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# Center for Smart Agriculture

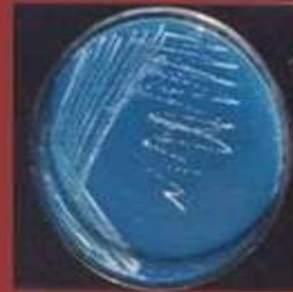
## Course: Organic Farming



*Rhizobium*



*Azotobacter*



*Azospirillum*



PSM



*Azolla*



Cyanobacteria



**Topic:** Classification of different type of Biofertilizers



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# TYPES OF BIOFERTILIZERS

Bacterial

Fungal

Algal

Aquatic fern

Earthworms



*Rhizobium*



*Azotobacter*



*Azospirillum*



PSM



*Azolla*



*Cyanobacteria*





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## Bacteria:

Symbiotic nitrogen fixers.

*Rhizobium, Azospirillum* spp Free  
living nitrogen fixers.

*Azotobacter, Klebsiella* etc.,

## Algal biofertilizers:

BGA in association with Azolla

*Anabena, Nostoc, Ocillatoria*

## Phosphate solubilising bacteria:

*Pseudomonas, Bacillus megaterium*

## Fungal biofertilizer

VAM



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# Bacterial biofertilizers

The live cells of bacteria used as a biofertilizers

These microbes contains unique gene called as Nif-Gene which make them capable of fixing nitrogen.

The nitrogen fixing bacteria work under two conditions, Symbiotically

Free living bacteria (non-symbiotic).

The symbiotic bacteria make an association with crop plants through forming nodules in their roots.

The free living bacteria do not form any association but live freely and fix atmospheric nitrogen.



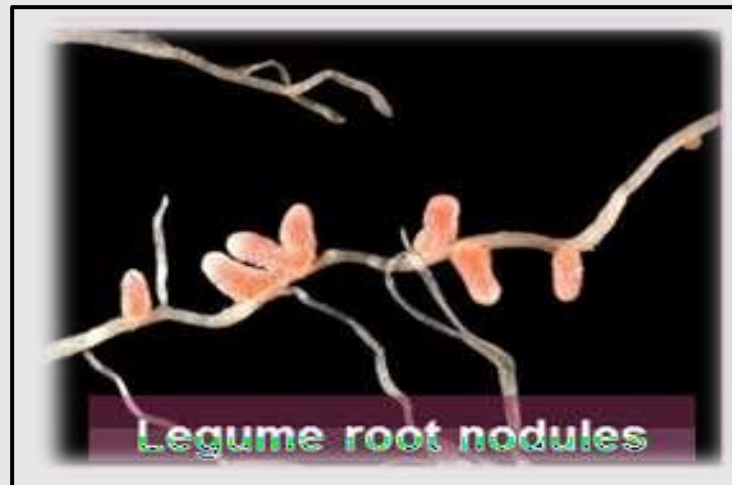
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# Symbiotic nitrogen fixers.

Most important symbiotic Nitrogen fixing bacteria is *Rhizobium* and *Azospirillum*.

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- ✓ The name ***Rhizobium*** was established by Frank in 1889.
- ✓ This genus has seven distinct species based on "Cross Inoculation Group Concept".



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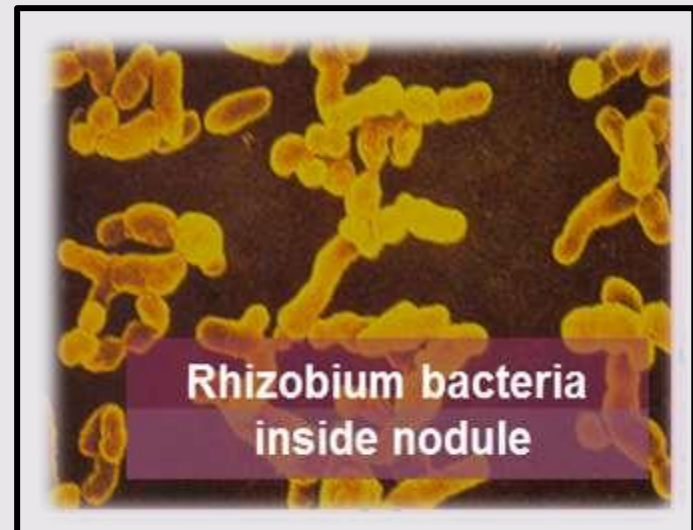
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- ✓ More than twenty cross-inoculations groups have been established.
- ✓ A new classification has been established for *Rhizobium*.
- ✓ That is 'slow growing rhizobia' known as *Bradyrhizobium* and the other group is 'fast growing rhizobia' called *Rhizobium*.
- ✓ *Rhizobium* can fix **50-300** kg/ha



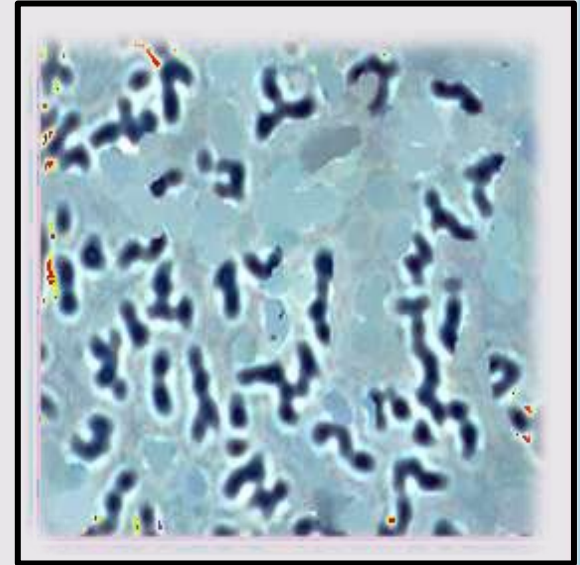


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# Azospirillum:

- ✓ It mainly present in cereal plants.
- ✓ inhabits both root cells as well as surrounding of roots
- ✓ forming symbiotic relation and increasing nitrogen fixing potential of the cereal plant.
- ✓ Azospirillum is recognized as a dominant soil microbe
- ✓ nitrogen in the range of 20- 40 kg/ha in the rhizosphere in non-leguminous plants such as cereals, millets, Oilseeds, cotton etc.







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# Free living bacteria

Large number of free living or non -symbiotic bacteria (does not form nodules but makes association by living in the rhizosphere) present in soil.

Commonly used free living bacteria are

- *Azotobacter*

it will not associated with plant.

*Azotobacter* is a biofertilizer which provides the required amount of nitrogen to the plant from the soil.



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# Azotobactor

*Azotobactor* is a heterotrophic free living nitrogen fixing bacteria present in alkaline and neutral soils.

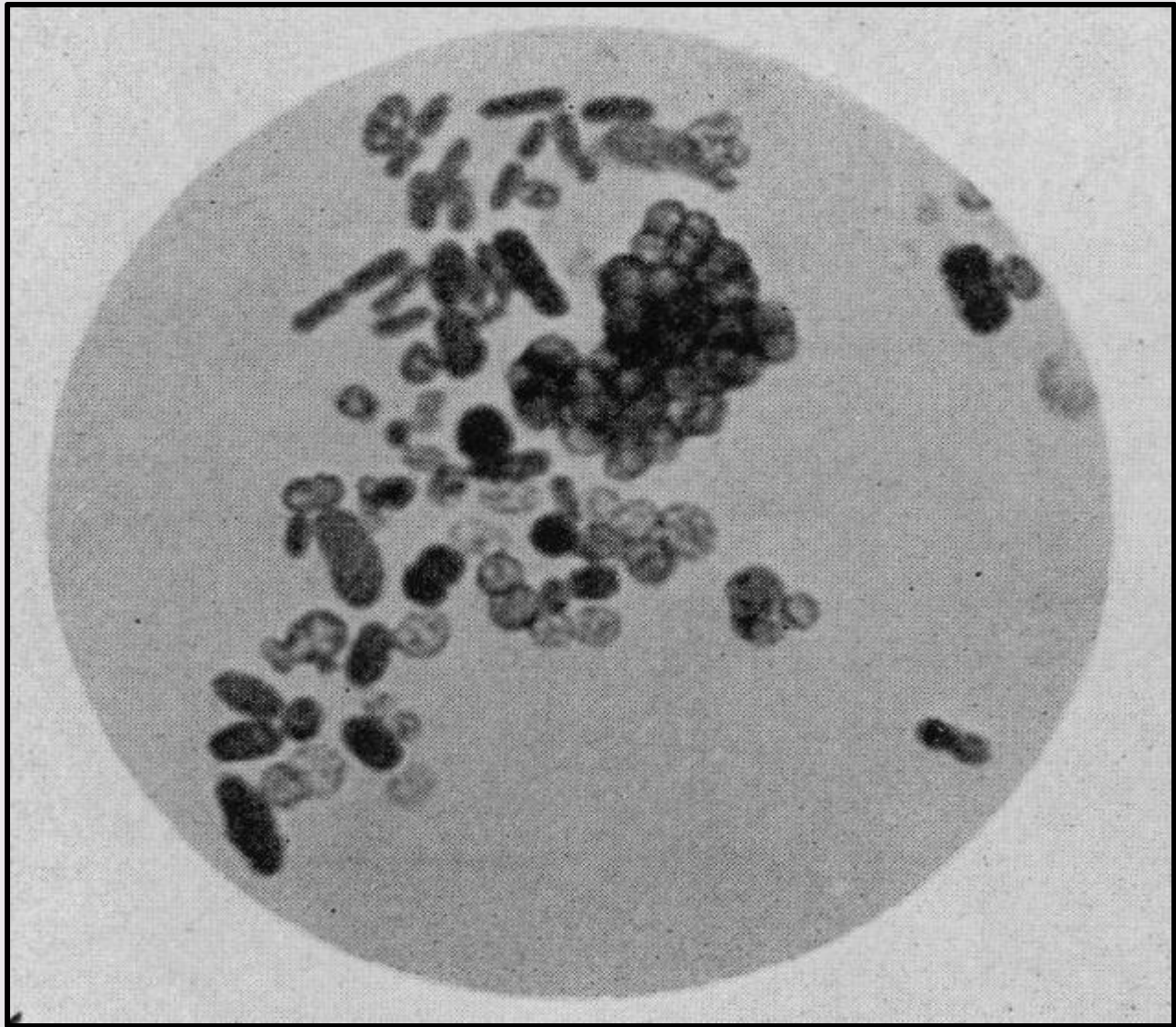
*Azotobactor* is the most commonly occurring species in arable soils of India.

Apart from its ability to fix atmospheric nitrogen in soils, it can also synthesize growth promoting substances such as auxins and gibberellins and also to some extent the vitamins.



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Azotobactor bacteria



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THANK YOU