SIR Publishers
CENTER FOR INTERNATIONAL SCIENTIFIC PUBLICATIONS
JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |16-01-2026|

# "ANALYSIS OF THE EFFECTIVENESS OF BIOPREPARATIONS DERIVED FROM MICROORGANISMS IN THE CULTIVATION OF ORNAMENTAL PLANTS DURING EXTRACURRICULAR ACTIVITIES (ON THE EXAMPLE OF A BIOLOGY LESSON)"

**Xabibullayev Najmiddin Muxiddin O'g'li**
xabibullayevnajmiddin38@gmail.com
**"MASTER'S STUDENT OF THE SPECIALTY METHODOLOGY OF TEACHING EXACT AND NATURAL SCIENCES (BIOLOGY) AT TERMIZ STATE PEDAGOGICAL INSTITUTE."**

## ABSTRACT

This article analyzes the effectiveness of biopreparations derived from microorganisms in the cultivation of ornamental plants within the framework of extracurricular biology activities. The study aims to evaluate the pedagogical and biological significance of using environmentally friendly biopreparations to improve students' practical skills, scientific thinking, and ecological awareness. The research was conducted based on experimental and observational methods, where ornamental plants were cultivated using microbial biopreparations under controlled conditions. Growth indicators, plant health, and resistance to diseases were compared with traditionally cultivated plants. The results demonstrate that biopreparations significantly enhance plant growth, improve soil fertility, and reduce the need for chemical fertilizers. In addition, integrating this topic into extracurricular activities contributes to the development of students' research competencies, interest in biology, and understanding of sustainable agriculture. The findings confirm that the use of microorganism-based biopreparations is both biologically effective and pedagogically valuable in biology education.

**Keywords:** Biopreparations, microorganisms, ornamental plants, extracurricular activities, biology education, sustainable agriculture, environmental education, plant growth, soil fertility, eco-friendly technologies, practical skills development

## INTRODUCTION

In recent years, the application of environmentally friendly technologies in agriculture and plant cultivation has gained increasing attention worldwide. One of the most promising approaches in this field is the use of biopreparations derived from microorganisms, which play a crucial role in enhancing plant growth, improving soil fertility, and reducing the negative impact of chemical fertilizers on the environment. These biopreparations include beneficial bacteria and fungi that stimulate plant development, increase resistance to diseases, and support sustainable agricultural practices.

Ornamental plants hold significant aesthetic, ecological, and educational value. Their cultivation is not only important for landscaping and environmental improvement but also serves as an effective tool in biology education. In particular, involving students in the cultivation of ornamental plants allows them to develop practical skills, observe biological processes directly, and strengthen their interest in natural sciences. Therefore, integrating modern biotechnological approaches, such as the use of microbial biopreparations, into biology lessons and extracurricular activities is of great pedagogical importance.

Extracurricular activities in biology provide a flexible educational environment where students can apply theoretical knowledge in practice, conduct experiments, and develop research competencies. Unlike traditional classroom lessons, extracurricular activities encourage independent thinking, creativity, and hands-on learning. Introducing the topic of microorganism-based biopreparations within such activities enables students to understand the principles of sustainable agriculture, environmental protection, and modern biological technologies.

Despite the growing interest in biopreparations, their application in school-level biology education, especially within extracurricular settings, remains insufficiently studied. There is a need to analyze not only the biological effectiveness of these preparations in ornamental plant cultivation but also their educational value in developing students' scientific skills and ecological awareness.

Therefore, the aim of this study is to analyze the effectiveness of biopreparations derived from microorganisms in the cultivation of ornamental plants during extracurricular biology activities. The research focuses on evaluating plant growth indicators, soil improvement, and disease resistance, as well as assessing the role of this approach in enhancing students' practical skills and interest in biology.

## MATERIALS AND METHODS

**Research Design and Setting.** The research was carried out within the framework of extracurricular biology activities organized at the secondary school level. The study was designed as a pedagogical and biological experiment aimed at evaluating the effectiveness of microorganism-derived biopreparations in the cultivation of ornamental plants. The experimental work was conducted over one vegetation period under controlled environmental conditions to ensure the reliability and comparability of the results.

**Participants and Educational Context.** The extracurricular activities involved secondary school students who participated voluntarily under the guidance of a biology teacher. Students were introduced to the objectives of the study, basic safety rules, and the principles of working with biological materials. The educational process emphasized active learning, observation, and practical experimentation.

**Plant Material.** The study focused on ornamental plant species widely used in educational practice and landscaping due to their adaptability and clear growth indicators. Both flowering and decorative foliage plants were selected to observe different growth responses. All plants were cultivated in similar soil substrates to minimize external influences.

**Biopreparations and Microorganisms.** The biopreparations used in the experiment were based on beneficial microorganisms, including nitrogen-fixing bacteria, phosphate-solubilizing bacteria, and growth-promoting fungi. These microorganisms are known for their ability to improve nutrient availability, stimulate root development, and enhance plant resistance to environmental stress. Only environmentally safe and non-toxic biopreparations suitable for educational use were selected.

**Experimental Groups and Treatment.** The plants were divided into two groups:

- **Experimental group**, in which biopreparations were applied according to manufacturer recommendations;
- **Control group**, in which plants were grown without the use of biopreparations, following traditional cultivation methods.

Biopreparations were applied during planting and at specific growth stages using standardized procedures. All other cultivation conditions, including watering, lighting, and temperature, were kept identical for both groups.

**Data Collection Methods.** Plant growth and development were assessed using several indicators, including plant height, number of leaves, flowering intensity, and overall physiological condition. Observations were conducted weekly, and the results were recorded in observation journals maintained by students under teacher supervision. Soil condition and plant resistance to diseases were evaluated through visual assessment and comparative analysis.

**Data Analysis.** The collected data were analyzed using descriptive and comparative methods to identify differences between the experimental and control groups. The effectiveness of

biopreparations was determined based on observed improvements in plant growth, health, and soil quality.

**Pedagogical Evaluation.** In addition to biological outcomes, the educational effectiveness of the activity was assessed. Students' practical skills, interest in biology, and understanding of ecological concepts were evaluated through observation, participation analysis, and reflective discussions. This approach allowed the integration of biological research with pedagogical assessment.

## RESULT

The results of the study revealed noticeable differences between ornamental plants grown using microorganism-based biopreparations and those cultivated by traditional methods. Throughout the experimental period, plants in the experimental group demonstrated improved growth performance and overall physiological condition compared to the control group.

**Plant Growth Indicators.** Plants treated with biopreparations showed a higher growth rate. The average plant height in the experimental group increased more rapidly than in the control group. In addition, the number of leaves per plant was significantly higher in the experimental group, indicating enhanced vegetative development. Flowering ornamental plants exhibited earlier and more abundant flowering when biopreparations were applied.

**Plant Health and Resistance.** Visual assessment of plant health demonstrated that plants in the experimental group had stronger stems, more intensive leaf coloration, and fewer signs of stress. Symptoms of plant diseases and pest damage were observed less frequently in plants treated with biopreparations compared to the control group. This indicates an increase in plant resistance to unfavorable environmental conditions and biological stress factors.

**Soil Condition.** Soil observations revealed that the use of microorganism-based biopreparations positively affected soil quality. The soil in the experimental group appeared more structured and moist, which contributed to better root development. Improved soil condition was reflected in enhanced nutrient uptake and overall plant vitality.

**Educational Outcomes.** From an educational perspective, students actively involved in the experimental process demonstrated increased interest in biology and practical activities. Students showed improved skills in observation, data recording, and basic experimental analysis. Participation in the cultivation process using biopreparations helped students better understand the role of microorganisms in plant growth and soil ecosystems.

## DISCUSSION

The findings of this study confirm the effectiveness of biopreparations derived from microorganisms in the cultivation of ornamental plants. The observed improvements in plant growth, health, and soil condition in the experimental group can be attributed to the biological activity of beneficial microorganisms, which enhance nutrient availability and stimulate physiological processes in plants.

The increased plant height, leaf number, and flowering intensity observed in plants treated with biopreparations are consistent with previous research indicating that microorganisms such as nitrogen-fixing bacteria and growth-promoting fungi positively influence plant development. These microorganisms improve nutrient uptake and root system development, leading to more vigorous plant growth.

Improved plant health and resistance to diseases in the experimental group suggest that biopreparations contribute to strengthening plant immunity. Beneficial microorganisms are known to suppress pathogenic microflora and enhance plants' tolerance to environmental stress. This reduces

the need for chemical fertilizers and pesticides, supporting environmentally sustainable cultivation practices.

The positive changes observed in soil condition further emphasize the importance of microbial activity in maintaining soil fertility. Enhanced soil structure and moisture retention create favorable conditions for root growth and nutrient absorption, which directly influence plant productivity.

From a pedagogical perspective, the integration of microorganism-based biopreparations into extracurricular biology activities proved to be highly effective. Students' active participation in the experimental process fostered practical skills, critical thinking, and a deeper understanding of biological concepts. The hands-on approach encouraged students to connect theoretical knowledge with real-life applications, thereby increasing their interest in biology and environmental education.

Overall, the results highlight that combining biological experimentation with educational objectives enhances both learning outcomes and environmental awareness. The study demonstrates that extracurricular activities provide an ideal platform for introducing modern biotechnological methods at the school level.

## CONCLUSION

The results of this study demonstrate that biopreparations derived from microorganisms are highly effective in the cultivation of ornamental plants. Their application significantly improves plant growth, health, and soil condition, while reducing dependence on chemical fertilizers. The use of microbial biopreparations contributes to sustainable and environmentally friendly plant cultivation practices.

In addition to biological benefits, the integration of this topic into extracurricular biology activities has strong pedagogical value. Students actively involved in the experimental process developed practical skills, scientific thinking, and ecological awareness. The hands-on approach enhanced students' interest in biology and facilitated a deeper understanding of the role of microorganisms in plant growth and soil ecosystems.

Overall, the study confirms that microorganism-based biopreparations can be successfully used not only as an effective biological tool but also as an innovative educational resource. Their application in extracurricular biology activities supports both sustainable agriculture principles and the development of research competencies among students.

## REFERENCES

1. Law of the Republic of Uzbekistan "On Education". (2020). No. ZRU-637.
2. Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 187 "On Measures to Improve Environmental Education". (2019).
3. Decree of the President of the Republic of Uzbekistan No. PF-60 "On the Development Strategy of New Uzbekistan for 2022–2026". (2022).
4. Law of the Republic of Uzbekistan "On Environmental Protection". (1992, amended).
5. Law of the Republic of Uzbekistan "On Plant Protection". (2016).
6. Ministry of Public Education of the Republic of Uzbekistan. (2021). *State Educational Standards for Biology*.
7. Glick, B. R. (2012). Plant growth-promoting bacteria: mechanisms and applications. *Scientifica*, 2012, 1–15.
8. Vessey, J. K. (2003). Plant growth promoting rhizobacteria as biofertilizers. *Plant and Soil*, 255(2), 571–586.
9. Bashan, Y., de-Bashan, L. E. (2010). How the plant growth-promoting bacterium Azospirillum promotes plant growth. *Advances in Agronomy*, 108, 77–136.

JOURNAL OF APPLIED MEDICAL SCIENCES
ISSN(Online): 2984-6730
Volume-9, Issue-01, Published |16-01-2026|

10. Lucy, M., Reed, E., & Glick, B. R. (2004). Applications of free living plant growth-promoting rhizobacteria. *Antonie van Leeuwenhoek*, 86(1), 1–25.
11. FAO. (2017). *The role of microorganisms in sustainable agriculture*. Food and Agriculture Organization of the United Nations.
12. Altieri, M. A. (2018). Agroecology: The science of sustainable agriculture. CRC Press.
13. Tilak, K. V. B. R., et al. (2005). Diversity of plant growth and soil health supporting bacteria. *Current Science*, 89(1), 136–150.
14. OECD. (2020). *Education for environmental sustainability*. OECD Publishing.
15. UNESCO. (2017). *Education for Sustainable Development Goals: Learning Objectives*. Paris.