

# Plasticity of root hair development in a wheat ancestor and a landrace under nutrient deficiencies

I. Madani, T. Rongsawat, A.A. Very, H. Sentenac, J.B. Peltier

UMR B&PMP, CNRS-INRAE-Supagro-Univ Montpellier, 2 place Pierre Viala – 34060 Montpellier Cedex 2

[Ikram-madani@outlook.fr](mailto:Ikram-madani@outlook.fr)

## ABSTRACT

While root hairs strongly contribute to soil foraging for nutrient ion acquisition, no affordable high-throughput methodology for phenotyping the development of this cell type in intact whole root systems was available. We established such a methodology and used it to compare two wheat genotypes, an ancestor and a landrace, by analyzing the contribution of root hairs to the entire root system surface area, root hair length and density per root class (seminal and lateral roots) under conditions of either phosphate (Pi), nitrogen (N) or potassium (K) shortage. Nutrient shortage always resulted in an increase in root surface area that was mainly due to a large increase in root hair area. Root hair characteristics, such as density and length per root class, were dependent to the limiting nutrient. In both wheat genotypes, (i) Pi shortage had a large effect on root hair length in seminal roots while it poorly affected root hair density; (ii) N shortage had a significant effect on root hair length and density of lateral roots while it had no effect on root hair characteristics in seminal roots in both genotypes; (iii) K deficiency resulted in increased root hair density in seminal and lateral roots but poorly affected root hair length in the two wheat genotypes. Comparison of the responses of the two genotypes to each treatment indicated that the root system and root hair development was more plastic in the wheat ancestor than the landrace under all starvation conditions. Investigating the consequences of domestication/selection on the developmental plasticity of root and root hair traits in response to environmental constraints would provide valuable information for breeding new cultivars as well as for understanding the agro-ecological value of using varietal mixtures to decrease the level of competition between root systems of plants grown at high density.