Co-cropping of wheat cultivars with contrasted root systems: plot scale study to understanding the mechanisms underlying its resilience against environmental stresses

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INTRODUCTION

Aim

Investigate how a combination of wheat (*Triticum aestivum*L.) phenotypes with contrasted root architectures ("deep" and "shallow" root systems) affects nutrient acquisition and microbe-root interactions in soil.

Hypothesis

The phenotype combination has beneficial effects on nitrogen acquisition and stimulates the microbe-root interactions within the whole soil profile through better distributed root carbon exudation.

GENOTYPES

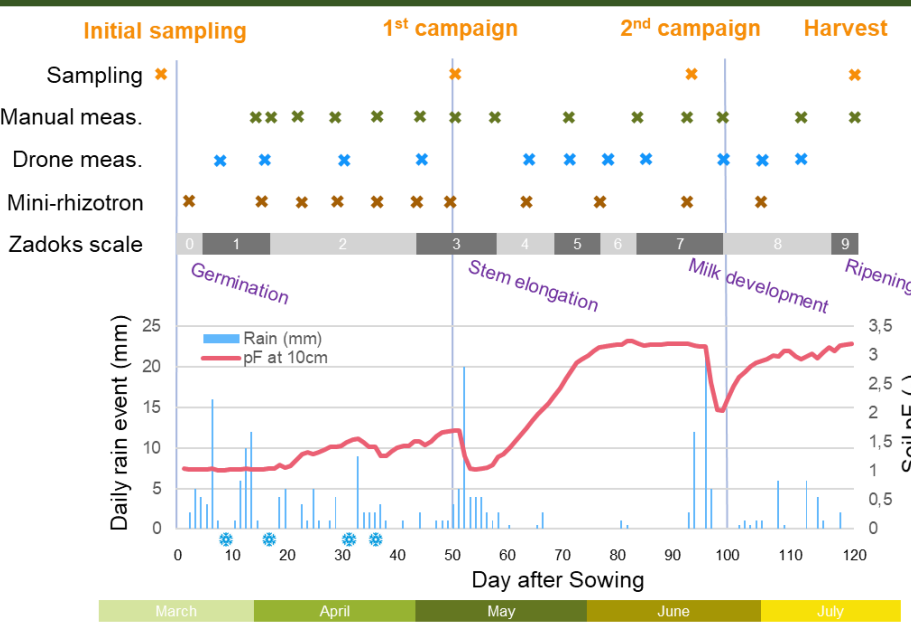
Experimental spring wheat genotypes with contrasting seminal root angles (RA°) (Rambla et al., 2022):

➢ Deep root system (**DRS**) genotype: RA°: 66°
➢ Shallow root system (**SRS**) genotype: RA°: 110°
➢ Co-cropping of **DRS** and **SRS** genotypes (**Mix**)

EXPERIMENTAL DESIGN

Methods:

- Soil and plant **water potential (**psychrometry*),* **RLD** evolution (Mini-rhizotron), **physiological measurements**: e.g., chlorophyll content, LAI (manually / drone)
- Labelling and sampling campaigns at key develop. stages:
  - ^{15}N / ^{13}C / ^{18}O / ^{2}H
  - Microbial analysis (biomass, bact./fungi abundance, zymography)

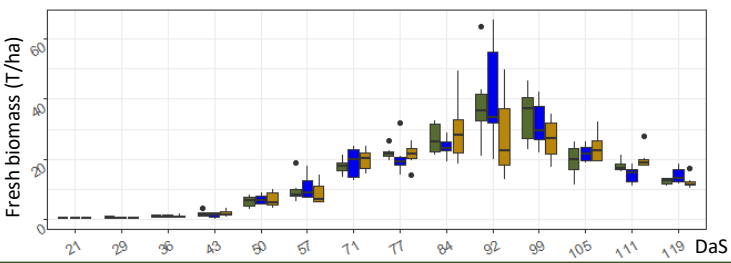


20/03/2023 - 18/07/2023
300 seeds/m2
Silty loam soil, Selhausen
180 kgN/ha, in 3 times
Ambient conditions
No irrigation

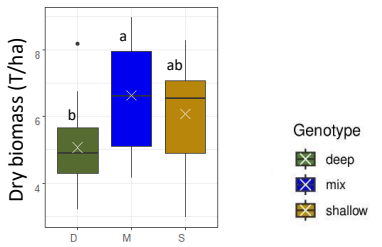
RESULTS

- The ear dry biomass is higher for the co-cropping **Mix** (respectively 8% and 24% more than the **SRS** and **DRS**), after a relatively average evolution of fresh matter between **SRS** and **DRS**.
- What can explain this difference in final yield, in terms of physiology, nutrient and water use and interactions with microbial communities?

Aboveground fresh biomass evolution



Ear dry biomass, harvest stage



OUTLOOK

Sampling campaigns (stem elongation and milk development)

▪ Will provide more detailed insights into the temporal effects of the root system on the microbial community, water and nutrient flow after a prolonged period of drought stress (12.6 mm rainfall within 7 weeks).

Drone measurements

▪ Will allow following the physiological evolutions (LAI, chlorophyll content, water stress...) of the modalities while integrating their spatial variability.

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References: Rambla, C., Van Der Meer, S., Voss-Fels, K.P., Makhoul, M., Obermeier, C., Snowdon, R., Ober, E.S., Watt, M., Alahmad, S., Hickey, L.T., 2022. A toolkit to rapidly modify root systems through single plant selection. Plant Methods (2022) 18:2, 1-13.