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Center for Smart Agriculture

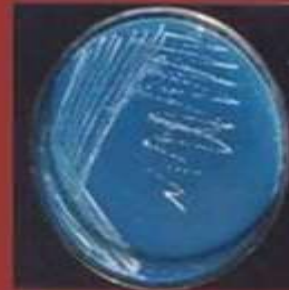
Course: Organic Farming



Rhizobium



Azotobacter



Azospirillum



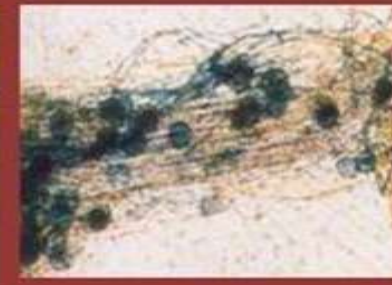
PSM



Azolla



Cyanobacteria



Topic: Botanicals and their uses Nitrogen-fixing biofertilizers



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Phosphorous (P) is the next essential macro element after nitrogen. Phosphorus is required in a soluble form for maximizing crop growth and production. It plays a significant role in plant metabolism and is important for the functioning of key enzymes that regulate the metabolic pathways. The phosphate available in soil occurs in three forms: soil solution phosphate, insoluble organic phosphate and insoluble inorganic phosphate.



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The greater part of soil phosphorus, approximately 95–99% is present in the form of insoluble phosphates. This means that soils contain a high amount of total phosphorus, but its availability to plants is very low and it is often a limiting factor for plant growth.



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A major characteristic of phosphorus biogeochemistry is that only 1% of the total soil phosphorus (400–4,000 kg P/ha in the top 30 cm) is incorporated into living plant biomass during each growing season (10–30 kg P/ha), reflecting its low availability for plant uptake. Phosphorus deficiency in plants leads to chlorosis, weak stem and slow growth.



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The solubilization of phosphorus in nature is due to the activity of phosphate-solubilizing microorganisms (PSM) which belong to several genera:

- *Pseudomonas*
- *Bacillus*

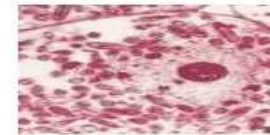
Microscopic Photographs of Different Genera of PGPR



Pseudomonas



Bacillus



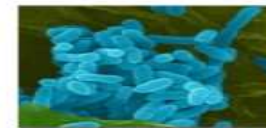
Rhizobium



Azospirillum



Azotobacter



Burkholderia



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Plant-growth-promoting rhizobacteria (PGPR)

A group of rhizosphere bacteria (rhizobacteria) that exerts a beneficial effect on plant growth is referred to as plant-growth-promoting rhizobacteria or PGPR. PGPR is a generic acronym that indicates bacteria which, in some often unknown way, can stimulate plant growth.