

Year of CfP: 2009

Project No 0902-008

Project title: Modelling of water and nutrients uptake by plant root systems: a mathematical and numerical approach with explicit account of root system architecture
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Units managing the project: EMMAH (Mediterranean environment and modelling of agri-hydrosystems) [INRA]

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Research units from the Foundation's scientific network involved: PSH

Subthematic axes: STDI-1 (Socio-Technical Dynamics of Innovation 1: *Agri-environmental innovations, agri-ecosystems, resources management*)

Objectives:

Among mineral nutrients, nitrogen (N) and phosphorus (P) are key elements for plant growth. Intense use of N and P as fertilizers input in modern agriculture has led to the current high productivity of crops but at the expense of the alteration of water resources or greenhouse gases emission. From another point of view, the availability of P might be limited in the future for agriculture because of the exhaustion of P-ores. As an answer to these problems, low-input agriculture shall be devised by optimizing the use of fertilizers (or soil natural resources) and water by plant roots in the soil.

The aim of this proposal is to better understand the interactive effects between root system architecture (geometry, growth) and P / water uptake, in relation with the soil spatial variability of resources. This will be undertaken by numerical modelling and mathematical optimization with different levels of details in the description of the root system. This should result in a modelling coupling soil water/nutrient transfer and uptake by a root system architecture, including retro-actions between aerial and subterranean parts of the plant.

Total Agropolis Fondation funding: €42,514 (running costs, participation to a meeting, salary for 4 months for a software coding student, support for 3 pre-doctoral students)

Funding category (ies): Agropolis Fondation small grants (support for small exploratory, risky and innovative projects, « proof of concept », new frontier research; support to pre-doctoral students)

Project duration: 01 November 2009 - 31 October 2012

Keywords: modelling – water – nutrients – root – architecture – nitrogen - phosphorus