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Agricultural importance of nitrogen-fixing bacteria in legumes

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Annotation: This article describes and highlights the meaning, structure and reproduction of bacteria living symbiotically in the roots of legumes that absorb free nitrogen from the air.

Keywords: Legumes, nodule bacteria, free nitrogen, microorganisms, protein.

Introduction

One of the most important indicators of soil is its fertility. Productivity, in turn, is related to agrophysical, agrochemical, and agrobiological processes in the soil. Fertility depends on whether the plant growing in the soil can provide nutrients, water, and some other conditions necessary for its growth, development, and reproduction. Different processes in the soil determine fertility of the soil.

In addition, the help of the processes with the participation of beneficial bacteria in increasing soil fertility is noteworthy. Tuganac bacteria are aerobic bacteria that accumulate in the roots of leguminous plants (soybeans, mung beans, peas, alfalfa, beans, etc.) and enrich the soil with pure nitrogen by directly assimilating free nitrogen from the air.

We know that legumes are distributed all over the world and in terms of economic value, they are second only to grains. It has been determined that 25-35% of the world's protein production is provided by legumes, which occupy an area of almost 250 million hectares. When a new leguminous plant is first planted in the soil, specific rhizobia strains are usually not abundant and artificial inoculation is necessary to ensure a high level of nitrogen fixation, resulting in a significant increase in yield. However, as a result of the cultivation of leguminous plants for many years, a large population of specific rhizobia is formed in the soil. Rhizobia are soil bacteria capable of forming nitrogen-fixing nodules in the veins and, in some cases, the stems of plants of the Leguminosae family. According to some authors, although there are 700 genera and 18000-20000 species of leguminous plants, only 27 species of plants produce nodules belonging to 6 genera.

It is known that biological drugs, that is, mainly bacterial drugs, are used to increase the productivity of crops. However, in recent years, the deterioration of the ecological situation, the soil microflora, its agrophysical and agrochemical composition, and the pollution of water bodies,

which are causing severe negative consequences for the body of people and warm-blooded animals, limit the possibilities of using chemical preparations.

Nodule bacteria both grow and reproduce. Growth refers to the proportional increase of all chemical substances (protein, PNK, DNK, etc.) in a cell. As a result of growth, the size, and mass of the cell increase. After the size of the cell reaches a certain level, it begins to multiply. Reproduction is carried out by transverse division, and sometimes by budding or spore formation [1-3].

1 – picture. Development of root nodules in the soybean root system

Thus, a colony of bacteria is formed as a result of growth and reproduction. Their reproduction takes place at a very high speed. The generation time depends on the type of bacteria, age, and external environment (nutrient composition, temperature, pH). If the optimal generation time is 20-30 minutes, 6 generations can be obtained in 2 hours. Bacteria divide every 15-18 minutes while the nutrient medium is flowing. It is possible to observe changes in the growth rate of bacteria in liquid nutrient media over time. Bacteria entering the nutrient medium first adapt to it, then multiply rapidly and reach a maximum. Depending on the decrease in nutrients and the increase in products, growth slows down and stops.

The development cycle of bacteria consists of several phases:

- Stationary phase - lasts 1-2 hours after the bacterium enters the nutrient medium. Cell numbers do not increase during this phase.

- Lag phase - inhibition of reproduction. In this phase, bacteria grow intensively, but their division is very rare.

- Logarithmic - exponential growth phase. Reproduction goes at a high speed, and the number of cells increases according to a geometric progression.

- Negative Acceleration Phase - Cells are less active, generation time is extended because nutrients are reduced, and toxic substances are produced, as a result, reproduction slows down, and some cells even die.

- Stationary phase - The number of cells being produced equals the number of cells dying. Therefore, the number of living cells remains at a uniform level for a certain period. The number of living and dead cells increases gradually.

- In the next phase, the number of dead cells increases. Called the logarithmic phase of cell death, dying continues at a constant rate. Then, cell death gradually decreases.

- In the last phase, cell death is associated with changes in the physicochemical properties of the nutrient medium. Unfavorable conditions for bacteria occur. Cells die at such a rate that eventually they all die. In addition, there is a way to increase the growth of bacteria by constantly renewing the nutrient medium. This type of multiplication is carried out in hemostats or turbidiostats. This method is widely used in industry.

In the words of K.A. Temiryazev, he states that "by planting leguminous crops, we do not reduce the fertility of the soil, on the contrary, we improve it, because after these crops we can hand over the soil to future generations in a fertile state" [4].

Biological nitrogen fixation is one of the main ways to solve the plant oxygen problem. The penetration of air nitrogen into the biological cycle ensures the production of additional protein on earth. More protein accumulates in the crop of plants that absorb biological nitrogen. The protein produced in the presence of biological nitrogen is ecologically clean, of high quality, and gives good results in food and livestock feeding.

Based on the above, in conclusion, microbial preparations are inexpensive to obtain, easy to separate, and have high efficiency. They help to improve the health of the root layer of the soil, reduce the number of phytopathogens in it, regulate the organo-mineral balance of the soil, and improve the growth and development of crops. and further increases the possibility of high yield.

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