SE-1: BIOFERTILIZERS AND BIOPESTICIDES

Unit 3 Phosphate Solubilizers- Phosphate solubilizing microbes- Isolation, characterization, mass inoculums production, field application

Phosphorous is the second most vital nutrient next to nitrogen required for the growth of microorganisms and plants. But most of the phosphorus is not available to plants. Phosphorus (P) is a macronutrient required for the proper functioning of plants. Because P plays a vital role in every aspect of plant growth and development, deficiencies can reduce plant growth and development. Though soil possesses total P in the form of organic and inorganic compounds, most of them remain inactive and thus unavailable to plants. Since many farmers cannot afford to use P fertilizers to reduce P deficits, alternative techniques to provide P are needed. Phosphate solubilizing microbes (PSMs) are a group of beneficial microorganisms capable of hydrolyzing organic and inorganic insoluble phosphorus compounds to soluble P form that can easily be assimilated by plants. PSM provides an ecofriendly and economically sound approach to overcome the P scarcity and its subsequent uptake by plants.

There are several phosphate solubilising microorganisms (PSM) present in the soil, for example the species of *Pseudomonas, Bacillus, Micrococcus, Flavobacterim, Aspergillus, Penicillum, Fusarium, Sclerotium,* etc. They can utilize tri-calcium phosphate [Ca3(PO4)2], apatite, rock phosphate, FePO4 as a sole source of phosphate present in medium. The indication of phosphate utilization is t hat they produce clearing zone around each colony. They secrete organic acid such as acetic acid, lactic acid, succinic acid, propionic acid, formic acid, etc. Consequently, bound form of phosphates are solubilized and charged molecules of phosphorous (PO4-3) are absorbed by the plants.

Therefore, the PSM save over 30-50 Kg/ha of super-phospahte and increase crop yield up to 200-500 kg/ha.

**Isolation of Phosphate Solubilizer-**

For the isolation of Phosphate solubilizing microorganisms (PSM), **Pikovskaya Medium** are used. A small amount of soil (1g) is collected from field and serially diluted in known volume of water. Each plate with 1ml of soil suspension is incubated at 28°C for about 4-5 days. Only PSM grow and form colony which can be identified due to formation of clear zone around the colonies. Such colonies are picked up, purified and preserved for further use.

**Mass Production of inoculums-**

* The PSM are produced on a large scale in a large fermentor containing Pikovaskaya medium.
* Starter culture is transferred in a fermentor containing Pikovaskaya medium and grown at

28°C for 10-15 days.

* Culture broth is harvested when cells have attained 108-109 cells/ml
* Different carriers (e.g. wood, charcoal powder, peat, lignite are used for inoculums production. The carrier is powdered, neutralized, sterilized and mixed with broth inoculants.
* Carrier and inoculants are properly mixed till 40% moisture is attained.
* Mixture is left for curing followed by packing in polythene bags and stored at 15-20°C

**Field application-**

Slurry is prepared by diluting the PSM in water and treating with gum arabic and CaCO3. Seeds to be sown in field are mixed in slurry for bacterisation and dried in shade. The PSM adhere on seed surface. Then the bacterised seeds are sown in field.

The PSM solubilise 20-30% phosphate which is then absorbed by the plants. consequently, plant growth is increased. The PSM can be used for all types of plants because they are heterotrophs and show host-specificity.

Benefial effect of seed inoculation with phosphobacterin has been reported on barseem and wheat. On application of PSM, crop yield of vegetables was increased. But this increase got more potentiated on co-inoculation of PSM with *Azospirillum.*