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A Review: Bio-Fertilizers- Power of Beneficial Microorganisms in Soils

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Abstract

Bio-fertilizers 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. They accelerate certain microbial processes in the soil which augment the extent of availability of nutrients in a form easily assimilated by plants. The use of bio-fertilizers is one of the important components of integrated nutrient management, as they are cost effective and renewable source of plant nutrients to supplement the chemical fertilizers for sustainable agriculture.

Keywords: Bio-fertilizer; Sustainable agriculture; Liquid bio-fertilizer

Abbreviations: PGPB: Plant Growth Promoting Bio-Fertilizer; KSB: Potassium Solubilizing Bio-Fertilizer; KMB: Potassium Mobilizing Bio-Fertilizer; SOB: Sulfur Oxidizing Bio-Fertilizer; NFB: Nitrogen Fixing Bio-Fertilizers

Introduction

Some strategies increasing the quality of the soil are needed to ensure sustainability in soil fertility. Increasing the population of beneficial microorganisms in rhizosphere by bio-fertilizers is one of these strategies. Biofertilizers keep the soil environment rich in all kinds of micro- and macro-nutrients via nitrogen fixation, phosphate and potassium solubalisation or mineralization, release of plant growth regulating substances, production of antibiotics and biodegradation of organic matter in the soil [1]. However, bio-fertilizers cannot replace chemical fertilizers, but they can reduce the utilization of chemical fertilizers and support sustainable agricultural systems.

Importance in the Agriculture of Bio-Fertilizers

Bio-fertilizers are the preparations containing live or latent cells of efficient strains of nitrogen fixing, phosphate and some elements solubilizing, plant growth substances producing and some soil-borne diseases preventing micro-organisms. The aim of bio-fertilization is to accelerate the microbial processes which augment the availability of nutrients that can be easily assimilated by plant and to increase the number of useful microorganisms in soil [2]. Bio-fertilizers are eco-friendly organic agro-inputs and provide those benefits:

a) more cost-effective than chemical fertilizers,

b) increase nitrogen content of soil and the supply or availability of nitrogen to leguminous,

c) increase solubility of the insoluble phosphate from organic and inorganic phosphate sources,

d) increase soil fertility, fertilizer use efficiency and ultimately the yield by 20-30 % in general,

e) secrete certain plant growth promoting substances,

f) exhibit anti-fungal activities and protect the plants from pathogenic fungi,

g) Replace chemical nitrogen and phosphorus by 25 % and therefore helps to environment protection, and

h) Improve phosphorus nutrition of plants [3].

Bio-Fertilizers used in Agriculture

The different types of bio-fertilizers used in agricultural soils:

a) Nitrogen fixing bio-fertilizers (NFB): Examples include *Rhizobium Spp*., *Azospirillum Spp*. and Cyanobacteria,

b) Phosphate solubilizing bio-fertilizer (PSB): Examples include *Bacillus Spp*., *Pseudomoona Spp*. and *Aspergillus Spp*.,

c) Phosphate mobilizing bio-fertilizers (PMB): Examples are Mycorrhiza,

d) Plant growth promoting bio-fertilizer (PGPB): Examples include *Pseudomonas Spp*.,

e) Potassium solubilizing bio-fertilizer (KSB): Examples include *Bacillus Spp*. and *Aspergillus niger*,

f) Potassium mobilizing bio-fertilizer (KMB): Examples include *Bacillus Spp*. and

g) Sulfur oxidizing bio-fertilizer (SOB): Examples include *Thiobacillus Spp* [4].

Application of Bio-Fertilizers

Bio-fertilizers are produced in liquid, powder and granular forms and applied to soil, compost, seed, seedling and plant leaves. In the application of bio-fertilizers, the instructions and warnings on the label must be complied. There are three ways in using bio-fertilizers:

a) Inoculation to seed,

b) Seedling root dip and

c) Field application.

Out of these three common applications, some liquid bio-fertilizers can be sprayed to plant leaves [5]. Applications of bio-fertilizers can be failure in some circumstances. The main reasons of this situation can be high soil fertility status, unfavorable pH, high nitrate level, high temperature, drought, deficiency of P, Cu, Co, Mo or presence of toxic elements and microbial fertilizer with low quality.

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