Transnational Access Report

1. General Information

Project Acronym (ID):	RootScreen
Project Title	Characterization of pearl millet root architecture
Installation used	MicroCT (UNOTT)
Name of Group Leader	Yann GUEDON
Name of organization	Institut de Recherche pour le Développement (France)
E-mail address	yann.guedon@cirad.fr

2. Duration of access

April 21 2014	May 18 2014

3. Access to the Installation

MicroCT (University of Nottingham)

4. Project summary (max. 250 words)

Pearl Millet is one of the major cereal crops for food and forage production in arid and semi-arid areas such as sub-Saharan Africa. It can grow in marginal soils and under precipitation ranging from 200-800 mm/year where other crops such as maize or sorghum would fail. It therefore plays an important role for food security in large part of the World. Root system architecture in particular determines water and nutrient uptake, as roots respond to biotic and abiotic factors to optimize their growth. Very little is known about the genetic factors controlling pearl millet root architecture and its response to environmental factors.

The objective of the PEARL project was to use the **MicroCT** facility at the University of Nottingham to analyse the growth of the whole 3-D pearl millet root system in soil.

5. Main achievements (max. 250 words)

We were also able to generate time series of root development for a given plant. Interestingly, in some high-resolution scans we were even able to observe the presence of aerenchyma in some roots (Fig 1A, insert). We observed that as pearl millet has a rapid root growth, the limited pot volume was rapidly limiting root growth.

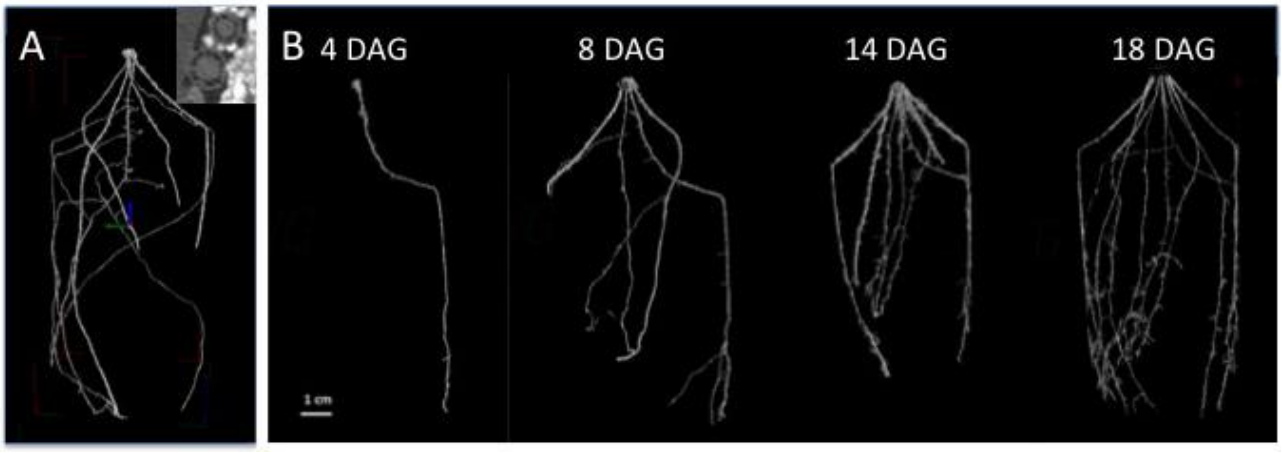

Figure 1: Images of pearl millet root systems obtained by μCT. (A) Root system from a well-watered plant 8 days after germination extracted using VGS studio. **Insert**: section through 2 roots showing the presence of an aerenchyma in the outer layers. **(B)** Time series for a well-watered plant.

Drought treatment reduced shoot biomass. We generated a simple Python script to calculate the volume of soil exploited for the 3D root architectures obtained. 8 days after germination the volume of soil exploited by the root system of plants under drought stress was inferior to the volume exploited for well-watered plants. However, at later time points, the volume of soil explored was similar for both treatments. This suggests that after an early inhibition of root growth by drought between day 4 and 8 DAG, root growth is stimulated at later stages to reach similar soil exploration 18 DAG. Indeed, comparison of root systems at different time points for well-watered and drought-stressed plants confirm that root growth is first inhibited between 4 and 8 DAG and then is stimulated in response to drought (Fig 2). Together with the reduced shoot biomass, this suggests a reallocation of resources for root growth in conditions of drought stress.

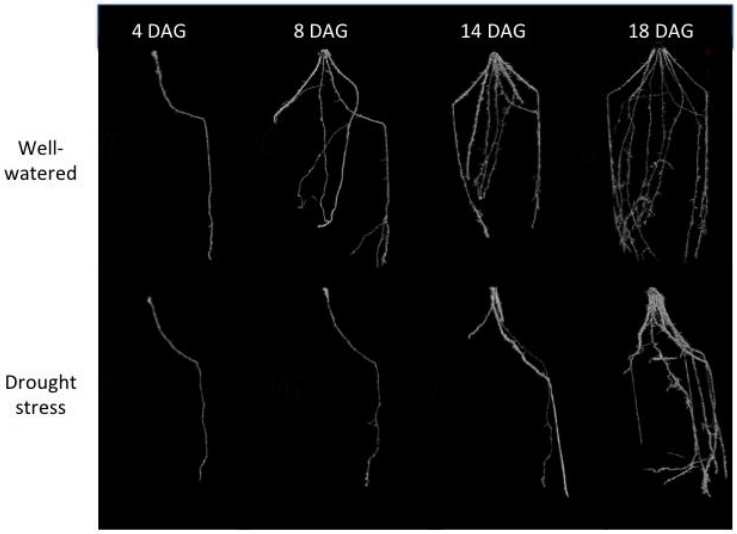

Figure 2: Comparison of root system growth in well-watered and drought stressed plants.