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BIOFERTILIZERS: BOOSTER FOR ENHANCING SOIL FERTILITY

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INTRODUCTION:

The green revolution has increased food production through chemical fertilisers, but sustainability has been less discussed. Excessive use of these fertilisers disrupts ecological balance, lowers soil fertility, and harms the ecosystem. Biofertilizers, often referred to as "microbial inoculants," are recognized as safe supplements to chemical fertilisers, promoting soil health preservation, increased fertility, and improved crop quality. These alternatives offer a sustainable way to feed plants without compromising environmental or sustainability.

Chemical fertilizers have been linked to environmental damage, but biofertilizers offer a sustainable alternative. These inexpensive inputs enhance soil fertility and crop yields without causing environmental damage. Biofertilizers introduce beneficial bacteria and fungi, such as arbuscular mycorrhiza fungi (AMF) and plant growth promoting rhizobacteria (PGPR), and nitrogen fixers to the soil. They protect the ecosystem and ensure natural nutrient availability. Biofertilizers are recognized as organic and do not contain harmful ingredients.

In India, the use of biofertilizers mitigates the drawbacks of traditional chemical fertilizers, preventing soil degradation, water contamination, and environmental damage. Therefore, it is crucial to use biofertilizers in agriculture for sustainable growth.

BIOFERTILIZER?

In addition to being referred to as microbial inoculants, biofertilizers are cultures of certain soil organisms that have been purposefully cultivated with the objective of increasing crop output and improved soil fertility. In addition to enhancing the production of the crop to which they are applied, these biofertilizers also improve the yield of crops that are grown after the initial crop. Additionally, biofertilizers improve the availability of nutrients that are easily absorbed by plants. This is accomplished by accelerating particular microbial processes that occur in the soil. In addition, they are responsible for the preservation of the natural environment and are an essential component of integrated nutrient management. If chemical fertilizers are utilized in an excessive or insufficient manner, they have the potential to

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cause dangerous compounds to build in the soil. The use of these fertilizers on a consistent basis can lead to a decrease in soil fertility and an increase in soil acidity. Due to the fact that inorganic fertilizers are easily soluble in water, they have the potential to cause contamination of both the groundwater and the deep soil. On the other hand, it has been demonstrated that biofertilizers are capable of successfully addressing all of these difficulties without causing any adverse impacts. The use of biofertilizers is essential for plants in order to maintain the fertility of the soil. In addition to assisting in the solubilization and mineralization of other plant nutrients, such as phosphates, the microorganisms that are included in biofertilizers are responsible for delivering atmospheric nitrogen from the atmosphere straight to the plants. It is possible to attain excellent agricultural yields with the assistance of biofertilizers since they nourish the soil with nutrients. As a result of the utilization of biofertilizers, the issues that are related with either an excessive or an insufficient application are eliminated. The application of biofertilizers over an extended period of time increases the fertility of the soil by accumulating nutrients in the soil. It is via this process that the natural fertility of the soil is preserved, and the elimination of poisonous materials that can cause plant illnesses is achieved. This has positive effects on the environment, plants, and the beneficial microorganisms that are necessary for the growth of plants. Furthermore, biofertilizers are efficient in terms of both cost and environmental impact, which makes them readily available to farmers.

CLASSIFICATION OF BIOFERTILIZERS

They are classified into different types depending on the groups of microorganism they contain

- ✓ **Nitrogen-fixing biofertilizers (NFB):** Though most plants are unable to fix atmospheric nitrogen, an estimated 78.8 % of the gaseous components in the atmosphere are nitrogen. A collection of microbes found in N-fixing biofertilizer can fix atmospheric nitrogen and convert it into organic (useful) forms in the soil and legume root nodules, therefore making it available to plants. For instance, blue green algae, Azotobacter, Azospirillum sp., and Rhizobium sp.
- ✓ **Phosphate Solubilizing biofertilizers (PSB):** Numerous bacteria belonging to the genus Bacillus, Pseudomonas, Micrococcus, Streptomyces, and Flavobacterium, as well as fungus belonging to the genus Aspergillus, Penicillium, and Trichoderma, are capable of effectively dissolving insoluble phosphate of rock phosphate groups.

Organic acids are released by these bacteria, which then solubilize the insoluble phosphorus that has been given to the soil. This phosphorus is thus made available for plant absorption.

- ✓ **Phosphorus Mobilizing biofertilizers (PMB):** Microbes that mobilize phosphorus play a role in the processes that change soil phosphorus. The phosphorus in the soil, both soluble and fixed, was mobilized. As a result, plants may be able to take phosphorus in a sustainable manner and soil phosphorus availability increases. Among them are Mycorrhiza.
- ✓ **Potassium Solubilizing biofertilizers (KSB):** An important feature of these biofertilizers is their ability to solubilize minerals, such as potassium, and turn the insoluble form into a soluble form that plants can readily absorb. Bacillus species and Aspergillus niger are two instances of such creatures.
- ✓ **Potassium Mobilizing biofertilizer (KMB):** Specific strains of bacteria have the ability to mobilize potash by converting insoluble potash into soluble potash, so making it available for plants. Some examples include species of Bacillus.
- ✓ **Sulphur Oxidizing biofertilizer (SOB):** making it available to plants. Examples include Bacillus sp
- ✓ **Zinc solubilizers**: Rhizobium, Azospirillum, Azotobacter, BGA, B. magaterium, Pseudomonas striata, and Mycorrhiza are popular bio-fertilizers. These only provide major nutrients, but soil contains many microorganisms that can turn micronutrient s into bio-fertilizers for zinc, iron, copper, etc. B. subtilis, Thiobacillus thioxidans, and Saccharomyces sp. solubilize zinc. Bio-fertilizers like this can solubilize fixed micronutrients like zinc. The results show that Bacillus sp. (Zn solubilizing bacteria) can be used as a zinc bio-fertilizer in soils with high native zinc or with insoluble zinc compounds like ZnO, ZnCO3, and ZnS instead of expensive zinc sulphate

BIOFERTILIZER FOR SUSTAINABLE CROP PRODUCTION:

The soil is no longer suitable for growing crops since its fertility has been reduced due to the long-term overuse of chemical fertilizers. The over-application of these inorganic inputs has also caused significant harm to the environment and human health, including water contamination, soil erosion, and biodiversity loss. Applying biofertilizers, on the other hand, could protect soil against dryness and diseases transmitted through it while simultaneously restoring the soil's natural fertility. These biofertilizers boost agricultural productivity by activating

soil microbes, which in turn promote plant growth. They don't harm the environment in any way, are inexpensive, and can be replenished. Because they help alleviate problems caused by a growing population outpacing food production due to extensive chemicalization in agricultural ecosystems, biofertilizers are an important part of integrated nutrient management (INM). The soil is no longer suitable for growing crops since its fertility has been reduced due to the long-term overuse of chemical fertilizers. The over-application of these inorganic inputs has also caused significant harm to the environment and human health, including water contamination, soil erosion, and biodiversity loss. Applying biofertilizers, on the other hand, could protect soil against dryness and diseases transmitted through it while simultaneously restoring the soil's natural fertility. These biofertilizers boost agricultural productivity by activating soil microbes, which in turn promote plant growth. They don't harm the environment in any way, are inexpensive, and can be replenished. Because they help alleviate problems caused by a growing population outpacing food production due to extensive chemicalization in agricultural ecosystems, biofertilizers are an important part of integrated nutrient management (INM).

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