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# Potential Role of Beneficial Bacteria in Agricultural Crops

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**Introduction:**

Food was desperately needed to boost the 1950s and 1960s economies. To boost output, farmers were instructed globally to rely on intensive production techniques and synthetic pesticide inputs. These chemical-based farming methods undoubtedly significantly raised crop yields. However, the careless use of agrochemicals has seriously harmed the health of people and animals as well as greatly contributed to environmental contamination. Furthermore, the net cash return for farmers has decreased due to the rising cost of these agrochemicals. Over 2.5 million tons of synthetic pesticides were used annually worldwide at the beginning of this millennium. Mixtures of beneficial and naturally occurring microorganisms, such as photosynthetic bacteria (Rhodopseudomonas palustris and Rhodobacter sphaeroides), lactobacilli (Lactobacillus plantarum, L. casei, and Streptococcus lactis), yeasts (Saccharomyces spp.), and actinomycetes (Streptomyces spp.), are considered effective microorganisms. By boosting photosynthesis, generating bioactive compounds like hormones and enzymes, managing soil illnesses, and quickening the breakdown of lignin-containing materials in the soil, these advantageous microbes increase crop development and production. The PGPR present promote positive effects on plant development and health, inhibit pathogenic microorganisms, and hasten the availability and absorption of nutrients. Thus, it is necessary to utilize PGPR for ongoing positive agricultural objectives in the effort to increase crop output and soil fertility as well as to lessen the harmful effects of chemical fertilizers on the environment. The area around the root is known as the rhizosphere, and this is where PGPR are found. PGPR seed inoculation can be achieved by drench administration, seed bacterization, or a combination of treatments. Plant growth reductions due to weed infestation, drought stress, heavy metals, salt stress, and other unfavorable environmental circumstances are offset by PGPR (Babalola et al., 2007).

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**The role of beneficial bacteria in agricultural crops includes**

- Affecting plant development, nutrient cycling, disease prevention, and soil health.
- Giving crops access to nutrients.
- Inducing the synthesis of plant hormones to promote plant growth.
- Limiting or preventing plant pathogen activity.
- Enhancing the structure of soil.
- Leaching or bioaccumulating inorganic materials.
- Bioremediation of soil polluted with metals.
- The deterioration and breakdown of soil-based organic materials.
- Preserving and enhancing the fertility of the soil.
- Nitrogen fixation, which releases nitrogen so that plants may use it.

**Some important bacteria include-**

**Photosynthetic bacteria:**

Two types of bacteria that are involved in photosynthesis include Rhodopseudomonas palustris and Rhodobacter sphaeroides. These microbes are independent, self-sufficient bacterial colonies. They help other bacteria in an EM culture and act as the focal point of EM activity. They produce useful molecules from the secretions of plant roots, organic materials, and harmful gasses like hydrogen sulfide by using sunlight and the heat from the soil as energy sources (Kim et al., 2004). Numerous essential compounds, including sugars, polysaccharides, amino acids, nucleic acids, and bioactive molecules, are produced by these bacteria and aid in the growth and development of plants (Higa, 2000). The metabolites that these microbes create are directly absorbed by plants.

**Lactic Acid Bacteria:**

Lactobacillus plantarum, Lactobacillus casei, and Streptococcus lactis are examples of actic acid bacteria. They use sugars and other carbohydrates made by photosynthetic bacteria and yeasts to make lactic acid (Hussain et al., 2002). Strongly sterilizing, lactic acid inhibits dangerous microbes like Fusarium and promotes the breakdown of organic materials. By encouraging the fermentation and breakdown of substances like cellulose and lignin, these bacteria mitigate the negative effects of organic matter that has not broken down.

**Plant growth-promoting Rhizobacteria (PGPR):**

Rhizobacteria that promote plant growth (PGPR) are found close to plant roots, where they colonize and lower the incidence of illness. Among crop plants, legumes are special

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because they can fix N2, a resource that is limited in the agroecosystem. Numerous examples of how legumes planted either in rotation or otherwise increased the yield of a non-legume crop can be found throughout the history of crop husbandry. Nodules on leguminous plants can be formed by soil bacteria from the Rhizobiaceae family and genera Rhizobium, Bradyrhizobium, Sinorhizobium, Mesorhizobium, Allorhizobium, and Azorhizobium (Wei et al., 2008). Certain N-fixing rhizobia bacteria, such as Rhizobiaceae or α-Proteobacteria, influence the process of N fixation in nature (Buragohain et al., 2017). Rhizobacteria that promote plant growth (PGPR) are found close to plant roots, where they colonize and lower the incidence of illness. Among crop plants, legumes are special because they can fix N2, a resource that is limited in the agroecosystem. Numerous examples of how legumes planted either in rotation or otherwise increased the yield of a non-legume crop can be found throughout the history of crop husbandry. Nodules on leguminous plants can be formed by soil bacteria from the Rhizobiaceae family and genera Rhizobium, Bradyrhizobium, Sinorhizobium, Mesorhizobium, Allorhizobium, and Azorhizobium (Wei et al., 2008). Certain N-fixing rhizobia bacteria, such as Rhizobiaceae or α-Proteobacteria, influence the process of N fixation in nature (Buragohain et al., 2017).

**Nematophagous bacteria:**

Nematophagous bacteria have a variety of functions, one of which is to enhance plant health. By directly suppressing nematodes, encouraging plant development, and aiding the colonization and activity of microbial antagonists in the rhizosphere, they work in concert.

**Conclusion:**

Beneficial bacteria enhance the growth, productivity, and quality of a variety of horticultural and agricultural crops, as several studies have shown. This is probably because organic matter breaks down more quickly, biogenic compounds are produced, the quality of the soil is improved, and symbiotic development and efficacy are enhanced. However, the type of soil, the supply and quantity of soil nutrients, and the species of test crop all impact the beneficial bacterial affectivity differently. The dirt that adheres to the root in addition to the loose soil surrounding it is known as the rhizosphere, which is the soil-plant root interphase. Plant diseases may be biologically controlled by plant growth-promoting rhizobacteria (PGPR).

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