## Special Issue

# Crop Microbiome and Stress: Interactions, Mechanisms, and Applications

## Message from the Guest Editors

Understanding and harnessing plant microbiomes which encompass the rhizosphere, endosphere, and phyllosphere communities—are essential for improving nutrient cycling, suppressing pathogens, and enhancing stress resilience in agriculture. Nonetheless, the efficacy of microbial inoculants in field trials is frequently constrained by edaphic heterogeneity, climatic fluctuations, and context-dependent plant-microbe interactions, including cultivar-specific responses. Mechanistic insights into signalling networks, metabolite exchange, and community assembly remain scarce, and multi-omics datasets are often analysed in silos. This Special Issue tackles these bottlenecks by spotlighting high-throughput metaomics for capturing microbial diversity, spatial metabolomics to map in situ chemical dialogues, and emerging genome- and microbiomeediting tools. Systems-level modelling and machine learning approaches enable the rational design of synthetic consortia, while root-exudate engineering and holobiont-based breeding integrate microbes into plant improvement programmes. We will also address the regulatory, ethical, and socio-economic frameworks that shape field deployment.

## **Guest Editors**

Dr. Soon-Jae Lee

- 1. Department of Ecology and Evolution, University of Lausanne, 1015 Lausanne, Switzerland
- 2. The Swiss National Centre of Competence in Microbiomes Research, 1015 Lausanne, Switzerland
- 3. African Genome Centre, UM6P, Ben Guerir 43150, Morocco

## Prof. Dr. Li Wang

College of Life and Environmental Science, Wenzhou University, Wenzhou 325035, China

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Agriculture
Editorial Office
MDPI, Grosspeteranlage 5
4052 Basel, Switzerland
Tel: +41 61 683 77 34
agriculture@mdpi.com

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## Editor-in-Chief

## Prof. Dr. Les Copeland

Sydney Institute of Agriculture, School of Life and Environmental Sciences, The University of Sydney, Sydney, NSW 2006, Australia

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