American Journal of Biology and Natural Sciences
https://biojournals.us/index.php/AJBNS
ISSN: 2997-7185

Economic Efficiency Assessment of Biopreparation Production Based on Epiphytic Bacteria on an Industrial Scale

Ruzieva, Inobat Djuraevna, Mammadiev Abdusahat Hasanovich
Associate Professor, Department of Biology and Technology of Agricultural Products, Denau Institute of Entrepreneurship and Pedagogy, Denau, Uzbekistan

Received: 2024, 15, May
Accepted: 2025, 21, Jun
Published: 2025, 07, Jul

Annotation: In this article, the following varieties of gossypium hirsutum L. were selected from farms near industrialized areas of Shorchi district: C6524, An-Boyovut-2, Andijan 37, Bukhara 6, C4727, Zharkurgan. These test varieties were grown in liquid nutrient medium with the associatively viable bacteria Bacillus subtilis SKB-256 to obtain a biopreparation based on epiphytic bacteria on an industrial scale. Biohumus, phosphogypsum, manure, soil and wood chips were used as environmentally friendly substrates, and their agrophysical, physicochemical and biological properties, which determine the level of soil productivity in order to obtain high-quality crops from plants, were also studied.

Keywords: industrialized area, nutrient media, biopreparations, microorganism, soil properties, plant, seed germination.

Introduction. Today, one of the main tasks of agriculture is to satisfy the growing world population's need for high-quality food products and to produce environmentally friendly products, and this problem can be solved by studying the relationships between plants and microorganisms. Until recently, scientific research on the microflora of plants was mainly limited to the study of rhizosphere microorganisms that live in the soil and in symbiosis with plants. On the other hand, epiphytic microorganisms living on the surface of the phyllosphere, especially their interactions with plants, have been neglected.

The level of study of the problem. According to the data studied to date, in determining the role of microorganisms in plant life, the main attention is paid to soil and, in particular, extensive research is being conducted on endophytic microorganisms living in the rhizosphere and in symbiosis with plants (Belimov R.N., 1995; Bell, 1995; Trasenko, 2005; Nikibina, 1998; Lobakova, 2004; Zvyagintsev, 1993; Voznyakovskaya, 1989, Tikhanovich et al., 2005; Petrov et al., 2002; Davranov 1999, 2002, 2009, 2011; Mannanov 2010; Egamberdieva et al. 2005, 2010, 2011, Alikulov et al. 2022 a 2022 b and x.k). In addition, the use of bacterial fertilizers based on rhizobacteria of the genus Bacillus for crops in agriculture has been widely reported (Rivas et al., 2006; Hafeezet al., 2006; Zaiddi Khan et al., 2009). The role of epiphytic bacteria in plant life was first identified in 1944 by Ya.P. Khudyakov and continued 25 years later in 1969 by Yu.M. Voznyakovskaya. After that, microorganisms living in the above-ground part of various perennial plants were identified (Zvyaginsov, 1993; Yevsev, 2004; etc.), and the epiphytic microflora in the pathogenesis of the fern was studied by Grodniskaya in 2005.

The following varieties of cotton (Gossypium hirsutum L.) were selected as the object of research: C6524, An-Boyovut-2, Andijan 37, Bukhara 6, C4727, and Zharkurgan in the territory of the "Shermuhammad Bobo" farms in the Shorchi district, located around the industrialized area.

According to the results of the study, to obtain a biopreparation, the associatively viable bacteria Bacillus subtilis SKB-256 were grown in a liquid nutrient medium (in a 1:1:1 ratio) on a substrate prepared from Californian worm biohumus and phosphogypsum as a sorbent and coal waste as a binder (in a 1:1:1 ratio) for 5 days.

To select the substrate, inexpensive and environmentally friendly substrates were used: biohumus, phosphogypsum, manure, soil and wood shavings. Before inoculation into the substrate, the cultures were grown in liquid nutrient medium GPB for 24 hours. Then, the grown cultures were inoculated into the substrate at a rate of 30 min/hq/g. Each strain was inoculated separately into the substrate and 3 different strains were inoculated together in a 1:1:1 ratio and grown at 270C for 5 days. The number of cells in the grown strains was calculated by the dilution method. Substrates with a high cell count were used to create a microbial composition.

The effect of microorganisms on the plant root system was studied by the Menkina method. The effect of individual strains and associations of microorganisms on the main parameters of plants and plants was analyzed according to (Dospekhov, 1987).

The effect of microorganisms on the quality of cotton fiber and seed parameters was studied by the Menkina method. The data were statistically analyzed in the Stat Revew 5 program.

The experimental variants were placed in 4 replicates, and the variants not treated with microbial fertilizer served as the control.

Before seed treatment, the seeds were soaked for 12 hours, then 2.5 kg of microbial fertilizer in a 10:1 ratio per 60 kg of seed was sprayed, allowed to dry for 1 day, and sown in 100x80 cm plots. After that, microbial fertilizer was applied during the growth period of the agrophytocenosis and before flowering.

Cotton seeds (Gossypium hirsitum L) served as the research material. Bacillus subtilis strain SKB-256 was used as the inoculant. The seeds were sterilized by soaking in concentrated sulfuric acid for 5 minutes. Then, they were washed 5 times with sterile water and grown in moistened Petri

dishes at 28°C for 2 days. The grown seeds were inoculated for 1 hour with a suspension of bacteria grown in meat peptone broth and diluted to 10-7 cfu/ml.

Inoculated seeds were aseptically placed in test tubes with a diameter of 20 mm and a length of 200 mm, filled with 10 ml of 0.75% aqueous agar. The plants were grown at 25°C for 8 days with 12,000 lux of light (16 hours per day) (Kurdysh et al. 2009). As a control, uninoculated, water-sprayed seeds were taken.

Observations were made during the period of seed germination, the appearance of cotyledons, budding, the appearance and maturation of flowering spikelets.

To study the effect of the microbial composition, 28 plots with an area of 100 m were allocated. Seeds treated with the microbial composition were sown in 24 of them.

The normal growth and development of plants and the production of high-quality crops largely depend on the agrochemical properties of the soil, including the amount of humus and nutrients. Humus is not only the main source of nutrition for plants, but also a high-molecular organic substance that determines the level of soil fertility, regulates their agrophysical, physicochemical and biological properties. In recent years, in the context of the intensive farming system, attention has been paid to the expansion of arable land, the expansion of cultivated land, crop rotation, improved water supply, and the use of organic fertilizers.

As a result of visual analysis, a difference was observed in the specificity of the colonization of the studied bacteria around the root, that is, the intensity and location of microcolonies. For example, in plants inoculated with Bacillus subtilis strain SKB-256, microcolonies were formed in the basal part of the root, while in seedlings treated with Azotobacter chroococcum A-2, the root was wrapped like a sheath. It was found that in plants treated with a concentrated suspension of Bacillus subtilis strain SKB-256 with a cell number of 10-6 cells/ml, microcolonies in the root were located almost along the entire length of the root and root hairs.

Conclusion. In this article, high yields were achieved when the microbiological biopreparation "Epifit BS" was used in conjunction with mineral fertilizers during the development of cotton plants to obtain natural high yields from agricultural plants based on epiphytic bacteria.

References

1. Egamberdieva D., Juraeva D., Davranov K. Enzymatic Activity of Soil Bacteria from Calcareous Calcisol Soil of Uzbekistan, In: Proceeding book of International Conference “Enzymes of Environment: activity, ecology, applications”, Prague, Czech Republik, 2003 P. 144.
2. Egamberdieva D., Davranov K. The use of biofertilizers in semi arid soils: An Uzbekistan case studies, In: Proceeding book of 7th Plant Growth Promoting Rhizobacteria Workshop, 2006, 28 May-2 June, Noordwijkerhout, the Netherlands.
3. Egamberdieva D. Alleviation of salinity stress in radishes with phytohormone producing rhizobacteria. Journal of Biotechnology, 2008, 136, P-262.
4. Egamberdieva D., Islam R. Secondary Salinity Effects on Microbial Biomass in Irrigated Cotton Soils. In Proceeding book of International Annual meeting of American Society of Soil Science, ASA, CSSA, 2007, 4-8 November, USA.
5. Zhang R., Chang L., Xiao L. Diversity of the epiphytic bacterial communities associated with commercially cultivated healthy and diseased Saccharina japonica during the harvest season // Journal of applied phycology, 2020. Volume 32, pp. 2071-2080.
6. Kakhramon Davranov, Vyacheslav Shurigin, Absakhat Mammadiev, Kholida Ruzimova. EPIPHYTIC BACTERIA BACILLUS SUBTILIS UZNU-18 FROM JERUSALEM ARTICHOKE (HELIANTHUS TUBEROSUS L.) – THE ACTIVE BIOCONTROL AGENT OF PHYTOPATHOGENIC MICROORGANISMS. Mikrobiol. jurn., 2019, T. 81, № 3.