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Mycorrhizal Fungi: An Important Tool for Rhizosphere Engineering

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Abstract: *Mycorrhizal fungi are a component of rhizosphere microbiome, facilitating symbiotic relationships with plant roots that enhance nutrient uptake, bolster stress tolerance and modulate plant immune responses. Emphasis is placed on the intricate interactions within the rhizosphere an ecologically dynamic interface between roots and soil biota which significantly influence plant growth, development, and productivity. The concept of rhizosphere engineering is introduced as an innovative, sustainable strategy to manipulate and optimize soil microbial consortia for enhanced plant performance. Within this framework, mycorrhizal fungi emerge as biofunctional agents capable of modifying rhizospheric nutrient fluxes, altering root exudate composition, and reinforcing beneficial plant-microbe interactions. Particular focus is given to arbuscular mycorrhizal fungi (AMF) due to their widespread occurrence and proven roles in phosphorus solubilization, water-use efficiency, and abiotic stress mitigation. The review synthesizes current research findings to illustrate how strategic incorporation of mycorrhizal inoculants into conventional and conservation-based agricultural systems can engineer a functionally resilient rhizosphere. The synergistic application of mycorrhizae in rhizosphere engineering is proposed as a viable tool for promoting agroecosystem sustainability, optimizing nutrient cycling, and supporting long-term soil health. This chapter offers a comprehensive overview and updated classification of mycorrhizal fungi, delineating their taxonomic diversity and ecological functionality.*

Keywords: Rhizosphere, Mycorrhizae Fungi, Rhizodeposits, Rhizosphere Engineering

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