Growth-Promoting Rhizobacteria Reduce Batavia Lettuce's Fertilizer Need

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The use of synthetic chemical fertilizers is essential in conventional agriculture. However, the sector faces significant challenges due to these fertilizers' uneven application and rising costs. One potential solution is to optimize crop management practices and improve resource use efficiency. The application of biostimulants and biofertilizers represents an innovative, natural, environmentally friendly, sustainable, and cost-effective technology that can help address these issues. In soilless cultivation, plants are grown using nutrient solutions made from mineral nutrients, but beneficial microorganisms are typically absent in these systems. In this study, we investigated the impact of introducing Plant Growth Promoting Rhizobacteria (PGPR) as an alternative to traditional mineral fertilizer for hydroponic floating lettuce cultivation.

By reducing mineral fertilizers at various ratios (20%, 40%, 60%, and 80%) and applying PGPR, we observed remarkable improvements in multiple growth parameters. PGPR led to significant enhancements in plant weight, leaf number, leaf area, leaf dry matter, chlorophyll content, yield, and nutrient uptake in soilless-grown lettuce. Plant Growth-Promoting Rhizobacteria (PGPR) enhance and provide some essential phytonutrients and aid in biological nitrogen fixation. They help solubilize essential minerals like phosphorus (P), potassium (K), zinc (Zn), and iron (Fe). PGPR also regulates phytohormone levels—such as auxins and gibberellins, and influences plant growth and abiotic and biotic stress tolerance, serving as an effective biological control agent. Combining 80% mineral fertilizers with PGPR demonstrated a lettuce yield that did not significantly differ from the control treatment with 100% mineral fertilizers. Moreover, PGPR application improved the essential mineral concentrations and enhanced human nutritional quality, including higher levels of phenols, flavonoids, vitamin C, and total soluble solids.

The potential benefits of reduced synthetic mineral fertilizers, financial savings, environmental conservation, and enhanced nutritional and antioxidant content in lettuce make it a promising and sustainable approach to hydroponic floating lettuce cultivation. Improving the limitations of PGPR contributes to practical use in soilless cultivation. Current challenges include inconsistent effectiveness across plant species and environmental conditions and difficulties maintaining bacterial viability in nutrient solution and root area. Future research should refine PGPR application methods, identify strains adapted to soilless systems, and determine effective dosages. Evaluating shelf life, disease suppression potential, and tolerance to environmental variations will ensure consistent benefits, enhancing plant growth and health in soilless cultivation.

For the complete publication, please see:

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