Bioculture for better agriculture

"Development of phosphate solubilizing bacterial bio culture for minimizing consequences of chemical fertilizers."

Dr. GARE .S.S [1+] AND SWAMI.S.S [2+]

1: Assistant Professor, Department Of Microbiology, V.N.B.N.College Shirala., Dist. Sangli, Maharashtra, India

2 Assistant Professor, Department Of Alcohol technology, R.C.S.T College Islampur., Dist.- Sangli, Maharashtra,India

Introduction:

Bio cultures can be used as supplements to chemical fertilizers; they are comparatively inexpensive and renewable sources of plant nutrients. Bioculture is selecting strains of microorganisms that are beneficial to the growth of plants. These microorganisms are cultured in the laboratory, mixed with suitable carrier materials, and then applied to the fields. They maintain soil health and minimize pollution of the environment by lowering the use of chemicals (Tripti *et al.*, 2012). Bio cultures are used to treat seeds, plantlets, and grown plants. The popularity of bio-culture cultures is due to their eco-friendly, non-hazardous, and non-toxic nature. The living microorganism colonizes the rhizosphere or colonizes the interior of the plant, they promote growth by increasing the availability of nutrients and help in the breakdown of inorganic substances in an organic form, increasing the supply of growth stimulus to the seeds of crops, plant surfaces and even in the soil can help in greater productivity.

The role of microorganisms in converting insoluble forms of nutrients into soluble forms is well known. After nitrogen, phosphorus is second in terms of importance for growth in plants. Phosphorous is 0.2% of the dry weight in plants. Phosphorus is obtained by the plant as phosphate anions. Phosphate-solubilizing bacteria possess the capability to convert phosphorus from insoluble to soluble form (Keneni *et al.*, 2010). Phosphatic fertilizer when applied to the soil it has seen that only a small amount is utilized by the plants. In India, it has been estimated that about 98% of the soil has some amount of deficit in phosphorus. Chemical fertilizers having phosphorus have a disadvantage, inorganic phosphates when applied to the soil are immobilized and thus not available to the plant (Karpagam and Nagalakshmi, 2014). PSBs or Phosphate solubilizing bacteria help in converting phosphorus into soluble forms by acidification by organic acids, and chelating oxo acids from sugars. They also produce enzymes like phosphatase enzymes that help in further degradation. Inoculation of PSBs in soil or near the rhizosphere of the plants has been shown to promote the growth of plants as a stimulatory effect. Plant roots can take up different forms of phosphorus like $H2PO^{4}$, and HPO^{2-}, this take-up normally depends upon the soil pH, temperature, moisture content, and other nutrients or minerals present in the soil (Rajsekaran *et al*,2012).

This research is aimed at the development of efficient phosphate-solubilizing bacteria from local soil samples. We tried phosphate-solubilizing bio culture for plant growth in pots.

Objectives:

- Collection of soil samples from different regions.
- Enrichment of soil samples
- Isolation of phosphate-solubilizing bacteria
- Development of bioculture
- Application of bio culture for plant growth in pots

Materials and Methods:

Collection of soil samples: Five soil samples were collected from various soil samples and soil samples were brought to the laboratory by sterile polythene bags.

Enrichment of soil sample: Five soil samples were inoculated in a selective and sterile Pikovskaya's broth medium containing l^{-1}: glucose, 10 g; $Ca_3(PO_4)_2$, 5 g; $(NH_4)_2SO_4$, 0.5 g; NaCl, 0.2 g; $MgSO_4 \cdot 7H_2O$, 0.1 g; KCl, 0.2 g; yeast extract, 0.5 g; $MnSO_4 \cdot H_2O$, 0.002 g; and $FeSO_4 \cdot 7H_2O$, 0.002 g. All soil-added flasks were kept at room temperature for 72 hrs. The number of phosphate-solubilizing bacteria was increased in both called enrichment.

Isolation of Phosphate solubilizing bacteria: Each enriched soil sample was separately streaked on a KB medium. All streaked plates were incubated at room temperature for 72 hrs. The incubated plates were examined for the development of a clear zone around the colony.

Development of bio culture: The maximum clear zone showing colonies was selected for the development of phosphate-solubilizing bio culture. All potential phosphate-solubilizing bacteria were brought together. Such mixed bio culture was applied to plants for growth.

Pot experiment: Such bio culture was mixed with silica powder as a carrier. Carrier-applied bio cultures were mixed directly into the soil of the pot plant. The height of the plants grown in pots was measured and the effect of developed bio culture was studied.

Results and discussion: A total of 10 phosphate-solubilizing bacteria were isolated from five soil samples. Out of 10 phosphate-solubilizing bacteria, 3 phosphate-solubilizing bacteria were showing a maximum zone of inhibition on a KB agar medium. The results of phosphate solubilizing isolates were represented in table no.1. The highest clear zone was observed for isolate SG3 and the lowest clear zone was observed for isolate SG7. The clear zone in mm for the rest of the other isolates was in between the clear zone of isolate SG3 and SG7. The isolates SG1, SG2, and SG3 were selected for further study. These three isolates were separately grown in a broth medium and then mixed with a carrier. Such a mixture was applied to plants grown in pots. This mixture increased plant growth when compared with the control.

Table no.1: Zone diameter of isolates on medium

Sr. No.	Isolates	Zone diameter in mm
1	SG1	07
2	SG2	08
3	SG3	09
4	SG4	04
5	SG5	03
6	SG6	02
7	SG7	01
8	SG8	02
9	SG9	03
10	SG10	02

Conclusions:

The bio cultures are environmentally friendly and alternative to chemical fertilizers. The drastic shift in pH of the medium on the acidic side shows the production of organic acid and enzymes by the microorganisms. This can be helpful for the solubilization of the phosphate provided in the medium.

Field trial output of the PSB bio culture shows marked differences in soil fertility and increased plant height of pot-grown plants.

References:

- Karpagam, T. and Nagalakshmi, P.K., (2014). Isolation and characterization of phosphate solubilizing microbes from agricultural soil. Int *J Curr Microbiol Appl Sci*, 3:601-14.
- Keneni, A., Assefa, F., and Prabu, P.C., (2010). Isolation of Phosphate solubilizing bacteria from the rhizosphere of Faba Bean of Ethiopia and their abilities on solubilizing insoluble phosphates. *J. Agri. Sci. Tech*. 12:79-89.
- Tripti, Kumar, V., and Anshumali., (2012). Phosphate Solubilizing Activity of Some Bacterial Strains Isolated from Chemical Pesticide Exposed Agricultural Soil. *Int J Eng Res Devl* 3(9): 01-06.
- Rajasekaran S., Ganesh Shankar, K., Jayakumar, K., Rajesh, M., Bhaaskaran, C., Sundaramoo rthy, P**. (**2012). Biofertilizers current status of Indian agriculture. *Int. J. Environ. Bioenergy*, 4(3): 176-195.