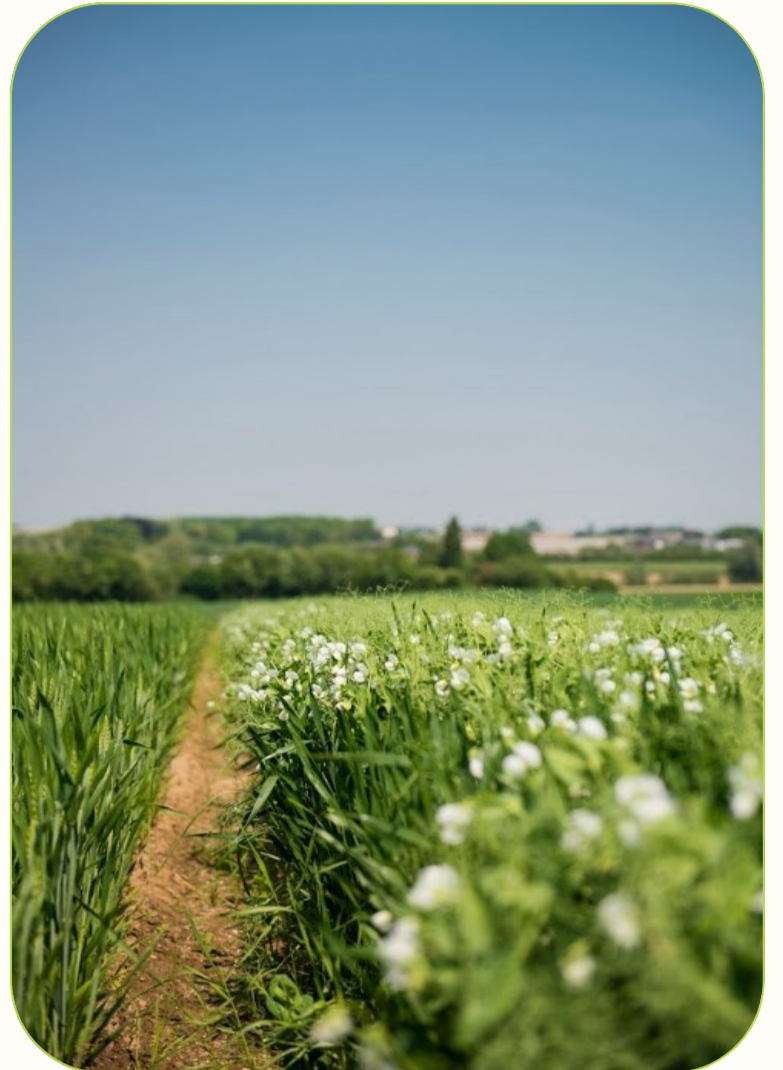


Improving control of soil phosphorus availability by agricultural practices

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Introduction

Agriculture is facing a big challenge. As world population raises, agriculture aims to produce enough food in a sustainable way. During the last decades, the use of nitrogen (N) and phosphorus (P) fertilizers has expanded at a faster rate than the world food production leading to a reduce in their efficiency (Rockström *et al.*, 2009) and their accumulation into soils. P is quite abundant in soil but the major part is not present as the available form for plants. Phosphate ions (available form) are poorly mobile and in low concentration in the soil solution because they make multiple and strong associations with soil compounds (Hinsinger, 2001). Concerns about increased P loadings into the environment led to develop alternative agricultural practices that can compensate for P fertilization and improve soil P availability (Ohno *et al.*, 2005).



Objectives

This PhD research aims to investigate the performance of non-conventional agricultural models to improve efficiency of soil P mobilization by plants. The behavior of P in the soil-water-plant system will be studied at various scales (profile, aggregate, and rhizosphere). The studied agro-ecosystems are : « Export of crop residues versus residues restitution », « intercropping versus monocropping » and « introduction of animal (through manure recycling) versus no animal ». This project is organized in two issues : a characterization of the spatio-temporal soil P distribution and the study of the soil P



Implementation of the project

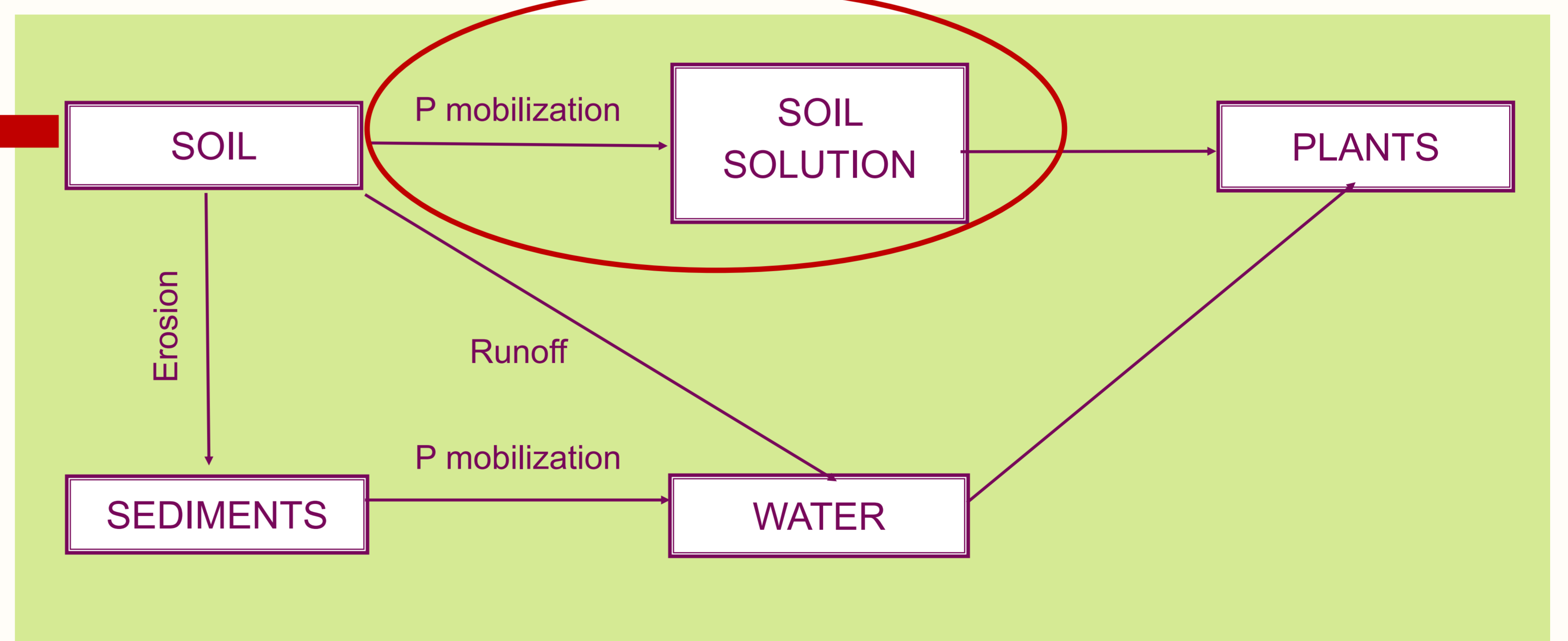


Developing an **experimental device** in controlled conditions
 Modeling with **geochemical models**
 Aim : to isolate the effect of the rhizosphere, the action of microorganisms and the soil solution

Study of *the interactions between elements in the soil solution*

DYNAMICS

DISTRIBUTION



Phosphorus cycle

Spatial

- Mapping of soil pits :
 - Pits : 100 X 50 cm
 - +/- 100 samples/pit (cylinders of 100 cm²)
 - Characterization : COT, P (total, organic, inorganic), soil pH, bulk density

Temporal

- Monitoring of soil pH, available elements (Ca, Mg, K and P) and TOC by sampling 2X/year (in spring and in fall)

References

- Hinsinger, P. (2001). Bioavailability of soil inorganic P in the rhizosphere as affected by root-induced chemical changes: a review. *Plant Soil* 237, 173–195.
- Ohno, T., Griffin, T.S., Liebman, M., and Porter, G.A. (2005). Chemical characterization of soil phosphorus and organic matter in different cropping systems in Maine, U.S.A. *Agric. Ecosyst. Environ.* 105, 625–634.
- Rockström, J., Steffen, W., Noone, K., Persson, VAAsa, Chapin, F.S., Lambin, E.F., Lenton, T.M., Scheffer, M., Folke, C., and Schellnhuber, H.J. (2009). A safe operating space for humanity. *Nature* 461, 472–475.