THE IMPORTANCE OF MICROORGANISMS IN INCREASING SOIL FERTILITY AND THEIR STUDY

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Abstract. This article highlights the types of soil microorganisms, their ecological significance, and their impact on soil fertility. During the study, the activities of bacteria, fungi, actinomycetes, and other microorganisms were analyzed, emphasizing their role in plant growth and in the decomposition of organic matter. In addition, the article provides information on the effects of anthropogenic factors—such as chemical fertilizers, pesticides, and climate change—on soil microflora. The results obtained contribute to strengthening the scientific basis for the application of biological methods in soil ecology and agriculture.

Keywords: soil microorganisms, bacteria, fungi, actinomycetes, soil fertility, ecology.

Introduction

Soil is a complex natural system composed of living and non-living substances, containing all the necessary conditions for plant growth and development. Soil fertility refers to the soil's ability to provide plants with nutrients, water, air, and heat. In this process, microorganisms such as bacteria, fungi, actinomycetes, and algae play an essential role.

Main Part

When determining measures to combat agricultural crop diseases, it is crucial to correctly identify the types of disease-causing microorganisms, understand their biological characteristics, and properly apply effective control agents.

In agriculture, the fight against crop diseases requires the consideration of regional soil-climatic conditions and plant types, applying a complex of agro-technical measures. One of the most well-known and effective methods is **crop rotation**. Following crop rotation principles prevents the accumulation of infections in fields. Adherence to these principles reduces disease incidence and promotes the proliferation of saprotrophic and antagonistic microorganisms in the soil.

1. Types of Microorganisms and Their Functions

The number of microorganisms living in the soil is extremely large. They participate in almost all biological processes. They can be divided into the following groups:

- **Nitrogen-fixing bacteria** – such as *Azotobacter*, *Rhizobium*, and *Clostridium*, bind atmospheric nitrogen and convert it into forms that plants can absorb.
- **Nitrifying bacteria** – including *Nitrosomonas* and *Nitrobacter*, convert ammonia into nitrites and nitrates, which are essential nutrients for plants.
- **Cellulose-decomposing microorganisms** – break down organic matter from plant residues, resulting in the formation of humus.
- **Mycorrhizal fungi** – live in symbiosis with plant roots, enhancing their ability to absorb nutrients.

2. The Role of Microorganisms in Humus Formation

Organic residues (leaves, stems, roots) are decomposed by microorganisms, resulting in the formation of **humus**—the key component determining soil fertility. Humus improves soil structure, enhances water retention capacity, and increases nutrient reserves.

3. Biological Fertilizers and Their Advantages

In recent years, biological fertilizers such as biohumus, azotobacterin, phosphorobacterin, and rhizotorfin have been widely used. Their benefits include:

- Enhancing the activity of natural soil microflora;
- Reducing the need for mineral fertilizers;
- Stimulating plant growth and increasing yield;
- Causing no harm to the environment.

4. The Importance of Microorganisms in Maintaining Soil Ecological Balance

Microorganisms not only ensure the circulation of essential nutrients for plants but also participate in the decomposition of harmful substances. They play a crucial role in soil purification, restoration, and maintaining biological balance.

The number of fungi in the soils of our Republic depends on the crop type and soil fertility. When agro-technical measures are not properly carried out, the number of pathogenic fungi increases. Studying this issue scientifically is extremely relevant today, as desertification and salinization processes are intensifying in our country. This problem also applies to **potato cultivation**.

To identify the types of pathogenic microorganisms and soil microflora in the upper soil layer under laboratory conditions, the following procedure is implemented:

First, soil samples are taken from the field using the **envelope method**. Samples are collected from five points in the field, each at three depths—10, 20, and 30 cm—and placed in pre-prepared sterile paper bags. The collected samples must be analyzed in the laboratory within five days from the date of collection. Soil samples stored for more than five days are considered unsuitable for examination.

Conclusion

The role of microorganisms in maintaining and increasing soil fertility is invaluable. They serve as a natural source of fertilizers, key participants in nutrient cycling, and fundamental factors in ecological stability. Therefore, in agriculture, the broad application of biological methods, the use of microorganism-based fertilizers, and the preservation of the living component of soil are among the most important directions of sustainable farming.

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