AGRIALLIS
Science for Agriculture and Allied Sector: A Monthly e Newsletter
Volume 2 – Issue 9
Online ISSN: 2582-368X
www.agriallis.com

POTASSIUM SOLUBILIZING BACTERIA: A PROMINENT NUTRIENT BOOSTER IN SOIL

Article Id: AL202094

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Potassium (K) is the third important plant nutrient after N and P and is a fundamental macronutrient for plant growth (Parmar *et al.*,2013). In soil, K is the most abundant macronutrient and is the 7th most abundant element in the lithosphere (2.6%) (Etesmi*et al.*, 2017). It can be more easily leached in the soil system, and in Indian soil total, K content varies from 0.5 to 3.0%.

Suitability for adaptation of Potassium Solubilizing Bacteria (KSB)

- K biofertilizers are compatible with biopesticides and other biofertiliers.
- Self-life of this biofertilizer is stable for 1 year from the date of manufacturing.
- It is suitable for application on cereals, millets, pulses, forage crops, spices, medicinal crops, ornamental crops and all other crops.
- K soluble Bacteria are available in different formulations (powder, liquid).

Strains of Potassium Solubilizing Bacteria (KSB)

It is known that Potassium Solubilizing Bacteria (KSB) can solubilize K bearing minerals and convert the insoluble K to soluble forms of K available to plant uptake. Many Bacteria such as *Acidothiobacillus ferroxidans*, *Paenibacillus* spp, *Bacillusmucilaginosus*, *B.edaphicus*and *B.circulans* have the capacity to solubilize K minerals (Etesami *et al*., 2017).

Main Mechanisms of Potassium Solubilizing Bacteria (KSB)

Following are the various processes by which KSB helps in solubilizing K bearing minerals and convert the insoluble K to soluble Forms of K.

- **Acidolysis:** Secretion of various enzymes to solubilise essential nutrients.

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- **Chelation:** Bonding of ions and molecules to metal ions. They are mostly organic compounds.
- **Exchange reactions:** It enhances the dissolution of K ions by providing protons from other cations like Ca^{2+}.
- **Complexolysis:** Complex formation organic acids and metal ions such as iron, calcium help to solubilise ion. K solubilisation occurs by complex formation between organic acids and metal ions as Fe^{2+}, Al^{3+}, Ca^{2+} (Koushalya, 2018).
- **Production of Organic Acid:** Acid like citric acid, malic acid, oxalic acid, ferulic acid, syringic acid produced by KSBs (by organic matter decomposition) enhances the K solubility (Setiawati, *et al*., 2016). The product of decomposed organic matter such as acetate, citrate and oxalate can increase mineral dissolution in soil.

Isolation of KSB: Potassium solubilizing microorganisms can be isolated by serial dilution methods using Aleksandrov medium.

Method of Application

- **Seed Treatment:** Mix 10g of biofertilizer with 10g of crude sugar insufficient water to make a slurry and coat 1 kg o seeds.
- **Seedling Treatment:** Mix 100g of biofertilizer with sufficient quantity of water and organic manure to form a slurry. The seedlings are dipped in this slurry for 30 minutes prior to planting get attached to the roots.
- **Soil Application:** Mix 3-5 kg/acre of K biofertilizer with compost and apply to an acre of soil.
- **Drip Irrigation:** Mix 3 kg/ acre of K biofertilizer in drip stream.

Advantages of Potassium Solubilizing Bacteria (KSB)

- Effectively mobilize unavailable potassium ions and make it available to the plants.
- Natural potassium solubilization improves both plant and soil health and also aids in soil remediation.
- The increase in the beneficial microbe population in soil improves soil health.
- Eco friendly.

Limitations of Potassium Solubilizing Bacteria (KSB)

- Not easily available in the market and lack of awareness in farmers.

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- Prone to contamination with other chemical fertilizers and pesticides.
- Surplus products may be disposed of in croplands.
- Smoke inhale during application can be harmful.
- Direct incidence may cause irritation, and therefore it is recommended that the operator should use protective gear (gloves, apron, mask, eye mask).

Conclusion

Using KSBs enhance the use efficiency of K and also mitigate the application of chemical K fertilizers as India is the importer of the potassic fertilizers. It is safe to use along with other biofertilizers. It is an effective component in IPM and INM programs.

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