

ROOT ARCHITECTURE PHENOTYPES IN BREAD AND DURUM WHEAT

CLOTHILDE COLLET, THOMAS DAGBERT, XAVIER DRAYE.

EARTH AND LIFE INSTITUTE, UNIVERSITÉ CATHOLIQUE DE LOUVAIN, BELGIUM.

CONTACT: clothilde.collet@uclouvain.be

The SolACE project is seeking for improved management of **below-ground** processes in agriculture. Roots play significant roles in water and nitrogen **extraction** and in the **adaptation** to stresses coming with changing environments. In order to explore the possibilities of manipulating root architecture through breeding, we have phenotyped diversity panels of bread and durum wheat using a high-throughput **semi-controlled conditions aeroponic platform**. The resulting dataset will be a resource within SolACE to analyse and explore the diversity of architectural patterns, to dissect the genetic variation through association genetics and to develop predictive breeding approaches through modelling.

RootPhAir platform

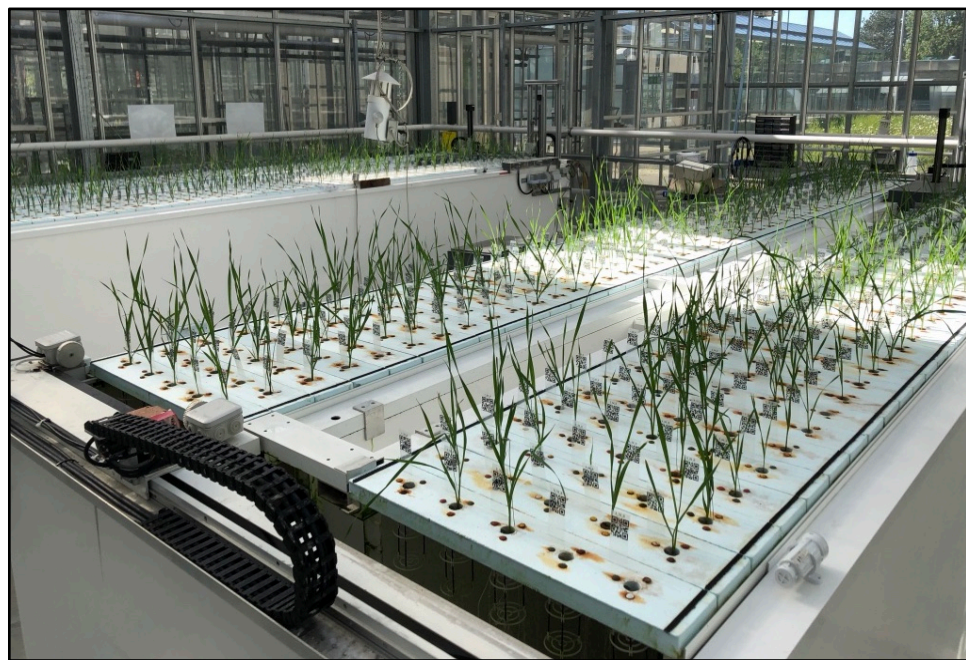
High throughput phenotyping of root system dynamics

- 990 plants (495 in two independent setups)
- 2D backlight scanning
- 2h temporal resolution, 700 DPI spatial resolution
- Aeroponics cultivation, contact-free

Material and design

Two diversity panels suitable for association genetics have been phenotyped

- 233 bread wheat genotypes
- 250 durum wheat genotypes
- Augmented RCBD to control environmental variability
- Two replicated experiments, four plants per genotype



RootPhAir Platform

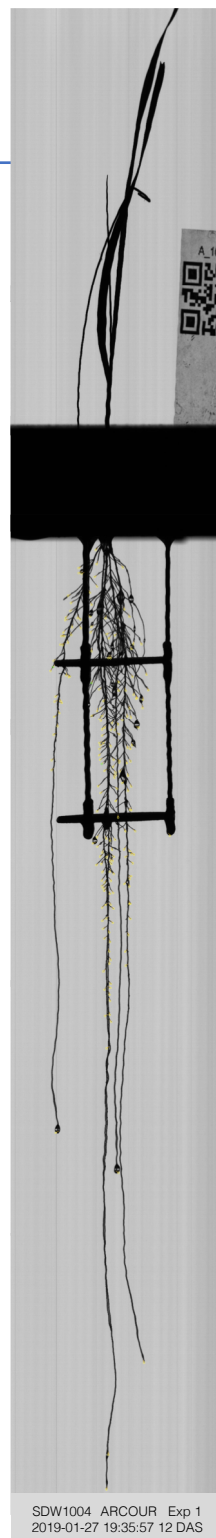


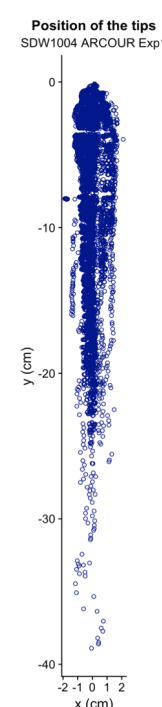
Image analysis

Root tips identification and tracking

- Automated in-house software (Aeroscan)

Dataset consolidation

- Identification of outlier tips, roots or plants
- Semi-automated with in-house software (Aeroviewer)



Phenotypic space dimensions

Dynamics of root growth and emergence

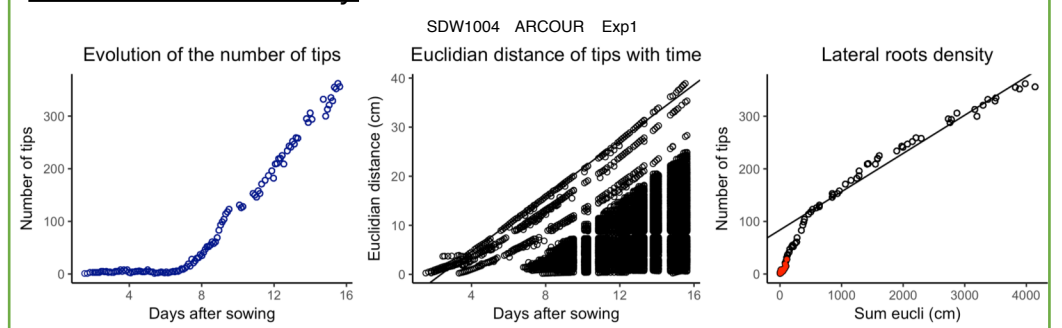
- Elongation rate of embryonic roots + classification
- Average lateral root density
- Sequence of embryonic and lateral root emergence
- Tropism behaviour

Root system shape

- Maximum length
- Convex hull area
- Root angle between first seminal
- More to come...

Preliminary results

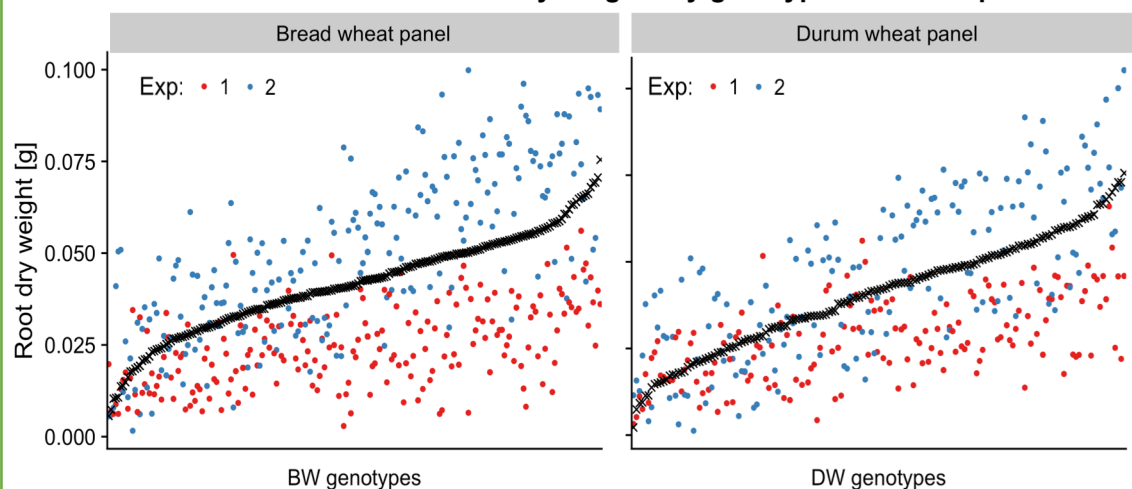
Lateral root density



Root system dry mass

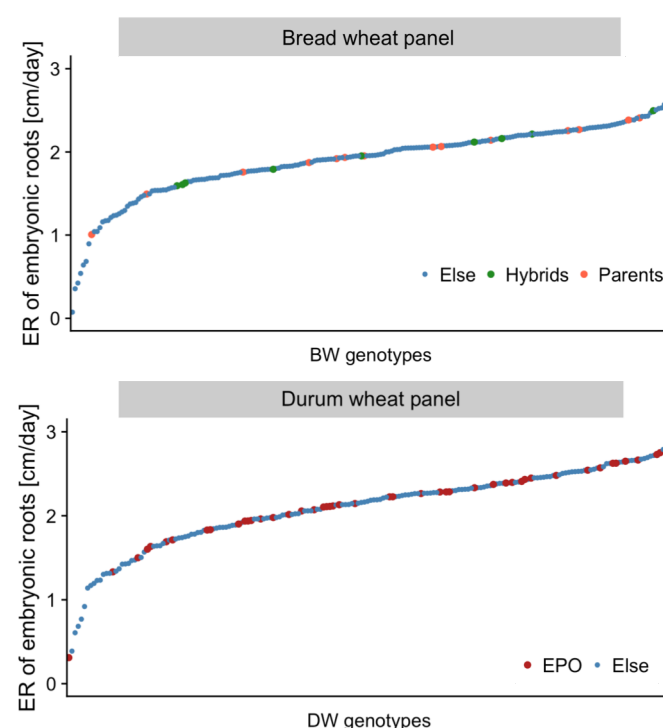
- Large variability in each panel
- Significant differences between experiments
- Similar genotypes ranking in both experiments

Same trend observed for root dry weights by genotype on both experiments



Elongation rate (ER)

- Higher diversity range of ER for DW panel



Convex Hull Area

