

BIOFERTILIZERS: BETTER APPROACH TOWARD FORMING

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ABSTRACT

In the present scenario, chemical fertilizers are seem to be a good source of inorganic nutrients to fulfill the need of increasing demand of crop production. Although, with respect to the time, so many adverse effects of chemical fertilizers on human health, natural microflora of soil and on the ecosystem have been reported which are not stoppable. On the other hand, in our nature, a great number of useful soil micro-organisms are found that can help plants to absorb nutrients. A bio-fertilizer is a substance which contains beneficial living microorganisms and used as a modernized form of organic fertilizer. From few decades, biofertilizers are reported to exhibit similar beneficial and lesser harmful impacts on the ecosystem. Hence, as an alternative of chemical fertilizers, biofertilizers are broadly used as a healthier and sustainable method for agriculture. In this review, we will discuss about the adverse effects of chemical fertilizers on different parts of environment in contrast to the benefits of biofertilizers along with the brief history and mechanism of action of bacterial biofertilizers.

Keywords: Inorganic fertilizers, Biofertilizers, Adverse effects, Ecosystem, Beneficial micro-organisms, Biological nitrogen fixation.

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INTRODUCTION

In the past decades, the use of inorganic fertilizers has become very popular throughout the world as they are effortlessly affordable and showed rapid action due to their prompt release of nutrients [1]. Although, the use of chemical fertilizers and pesticides has helped lot in increase in the crop productivity the same has also a cause of subsequent deterioration of soil health, cause biomagnification, increase in microbial resistance, increase in soil salinity, etc. [2,3].

A number of researches on the adverse effects of inorganic fertilizers have revealed that their harmful activities cannot be overlooked. Such as use of chemicals is a great cause of increased level of salts and minerals in soil, in water bodies as well as in soil micro-organisms [4]. Apart from this, the same has also seen to associate with the low quality of harvested crops. Various studies on the human and other animals also indicated a number of negative impacts of chemicals used as fertilizers, such as impairment in their physiology; abnormal functioning of respiratory system, nervous system, and reproductive system. Long-term uptake of such agriculture products have observed to be connected with the serious malfunction of human life cycle [1-5]. Hence, awareness toward the excessive use of chemicals fertilizers has been taken to various spheres. Eco-friendly practices of agriculture are challenge for present time of great demand of foods and limited natural resources [6-8].

In nature, a number of beneficial and harmful microbes have been recognized and categorized. Out of these, some of the soil microbes have ability to increase mineral and nutrients in soil by different mechanisms [9]. These microbes with some special types of organic compounds are commonly using to enhance productivity of plant in the place of chemical fertilizers. Such, substances are called biofertilizers. To fulfill the need of growth nutrients, biofertilizers are proved to be a better option. Many scientific data revealed that the biofertilizer has numerous advantages over chemical fertilizers [10-12].

Biofertilizers are not only cost effective, eco-friendly, and secure for animal body but they also serve as a renewable source of plant nutrients. In addition to this, the same have capacity to work as important components of integrated nutrient management [1,5,13]. In this review article we have mentioned a brief description on various

harmful effects of chemical fertilizers on different components of environment like soil, water, air, animals, plants, etc., has been given along with pollution caused due to their excessive application [14]. Here, we have also summarized the beneficial effects of biofertilizers over inorganic fertilizers [15,16].

ADVERSE EFFECTS OF CHEMICAL FERTILIZERS

Chemical fertilizers are synthetic compounds created specifically to increase crop yield. These are rich sources of nitrogen, potassium, phosphate, etc. They may be single nutrient based (potassium, urea) or may be complex or blended having a mix of more than two nutrients such as ammonium phosphate, nitrophosphate, potassium chloride, and other nutrients. For example, ammonium nitrate is a good source of soluble nitrogen and ammonium ions for plants [17-19]. The main role of fertilizers is to add nutrients to the soil, but chemical fertilizers cannot add anything else other than inorganic ions to plants [20-23]. Although, chemical fertilizers are very helpful to enhance the crop yield their negative impacts and drawbacks cannot be neglected. Most of the inorganic fertilizers do not contain micronutrients which are essential for plant growth [24-26]. The same are unable to add organic content to the soil. Some studies have revealed that the synthetic fertilizers do not support microbiological lives in the soil which are essential to maintain soil quality [14,17,26].

Although, every chemical fertilizer need to be applied in their specific limited amounts but in most of the cases these are seen to be over applied that reported to cause root burn, exo-osmosis and found to create toxic concentration of salts [27-29]. Some findings revealed that most of the chemical fertilizers release their nutrients too quickly which results an abnormal plant growth. Many times, this kind of plants are weak, more prone for disease, with less fruiting. In addition to this, because of easy solubility and uncontrolled availability synthetic fertilizers often leach deep down in soil that serve as a source of underground water pollution [21,29].

A number of chemical fertilizers considered to serve as a potential source of natural radionuclide and heavy metals. A large majority of the heavy metals such as Hg, Cd, As, Pb, Cu, Ni, and Cu; natural radionuclide such as ²³⁸U, ²³²Th, and ²¹⁰Po have been reported as a component or adulteration in the same [30]. Due to a long history of

