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POTASSIUM SOLUBILIZING ACTINOMYCETES: UNEXPLORED BUT VIABLE OPTION FOR SOIL FERTILITY

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Potassium (K), is an essential nutrient and a major constituent within all living cells and major macronutrients in plant growth and development. Potassium is the most abundant nutrient constituting about 2.5 per cent of the lithosphere. The available potassium status in Indian soils has been categorized into three classes where 21 per cent districts fall in low, 51 per cent in medium and 28 per cent in high potassium content soils. K is present in several forms in the soil, including mineral K, non-exchangeable K, exchangeable K, and solution K. Depending on soil type, from 90 to 98 % of soil mineral K is in various forms like feldspar (orthoclase and microcline) and mica (biotite and muscovite). Only 1 to 2 % soil potassium source is called the exchangeable or readily available potassium and is found on the cation exchange sites or in the soil solution. In total soil major portion of potassium exists in insoluble K minerals and very little potassium becomes available to plants.

Certain groups of microorganisms including bacteria, fungi and actinomycetes are known to solubilized potassium minerals into soluble form which can be utilized by the plants. Microbial inoculants that are able to dissolve potassium



from mineral and rocks have influence on plant growth and have both economic and environmental advantage.

Numerous studies have documented the release K from K bearing minerals. The potassium solubilizing bacteria (KSB) and fungi reported to solubilize K-bearing minerals and convert the insoluble K to soluble forms of K available to plant uptake. Hence KSB can be an effective alternative to chemical fertilizers. Many microorganisms such as *Acidithiobacillus ferrooxidans*, *Paenibacillus spp.*, *Bacillus mucilaginous*, *Bacillus extroquens*, *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus terreus* etc. have capacity to solubilize K minerals (e.g., biotite, feldspar, illite, muscovite, orthoclase, and mica). Some species of rhizobacteria are capable of mobilizing potassium in accessible form from insoluble K. There are considerable population of K solubilizing microorganisms in soil and rhizosphere. The mechanism of Potassium solubilization is through the production of organic acids, acidolysis, polysaccharides, complex lysis, chelation, and exchange reactions.

Actinomycetes are aerobic, spore forming, Gram-positive and free-living bacteria with aerial mycelia. Actinomycetes found in soil are *Actinomyces meyeri*, *Actinomyces israelii*, *Nocardia brasiliensis*, *Nocardia asteroides*, *Streptomyces coelicolor*, *Streptomyces scabies*, etc. Actinomycetes play important ecological roles in soil nutrient cycling and are recently being regarded as plant growth promoting rhizobacteria. They favor plant growth directly through several mechanisms including Nitrogen fixation, P-solubilization, 1-aminocyclopropane-1-carboxylate deaminase production, indole acetic acid production, siderophore production, chitinase production and several cell wall-degrading enzymes etc.

Actinobacteria solubilized K minerals, can quickly conserve our existing resources and avoid environmental pollution. Many potassium solubilizing bacteria and fungi reported to show significant increase in germination percentage, seedling vigor, plant growth, yield, and K uptake in plants under greenhouse and field conditions. However, the applications of Actinomycetes as Potassium solubilizers or Plant growth promoters in agriculture field are relatively less explored. As per available data potential of actinomycetes for Potassium solubilization is yet poorly explored. The importance of Actinomycetes in soil is well established. They are sporulating organisms can survive for longer period in adverse environmental condition. This property can be exploited in developing long lasting effective actinomycetes inocula for potassium solubilization.



Potassium solubilizing actinomycetes can act as an alternative and viable technology to solubilize insoluble K into soluble form, their application in agricultural practice is not revealed yet because of several factors including lack of awareness about bio-fertilizers amongst the farmers; slow influence of the K bio-fertilizer on crop yield; less interest in scientific community on the development of K bio-fertilizer technologies; unavailability of proper and well equipped culture collection banks and deficiency in technology in respect to carrier suitability and product formulations. Therefore, there are immense possibilities to use actinomycetes as K-bearing rock materials solubilization and potassium solubilizing biofertilizers for further increasing the production of crops. Overall, the multifunctional property of actinomycetes makes them unique and their potentials are yet to be fully exploited.



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