

CLASSIFICATION OF BACTERIAL AND FUNGAL BIOPREPARATIONS

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<https://doi.org/10.5281/zenodo.7838290>

Abstract. *The article describes in detail the advantages of microbiological biopreparations over chemical preparations, their environmental safety in the production of agricultural products, the ability to reduce energy consumption per product unit, the improvement of food quality, and the enzymatic and microbiological activity of soil.*

Keywords: *"Стерня-12", Bacillus subtilis 1K, Bacillus subtilis 3K, Bacillus subtilis 26D, Bacillus licheniformis 94, Azotobacter chroococcum BH-1811.*

INTRODUCTION

Biopreparations, biotechnology and agricultural microbiology, in particular, one of the achievements of the field of plant science, fungal and bacterial biopreparations have a complex effect. It can be used to prepare seeds before sowing, in plants during the growing season, to store agricultural products, and to prepare the soil before planting. As a result, the vegetation period of plants accelerates and creates healthy soil agocenosis conditions. At the same time, it prevents contamination of the soil with residual amounts of fungicides, herbicides, insecticides, phytopathogenic micromycetes and their metabolic products.

Currently, bacterial preparations based on a single culture of microorganisms are known for agriculture, which prevent the development of phytopathogenic fungi and bacteria, and also have a positive effect on the growth and development of plants, as well as It helps to fix atmospheric nitrogen and convert insoluble soil phosphates into soluble form.

Microbial fertilizers replace chemical fertilizers that pollute the environment.

They are used to increase productivity in an environmentally friendly way, based on the principles of sustainable agriculture. The biggest problem is that the quality of food products today is very low, which leads to insecurity and further commercialization. To increase production, commercialization of microbial fertilizers should achieve quality and comprehensive results. Therefore, a lot of research is being done in this area. In order to develop an optimal product, it is important to know and understand the process, including the physiology of bacteria and plants, and the technological processes of mass reproduction.

Microorganisms are a key link in improving soil fertility. Nitrogen, phosphorus, and potassium are among the mineral nutrients most needed by plants. These basic nutrients are also actively used by soil microorganisms and make them easily absorbed by plants.

Nitrogen in the atmosphere can be assimilated by microorganisms. Nitrogen biofixers are widely distributed in various soils in symbiosis with plant organisms and in free form. Microorganisms convert phosphorus and potassium elements into a state that plants can absorb.

During the life of beneficial bacteria and fungi, it is an important factor in the formation of biologically active substances: they accelerate growth and development, hydrolytic enzymes, amino acids, vitamins, as well as compounds that inhibit the development of pathogenic bacteria

and fungi. Also, microorganisms synthesize useful substances for plants, enrich the soil and create important compounds for the growth and development of plants.

MAIN BODY

It is known that microbiopreparations are living cells of microorganisms selected for their beneficial properties, as well as their metabolic products, which are adsorbed in a liquid or a neutral carrier. Such a preparation allows microorganisms to create a large concentration of beneficial properties (1 ml or 1 g of the preparation contains up to 1-5 billion bacterial cells). Therefore, introduced microorganisms can successfully compete with the local microflora and are easily absorbed by the plant. The geography of distribution of microorganisms depends on the influence of environmental factors: humidity, type of substrate, acidity, temperature, soil salinity, etc.. It is known that soils are characterized by different associations (complexes of dominant soil microorganisms). Therefore, it is appropriate to use a microbial community rather than a biological species as the object of microbial geography. Depending on environmental and anthropogenic factors, specific microbiocenoses in which different taxonomic and physiological microorganisms live together have developed in different types of soils. potassium groups. Among them there are beneficial and negative microorganisms that affect plants.

Enrichment of the soil to create microbial complexes from agronomically useful strains of microorganisms and influence the processes in it is of great scientific and practical interest. Polyvalent drugs based on the composition of microorganisms and biologically active substances are more stable and effective in different agro-climatic conditions, provided that the bacteria are ecologically and physiologically compatible and the components are individually selected. .

Such multicomponent preparations can include symbiotic, associative and rhizosphere microorganisms. It should be taken into account that the effect of the plant on the community of microorganisms in the root zone is stronger than the effect of abiotic environmental factors. Many studies in the field of creating microbial preparations show that properly selected and applied microbial preparations have a positive effect on the biochemical activity of the soil. The creation of biological preparations with complex effects that contain the properties of biological fertilizers and fungicides, insecticides at the same time solve many problems of biological protection of plants and the final product (vegetables, fruits, fruits , herbs and animal feed) allows to improve the quality.), as well as improving the condition of soils, i.e. their fertility. In turn, this leads to the reduction or elimination of the use of chemical plant protection agents - herbicides, fungicides and mineral fertilizers. As a result, with the help of chemical means, the load on the soil, especially on agro-beneficial microorganisms, is reduced. It also increases the biological activity of the soil by increasing the amount of beneficial microflora and thus soil fertility.

Microorganisms - representatives of the Rhizobiaceae family, as well as the genera Azotobacter, Bacillus, Pseudomonas, Agrobacterium, and Azospirillum are often used to create bacterial preparations that increase crop productivity. Such preparations are ecologically safe, because they are created on the basis of microorganisms isolated from natural objects. When choosing crops as a basis for mono or composite preparations, preference is given to strains capable of producing biologically active substances, showing phosphatase activity, fixing atmospheric nitrogen, suppressing the development of phytopathogens and stimulating the formation of plants [15-20]. . In this case, the selected microorganisms should have colonization activity towards the root system of plants and the ability to coexist in their rhizosphere.

"Стерня-12" biopreparation contains bacteria belonging to the group of antagonists, which protect plants from diseases and improve the phytosanitary condition of the soil. First of all, these bacteria are phytopathogens and have antagonistic properties, the genus *Bacillus* enterobacteria: *Bacillus subtilis* 1K, *Bacillus subtilis* 3K, *Bacillus subtilis* 26D, *Bacillus licheniformis* 94. Due to the production of antibiotics, these bacteria protect against various pathogens (root rot, scab, protects against rhizoctoniosis, powdery mildew, etc. All studied strains of *Bacillus subtilis* produce their individual set of antibiotic substances.

Bacteria of the *Bacillus* strain, in addition to antibiotic properties, produce hydrolytic enzymes - chitinases and glucanases, which are involved in the decomposition of chitin of phytopathogenic fungi.

Bacteria of the *Bacillus* strain also cause soil phosphorus to be absorbed by plants, and as a result can improve phosphorus and nitrogen nutrition. *Bacillus subtilis* bacteria dissolve insoluble phosphorus and produce compounds such as phosphatases and organic acids. Thus, *B. subtilis* secretes phytases into the extracellular environment, which hydrolyze salts of phytates - inositol hexaphosphoric ester.

B. subtilis strain 26D is an endophyte. An important advantage of endophytic bacteria is their ability to increase the adaptive capacity of plants. It was found that these bacteria increase the resistance of plants to various negative environmental factors.

A characteristic feature of *B. subtilis* 26D strain.

- a) has a peptide and low molecular and antibiotic composition;
- b) enhances the absorption of macro and micronutrients, including calcium, iron, or vice versa, has the property of breaking down heavy metals or toxic substances.
- c) it has the property of converting phosphorus from insoluble to soluble, as well as absorbing free nitrogen;
- d) the presence of enzymes (chitinases, β -1,3-glucanases), as well as toxins that break down the cell walls of pathogens;
- e) the presence of growth regulators and various signal molecules (auxins, cytokinins, abscisic, salicylic acids and jasmonates);
- f) the presence of enzymes regulating ethylene synthesis, etc.

The biological product contains bacteria with a high level of production of hydrolytic enzymes. There are *Bacillus subtilis* 1, *Bacillus subtilis* 3/28, *Bacillus subtilis* 3K bacteria that produce biologically active substances, vitamins, and amino acids that increase soil fertility and plant immunity. Biologically active substances enhance the development of root and transmission systems, increase resistance to stress and help increase plant productivity. The bacteria in the biopreparation synthesize all vitamin complexes. These vitamins are absorbed and accumulated in plants, improve the development of plants and the quality of agricultural products.

The drug contains *Azotobacter chroococcum* - an aerobic, free-living nitrogen-fixing bacteria strain.

Also, bacteria break down organic matter and release phosphorus from them, turning it into soluble salts of phosphoric acid. Phosphoric acid compounds formed later are assimilated by plants *Bacillus megaterium* var. *phosphaticum* contained in the preparation - decomposition of phosphorus (organic and mineral) unavailable to plants, turning it into a mineral form that is easily digestible for them.

Post-harvest plant residues are an important source of soil nutrient replenishment. As a result of their plowing, nutrients accumulate in the soil: nitrogen, phosphorus, potassium, etc. However, the decomposition of plant residues is slow due to the lack of specific microflora, nutrients are not supplied to plants in the first year. Lignin and phenols accumulate in the soil, inhibiting the growth of cultivated plants and slowing the mineralization of organic matter, and pathogens and toxin-producing fungi accumulate.

Processing the soil and plant residues of the previous crop with the biological product "Стерня-12" is an effective means of improving the biogenicity and nutrition of the soil, accelerating the decomposition of plant residues, and increasing the yield and quality of cultivated crops.

The popular bacteriophage drug based on *Bacillus subtilis* IPM-215 strain. A specific disadvantage of bacteriophage is that it is carried out in specially limited areas. According to the sources, the bacterial biopreparation has the ability to effectively protect plants against diseases in open ground conditions, absorb free nitrogen and mobilize phosphates. The composition of the drug is multi-component, and the technology of obtaining the drug is multi-stage and complex.

Azotobacter chroococcum BH-1811, designed to increase crop productivity and increase their resistance to various diseases. The drawback of the drug is its low effectiveness against fungal and bacterial pathogens of agricultural crops and lack of ability to mobilize phosphates.

Biopreparation for accelerating growth and protecting plants from diseases - Extragan containing strains of *Bacillus mycoides* var. B.A. VNIISHM No. D138 and *Azotobacter vinelandii* var. NP VNIISHM No. D24. A biopreparation, a mixture of suspensions of thirteen different strains, for autumn, spring and summer tillage, root and root care of plants during the growing season, a biological product known for protecting seeds from diseases before planting.

B-1978, *Erwinia ananas* B-5292, *Lactobacillus casei* B-3961, *Pseudomonas fluorescens* B-1138, *Rhodospseudomonas palustris* B-1620. Biopreparation aimed at increasing soil fertility, improving it, and plant growth and development based on the addition of the hydrolyzate of the conifer extract mixture of *Bacillus subtilis* K-4, *Bacillus subtilis* Be-12, *Bacillus amyloliquefaciens* 30-40 strains. Carotene paste, based on several strains of bacteria belonging to different taxonomic groups, the main drawback of preparations is the multi-component nature of microorganisms with different nutritional needs, which require special cultivation conditions and different environmental conditions for maximum manifestation of properties. In addition, these biological products are not sufficiently effective in protecting plants against a wide range of plant pathogens.

Biopreparation called Prototype is very effective according to the achieved result Integral. The composition of the preparation includes a mixture of culture fluid containing the bacterial strain *Bacillus subtilis* 24D (ARRIAM 129) at a concentration of 5×10^9 cells / ml, humates and micronutrients in the following weight% ratio: culture fluid - 70-75, humates - 20, micronutrients - 5-10.

The main disadvantages of the prototype are the production and cultivation of *Bacillus subtilis* 24D (ARRIAM 129) strain, which takes 48 hours; low concentration of microbial cells in the drug (5×10^9 cells / ml); It is necessary to add trace elements (5-10% of the total weight of the drug) and a large amount of humates (20% of the total weight) to the composition of the drug, which reduces the titer of the producing cells. Changing the composition of a biological drug increases its price; as well as the lack of information on the intensity of culture sporulation, which

determines the ability to survive in a bacterial environment; lack of antibacterial activity and a complex effect on soil agrocenosis (the drug is intended only for the prevention of diseases before planting seeds and vegetative plants of agricultural crops, fruit trees and berry bushes.

Preparations based on the culture of bacteria belonging to the genus *Bacillus* have a number of high-level activities at the same time (fungicidal, bactericidal, aimed at increasing the growth and development of plants, increasing their productivity and soil fertility.

CONCLUSION

Thus, bacterial preparations based on a single culture of microorganisms are known for agriculture, which prevent the development of phytopathogenic fungi and bacteria, and also positively affect the growth and development of plants, as well It helps to fix atmospheric nitrogen and convert insoluble soil phosphates into soluble form.

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