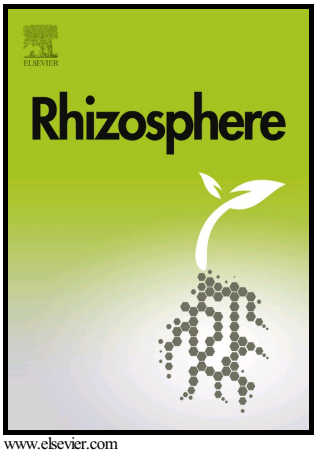

New Understanding of Rhizosphere Processes Enabled by Advances in Molecular and Spatially Resolved Techniques

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New Understanding of Rhizosphere Processes Enabled by Advances in Molecular and Spatially Resolved Techniques

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Abstract

Understanding the role played by microorganisms within soil systems is challenged by the unique intersection of physics, chemistry, mineralogy and biology in fostering habitat for soil microbial communities. To address these challenges will require observations across multiple spatial and temporal scales to capture the dynamics and emergent behavior from complex and interdependent processes. The heterogeneity and complexity of the rhizosphere require advanced techniques that press the simultaneous frontiers of spatial resolution, analyte sensitivity and specificity, reproducibility, large dynamic range, and high throughput. Fortunately many exciting technical advancements are now available to inform and guide the development of new hypotheses. The aim of this Special issue is to provide a holistic view of the rhizosphere in the perspective of modern molecular biology methodologies that enabled a highly-focused, detailed view on the processes in the rhizosphere, including numerous, strong and complex interactions between plant roots, soil constituents and microorganisms. We discuss the current rhizosphere research challenges and knowledge gaps, as well as perspectives and approaches using newly available state-of-the-art toolboxes. These new approaches and methodologies allow the study of rhizosphere processes and properties, and rhizosphere as a central component of ecosystems and biogeochemical cycles.

Keywords

Rhizosphere processes; Holistic view; research challenges.

Critical ecosystems services necessary to support human life such as fresh water and arable land are increasingly taxed by multiple demands. Future population growth will