# Soil physical fertility: thesis project for water-soil-plant model improvement

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## Introduction

Quantities of nutrients like N, P and K in the soil are generally assumed to be the more important parameters of its fertility. Mineral fertilization - notably through the application of inorganic fertilizers - provides required nutrients quantities for the optimum plant growth. The physical fertility of the soil such as water holding capacity, porosity, bulk density, hydraulic conductivity…, which creates suitable environment for the availability and uptake of these nutrients, is often ignored [Rasool *et al.*, 2007].

The present thesis project purposes the development of a physically-based model linking agricultural practices (fertilization, tillage) and changes of soil physical properties related to water, soil and plants interactions and their effects on soil hydrology.

## Material and methods

### Laboratory studies

Amendment and climatic scenarios will be tested in laboratory on a soil column (or similar -) system to define impacts on soil physical propertie's evolution through fertilization, and, even more, differently through the way of fertilization (organic or inorganic). Especially, Bulluck *et al*. [2002] and Caravaca *et al.* [2002] observed that bulk density decreases with compost amendment. Rasool *et al.* [2007], for their part, have revealed that water holding capacity and total porosity both increased with the application of farm yard manure and inorganic fertilizers, this enhancement being even more important in the case of the farm yard manure.

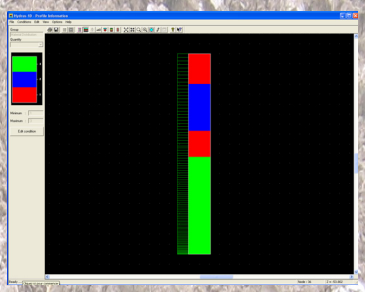


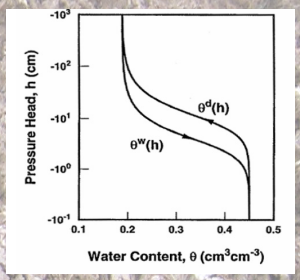
### Field experiment

In situ measurements will be realised to compare tillage and no tillage's effects on soil properties such as infiltration rate, retention curve or hydraulic conductivity. Validation of the model will be considered with this field experiment.


### Model establishment

The model will be integrated in a pre-existing program with a physically-based code for simulating water, heat and solute movement in a variably saturated soil column.

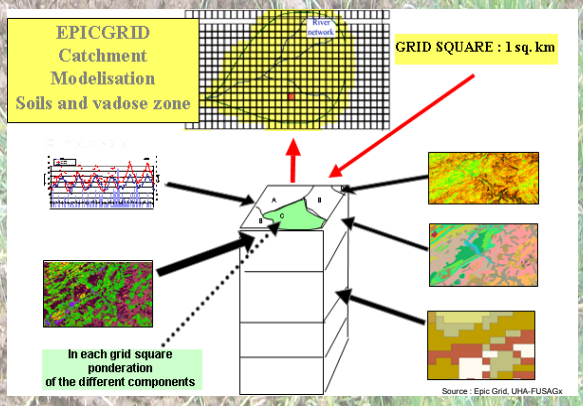





Hysteresis in the retention curve and in the hydraulic conductivity will be taken into account in the model.

### Regional watershed model transfer

Finally, the model will be adapted and transferred for a regional watershed operational model use.




## Conclusion

If chemical fertility and related physico-chemical phenomena are already well known and described, the evolution of the soil physical properties needs further investigation for an improvement of water – soil – plant model establishment [Pernes-Debuyser and Tessier, 2004]. The aim of this project is to develop a physically-based model linking agricultural practices and changes of soil physical properties and to validate it with laboratory and in situ measurements.

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