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Module-9

Phosphorous Solubilizing Bacteria



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Phosphate solubilizing bacteria (PSB) are beneficial bacteria capable of solubilizing inorganic phosphorus from insoluble compounds.

- P-solubilization ability of rhizosphere microorganisms is considered to be one of the most important traits associated with plant phosphate nutrition.
- It is generally accepted that the mechanism of mineral phosphate solubilization by PSB strains is associated with the release of low molecular weight organic acids, through which their hydroxyl and carboxyl groups chelate the cations bound to phosphate, thereby converting it into soluble forms.
- PSB have been introduced to the Agricultural community as phosphate Biofertilizer



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Phosphorus (P) is one of the major essential macronutrients for plants and is applied to soil in the form of phosphate fertilizers.

- However, a large portion of soluble inorganic phosphate which is applied to the soil as chemical fertilizer is immobilized rapidly and becomes unavailable to plants.
- Currently, the main purpose in managing soil phosphorus is to optimize crop production and minimize P loss from soils.
- PSB have attracted the attention of agriculturists as soil inoculums to improve the plant growth and yield.
- When PSB is used with rock phosphate, it can save about 50% of the crop requirement of phosphatic fertilizer.



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- The use of PSB as inoculants increases P uptake by plants. Simple inoculation of seeds with PSB gives crop yield responses equivalent to 30 kg P₂O₅ /ha or 50 percent of the need for phosphatic fertilizers.
- Alternatively, PSB can be applied through fertigation or in hydroponic operations.
- Many different strains of these bacteria have been identified as PSB, including *Pantoea agglomerans* (P5), *Microbacterium laevaniformans* (P7) and *Pseudomonas putida* (P13) strains are highly efficient insoluble phosphate



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Potassium solubilization bacteria

Basically, biofertilizer is a substance which contains microorganisms that colonizes the rhizosphere or the zone that surrounds the roots of plants .

- These microorganisms have ability to convert nutritionally important elements such as nitrogen, phosphorus and potassium (NPK) from unavailable to available form through biological processes.
- There is evidence that prove the beneficial microbes had been used in agriculture practices since 60 years ago and now these beneficial microbial populations show that they can also resistance to adverse environmental stresses.
- Potassium solubilizing bacteria (KSB) such as *Bacillus mucilaginosus* and *Bacillus daphicus* are example of microorganisms that used in biofertilizer.



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KSB are able to solubilize potassium rock through production and secretion of organic acids .

- Fundamentally, potassium is a macronutrient in plants and animals. Recent studies have proved that potassium can increase the plant height, fresh plant weight and also increase herbage and oil yield on the patchouli.
- However, during the last decades, the issue of sustainable soil potassium management has partly been ignored since the potential environment impact of nitrogen and phosphorus has been considered a more important problem.
- Furthermore, the application of biofertilizer somehow has not achieved constant effects compared to chemical fertilizer.
- The mechanisms and interactions among these microbes still are not well understood, especially in real applications.



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- Fundamentally, KSB is a heterotrophic bacterium which is obtaining all their energy and cellular carbon from pre-existing organic material.
- Thus, they are important in the formation of humus in soil, the cycling of other minerals tied up in organic matter, and the prevention of build up of dead organic materials.
- Besides, KSB are aerobic bacteria which play an important role in maintaining soil structure by their contribution in the formation and stabilization of water-stable soil aggregates.
- In addition, this gram positive bacterium can produce substance that stimulate plant growth or inhibit root pathogens.



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- Moreover, KSB specifically are well known for its capability to solubilize rock potassium mineral such as micas, illite and orthoclases.
- This is done through the production and excretion of organics acids. Therefore, KSB are function to increase potassium availability in soils besides increase mineral contents in plants.
- This kind of bacteria is very useful study although potassium is not main nutrient compared to nitrogen and phosphorus, since plant will not growth steadily without potassium.