

## Biofertilizer: A Sustainable Approach for Agriculture

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### Abstract

The overall extension in human populace raises a major danger to the food security of every person as the land for the agriculture is restricted and, surprisingly, diminishing with time. Consequently, rural efficiency and proficiency ought to be improved fundamentally inside the following couple of a long time to satisfy the gigantic need of food by arising populace. Bio-manure contains microorganisms that advances the satisfactory supply of supplements to the host plants and guarantee their satisfactory development and improvement along with their physiological regulations. As agro-climatic conditions and soil characteristics varies broadly so an broad range of strains for each bio-manure needs to be isolated for every area. Bio-composts are eco-accommodating, and is one of the best current device for the agriculture and are used to work on the quality and richness of soil. In this manner it acts as financially and is likewise environmentally sound course for improving supplement supply. An excess of reliance on the synthetic composts for more yield creations will hurts both biological climate and human prosperity with incredible seriousness. Exploitation of microorganisms as biofertilizer is viewed as to some degree an option in contrast to chemical manures in agrarian area due to their expansive probability in upgrading the harvest creation and food security. It has been seen that couple of microorganisms including the plant development advancing microscopic organisms, growths, Cyanobacteria, and so on have showed biofertilizers-like practices in the agrarian region. Broad work on biofertilizers has promoted their ability of giving expected supplements to the plants in sufficient amount that achieved the improvement of yield.

**Keywords:** Population; Climate; Agriculture; Economy; Fertilizer; Eco-friendly

### Introduction

With the normal ascent in the overall populace, growing regular natural harm is expending because of quick improvement and development in industrialization and urbanization [1]. Likewise, it is a very critical test to take care of this enormous populace at present which naturally increases with time. Notwithstanding, the huge use of synthetic composts in agriculture makes the country self-subordinate in giving enormous amount of food supply and yet harms the climate to an excessive extent and causes horrendous consequences for living beings [2]. There has been gigantic use of bug sprays, fungicides and pesticides to fabricate the efficiency yet these items are responsible for draining the crucial minerals from the soil thus it make influence in a negative way. This issue prompts the production of biofertilizers which are the cultures of microorganisms stuffed in transporter material. Biofertilizers involve live or idle cells of the effective kinds of phosphate solubilizing, nitrogen fixing or cellulolytic microorganisms used for the application to seeds, soil or treating the regions of soil [3,4]. Bio-compost and natural fertilizer are eco-accommodating and cheapest source of the plant supplements for feasible harvest yield in low-input farming. The huge job of biofertilizers alone or in the mix with natural or inorganic composts has obtained affirmation in sustainable production of crop yield [5,6]. The availability of fluid biofertilizer in the market is on the addition as one of the options in contrast to the pesticides and chemical compost, and another benefit is in the number of population present in microorganisms. Biofertilizers likewise works to stimulate for plant development and advancement, enact soil organically, restore the soil ripeness and provide protection against the soil borne infections along with dry spell. Economically, it has been seen that biofertilizers are helpful in financial way, and lessens the expenses towards composts use, especially concerning nitrogen and phosphorus. Rhizobacteria have excellent ability to oppose the particular weighty metals and in this way advance the development of host plants by various components as nitrogen fixation, creation of phytohormones and solubilisation of minerals and siderophores

and also in transformation of supplement components. It has been accounted that 1-aminocyclopropane-1-carboxylate (ACC) deaminase-creating microorganisms plays an important role in facilitating of different kinds of stress in plants, including the effect of heavy metals. In this regard, different heavy metal resistance processes have been included in different microorganisms. It incorporates: rejection, bio sorption, dynamic expulsion, or bioaccumulation both in outer as well as intracellular spaces. Table 1 shows the portrayal of certain microorganisms that are valuable as biofertilizers.

In this manner, the common targets or objective of biofertilizer is to give monetary and regular benefits among which is soil quality improvement that contributes hugely to food quality and security or wellbeing, human and creature's prosperity as well as environmental quality.

### Types of biofertilizer formulation

Biofertilizers are the living microbial cells in the suitable state which are for the upgrade of fertility of soil. Their formulation is in such a way that they are in a reasonable state and at exactly the same time, they are additionally proficient to improve soil richness, efficiency, as well as plant development. Formulation of the biofertilizers is completed by multistep techniques in which more than one strains are joined along with the specific added substances that protect the cells in there storage time period [7]. Further developed formulation of the biofertilizers is

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**Table 1:** The names, descriptions and habitats of some common and useful biofertilizers.

Sr.No.	Names	Description	Where it leaves	References
1.	<i>Cyanobacteria</i>	Also called as blue-green bacteria, blue-green algae or cyanophyta. They are photosynthetic nitrogen fixers.	Soil, ocean and in fresh water	(Taylor et al. 2014)
2.	<i>Rhizobium</i>	Genus of the gram negative soil bacteria. It works to fix nitrogen and colonizes plant cells in the root nodules	Stem nodules and root nodules	(Qin et al. 2014)
3.	<i>Azospirillum</i>	Gram negative aerobic bacteria. Helpful in nitrogen fixations and plant nourishment. Moreover, also produces growth promoting substances.	Soil	(Serelis et al. 2013)
4.	<i>Azotobacter</i>	These are aerobic and are good in Nitrogen fixation. Useful as biopolymers and food additives. Produces antibodies which suppresses the root pathogens	Soil	(Oldroyd and Dixon 2014)
5.	Vermicompost	It has N, P, K, S, hormones, antibiotics and enzymes which helps to improve the quantity and quality of crop yield.	Soil	(Gutiérrez-Miceli et al. 2007)
6.	<i>Mycorrhiza</i>	Group of fungi that consists of a number of types based on various structures shaped inside or outside the root. These are the specific fungi that match with number of Favorable parameters of host plant on which it grows.	Soil	(Vos et al. 2013).
7.	<i>Pantoea agglomerans</i>	Gram negative bacteria earlier called <i>Enterobacter agglomerans</i> . Known for the phosphate solubilizing bacteria.	Plant surfaces and animal faeces	(Kouvoutsakis et al. 2014)
8.	<i>Pseudomonas Putida</i>	It is a gram-negative, rod shaped saprophytic soil bacterium which is used as soil inoculant to cure the naphthalene contaminated soils.	Soil	(Annesini et al. 2014)
9.	<i>Bacillus</i>	A genus of gram positive rod-shaped bacteria and is a member of phylum <i>Firmicutes</i>	Non-sterile soil	(Kumari and Sarkar 2014)

fundamental for making and commercializing the new biofertilizers that are more steady, more compelling, or of better quality and that additionally address the farmers' requirements [8]. A portion of the ideal elements of good formulation are as –

(i) It ought to allow the expansion of supplements, should have effectively adjustable pH, and be contained a sensible low-evaluated natural substance in satisfactory stock and accessibility [9].

(ii) The biofertilizers ought to be nontoxic, biodegradable as well as non-contaminated.

(iii) It ought to allow fast and controlled arrival of microbes into soil and can be applied with the standard cultivating machinery [10].

(iv) Long term storage: the biofertilizers should have sufficient timeframe of realistic usability and be metabolically viable in huge numbers under the serious conditions [10].

The four principal kinds of formulation that have been utilized broadly are-peat, fluid, granules, and freeze-dried powders.

**Peat formulations** Peat is made up of some degree decayed vegetation that is aggregated throughout the long term. It gives a supplement improved and safe climate for the development of broad scope of the microorganisms which can develop and shape the miniature settlements both on the outer layer of particles as well as in cervices.

**Liquid formulations** mostly liquid formulation is depend on the fluid, mineral or natural oils, oil in water, or on polymer-based suspensions. Fluid biofertilizers have procured noticeable quality just because of the simple dealing and handling and application both on seeds and in soil. They typically contain high cell fixation and furthermore permit for the utilization of a lower amount for the comparable proficiency. Furthermore, dissimilar to solid carrier-based biofertilizers, liquid formulation permits the maker to consolidate adequate proportions of supplements as well as cell protectants to redesign the performance [11].

Granules are formed from peat prill or little marble, silica grains

or calcite that are wetted with cement and blended well in with the powder-type inoculums. The granules are then coated with the objective microorganisms. The size of granules varies however the association of between the mother culture and final result quality is direct. The predominant is the mother culture; and the end product is considered as the superior one. Freeze-dried powders. These can be produced by utilizing soil, natural, or latent carrier dry biofertilizers are created which are utilized in specific cases.

### Mode of Biofertilizers Formulation

There are various ways for applying formed biofertilizers into soil and these are:

- Seed vaccination with powder formulation,
- Dry biofertilizers blended in with seeds in the seed container,
- Sprinkle technique - a limited quantity of water is blended in with the seeds before peat powders is added and mix properly,
- Slurry technique - In this the biofertilizer is suspended in the water then, at that point, add it to the seeds and mix properly,
- Seed pelleting,
- Biofertilizer and cement are applied as slurry to the seeds and subsequently covered with the ground material as like lime,
- Peat suspension in the water i.e., showered into the furrow during planting,
- Seed vaccination or Seed treatment,
- Seedling root plunge [12].

### Effect of Biofertilizers on Environment

In spite of the way that biofertilizers are comprehensively used in agribusiness all through the past couple of many years, the data's on their colonization and nature is inadequately illustrated. Also, the instrument behind their interaction with plant and tenant microbial community is yet an issue of interest among individuals. One of the essential issues

that choose the practicality of the biofertilizer in regular framework is the presence of native micro flora in rhizosphere. This significantly competitive community with various species in rhizosphere may impact the endurance and plant development advancing properties of biofertilizer [13]. Alongside this, bacterization of seeds and seedlings or soil corrections could convey changes to the construction of native microflora which is fundamental to be considered regarding security of presenting microbes in the climate [14]. The non-target impact, that is characterized as impact of the microbial biofertilizer on organisms separated from target microorganisms, impact on soil surface, impact on biogeochemical cycles, soil properties including water-holding limit and ripeness, porosity, and prevention of the soil erosion ought to be considered as carefully [15-17]. In this manner, prior to conveying biofertilizer in the environment, it is vital for gauge their non-target influences on the population of occupant micro flora, environment and what's more, point by point assessment on the impacts of biofertilizers is emphatically expected prior to redesigning the agricultural practices.

### Future Approaches of Biofertilizers

Presently, the use of various biofertilizers as a basic part of horticultural practice is the new arising field. In this manner, it is reasonable to expect that in future, the wide usage of biofertilizers will offer different powerful methodologies for the overall enhancement of agricultural field [18-20]. Notwithstanding, more wide utilization of biofertilizers will require not many issues with additional consideration and fundamental exercises to determine the issues [21-23].

a) Effective and feasible multi-useful biofertilizers should be picked for different harvests.

b) Elaborating the usage of biofertilizers from the examination lab and nursery preliminaries to enormous scope business use will require various high level new methodologies for the development, stockpiling, transportation, detailing, and use of these microorganisms.

c) It is vital to teach individuals and ranchers about the upside of using bio fertilizers in comparison of utilizing synthetic manures. The troublesome and dangerous impacts of prolonged used chemical composts ought to be highlight in front of individuals. The misconception about the microorganisms that they just act as specialists of illnesses wants to be corrected before the public begins to acknowledge the conscious arrival of the biofertilizer into the climate for an enormous scope [24, 25].

d) Initial biofertilizers are likely to be non - transformed bacterial strains which have been choosen for the specific positive characteristics; creations are expected for hereditarily designed strains which are of more effective in stimulating plant development or growth. Thus, specialists ought to exhibit to both general society and to managerial associations overall that hereditarily designed strains present no new peril or risk.

e) A quality control system ought to exist for the creation of inoculants and their applications in the field to guarantee and explore the upsides of beneficial interaction of plant-microorganisms. "Bio-manure Act" and severe rule for the quality control in business sectors and application should be laid out [26, 27].

### Conclusion

As the human populace expanding quickly, so in this way the world needs to manage a rising interest for food. An excess of dependence on substance composts and pesticides to fulfil the tremendous interest of food by developing populaces has urged the ventures to make hazardous

synthetic chemicals in a type of manures and pesticides. These synthetic compounds are hazardous for human use as well as truly impact the natural equilibrium in climate. Likewise the usage of biofertilizers can go about as a substitute choice since they assumes a critical part in plant strengtheners, plant wellbeing improvers, phytostimulators, and might potentially fix nitrogen. Biofertilizers works for soil improvement and are known for the long duration suitability. Further they are ecofriendly and imply no danger to the environment and in this manner it can be very well replaced with the chemical composts.

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