Joint French-South-East Asia Research and Training initiative

DYNAMIC OF LAND USE CHANGES AND SOIL ECOSYSTEM SERVICES (LUSES)

Internal Call for small proposal

Year 2013

Project responsible	Dr Didier Lesueur

Title
Capacity Building for Beneficial Microbes in Agriculture in South East Asia– Assessment, Delivery and Quality control

LMI partners (French)	Eco&Sols

LMI partners (Asian)	Land Development Department, Thailand

Others Partners	
Western Countries	Dr Lambert Brau et Laetitia Herrmann, Deakin University
Asian Countries	

Type of support	**Amount (€)**
Deadline (15 th of February)	
Student support	
Student research expenses	
Student mission	
Support to project building	
Collective training expenses	4,500
Mission (exploratory, support)	
Field support	
Exploratory project	
Beside project support (link to a bigger one)	
Equipment	
Others	

Asian Countries involved (put an x)

Thailand	Vietnam	Laos	Others
X	**X**	**X**	**X**

Working package involved (put an x)

WP1 Soil fertility and the dynamics of mineral nutrients	WP 2 Soil and water functional biodiversity	WP 3 Carbon storage in plant biomass and soil	WP4 Regulation of water flow and erosion s
X	X		

General context of the proposal

In developing countries, the high costs of nitrogenous and phosphate fertilizers and other agricultural inputs is driving the development and use of beneficial microbes to enhance crop production. Microbial products represent a relatively cheap alternative to fertilizers, and have been shown to perform very well in various environments. However, in many countries, there is little information on the actual content of these products and the regulation to control their quality is generally poor. This means that growers are purchasing these products without any quality control systems being in place. For an example, a recent study (2009 to 2011) undertaken on behalf of the Bill and Melinda Gates Foundation in sub-Saharan Africa (COMPRO – Commercial Products Project) showed that about 50% of the 120 tested commercial biofertilizers were full of contaminations and contained none of microorganisms as per the product information provided by the manufacturers/suppliers. Many of these and other commercial products can also be purchased in Asia, the direct consequence of which is that farmers are spending money on ineffectual products, will not see yield responses and may be reticent to trial proven products if they have negative experiences. There are also no programs in place in the target countries whereby researchers can identify and develop their own beneficial microbes and reduce dependence on imported products.

Successful use of these microbial products has been shown in Australia, North and South America and has also been assessed by the scientific consortium composed of TSBF/CIAT, IITA (Tropical Soil Biology and Fertility Institute/International Centre for Tropical Agriculture, International Institute of Tropical Agriculture), African agricultural research stations and Universities in the frame of the project COMPRO funded by Bill and Melinda Gates Foundation and coordinated by Dr Lesueur (leader of the proposal). New commercial products have appeared on the market as alternatives to common fertilizers. During 3 years, the COMPRO project evaluated over 120 of these new products on major legume, cereal and banana crops across diverse agro-ecological conditions in Ethiopia, Nigeria and Kenya in the laboratory, greenhouse and field conditions. Yield increases were shown with a number of products across different crop and soil types and the results demonstrated that there is potential for biological commercial products, but there is need for continued evaluation (as outlined above). Smallholders in Africa but also in SEA and Latin America may benefit from some of these products, on the condition that a good-quality product is correctly applied to the appropriate crop with appropriate soil and crop management.

Objective of the proposal

The introduction of plant growth promoting microbes that result in increased crop yields and/or reduce dependence on expensive fertilizers will have real and immediate benefits for the producers (higher yields, reduced input costs) and can also decrease the detrimental environmental effects of fertilizer inputs, such as eutrophication and decreased soil fertility.
Ultimately, the aim of this training class is to be the first step of a medium-term initiative to train people to be capable to assess the microbial quality of commercial inoculants and to distinguish ineffective products from quality inocula in their national markets and thus allow promotion of only the effective ones.
To allow SE Asian farmers to benefit from these new products, systems need to be in place to ensure only effective inocula are sold. Successful uptake of microbial inoculants requires their delivery in efficient and cost effective carriers which are also matched to the storage and transport capabilities of the regions in question. This course will also cover suitable inoculant carriers that can be sourced locally and affordably and will deliver microbes in sufficient numbers (such as peat or liquid formulations, rice husks and granules depending on the strains requirements).

Link with the LMI project (regional aspect, partnership, working package)

Capacity Building issue is very much important for the LMI LUSES and by financially contributing to this project of Training course on soil microbiology/biofertilizers targeting participants from Laos, Vietnam and Thailand but also from some other neighbouring countries such as Cambodia and Myanmar, LUSES will benefit a lot in terms of visibility at the regional level (beyond the borders of the LMI) at limited cost.
In addition, the topic and the different activities proposed within this proposal strongly fit with the objectives of the WP2 “Soil and water functional biodiversity” and partially with those of the WP1 “Soil fertility and the dynamics of mineral nutrients”.

Project description (one page maximum)

The program will be run as series of lectures/tutorials in the morning followed by hands on laboratory activities in the afternoon. This will ensure the theoretical basis exists for all participants prior to learning the hands on skills. According to the funding available, about 12 to 18 people could attend it (Crawford will fund 12, SELTAR may pay for about 3 or 4 and the rest should be LDD’s staff already in Thailand).

The course will give participants a sound understanding of microbiology, how to grow, purify and store bacteria, the benefits they can bring to agriculture and the proposed activities will give participants the skills to:

1. Isolate, purify and characterise bacteria using standard and robust methodologies from existing inoculant products and from native soils
2. Identify to genus level target bacteria using basic molecular biology techniques such as PCR (polymerase chain reaction) fingerprinting, and preparing bacterial DNA

for sequencing.

3. Identify all microorganisms (both bio-fertilizers and contaminant microorganisms) using the above techniques to determine the nature of microorganisms contained in the biofertilizers and see if it is in accordance with the indications provided by the suppliers.

4. Measure plant-growth promoting mechanisms (eg. Phosphate solubilisation) on strains to determine whether they are beneficial for crop production using robust and simple lab and/or greenhouse techniques.

5. Evaluate different application techniques (including new formulations) for selected high standard bio-fertilizers (practicality, numbers of microorganisms applied and conditions for microbial survival during storage, transport and after application).

The course will be organized at the Land Development Department in Bangkok where all the facilities are available (conference room, room for the lunches, laboratory of soil microbial ecology) and surrounded by cheap accommodation to avoid long travel times for.

The agenda of the course will be organized as follows:

Week 1
Monday AM: Theory
Structure and Function of Bacteria
Classification of Bacteria
Monday PM: Laboratory
Isolation and purification of bacteria, microscopy, enumerating bacterial numbers in products

Tuesday AM: Theory
Nutrition of Bacteria
Bacterial growth media
Tuesday PM: Laboratory
Preparing solid and liquid growth media, autoclaving

Wednesday AM: Theory
Bacterial Growth and Division
Sterilization and disinfection
Pathogenicity
Wednesday PM: Laboratory
Sterile technique, long term storage of bacterial cultures

Thursday AM: Theory
PCR (polymerase chain reaction) techniques for identifying bacteria I
Thursday PM: Laboratory
Setting PCR reaction, visualizing PCR products, interpreting results

Friday AM: Theory
PCR (polymerase chain reaction) techniques for identifying bacteria II
Friday PM: Laboratory
Setting PCR reaction, visualizing PCR products, interpreting results

Week 2
Monday AM: Theory
Theory:
Plant Microbe interactions, plant growth promoting bacteria
Monday PM: Laboratory
Media selection and use to identify plant growth promoting bacteria (eg phosphate solubilisation)

Tuesday AM: Theory
Setting up glasshouse trials to asses plant growth promoting bacteria
Tuesday PM: Laboratory
Setting up glasshouse trials to assess plant growth promoting bacteria

Wednesday AM: Theory
How to assess plant yields, statistical requirements.
Wednesday PM: Laboratory
Collecting glasshouse samples, preparation, drying, storage

Thursday AM/PM: Theory
Suitable products for inoculant delivery.

Friday
General discussion about the course and brainstorming about a regional proposal to develop on the importance of biofertilizers in agriculture in SEA.

Budget description:

The LMI proposal's budget aims to cover:

- The laboratory costs for all the chemical and consumables requested for the practical laboratories sessions.
- The lunches and other expenses such as local transports for the participants in direct relationship with the organization of the course.
- Edition and duplication of technical manuals and other documents the participants will need to get to improve their knowledge in applied soil microbiology.

Co-funding:

- A proposal entitled "Capacity Building for Beneficial Microbes in Agriculture in Laos, Burma and Cambodia – Assessment, Delivery and Quality control" has been submitted by Deakin University (Dr Lambert Brau) to Crawford Foundation in Australia. A total budget of € 28,000 has been requested to cover the total cost of

travels and subsistence/accommodation (12 participants) in Bangkok from the target countries, but also for the Australian colleagues of Deakin University who will travel to Bangkok for the course.

- A proposal has been submitted last month to the PPR SELTAR for € 4,000 for more participants from Myanmar and Cambodia (to cover the total cost of travels and subsistence/accommodation of these participants in Bangkok).
- All the conference rooms and laboratory facilities offered by the Land Development Department for the training course (approx € 2,000).
- Laboratory equipment and time dedicated to this event by LDD's researchers (approx. € 2,500) and Dr Didier Lesueur of Eco&Sols (approx. € 7,000).
- Laetitia Herrmann, a PhD student of Deakin University based at LDD working with Dr Lambert Brau and Dr Didier Lesueur will be fully involved in both lectures/tutorials in the morning and laboratory activities in the afternoon. She will work at 100% of her time on the organization and the monitoring of the course (specifically for the practical laboratory sessions on the afternoon). Her contribution in kind should approx. € 3,500.