

Plants and soil-borne microbes have developed mutually beneficial associations over the millennia. Plant root exudates are designed to attract beneficial microbes, promote colonization of the roots system, and enhance plant nutrition.

Plant Growth Promoting Rhizobacteria (e.g. [Bacillus subtilis](#) and Rhizobium) and Fungi (e.g. [Trichoderma](#) ) enhance crop nutrition by making certain mineral elements such as nitrogen and phosphate more available to the plant.

PGPRs may also promote root growth and branching, thereby increasing the soil area and associated minerals and water available to the plant. The larger the plant root volume, the more readily it takes up minerals such as calcium which are less mobile in the soil. This may consequently improve shelf life in some fruits, vegetables, and even flower crops.

Bio-fertilizers are capable of promoting plant growth when they are applied to the seed, roots, or canopy of crops. The benefit to plant growth is generally in proportion to the early and rapid establishment of the beneficial microbe on the seed or developing roots.

The use of bio-fertilizers during the propagation of transplants or on seeds is a simple cost-effective means of ensuring adequate initial inoculum on the roots. They can also be applied to crops in the field and greenhouse using conventional irrigation or spray equipment and are compatible with most chemical pesticides and fertilizers, making them easy to use.

The increasing cost of chemical fertilizers and the concern about potential negative environmental impact, make bio-fertilizers and increasingly important technology. Bio-fertilizers have the added value in that they may also promote the plant's immune system and compete with harmful plant pathogens and nematodes which conventional chemical fertilizers cannot do.