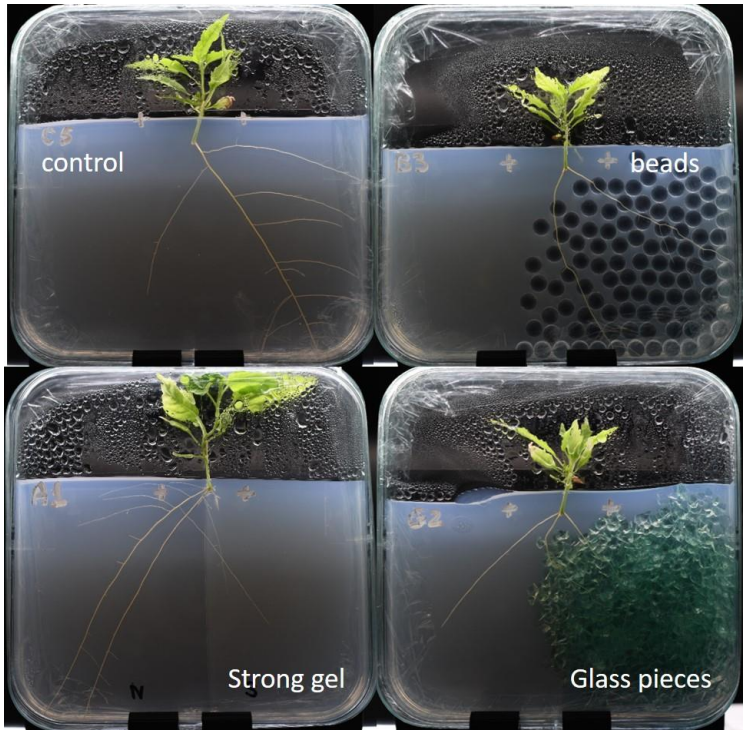
RSA Plasticity



Effect of localised water or mechanical constraints on root system architecture

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With the collaboration of:
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Action thématique concernée : *WP1*

Context —
Roots are the interface between soil resources and soil microbiome, and the shoot. A bad rooting reduces shoot growth, reduces resistance to stresses and can lead to significant economic loss. The root system architecture (RSA) responds to soil biotic and abiotic cues, such as the presence of fungi, water and mineral availability, pH or mechanical impedance. RSA can respond to local constraints but also to systemic signals. The way these environmental signals are translated into phenotypic changes of the RSA are overlooked, especially in trees.

Objectives —

- Determine if a local edaphic stress affects the development of the root system systemically
- Determine the stress induced development changes (root length, diameter, laterals, …)
- Determine if jasmonate-mediated signaling pathway is involved in the systemic signalling of the stress.

Approaches **—**
Poplar cuttings of the 717-1B4 genotype were grown *in vitro* in Petri dishes in order to be able to monitor the root development dynamics. The root system grows in a gel and can be followed by time-laps photography in the ROSI automate. This growing system allows us also to grow transformed lines affected in the perception of jasmonate (PtJAZ6 RNAi) and to test the involvement of this hormone in the response to local stress. We chose to work on mechanical stress first.

Key results **—**
- The root system phenotyping with the ROSI automate is now perfectly functional
- Several systems to apply a local stress were tested *in vitro* (insert of high-density gel, beads or glass pieces inclusion, insert of osmotic stress through PEG infusion) and optimized.
- The pipeline of root system developmental analysis with the SmartRoot software and a R script to analyse the SmartRoot outputs is well advanced.
- Despite all our efforts, up to now, the root systems of the *in vitro* plants (adventitious roots grown on the stem cutting) are so variable and poor that they compromise the tries repeatability and hinder robust conclusions. We recently identified a problem linked to the quality of mother plants that seem to get exhausted by growing too fast in our growth chamber.

Main conclusions including key points of discussion **—**
The adventitious root system of the *in vitro* grown poplars is very sensitive to environmental conditions but also depends on the mother plants quality and thus on the micro-cuttings quality.

Perspectives **—**
We currently continue to improve the analysis pipeline for an automatic extraction of quantitative parameters describing the RSA and its plasticity, taking into account spatial aspects (local changes of root traits) and temporal aspects (temporal changes of development). We are working on improving the mother plants quality to get better micro-cuttings quality and stronger root systems. In parallel, we are creating new experimental systems including local edaphic constraints to quantify the RSA plasticity of the root system issued from woody cuttings grown in soil and hydroponics. First tests are promising.

Valorization **—**
Internal Unit seminar by Lama Traboulsi (PhD student).

Leveraging effect of the project—
Discussions for technical and potential scientific collaborations with international scientists: Kerstin Nagel (Jülich), Guillaume Lobet (Louvain la Neuve), Tino Colombi (Upsala).