

PhD position on global agronomy

INRA and University of Bordeaux (France) propose a PhD position on potential limitation of organic farming development by the availability of nutrients at the global scale

Rationale

The capacity of organic farming to feed the planet is highly controversial. Some recent meta-analyses have compared the average yield per crop in organic vs conventional farming. Although these studies have provided some key elements to assess scenarios of dramatic development of organic farming in terms of food production, they suffer from two major limits.

First, these studies did not consider the potential impact of organic farming development on crop yields due to potentially increased competition for nutrient sources: since chemical fertilisers are banned in organic farming, the availability of approved nutrient sources for soil fertilisation (livestock effluents, composts, etc.) might be limited in some areas -eg, in stockless regions. In addition, some recent reports have highlighted that organic farming may be dependent from conventional farming to source nutrients –eg through conventional manure import. Such sourcing might turn to be limited if organic farming was to develop dramatically.

Second, those meta-analyses did not account for differences in crop rotations in organic vs conventional farming. However, crop rotations often differ between these farming types, eg to benefit from pest regulation and N₂ fixation services provided by longer, more diversified crop rotations. In particular, organic crop rotations often exhibit higher frequencies of leguminous crops and cultivated grasslands and lower frequencies of cereals. However, while this information is of critical importance to assess scenarios of organic farming development in terms of food production, we lack detailed and consistent data on crop rotations in organic vs conventional farming.

This PhD project aims to address these two limits and to assess the food production capacity of organic farming if it was to develop dramatically at the global scale. More generally, this project aims to discuss the potential contribution of organic agriculture to the global food security.

Objectives

This PhD project will aim to assess the food/feed production capacity of organic agriculture in scenarios of dramatic development (eg, over 20, 50 or 100% of the global agricultural area). It will focus on the ability to supply nitrogen and phosphorus to meet crop demand accordingly with organic production guidelines. Three steps will be considered. First, both nutrient supply from leguminous crops, organic livestock effluents and other sources (composts, conventional livestock effluents) and crop nutrient demand will be modelled, accounting for crop rotation characteristics in organic farming. Second, the ability of nutrient supply to meet crop nutrient demand will be checked under scenarios of organic farming development. Those scenarios will consider the global agricultural area under organic farming but also the conditions of organic farming development (eg, through recoupling of crop and livestock production). Finally, these results will be compared to scenarios of global food demand to estimate the ability of organic farming to meet food and feed

demand. We propose to develop this framework on a limited set of countries -from the global North and South- and then to expand it at the global scale.

This PhD project will use different kinds of data, eg about agroecosystem functioning, crop-livestock interactions and organic farming development. It will use a large scale modelling approach to estimate nutrient supply and demand. No experimental fieldwork is expected but contacts with organic farming stakeholders will be encouraged. Finally, this project will contribute to the development of global agronomy as an emergent scientific field.

Expected profile

- Master student with sound bases in agricultural sciences or in ecology with clear interest in agricultural issues. Experience in mathematical modelling or scenario assessment is an asset.
- Interest for large scale studies (country, planet)
- Excellent writing skills, fluent in English. If possible, some French notions.
- On top of that, you are rigorous, autonomous, creative and motivated by working in a research environment.

Supervision and working conditions

The PhD student will be co-supervised by Thomas NESME (associate professor at Univ. Bordeaux) and Sylvain PELLERIN (senior scientist at INRA). He/she will be engaged in a small group (3 permanent scientists) working on nutrient cycling modelling at large spatial scale (from the district to the planet). He/she will benefit from the experience of that group (eg, in modelling or about organic farming) as well as cooperations with other groups in France (mostly INRA Paris and CIRAD Montpellier) or abroad (mostly UBC, Vancouver, Canada).

The PhD student will be part of ISPA department (joint unit between INRA and Univ. Bordeaux on Soil, Plant and Atmosphere Interactions, <https://www6.bordeaux-aquitaine.inra.fr/ispa>), located at INRA campus, just a few minutes from Bordeaux downtown. He/she will graduate from Univ. Bordeaux.

The PhD student will be offered a three years contract with INRA. The gross salary will be 1750€ (including social security for illness, maternity and unemployment, as well as financial help for public transportation and canteen). The PhD is expected to start by Fall 2015.

How to apply?

Any Master student interested in this project is required to send his/her CV and a motivation letter to Thomas NESME (thomas.nesme@agro-bordeaux.fr) **before July 10th 2015**. The letter should illustrate how the candidate considers his/her skills and experiences match our expectations.