Transnational Access Report

1. General Information

Project Acronym (ID):	N-RSA
Project Title	Root system architecture of oilseed rape cultivars in response to nitrate
Installation used	MicroCT, greenhouse
Name of Group Leader	Christian Hermans
Name of organization	Université Libre de Bruxelles

2. Project summary (max. 250 words)

Background
Nitrogen fertilization is used for decades to increase crop yield but with harmful effects for the environment and human health (nitrate leaching in soil, greenhouse gas emission). Modifying root architecture to capture N sources more efficiently could represent a sustainable solution to maintain crop productivity whilst reducing fertilizer input. Our focus is on nitrate because it is the predominant N species in agricultural soils and it deeply impacts on root architecture. Local induction by nitrate patches stimulates lateral root elongation, whereas globally high external nitrate concentrations have a systemic inhibitory effect. Cultivated Brassica crops like oilseed rape, contribute to the world economy, health (polyunsaturated fatty acids) and environment (biofuel production). However, considerable improvment in N efficienies is still required to realize the full potential benefits of Brassica crops. Recent reports indicate that N-efficient cultivars of oilseed rape (Brassica napus) are characterized by a high rooting density during the vegetative growth stage. Therefore increasing the root foraging capacity could be a valuable strategy for maximizing N sources capture and seed set at low N input.
Objective
The objective is to capture the spatial heterogeneity of oilseed rape root system using µ-CT. The method will be used for characterizing some cultivars with contrasted lateral root branching, grown in soil pots with or without N fertilizers. Those cultivars were initially identified through in vitro screens on vertical agar plates.

3. Main achievements (max. 250 words)

We screened about 100 BnASSYST founder lines (donated by I. Bancroft, the University of York, UK), representing a structured sampling of the diversity across the gene pools of Brassica napus. Upon culture on vertical agar media, we observed that genetic variation existed for root morphological traits (primary root length, number of lateral roots, total lateral root length) in the crop response to nitrate supply. Note that the data set was used for GWA studies, in which significant association were found between SNPs and biomass production and root morphological traits.
Based on those root traits, we selected six contrasting lines: three with many lateral roots and three with fewer lateral roots. We grew those cultivars in soil pots. Seedlings were germinated individually in columns (55 mm diameter, 300 mm length) filled with unfertilised loess soil with or without nitrate salt addition in a greenhouse. We prepared a total of 6 (genotypes) x 2 (N conditions) x 5 (biological replicates) = 60 columns. A scan resolution of ~30 µm was used to maximise confidence in quantifying lateral roots, this was achieved by stitching together four separate scans (multiscan mode) to cover the whole length of the column. Due to poor/late germination of some accessions, some columns were excluded, and a total of 38 columns were scanned.