LIÈGE université
Gembloux
Agro-Bio Tech

Postdoc position (soil microbiology, soil nutrients cycling, plant physiology, plant metabolism) to investigate plant and fertilizers-based strategies to improve Nitrogen Use efficiency of crops and reduce Nitrification rate in cultivated soils.

The postdoc candidate will work within the started project "CATCH-BNI" funded by the EU program SUSCROP. (https://www.suscrop.eu/projects-second-call/catch-bni)

In the CATCH-BNI project (Improved nitrogen use efficiency in agriculture by CATCH crops as producers of Biological Nitrification Inhibitors), various catch-crops genotypes will be screened for their ability to influence nitrification rate in the soil. The best catch-crops candidates have then to be tested in combination with various ammonium-rich fertilizers (including organic fertilizers) after their incorporation to soil (as plant residues or as compost source or any other strategies) and later studied as a way to improve N use efficiency of following cereal crops. The work will consist in the fine screening of catch-crops using different plant and microbiological methods and will decipher the associated plant and soil mechanisms that are responsible for the nitrification inhibition/reduction. For this, different Nitrogen pools (microbial N, mineral N and emitted N20) will be measured in lab, greenhouse and field scale experiments using various types of platforms (hydroponics, pot and field experiments). Microbiological bio-assays and molecular methods will also be used to assess nitrification inhibition potential of the isolated tissues and compounds.

The recruited person is also expected to help in the overall coordination of the European project CATCH-BNI.

Research activities will be performed at University of Liège, Gembloux Campus (35 min by train from Brussels (Belgium)) in an international established team (Plant Genetics and Rhizosphere Processes) with research focus on 1) improvement of crops and 2) soil and rhizosphere management.

The other research partners of the project are the John Innes Center (Norwich, UK), IPK Research Institute (Germany) and the University of Basque Country (Spain).

Weblink of the lab: http://www.gembloux.ulg.ac.be/plant-genetics/

Profile The candidate should hold a PhD and have demonstrated expertise as well as scientific publications in soil microbiology, soil nutrients cycling, plant physiology or plant metabolism. Excellent oral and written communication in English is required as well as coordination skills.

Appointment is for 2 years with possibility of contract extension.

Benefits Net salary after taxes and social benefit costs is 2250 €/month.

Information and application: Prof. Cécile Thonar, Plant Genetics, Gembloux Agro BioTech, University of Liège, Belgium (cecile.thonar@uliege.be) Application (CV, cover letter, copy of diplomas and two letters of recommendation) should be sent by Email to Cécile Thonar with "CATCH-BNI APPLICATION" in the subject.

Deadline for application: 15th March 2022. Starting date: As soon as possible

General abstract of the project (more information on request):

Agrosystems in industrialized countries are confronted with important challenges: they are facing increasing food demand while they are requested to reduce external inputs and to minimize negative environmental impact. The widespread use of synthetic nitrogen (N) fertilizers has promoted the productivity and profit in agricultural plant production. However, due to the low nitrogen use efficiency (NUE) of crop plants, the intensive use of N fertilizers entails losses from the plant-soil system via NO3- leaching and/or N gas emissions, leading to soil, water and atmosphere pollution. Strategies aiming at optimizing the management of N fertilization and reducing N losses to the environment have the potential to provide a significant contribution to UN Strategic Development Goals (SDGs) dealing with global warming (SDG13), responsible production (SDG12), clean water (SDG6) and biodiversity (SDG15). In the CATCH-BNI project, we will investigate the potential of catch crops to provide key functions and services in the regulation of N cycling in conventional and organic agrosystems. The nitrification processes operated by soil bacteria and archaea lead to the rapid conversion of ammonium into nitrate which is prone to losses that subsequently pollute the environment. Nitrification is also associated with the production of greenhouse gases (NOx), a GHG emitted as well by dentrification. While chemical inhibition of nitrification has emerged as a tool to limit nitrate losses, several plant species were lately shown to display nitrification inhibiting activities, mostly through release of organic compounds present in their root exudates. Those compounds are named Biological Nitrification Inhibitors (BNIs). The characterization and use of BNIs allow the transfer of the nitrification inhibition strategy to organic production systems and also represents a low-cost alternative to the application of chemical inhibitors. Catch crops do alter nitrifying microbial communities when incorporated into soil before sowing the target crop. Indeed, tissues from certain plant species accumulate compounds with BNI activities during their development. Their use as green manure has been hypothesized to improve soil fertility and concomitantly provide compounds that reduce the speed of nitrification. This is for example the case for glucosinolate-containing plant tissues from mustard or rapeseed (Brassicaceae family), for which a greater accumulation of NH4+ was observed in soils amended with their tissues. In the CATCH-BNI project we will investigate the incorporation of catch crops with BNI potential into crop rotations as a mitigation strategy to slow down nitrification processes and retain ammonium in soils as well as to increase soil N pools for the subsequent target crop.

The main objective of the CATCH-BNI project is to design innovative approaches enabling the slow and controlled conversion of ammonium into nitrate in soils for optimal nutrition of target crops. For this, we aim at: 1) identifying catch crop plant species and/or cultivars with BNI activities in their root exudates and/or root and shoot tissues; 2) understanding how efficiently the N cycle is impacted by the use of BNI-producing catch crops and how the target crops perform (yield and NUE); 3) determining the best options and modalities to stabilize organic fertilizers with BNI plant material and 4) validating in real-field conditions the proposed innovations.