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Editorial

# Plant Growth Promoting Rhizobacteria (PGPR) as an Alternative Stratify for Plant Stress Tolerance

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The plants are affected by biotic and abiotic stresses which reduced the yield and quality of seeds. The environmental stresses change the physical, biochemical and molecular factors that adversely affected the plants' growth and development. The usage of chemical fertilizers and pesticides in agriculture degraded the soil quality and fertility. Therefore, it is a need of an hour to formulate safer and sustainable agricultural practices. Plant growth promoting rhizobacteria (PGPR) are treasurable bacteria that colonize plant roots and improve the plant growth by a wide variety of mechanisms [1]. It provides an economically mesmerising sound ways for defending plants against stress condition. PGPR may promote plant growth by regulating plant hormones, nutrient fixation for easy uptake by plant, production of siderophore, volatile organic compounds and protection enzyme [2].

PGPRs belong to a number of different bacterial families, including *Rhizobium, Bacillus, Pseudomonas, Burkholderia*, etc. PGPRs can improve the growth of many plants under abiotic stress conditions [3] and might therefore open new attractive strategy for a sustainable agriculture. A first Timmusk and Wagner [4] found the capability of *Paenibacillus polymyxa* to reduce the effect of drought stress in *Arabidopsis thaliana*. Following that discovery, many scientists have studied the ability of PGPR to stimulate the plant stress tolerance [5]. The application of *Rhizobium* and *Pseudomonas* to *Zea mays* enhanced the salt tolerance ability [6]. They induce the plant growth directly by supplementing nutrients such as phosphorus and nitrogen to the plants by nitrogen fixation and phosphate solubilisation in the soil [7]. Some microorganisms produce plant hormones, such as indole acetic acid and gibberellic acid, which induce increased root growth and thereby lead to enhanced uptake of nutrients [8].

Plants have the ability to acquire a state of induced systemic resistance (ISR) to pathogens after inoculation with PGPRs [9]. Several plant pathogens were controlled by applying PGPRs. In association with plant roots, PGPRs can prime the plant innate immune system and confer resistance to a broad spectrum of pathogens with a minimal impact on yield and growth [9]. Several PGPRs, including *Azospirillum brasilense, Acineto bacterlwoffii, Bacillus pumilus, Chryseobacterium balustinum, Paenibacillus alvei, Pseudomonas fluorescens, Pseudomonas putida* and *Serratia marcescens* colonize roots and protect on a large variety of plant species, including vegetables, crops, and even trees, against foliar diseases in greenhouse and field trials [11]. Therefore, PGPR can be used as an environmentally friendly, cost effective and economical tool for enhancing the growth and tolerating the stresses in plants.

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