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Importance of Bacteria to Agriculture

Bhagyarabi Pani
M.Sc. Scholar, Department of Genetics & Plant Breeding, SHUATS, Prayagraj, India

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Introduction

Bacteria are single celled prokaryotic (no membrane around nucleus) microorganisms that are either free-living in soil or water or diseases of plants or animals. As a disease of plants and animals bacteria are a risk for agricultural production. Bacteria, also called germs, are microscopic organisms not visible with the naked eye. Bacteria are everywhere, both inside and outside of your body. Bacteria can live in a variety of environments, from hot water to ice. Some bacteria are good for you, while others can make you sick. Bacteria are metabolically active and divide by binary fission. Medically they are a major cause of disease. Superficially, bacteria appear to be relatively simple forms of life; in fact, they are sophisticated and highly adaptable.

A Few Important Bacteria

Bacteria from all four groups perform important services related to water dynamics, nutrient cycling, and disease suppression.

1. **Nitrogen-fixing bacteria:-** form symbiotic associations with the roots of legumes like clover and lupine, and trees such as alder and locust. Visible nodules are created where bacteria infect a growing root hair. The plant supplies simple carbon compounds to the bacteria, and the bacteria convert nitrogen (N2) from air into a form the plant host can use. When leaves or roots from the host plant decompose, soil nitrogen increases in the surrounding area.

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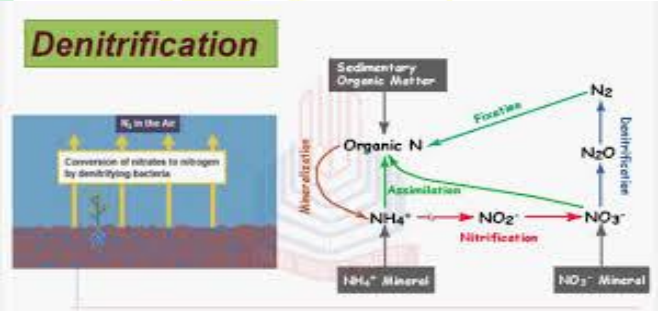
2. **Nitrifying bacteria:-** change ammonium (NH4+) to nitrite (NO2-) then to nitrate (NO3-) – a preferred form of nitrogen for grasses and most row crops. Nitrate is leached more easily from the soil, so some farmers use nitrification inhibitors to reduce the activity of one type of nitrifying bacteria. Nitrifying bacteria are suppressed in forest soils, so that most of the nitrogen remains as ammonium.

3. **Denitrifying bacteria** convert nitrate to nitrogen (N2) or nitrous oxide (N2O) gas. Denitrifiers are anaerobic, meaning they are active where oxygen is absent, such as in saturated soils or inside soil aggregates.



4. **Actinomycetes** are a large group of bacteria that grow as hyphae like fungi. They are responsible for the characteristically "earthy" smell of freshly turned, healthy soil. Actinomycetes decompose a wide array of substrates, but are especially important in degrading recalcitrant (hard-to-decompose) compounds, such as chitin and cellulose, and are active at high pH levels. Fungi are more important in degrading these compounds at low pH. A number of antibiotics are produced by actinomycetes such as Streptomyces.

Role of Bacteria

It has been extensively demonstrated that soil microorganisms interact with plant roots and soil constituents in the root-soil interface. The great set of interactions between soil, roots and micro-organisms leads to the development of dynamic environment called rhizosphere,where

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a variety of microbial forms can actively develop.Certain strains of the soil bacteria Pseudomonas fluorescens have anti-fungal activity that inhibits some plant pathogens. P. fluorescens and other Pseudomonas and Xanthomonas species can increase plant growth in several ways. They may produce a compound that inhibits the growth of pathogens or reduces invasion of the plant by a pathogen. They may also produce compounds (growth factors) that directly increase plant growth.

These plant growth-enhancing bacteria occur naturally in soils, but not always in high enough numbers to have a dramatic effect. In the future, farmers may be able to inoculate seeds with anti-fungal bacteria, such as *P. fluorescens*, to ensure that the bacteria reduce pathogens around the seed and root of the crop. Phosphorus after nitrogen is the inorganic nutrient most required by plants and microorganism on the ground is the limiting factor for development despite being rich in both inorganic organic form.

The phosphorus solubilizing microorganism constitute up to 40% of the population of soil bacteria and a significant portion of them are isolated from rhizosphere.However although many bacteria genera exhibit this ability to solubilize inorganic phosphorus is particularly interesting to detect this ability solubilize inorganic phosphorus is particularly interesting to detect this ability in groups with other properties of plant growth.

Microorganism can also interact with each other leading in many cases to synergistic interaction favoring plant growth. An example of such synergism is the is the interaction between mycorrhizae symbiosis formed by certain soil fungi and root phosphorus solubilizing microorganism. Microbial inoculants represent a new way of working towards a more sustainable and efficient agriculture clearly beneficial to society and farmers. This is a clean technology aligned with the principles of sustainable agriculture. Some bacteria affect water movement by producing substances that help bind soil particles into small aggregates (those with diameters of 1/10,000-1/100 of an inch or 2-200µm).Stable aggregates improve water infiltration and the soil's water-holding ability. In a diverse bacterial community, many organisms will compete with disease-causing organisms in roots and on aboveground surfaces of plants.