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# Center for Smart Agriculture

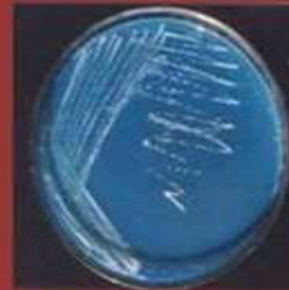
## Course: Organic Farming



*Rhizobium*



*Azotobacter*



*Azospirillum*



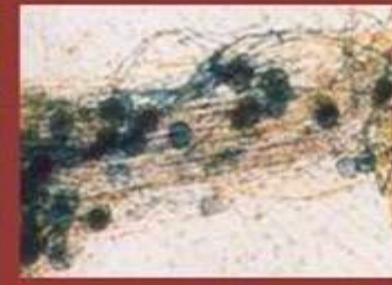
PSM



*Azolla*



Cyanobacteria



**Topic:** Botanicals and their uses Nitrogen-fixing biofertilizers



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# Mass production

- ❖ Isolated bacterial cultures were subculture in to nutrient broth
- ❖ The cultures were grown under shaking condition at  $30\pm 2^{\circ}\text{C}$
- ❖ The culture incubated until it reaches maximum cell population of  $10^{10}$  to  $10^{11}$
- ❖ Under optimum condition this population level could be attained within 4-5 days for *Rhizobium* 5-7 days for *Azospirillum* and 6-7



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- ❖ The culture obtained in the flask is called **Starter culture**
- ❖ For large scale production , inoculum from starter culture is transferred in to large flasks / fermentor and grown until required level of cell count is reached



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Nitrogen is the most limiting nutritional factor for plant growth. Suitable nitrogen application to growing plants has a favourable enhancing effect on growth, yield and quality. Since nitrogen is the main element in the composition of amino acids, which are required for the synthesis of proteins and other related compounds, it plays a role in almost all plant metabolic processes.



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Nitrogen is also an integral part of the chlorophyll molecule responsible for plant photosynthesis. Symptoms of nitrogen deficiency generally appear on the bottom leaves first; the lower leaves on the tips turn brown, usually disintegrate, and fall off. Nitrogen biofertilizers help agriculturists to determine the nitrogen level in the soil



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Only N-fixing microorganisms bring additional supplies of a nutrient (N) into the soil/plant system. All other biofertilizers simply solubilize or mobilize the nutrients that are already present in soils. Microorganisms that have the capacity to fix atmospheric  $N_2$  can be used as efficient biofertilizers. Their application in soil improves the soil biota and reduces the need of chemical fertilizers.



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## Free-living nitrogen fixers

The free-living, or non-symbiotic, nitrogen-fixing bacteria live outside plant cells and are associated with the rhizosphere, the part of soil under the influence of plant roots and their exudates. They are of four types:

- Free-living non-photosynthetic aerobic nitrogen-fixing bacteria such as *Azotobacter*, *Beijerinckia* and *Derxia*;
- Free-living non-photosynthetic anaerobic nitrogen-fixing bacteria such as *Clostridium*;



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# Azolla as a bio fertilizer

Azolla is a tiny fresh water fern common in ponds, ditches and rice fields.

It has been used as a biofertilizer for a rice in all major rice growing countries including India, Thailand, Korea, Philippines, Brazil and West Africa.

The nitrogen fixing work is accomplished by the symbiotic relationship between the fern and BGA, *Anabena azollae*.

In addition to nitrogen the decomposed Azolla also provides K, P, Zn and Fe to the crop





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Azolla



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*Azolla* biomass gets doubled within 5-7 days by vegetative methods.

fix 40-80 kg nitrogen / ha /  
year. good manure for  
flooded rice.

Increase of crop yield up to 15-20% has been observed while fertilizing the rice with *Azolla*  
Hybrids are growing  
faster Tolerant to heat  
and cold Fix 4-5% more  
nitrogen



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# Advantage of biofertilizers

Renewable source of nutrients

Sustain soil health

Supplement chemical fertilizers.

Replace 25-30% chemical fertilizers

Increase the grain yields by 10-40%.

Decompose plant residues, and stabilize C:N ratio of soil

Improve texture, structure and water holding capacity of soil

No adverse effect on plant growth and soil fertility.



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THANK YOU