

Refurbishment and establishment of the National Forestry Research laboratories at Kifu: Functionalizing acquired lab equipment

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1. Background

This report is an update of activities undertaken under the project aimed at functionalizing the laboratory facilities at NaFORRI. The project has been going on since July 2020. This the report covers the fourth quarter, which includes the months of April through June 2021. The key activities undertaken during this reporting period include collecting final dataset for the nodulation trial, characterization of rhizobia types from nodules, characterization of soil-borne pathogens in citrus soils, data analysis and preparation of technical reports for all the experiments. In the previous quarter, data collection from the experiments has been completed and the writing on technical publications is on-going but key highlights of data from each output is provided in the respective sections.

2. Details of activities carried out during the current reporting period

Most of the activities of the project centered on finalizing collection of data and writing of technical reports. On citrus soil-borne pathogens, culturing of pathogens and their identification was completed. Similarly, the identification of pest on sticky traps was completed. Furthermore, data on morphological identification of rhizobia families was largely completed but the contamination of the samples delayed progress of the identification process. The contamination challenge also affected eh identification of samples from soil in various agroecosystems. Nonetheless some microscopic slides were prepared and rhizobia and fungi identified using staining techniques (Fig. 1).

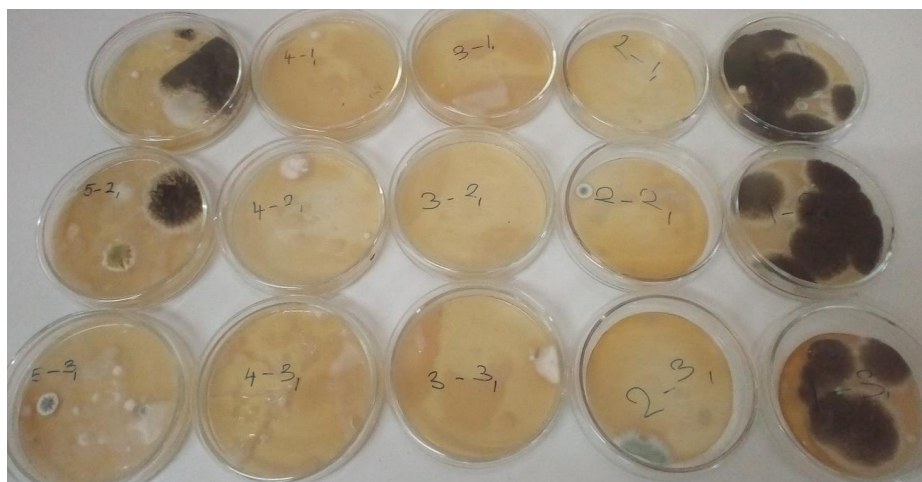


Fig. 1: Culturing of soil microbes for subsequent morphological identification using microscopic techniques:

The data collection from the greenhouse experiment with two legume species (Calliandra and Sesbania) was completed and analysis is ongoing. Preliminary analysis show that pruning frequency recues the number of nodules per plant, and that the soil moisture significantly reduces nodulation of calliandra but not Sesbania. (Fig. 3). The number of nodules per plant is generally higher in Calliandra compare to Sesmabnia but the average nodule size is larger in Sesbania compared to Calliandra (Fig. 3b).

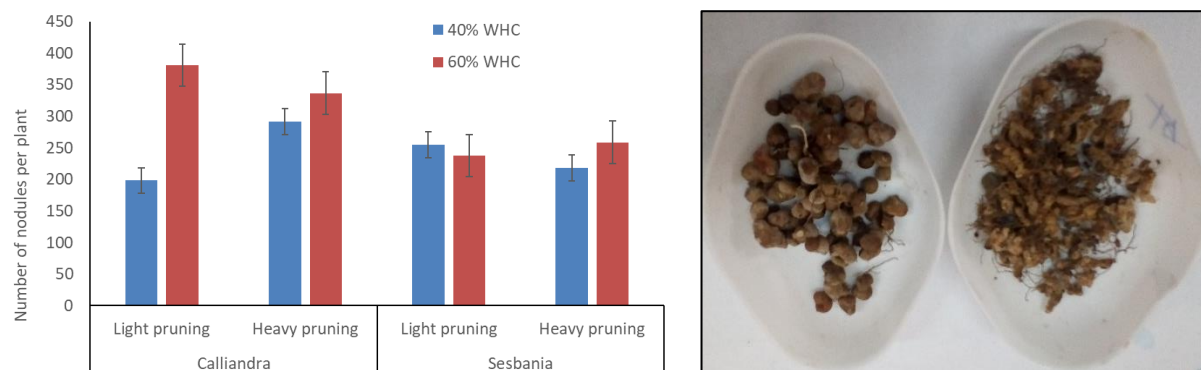


Fig. 3: Preliminary results from nodulation of short-rotation shrubs under greenhouse conditions.

Preliminary results from the characterization of mycorrhizae soil from various agroecosystems are shown in Table1

Table 1: List of Abscular mycorrhizal families and their occurrence selected Ugandan ecosystems

<i>Fungal taxon</i>	<i>Agroecosystem</i>
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	Tea plantation in humid lowland- (Kabarole)	Maize-beans (Worm humid) Masaka)	Highland climate Coffee-Banana (Mbale)	Semi-arid rangelands (Moroto)
<i>Order: Archaeosporales</i>				
<i>Ambisporaceae</i>	-	-	√	-
<i>Archaeosporaceae</i>	√	√	√	√
<i>Geosiphonaceae</i>	-	√	√	√
<i>Order: Diversisporales</i>	-	-	-	-
<i>Acaulosporaceae</i>	-	-	-	√
<i>Diversisporaceae</i>	√	√	-	√
<i>Entrophosporaceae</i>	√	√	-	√
<i>Gigasporaceae</i>	-	√	√	-
<i>Pacisporaceae</i>	√	-	-	√
<i>Order: Glomerales</i>	-	-	-	-
<i>Glomeraceae</i>	-	√	√	-
<i>Order: Paraglomerales</i>	-	-	-	-
<i>Paraglomaceae</i>	-	-	√	√

3. Summary of achievements during the current reporting period

Specific Objectives	Key Activity	Results	Outcomes
Assessed effectiveness of control practices of soil-borne pathogens in nursery soils and citrus seedlings	Drafting a technical report on effectiveness of control practices of soil-borne pathogens in nursery soils and citrus seedlings	Finalized quantification of selected pathogen numbers in the lab	Improved management of soil-borne citrus in nurseries and green houses
Develop guidelines for management of nursery pests on Citrus	Identifying and classifying Citrus arachnids and arthropod pests and drafting a technical report	Finalized collection of data to inform the technical report. Final datasets of symptomatic samples cultured quantification of bacterial colonies completed. Analysis of data underway.	
Developed management options that maximize rhizobia abundance in legume trees	Testing nodulation of various legume shrubs under contrasting soil conditions	Finalized harvesting of the final batch of samples on biomass collected; Distractive sampling of plants for nodule measurements done all the samples. Data analysis underway	Increased used of microbial inoculation for fertilizer trees
Document ecological conditions that maximize arbuscularmycorrhizal fungi in fruit trees agroforestry systems	Characterization of population of mycorrhiza in various agroecosystems	Culturing and identification of dominant strains of abscular mycorrhiza done completed and data analysis underway.	

4. On-going activities

The final stage in this project is the analysis of data and development for communication materials (research articles, user guides and policy briefs). These will be completed over the next three months. Overall, at least two manuscripts are envisaged and their tentative titles are as follows;

- (i) Effect of selected management options on nodulation of legume shrubs in a greenhouse
- (ii) Reducing soil-borne pathogens of citrus through selected soil sterilization options under nursery conditions

5. Major challenges and new direction

- The laboratory environment where the culturing was done is heavily contaminated, making it very difficult to isolate pure cultures of the microbes. We recommended that efforts be made to make the laboratory environment more sterile by replacing the windows and installing air filtration systems.
- We expected to perform some samples for DNA sequencing but the purchase of DNA extraction kits and primers for 16S rRNA, as the suppliers could not deliver them in time.

6. Lesson learnt

There is significant potential of NaFORRI technicians to undertake microbiological procedures and produce high quality data from the existing laboratory infrastructure. There is need to continue implementing laboratory-based activities in order to maintain their capacity and interest in laboratory based experiments. Scientists need to collaborate with other NARO institutes where more equipment is available to exploit the capacity within NARO. For example, Whereas NaFORRI labs do not have a gel electrophoresis, the only missing along the molecule process chain except sequencing; these facilities are available in at NaCRRI and could be used shared.

7. References

Palenzuela J., Ferrol N., Boller T., Azcón-Aguilar C., Oehl F. 2008. *Otospora bareai*, a new fungal species in the Glomeromycetes from a dolomitic shrubland in the Natural Park of Sierra de Baza (Granada, Spain). Mycologia