BIOFERTILIZER

WHAT IS BIOFERTILIZER?

- Is a **large population of a specific** or a group of **beneficial microorganisms** for **enhancing the productivity of soil**
- Either by **fixing atmospheric nitrogen** or by **solubilising soil phosphorus** or by stimulating plant growth through synthesis of growth promoting substances.
- Bio-fertilizers based on **renewable energy** source are **cost effective**, eco-friendly and can help to economise on the high investment needed for chemical fertilizer

Introduction

- In the last century, chemical fertilizers were used in agriculture. Farmers were happy of getting increased yield in agriculture in the beginning.
- But slowly chemical fertilizers started displaying their ill-effects such as:

  - Leaching out
  - Polluting water basins
  - Destroying micro-organisms and friendly insects
  - Making the crop more susceptible to the attack of diseases
  - Reducing the soil fertility and thus causing irreparable damage to the overall system

BIOFERTILIZERS

Biofertilizers are defined as preparations containing living cells or latent cells of efficient strains of microorganisms that help crop plants uptake of nutrients by their interactions in the rhizosphere when applied through seed or soil.

Applications of biofertilzers :

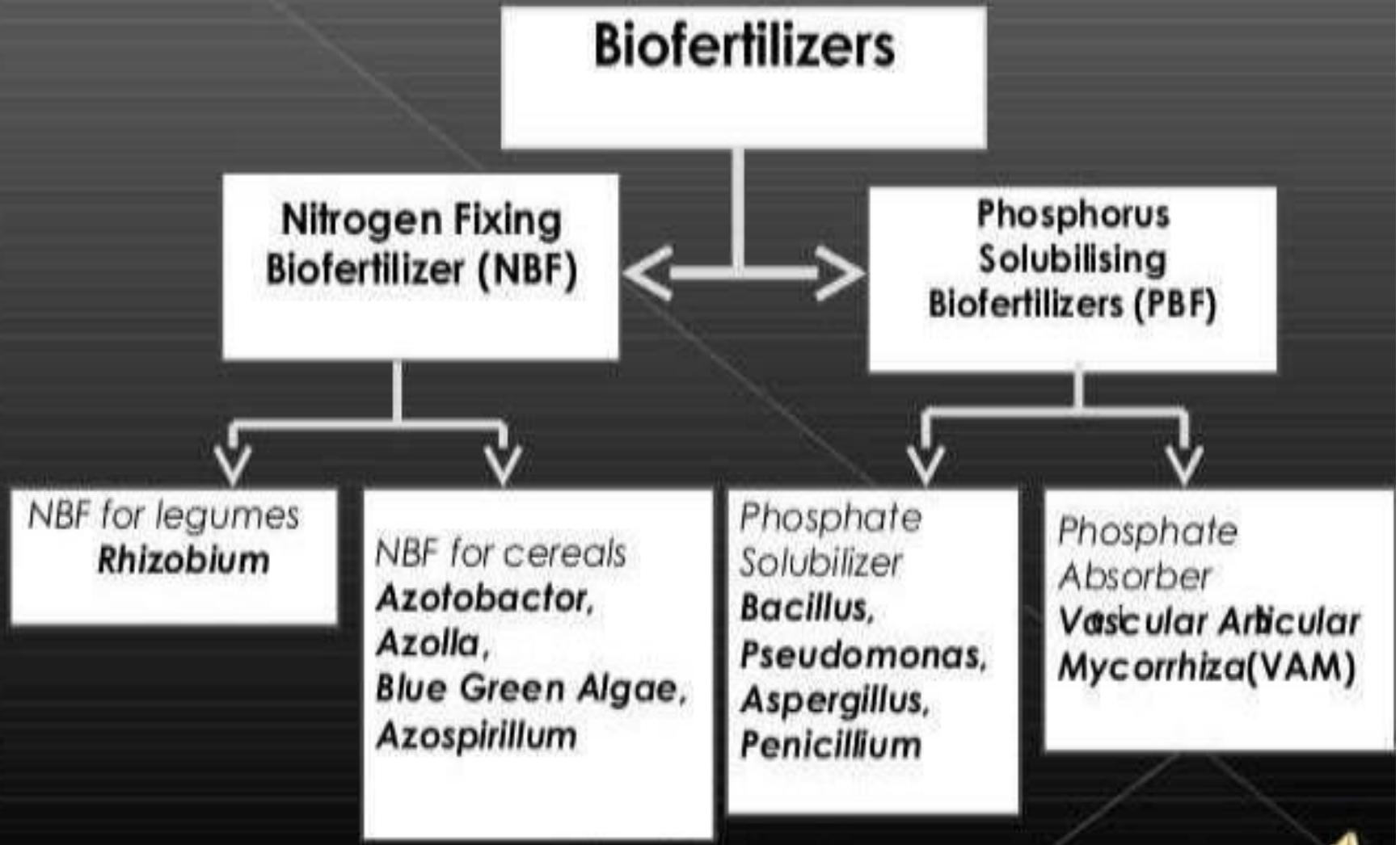
1. Seed inoculation method
2. Root inoculation method
3. Soil application

IMPORTANCE OF BIOFERTILIZERS

- Supplement fertilizers supplies for meeting the nutrient needs of crops.
- They liberate growth promoting substances and vitamins and help to maintain soil fertility.
- They suppress the incidence of pathogens and control diseases.
- Increase the crop yield by 10-50%. N_2 fixers reduce depletion of soil nutrients and provide sustainability to the farming system.
- Cheaper, pollution free, improves soil physical properties and soil health.

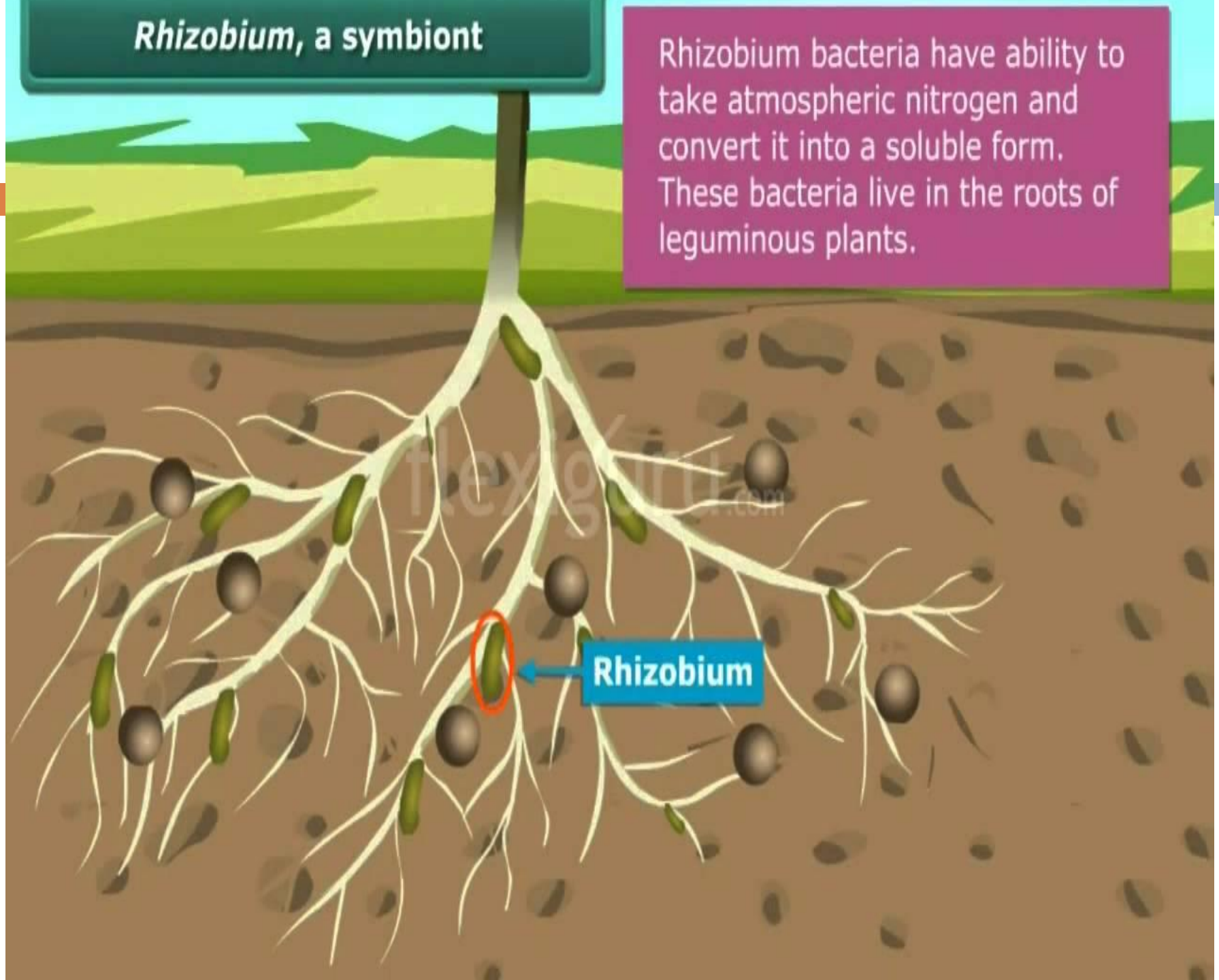
Classification of Biofertilizers

There are two main types of Biofertilizers:



NITROGEN FIXING BIOFERTILIZER FOR LEGUMES (NBF)

- **RHIZOBIUM**
- This belongs to the Gram Negative soil Bacterial group.
- Rhizobium is a soil habitat bacterium, which can able to colonize the legume roots and fixes the atmospheric nitrogen symbiotically. They are the most efficient biofertilizer as per the quantity of nitrogen fixed concerned. They are highly specific to form nodule in legumes, referred as cross inoculation group.
- The bacteria infect the legume root and form root nodules within which they reduce molecular nitrogen to ammonia which is utilized by the plant to produce valuable proteins , vitamins and other nitrogen containing compounds.


Rhizobium, a symbiont
Rhizobium bacteria have ability to take atmospheric nitrogen and convert it into a soluble form. These bacteria live in the roots of leguminous plants.
Rhizobium

NITROGEN FIXING BIOFERTILIZERS FOR CEREALS

- Blue Green Algae
- Azolla
- Azotobacter
- Azospirillum

1.Blue Green Algae

- It is a suitable nitrogen fixer for paddy soils ,fixing 25 kg N/ha/year.
- It releases the amino acid in the soil.
- It brings the insoluble phosphate to the available form of plant.
- It makes the plant hormone like Auxin, Indole Acetic Acid (ACC), Gibberellic Acid.

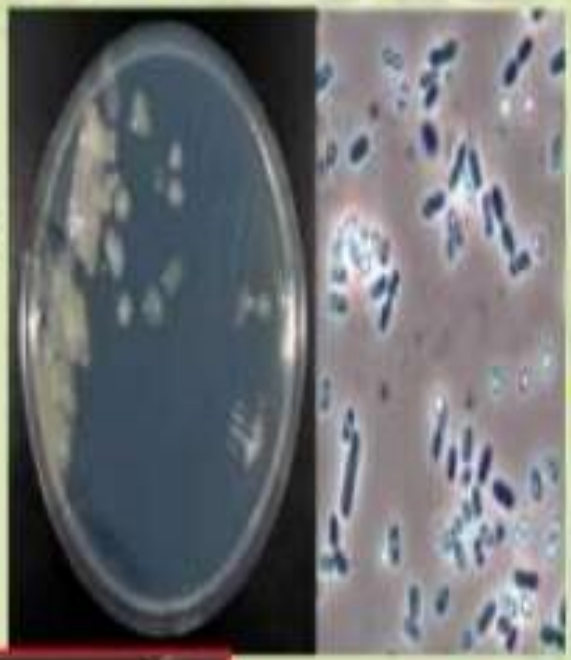
2. AZOLLA

- Azolla is a genus of seven species of aquatic ferns in the family Salviniaceae.

- *Azolla* is a free-floating water fern that floats in water and fixes atmospheric nitrogen in association with nitrogen fixing blue green algae . Rice growing areas in South East Asia and other third World countries have recently been evincing increased interest in the use of the symbiotic N2 fixing water fern *Azolla* either as an alternate nitrogen sources or as a supplement to commercial nitrogen fertilizers. *Azolla* is used as biofertilizer for wetland rice and it is known to contribute 40-60 kg N/ha per rice crop.
- **Nitrogen** is one of the most essential elements needed by plants for their growth and **Azolla**'s high **nitrogen** content makes it an ideal biofertilizer.

3.Azotobactor

- ***Azotobactor*** is a heterotrophic free living nitrogen fixing bacteria present in alkaline and neutral soils.
- ***Azotobactor chrococcum*** is the most commonly occurring species in arable soils of India.



- It is the important and well known free living nitrogen fixing aerobic bacterium. It is used as a Bio-Fertilizer for all non leguminous plants especially rice, cotton, vegetables etc. *Azotobacter* cells are present in abundant in the rhizosphere. The lack of organic matter in the soil is a limiting factor for the proliferation of *Azotobaceter* in the soil.
- Field experiments were conducted in 1992, 1993 and 1994 during the pre-kharif wet seasons to find out the influence on rice grain yield by the combined use of N-fixing organisms and inorganic nitrogen fertilizer which recorded increase in was yield.

Role of liquid Azotobacter as a Bio-control agent

- Azotobacter have been found to produce some antifungal substance which inhibits the growth of some soil fungi like *Aspergillus, Fusarium, Curvularia, Alternaria, Helminthosporium, Fusarium* etc.

4.AZOSPIRILLUM

- This is a free living or non -symbiotic bacteria (does not form nodules but makes association by living in the rhizosphere).

- Azospirillum species establish an association with many plants particularly with C4 plants such as maize, sorghum,sugarcane, etc.

- It is the most common organism and can form associative symbiosis on a large variety of plants.

- Azospirillum is recognized as a dominant soil microbe.

- It belongs to bacteria and is known to fix the considerable quantity of nitrogen in the range of 20- 40 kg N/ha in the rhizosphere in non- non-leguminous plants such as cereals, millets, Oilseeds, cotton etc. The efficiency of *Azospirillium* as a Bio-Fertilizer has increased because of its ability of inducing abundant roots in several pants like rice, millets and oilseeds even in upland conditions. Considerable quantity of nitrogen fertilizer up to 25-30 % can be saved by the use of *Azospirillum* inoculant. The genus *Azospirillum* has three species viz., *A. lipoferum*, *A. brasilense* and *A. amazonense*. These species have been commercially exploited for the use as nitrogen supplying Bio-Fertilizers.

Physical features of liquid *Azospirillum*

- The colour of the liquid may be blue or dull white.
- Bad odours confirms improper liquid formulation and may be concluded as mere broth.
- Production of yellow gummy colour materials comfirms the quality product.
- Acidic pH always confirms that there is no Azospirillum bacteria in the liquid.

Production of growth hormones:

- Azospirillum cultures synthesize considerable amount of biologically active substances like vitamins, nicotinic acid, indole acetic acids giberllins. All these hormones/chemicals helps the plants in better germination, early emergence, better root development

Role of Liquid *Azospirillum* under field conditions

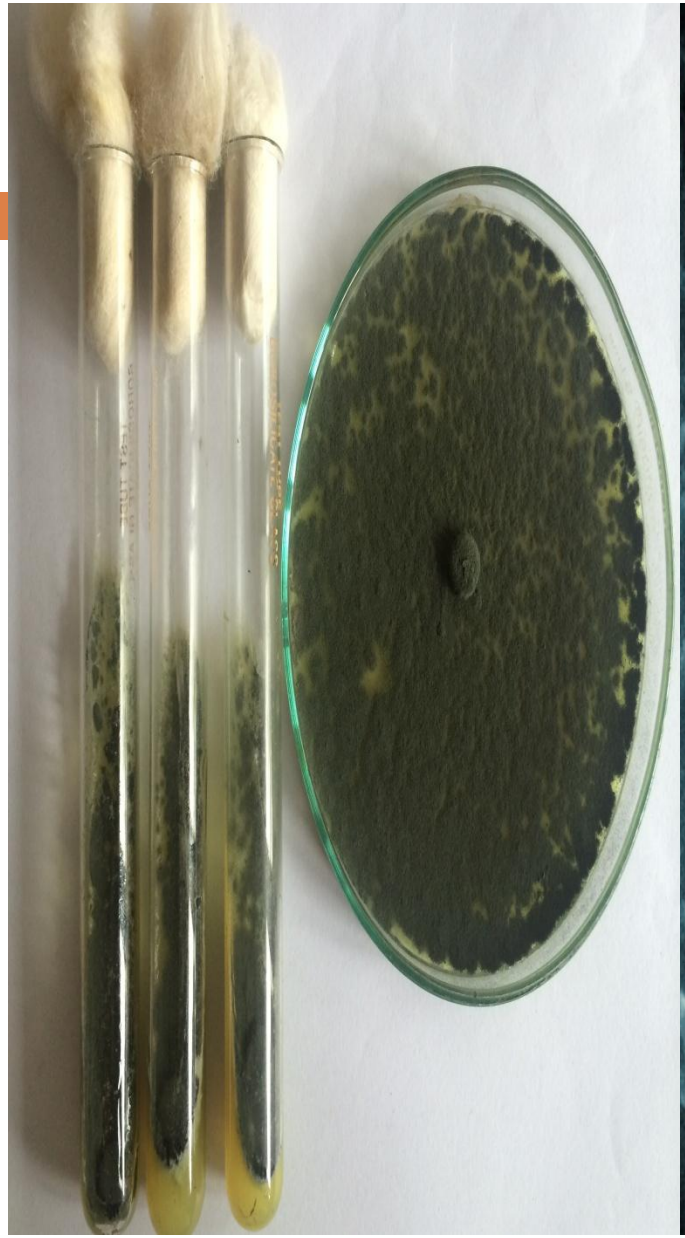
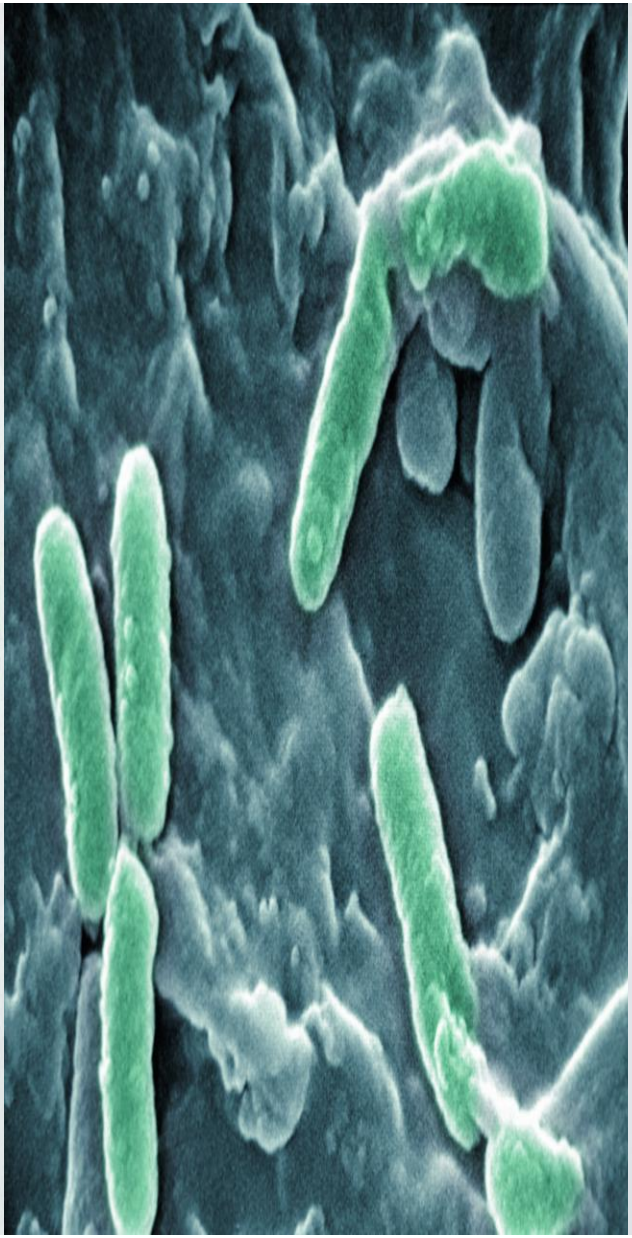
- Stimulates growth and imparts green colour which is a characteristic of a healthy plant.
- Aids utilization of potash, phosphorous and other nutrients.
- Encourage plumpness and succulence of fruits and increase protein percentage.

Signs of non functioning of *Azospirillum* in the field

- No growth promotion activity.
- Yellowish green colour of leaves, which indicates no fixation of Nitrogen.

PHOSPHATE SOLUBILIZER MICRO-ORGANISMS

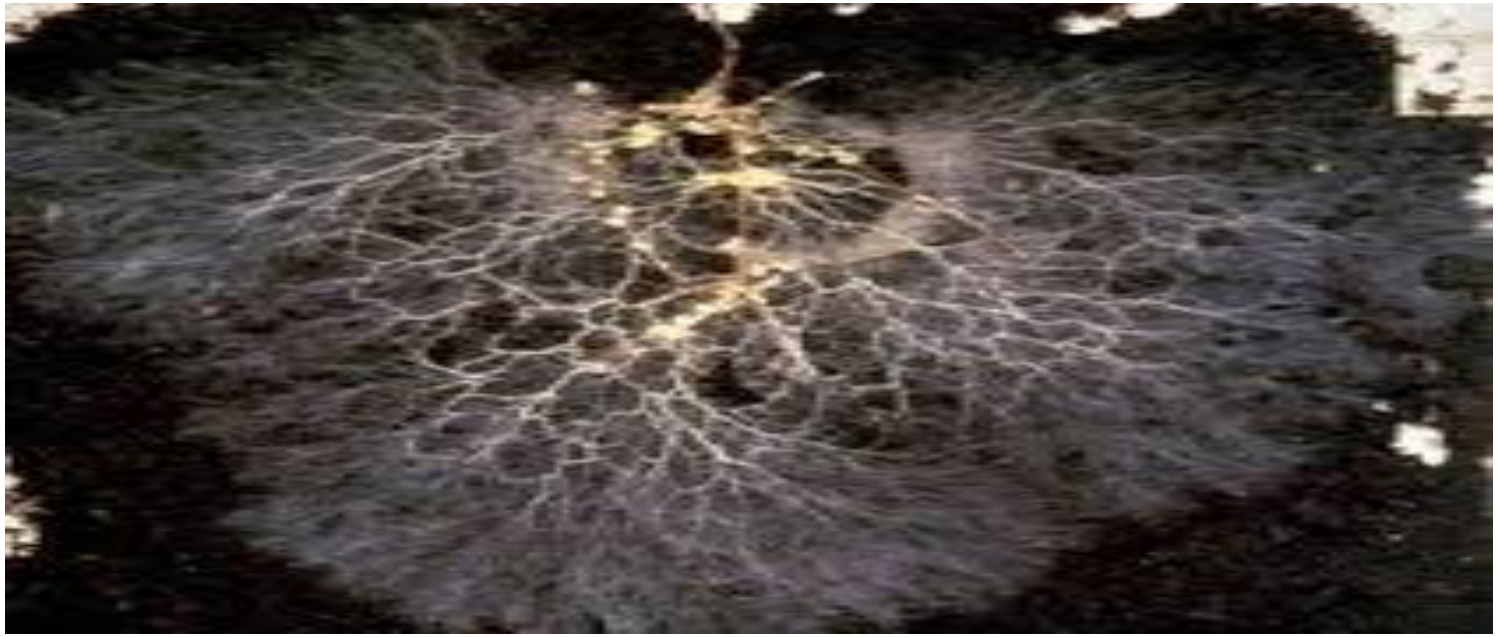
- Several soil bacteria and fungi, notably species of *Pseudomonas, Bacillus, Penicillium, Aspergillus etc.* secrete organic acids and lower the pH to bring about dissolution of bound phosphates in soil. Increased yields of wheat and potato were demonstrated due to inoculation of peat based cultures of *Bacillus polymyxa* and *Pseudomonas striata.*


PHOSPHATE ABSORBER

- **VESICULAR ARBUSCULAR MYCORRHIZA (VAM)**
- The term ***mycorrhiza*** was taken from greek language meaning 'fungus root', it was coined by Frank in 1885.
- Considered to be mutualistic association between fungi and plant roots.
- VAM helps in nutrient transfer mainly of phosphorus, zinc and sulphur.

- It is considered as the most beneficial root-inhabiting organisms, which forms a fungal mat over the root and protect the root of plant from the attack of soil borne pathogen.



LIQUID BIO-FERTLIZER APPLICATION METHODOLOGY

There are three ways of using Liquid Bio-fertilizers :-

- Seed treatment
- Root dipping
- Soil application

Seed Treatment

- **Seed Treatment** is a most common method adopted for all types of inoculants. The seed treatment is effective and economic. For small quantity of seeds (up to 5 kgs quantity) the coating can done in a plastic bag.
- The bag should be filled with 2 kg or more of seeds. The bag should be closed in such a way to trap the airs as much as possible. The bag should be squeezed for 2 minutes or more until all the seed are uniformly wetted. Then bag is opened, inflated again and shaked gently. Stop shaking after each seeds gets a uniform layer of culture coating.
- The bag is opened and the seed is dried under the shade for 20-30 minutes. For large amount of seeds coating can be done in a bucket and inoculant can be mixed directly with hand. Seed Treatment with *Rhizobium*, *Azotobacter, Azospirillum*, along with PSM can be done.
- The seed treatment can be done with any of two or more bacteria. There is no side (antagonistic) effect. The important things that has to be kept in mind are that the seeds must be coated first with *Rhizobium, Azotobacter* or *Azospirillum*. When each seed get a layer of above bacteria then PSM inoculant has to be coated as outer layer. This method will provide maximum number of each bacteria required for better results. Treatments of seed with any two bacteria will not provide maximum number of bacteria on individual seed

Root dipping

- For application of *Azospirillum*/PSM on paddy transplating/vegetable crops this method is used. The required quantity of *Azospirillum*/PSM has to be mixed with 5-10 litres of water at one corner of the field and the roots of seedlings has to be dipped for a minimum of half-an-hour before transplantation.

Soil application

- Use 200ml of PSM per acre. Mix PSM with 400 to 600 KGs of Cow dung FYM along with ½ bag of rock phosphate if available. The mixture of PSM, cow dung and rock phosphate have to be kept under any tree or under shade for over night and maintain 50% moisture. Use the mixture as soil application in rows or during leveling of soil.

DOs and DON'Ts for Entrepreneurs, Dealers and farmers

DOs

- Keep Bio-fertilizers bottles away from direct heat and sunlight. Store it in cool and dry place.
- Sell only Bio-fertilizers bottles which contain batch number, the name of the crop on which it has to be used, the date of manufacture and expiry period.
- If the expiry period is over, then discard it as it is not effective.
- Keep Bio-fertilizers bottles away from fertilizer or pesticide containers and they should not be mixed directly

DON'Ts

- Don't store Bio-fertilizers bottles under heat and sunlight
- Don't sell Bio-fertilizers bottles after their expiry period is over.
- Don't prick holes into the bottles or puncture them to pour the content
- Do not mix the Bio-fertilizers with fungicides, insecticides, herbicides, herbicides and chemical fertilizers.


NOTE: HEALTH OF A PLANT IS DIRECTLY PROPORTIONAL TO YOUR HEALTH
THANK YOU