ISSN: 2688-8653

Brief Description of Microbial Fertilizers

Lin Ma

[1] Institute of Land Engineering & Technology, Shaanxi Provincial Land Engineering Construction Group Co., Ltd, Xi'an 710075, China

[2] Shaanxi Provincial Land Engineering Construction Group Co., Ltd, Xi'an 710075, China

[3] Key Laboratory of Degraded and Unused Land Consolidation Engineering, the Ministry of Natural Resources, Xi'an 710075, China

[4] Shaanxi Provincial Land Consolidation Engineering Technology Research Center, Xi'an 710075, China

Abstract

In view of the current excessive application of chemical fertilizers in my country, agricultural production has fallen into the "petrochemical agriculture cycle" of high input, high pollution and high harm. We must vigorously advocate the use of microbial fertilizers to ensure the sustainable development of my country's agriculture. Through the progress in the fields of bacterial fertilizer, antimicrobial fertilizer, compound microbial fertilizer, PGPR preparation, mycorrhizal fertilizer and other fields, the advantages and significance of micro-fertilizer are expounded.

Keywords

Microbial Fertilizer; Green Agriculture; Sustainable.

1. Introduction

The five major problems facing the world today are population explosion, food shortage, resource scarcity, energy shortage, and environmental degradation. The emergence of microbial fertilizers is undoubtedly an effective way to alleviate these problems. On the premise of not polluting the environment, microbial fertilizer saves resources, saves energy, and more effectively improves the yield of food crops. Microbial fertilizers will play an important role in green agriculture (pollution-free agriculture) and ecological agriculture, which are vigorously advocated in modern agriculture.

Microbial fertilizer is mainly used for seed dressing, crop root sticking, foliar spraying, straw decomposition and compost fermentation. Its role has attracted the attention of domestic and foreign experts and scholars. Microbial fertilizers can be divided into bacterial fertilizers (such as nitrogen-fixing bacteria, rhizobia, phosphorus bacteria, potassium bacteria, photosynthetic bacteria), actinomycete fertilizers (such as antibiotics), and fungal fertilizers (such as mycorrhizal fungi) according to the types of microorganisms. According to the mechanism of action, it can be divided into rhizobia fertilizers, nitrogen-fixing bacteria fertilizers, phosphorus-resolving bacteria fertilizers, potassium-solving bacteria fertilizers, etc. According to the composition of fertilizer, it can be divided into single microbial fertilizer and compound (compound) microbial fertilizer. This article will introduce several types of microbial fertilizers.

2. Bacterial Fertilizer

2.1. Rhizobium Fertilizer

Rhizobium fertilizer is an inoculant used for legume crop inoculation, nodulation and nitrogen fixation of legume crop. Rhizobium fertilizer contains a large number of rhizobia, and its biggest

ISSN: 2688-8653

feature is that it can symbiotically fix nitrogen with leguminous plants, that is, after rhizobia fertilizer is applied to the soil, the rhizobia encounters the corresponding leguminous plants and invades the roots to form root nodules. The rhizobia in the nodules can fix nitrogen in the air and convert it into nitrogen compounds that can be used by crops for use by legume crops; while the carbohydrates produced by legume crops are used as energy for the life activities of rhizobia. form an interdependent symbiotic relationship [1].

2.2. Phosphorus Bacterial Fertilizer

Phosphorus is one of the essential nutrients for plant growth. It is not only a component of many important organic compounds in plants, but also participates in various metabolic processes in plants in various ways. plays an irreplaceable role. The most direct function of phosphorus bacteria is to convert insoluble or insoluble phosphorus in the soil into phosphorus in the soil solution. Therefore, the bacterial fertilizer made from phosphorus-solubilizing bacteria has great development and application value. The research on phosphate-solubilizing bacteria in my country started in the 1950s. In the 1990s, some researchers inoculated corn with a spore-forming bacillus isolated from wheat rhizosphere soil with strong ability to dissolve tricalcium phosphate. The sand culture test was carried out in and millet, and the results showed that the dry matter weight of corn increased by 32% to 45%, and the dry matter weight of millet increased by 5l%; and the iron phosphate-soluble bacteria were inoculated in the potting soil of water spinach and leaf lettuce. The results showed that not only It can increase yield and has the effect of reducing the application of half amount of phosphorus fertilizer. Therefore, phosphorus bacteria can be developed into phosphorus bacterial fertilizer, which can not only improve the effectiveness of phosphorus fertilizer applied to the soil, but also activate soil fixed phosphorus.

There are many kinds of microorganisms with the ability to dissolve phosphorus in soil, and there are some differences in the types and distribution of phosphorus-solubilizing bacteria in different soils and different crop rhizospheres. For example, the main organophosphine degrading bacteria in cultivated soil is Bacillus , while the forest and vegetable soils are mainly Pseudomonas, the phosphate-solubilizing bacteria in the rhizosphere of legumes are mainly Bacillus, and the phosphate-solubilizing bacteria in the rhizosphere of wheat are mainly Bacillus and Escherichia. . In addition, previous studies have found that most of the phosphorus-solubilizing bacteria in the soil exist in the plant rhizosphere, while the types and numbers of phosphorus-solubilizing bacteria in the non-rhizosphere soil are relatively small, and the number of organic phosphine bacteria is relatively more than that of inorganic phosphorus bacteria [2].

2.3. PGPR Preparations

Since the 1930s, many scholars have found that in the rhizosphere of plants, there are many bacteria that are beneficial to plants, and they can produce many growth-promoting substances in the process of growth and metabolism. These growth-promoting bacteria are collectively referred to as Plant Growth Promoting Rhizobacteria (PGPR).

The functions of PGPR are: 1. Secretion of plant biomass-promoting substances 2. Growth-promoting effect on nodulation of leguminous plants 3. The effect of promoting budding 4. Biological regulation of soil-borne diseases 5. PGPR and rhizosphere technology may be used in Explanation of farmland pollutants 6. Growth-promoting ability of some strains of rhizobia 7. Development and utilization of second-generation legume inoculants 8. Biological control of host plant diseases [3].

ISSN: 2688-8653

3. Actinomycete Fertilizer

Antibacterial fertilizer is a kind of actinomycetes that can secrete antibacterial substances and stimulants, inoculated in cake flour and soil (1:10) and fermented. It has the advantages of low cost, high fertilizer efficiency, disease resistance, growth promotion, simple composting method, and local materials, which can be used in paddy fields and dry fields, and is harmless to crops. For example, the problem of continuous cropping is one of the main reasons for the reduction of soybean yield and quality. The application of appropriate antibiotics can improve the rhizosphere micro-ecological environment and promote the normal growth and development of soybeans, thereby alleviating or even eliminating the harm of continuous cropping. . In the experiment, the soybeans were treated with antibacterial agents in the continuous cropping and continuous cropping areas, and the conventional treatment was used as the control. After two consecutive years of plot experiments, the results showed that the application of directional screening antibiotics at the same time of sowing significantly changed the composition of the rhizosphere microflora of the continuous cropping soybean. While the number of bacteria and actinomycetes increased significantly, the true number of The reduction means that the B/F and A/F values are increased, and the soil self-purification and health care ability are enhanced. Furthermore, it improved the nodulation and nitrogen fixation of the continuous cropping soybean, promoted the growth and development of the plant, increased the grain weight per plant, increased the nitrogen assimilation amount of the grain, and alleviated the physiological obstacle of nitrogen assimilation in the continuous cropping soybean. The number of beneficial microorganisms increased significantly and the number of harmful microorganisms decreased with the application of antibiotics.

Although phosphorus bacterial fertilizers play an irreplaceable role in agricultural development, due to limited research, there are still many deficiencies and problems: (1) There are many types of phosphorus bacteria, and their decomposition mechanisms are different and complex. Soil and plant types, and suitable phosphorus bacteria species are difficult to determine. (2) The changes of phosphorus bacterial fertilizers after application to the soil, the process of growth and decline, and the optimal conditions for dissolving phosphorus are still unclear. (3) There are few physiological and genetic studies on the phosphate-solubilizing properties of phosphorus bacterial fertilizers, especially in terms of indication and regulation. (4) A large number of studies have found that the effect of bacterial fertilizer alone is not obvious, so the rational application of phosphorus bacterial fertilizer and phosphorus fertilizer may have better results [4].

The species used are usually actinomycetes, such as Streptomyces flavonoids. "5406", which has been used in my country for many years, belongs to this category. Actinomyces 5406 is a kind of actinomycetes isolated from the roots of old alfalfa in Jingyang, Shaanxi Province in 1953, belonging to Actinomyces freundii. On the solid medium, the colony is round and raised, the initial surface is smooth, light yellow with greenish, after growth, the surface is powdery, white with pink, and the back is yellowish brown. The functions are as follows: 1. Anti-disease and deworming. Laboratory tests have shown that 5406 antibiotics can produce different antibiotics, which have inhibitory effects on more than 30 kinds of plant pathogens. Field tests have also proved that 5406 antimicrobial fertilizer can prevent rice seedlings from rotting and reduce the damage of cotton seedling stage root rot, sweet potato black spot, wheat rust, rice blast and so on. 2. Stimulate the growth of crops. 5406 antibiotics can secrete antibiotics, stimulate crop cell division and vertical and horizontal growth, break the dormancy of potatoes, promote the rooting and germination of various seeds and the growth of stems and leaves of seedlings, increase the tillering of wheat and rice, and make various crops mature in advance. 3. Increase the content of available nutrients in the soil. 5406 needs to be mixed with soil for cultivation. In addition to the cake soil itself containing a certain amount of nitrogen,

ISSN: 2688-8653

phosphorus, potassium and other nutrients, it can also generate organic acids through the life activities of 5406 antibiotics to convert the insoluble phosphorus in the rhizosphere soil into Available phosphorus. According to the statistics of the application of 5406 bacterial fertilizers in 15 soils across the country, the increase in available phosphorus can reach up to 215%, the lowest increase is 11%, and the average increase is 56.6%. 4. The use of 5406 antimicrobial fertilizer can increase production. In 1975, 5406 bacterial fertilizers were used nationwide to reach 6667 hectares. They were applied to crops such as grains, beans, fruits and vegetables, and the yield increase effect was good. Among them, the average yield of rice was increased by 10%, and the yield of dryland food crops was increased by 10%-20%. Vegetables can reach 20%-30%. Antibacterial fertilizers can be used as basal fertilizers or top-dressing fertilizers, and plants can be symbiotic with actinomycetes by soaking seeds, dressing seeds or dipping roots [5].

4. Fungal Fertilizer

Here we mainly introduce the mycorrhizal fertilizer in the fungal fertilizer. Mycorrhiza is a mycorrhizal symbiosis formed by certain fungi in the soil that infect the roots of plants. Due to the wide variety of plants that form mycorrhizae, there are also many types of fungi that form mycorrhizae, including basidiomycetes, ascomycetes, and fungi in algal fungi. The vesicular arbuscular mycorrhizae formed by most of the genera and species of the fungi of the order Mucormycaceae are referred to as VA mycorrhizas. The characteristics of VA mycorrhizae are: mycorrhizal fungi are algal bacteria without septa; arbuscular or bifurcated mycelia are formed in cortical cells; oval vesicles are formed in or between cortical cells; mycelial removal In addition to the above structures formed in the plant root cells, it also extends into the soil, sometimes very vigorously, thereby expanding the absorption surface, but does not form ectopic mycorrhizal bacterial sheaths (formed by hyphae, false thin skin).

Mycorrhizal symbionts (mycorrhizal fungi) are beneficial, and some are even necessary, for the growth of the host. People expand the beneficial mycorrhizal fungi together with their host plants, and then use the soil with mycorrhizal fungi (mycorrhizal soil) as an inoculant in agricultural and forestry production to increase crop yield and crop quality and improve tree quality. Survival rate. This mushroom soil containing artificially expanded beneficial mycorrhizal bacteria is called mycorrhizal fertilizer. Since they are all broad-spectrum hosts, host plants suitable for growth under experimental conditions, such as tomato, corn, etc., can be used as their host propagation materials. Isolation of mycorrhizal fungi by the single spore technique are spores that can be inoculated onto sterile or near-sterile host plants to obtain and maintain a "pure culture" of them.

The mechanism of action of mycorrhizal fungi fertilizers, the extension mycelium of exogenous and exogenous mycorrhizal fungi extends in the soil, expanding the absorption area of plant roots, and the mycelium of mycorrhizal fungi secrete a variety of extracellular enzymes, which strengthens the soil organic matter around the root system. The decomposition of mineral elements enriches the absorption of mineral nutrients by plant roots, and the secreted growth stimulants stimulate root growth. Phosphatase exists on the surface of mycorrhiza to hydrolyze organophosphorus compounds, which can enhance the amount of available phosphorus around mycorrhiza for root absorption. In addition, some mycorrhizal fungi of orchids obtain organic carbon sources and energy from the environment to supply plant symbionts with nutrients. Many experiments have shown that in poor soil, plants with mycorrhizae can absorb more phosphorus than plants with sterile roots, and significantly increase yield and improve quality; nursery saplings do not grow well without mycorrhizae [6].

ISSN: 2688-8653

5. Conclusion

In summary, we have seen that microbial fertilizers not only have many types and great benefits, the society's increasing demand for food and fertilizers, the demand for non-chemical fertilizers in modern ecological agriculture and organic agriculture, and the improvement of people's awareness of environmental protection, the application of microbial fertilizers. Has huge potential. However, microbial fertilizer cannot completely replace chemical fertilizers, and it needs to be used in combination with chemical fertilizers and organic fertilizers to achieve its maximum potential. Microbial fertilizers also have high requirements on the environment, and if care is not taken, it may cause fertilizer failure. We must take advantage of strengths and avoid weaknesses, make comprehensive utilization, and maximize the benefits of microbial fertilizers.

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