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## The rhizosphere: a playground and battlefield for soilborne pathogens and beneficial microorganisms

Jos M. Raaijmakers, Timothy C. Paulitz, Claude Alabouvette, Yvan Moënne-Loccoz

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Yves Dessaux  
Philippe Hinsinger  
Philippe Lemanceau  
*Editors*

DEVELOPMENT IN PLANT AND SOIL SCIENCES 104

# Rhizosphere: Achievements and Challenges

 Springer

Development in Plant and Soil Sciences 104

Yves Dessaux

Philippe Hinsinger

Philippe Lemanceau

Editors

**Rhizosphere: Achievements and Challenges**

Described by Hiltner over a century ago (1904), the rhizosphere is defined as the fraction of soil influenced by plant root activities. This dynamic, complex interface where soil, plant roots and microbes interact is a major hotspot of microbial activity, where numerous subtle molecular processes, as well as multiple feedback events take place. Rhizosphere investigations at the microscopic scale have driven spectacular academic advances in the fields of soil sciences or plant-microbe interactions. They bear promises in terms of environmentally-friendly procedures such as bioremediation or ecological engineering. The long recognized role of rhizosphere processes in plant nutrition and health, and more generally in plant adaptation to stress conditions, is now becoming central for designing sustainable management practices of agricultural and forest ecosystems. The rhizosphere, however, must also be considered and investigated at a much larger scale than its own, especially as a location where important steps of both carbon and nitrogen cycles occur, with obvious links with global changes. Major advances in understanding the rhizosphere have been achieved over the last two decades. Combined expertise in plant biology, microbial ecology and soil sciences and design of research strategies including the latest innovative methods in these fields opens exciting prospects for the future.

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Yves Dessaux · Philippe Hinsinger · Philippe Lemanceau  
Editors

# Plants and Soil

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 Springer

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### Cover caption:

Background photograph: Fababean (*Vicia faba* L.) grown in the long-term P-fertilizer field trial at Aùzeville (INRA Toulouse), exhibiting roots with N<sub>2</sub>-fixing nodules, abundant roots hairs and adhering soil, i.e. key players and features in the rhizosphere of legumes (photograph by P. Hinsinger).

Left insert photograph: *In situ* detection of *gfp*-tagged *Pseudomonas* sp. DSMZ 13134 cells on root surface of barley (*Hordeum vulgare* L.) using the CLSM (confocal laser scanning microscope LSM510, Carl Zeiss, Jena, Germany). Two-day old seedlings were inoculated with a bacterial suspension (10<sup>8</sup> cells per seedling). Plants were grown for two weeks in agricultural soil in pots in a greenhouse before analysis of the root colonization. Autofluorescent soil particles can be seen in the upper right corner (courtesy of K. Buddrus-Schiemann, Helmholtz Zentrum München, Neuherberg, Germany).

Right insert photograph: *In situ* detection of bacterial cells on the root surface of potato (*Solanum tuberosum* L.) grown under field conditions four weeks after planting. Fluorescence *in situ* hybridization (FISH) was performed using the oligonucleotide probe EUB-338-mix labeled with Fluos. Bacterial cells appear with the CLSM as green fluorescent signals and a clay particle can be seen as redish autofluorescence (courtesy of K. Buddrus-Schiemann, Helmholtz Zentrum München, Neuherberg, Germany).

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## Contents

### Editorial

#### **Rhizosphere: so many achievements and even more challenges**

Y. Dessaux · P. Hinsinger · P. Lemanceau

1-3

### Review Articles

#### **Carbon flow in the rhizosphere: carbon trading at the soil-root interface**

D.L. Jones · C. Nguyen · R.D. Finlay

5-33

#### **Nitrogen-fixing bacteria associated with leguminous and non-leguminous plants**

C. Franche · K. Lindström · C. Elmerich

35-59

#### **Biochemical cycling in the rhizosphere having an impact on global change**

L. Philippot · S. Hallin · G. Börjesson · E.M. Baggs

61-81

#### **Plant-microbe-soil interactions in the rhizosphere: an evolutionary perspective**

H. Lambers · C. Mougél · B. Jaillard · P. Hinsinger

83-115

#### **Rhizosphere: biophysics, biogeochemistry and ecological relevance**

P. Hinsinger · A.G. Bengough · D. Vetterlein · I.M. Young

117-152

#### **Plant root growth, architecture and function**

A. Hodge · G. Berta · C. Doussan · F. Merchan · M. Crespi

153-187

#### **The rhizosphere zoo: An overview of plant-associated communities of microorganisms, including phages, bacteria, archaea, and fungi, and of some of their structuring factors**

M. Buée · W. De Boer · F. Martin · L. van Overbeek · E. Jurkevitch

189-212

#### **Rhizosphere fauna: the functional and structural diversity of intimate interactions of soil fauna with plant roots**

M. Bonkowski · C. Villenave · B. Griffiths

213-233

#### **Plant-driven selection of microbes**

A. Hartmann · M. Schmid · D. van Tuinen · G. Berg

235-257

#### **Rhizosphere microbiota interferes with plant-plant interactions**

A. Sanon · Z.N. Andrianjaka · Y. Prin · R. Bally · J. Thioulouse · G. Comte · R. Duponnois

259-278

#### **Molecular communication in the rhizosphere**

D. Faure · D. Vereecke · J.H.J. Leveau

279-303

#### **Acquisition of phosphorus and nitrogen in the rhizosphere and plant growth promotion by microorganisms**

A.E. Richardson · J.-M. Barea · A.M. McNeill · C. Prigent-Combaret

305-339

#### **The rhizosphere: a playground and battlefield for soilborne pathogens and beneficial microorganisms**

J.M. Raaijmakers · T.C. Paulitz · C. Steinberg · C. Alabouvette · Y. Moëgne-Loccoz

341-361

#### **Rhizosphere engineering and management for sustainable agriculture**

P.R. Ryan · Y. Dessaux · L.S. Thomashow · D.M. Weller

363-383

#### **Rhizosphere processes and management in plant-assisted bioremediation (phytoremediation) of soils**

W.W. Wenzel

385-408

<b>Novel approaches in plant breeding for rhizosphere-related traits</b> M. Wissuwa · M. Mazzola · C. Picard	409–430
<b>Strategies and methods for studying the rhizosphere—the plant science toolbox</b> G. Neumann · T.S. George · C. Plassard	431–456
<b>Sampling, defining, characterising and modeling the rhizosphere—the soil science tool box</b> J. Luster · A. Göttlein · B. Nowack · G. Sarret	457–482
<b>Molecular tools in rhizosphere microbiology—from single-cell to whole-community analysis</b> J. Sørensen · M. Haubjerg Nicolaisen · E. Ron · P. Simonet	483–512
<b>Iron dynamics in the rhizosphere as a case study for analyzing interactions between soils, plants and microbes</b> P. Lemanceau · P. Bauer · S. Kraemer · J.-F. Briat	513–535