PLANET

Plant and soil health indicators from an agroecological perspective for sustainable rice production in Cambodia

ABSTRACT

Rice is the staple-food for 50% of the population on earth, the majority of which living under the poverty threshold. Rice production is consequently a crucial stake for global food security. Pests and diseases, including plant parasitic nematodes (PPN), are major biotic constraints reducing rice yields in Asia by about 37% (Suong et al., 2019). In recent years, rice producing countries have faced an increasing incidence of PPN. This is particularly due to the reduction in available
control means (prohibition of the use of nematicides due to their toxicity), to climate change (adjustment of water management which is known to control the incidence of pests) and socio-economic changes (decrease in the workforce) (De Waele, D. and Elsen, A., 2007). Cambodia, one of the least developed countries, is particularly threatened by these degradations. The AIDA unit (CIRAD) has implemented rice agroecological practices in this country based on no-till, direct sowing and a rotation of specific cover crops, all of which have made possible increase in rice yields (Suong et al.,
2019). As those practices represent a promising solution for sustainable rice production, their potential impact on pest management must be investigated. This project, with the support of the HealthyRice consortium (https://jeai- healthyrice.weebly.com/) and the combined skills of three units of the Agropolis foundation network (UMRs PHIM, Eco&Sols and UR AIDA), will aim to meet three main objectives:

1) Evaluation of the agro-ecological practices' efficiency to fight against the diseases caused by PPN in Cambodian rice agrosystems. We will compare rice yields and infection by PPNs in conventional versus agro-ecological practices, in the three main rice agro-ecosystems found in Cambodia (irrigated, flood plains and rainfed on upper sandy terraces).
2) Identify indicators of plant and soil health in agroecological systems. We will characterise the soil biodiversity per se (bacteria and fungi, free nematodes, invertebrates), and the presence of specific key organism groups, as well as soil physico-chemical and functional properties. All data will be correlated by multiple regression, multivariate analyses and co-occurrence network analysis, with the objective to find correlations between soil suppressiveness (reduction of the ability of PPNs to infect rice plants), biotic or abiotic soil characteristics to identify indicators of soil health.
3) Raising awareness of the Cambodian rice researchers and main stakeholders about the negative impacts of PPN and performances of agroecological practices. This will be done by organizing a final workshop emphasizing key findings of plant and soil health indicators, as well as producing didactic leaflets and blog posts on the JEAI website.

Keywords : Soil, Agroecology, Parasitism modelisation, Nematology

Funding : Labex

GOAL

The general objective is to support the agroecological transition by providing indicators demonstrating that the transition to a healthy agrosystem is underway. To promote this transition, we have established a "JEAI HealthyRice" network associating researchers with different skills (agronomy, bioinformatics, IPM, microbiome, soil sciences and social sciences) and cultures (French and Cambodian). This community needs to exchange, learn from each other to ensure synergy in their activities. The post- doctoral scholarship requested, thanks to its transversal skills will actively contribute to this co-learning. At the technical level, we will gather and consolidate science-based evidence on the indicators under agroecological management. At the social level, we will enhance collective learning by organizing an exchange platform and creating didactic material around these indicators. The project will empower farmers into assessing performances and impacts (soil ecosystem functions) and raise their awareness about agroecological practices.