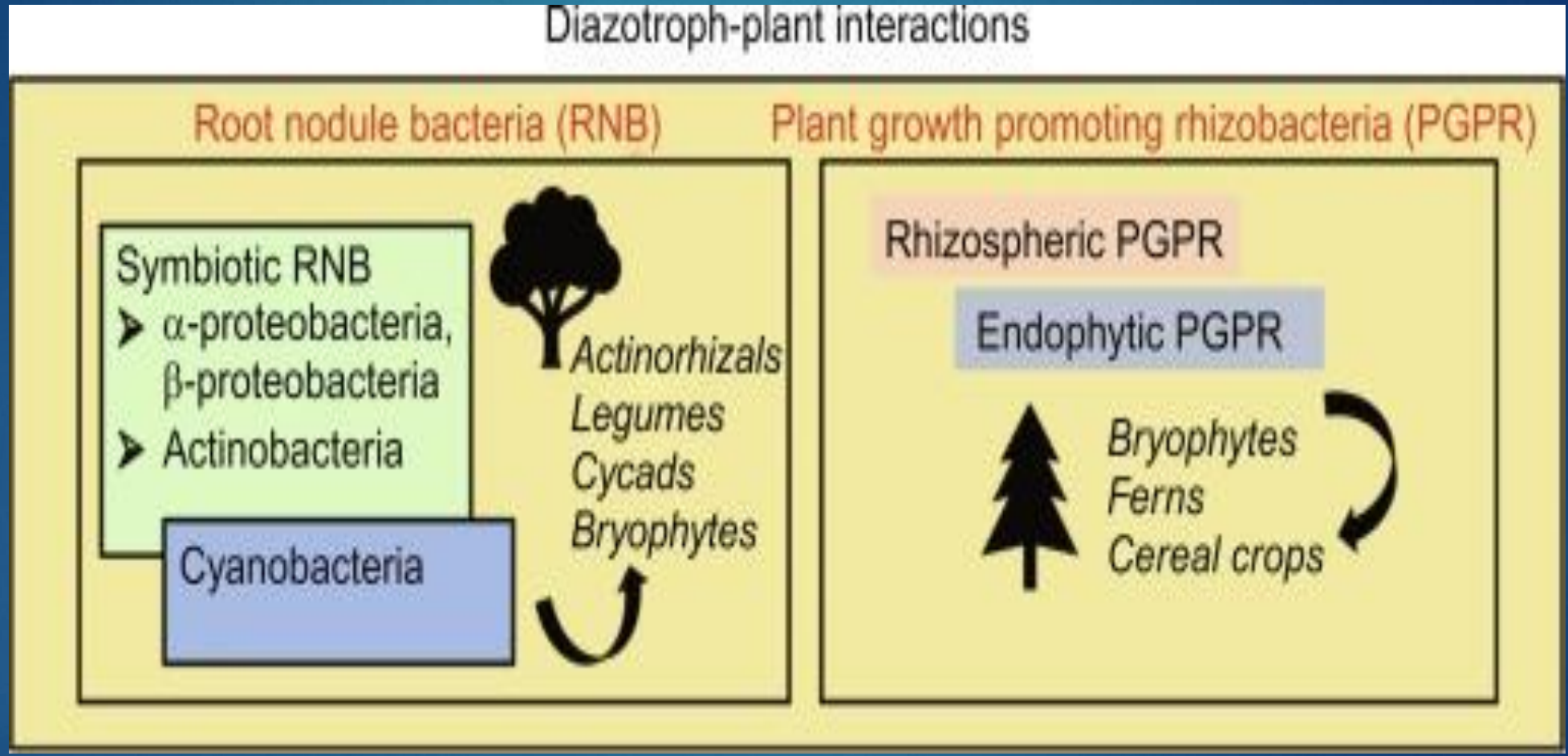
# $N_2$-Fixing Mechanism in Microbial Cells

- Nitrogen (N) is an essential macroelement for plants along with P, K, Ca, Mg, and S because it is essential for biosynthesis of amino acids and eventually proteins;
- the major building blocks of plants, animals, and other life forms. $N_2$-fixing microorganisms play the key role in biological $N_2$-fixation using the enzyme nitrogenase (Kim and Rees, 1994).
- It is a process in which atmospheric $N_2$ is fixed by microbial cells in the form of ammonia ($NH_3$) to fulfill their $N_2$ requirements.
- Microbes which can fix atmospheric $N_2$ are also known as diazotrophs and their metalloenzyme nitrogenase perform the main role in this regard.

- Two groups of bacteria, viz., *Rhizobia* mostly associated with leguminous plants and *Frankia*, associated with nonleguminous plants have been well studied.
- *Frankia* forms root nodules on more than 200 different species of woody angiosperms (Welsh et al., 2009).
- Beside symbiotic $N_2$-fixation, a large number of nonsymbiotic $N_2$-fixing bacteria have also been reported.
- Among the free-living nitrogen-fixing rhizobacteria, *Azotobacter*, *Clostridium*, *Azospirillum*, *Pseudomonas*, *Beijerinckia* are well recognized

- The symbiotic relationship of host plant-bacteria starts with a molecular signal between them.
- The roots of legume exude phenolic substances, primarily flavonoid compounds (biotin, thiamine, amino acids, etc.) in the rhizosphere and eventually, taken up by the bacteria (*Rhizobia*).
- Then the biomolecules (i.e., signals) bind with Nod D, a transcriptional regulator and stimulate a set of nodulation genes of bacteria (Long, 1996). These genes take part in the production of lipochitooligosaccharides (LCOs) called Nod factors.
- the Nod factors are the key molecules because their presence is essential for the host-microbe interaction, at post infection stages, and nodule development

Schematic representation of the different associations between diazotrophs and plant hosts.




BIOFERTILIZERS

# Thankyou….