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Advances in understanding the efficacy of root hairs in water uptake

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Although the impact of root hairs (RHs) in nutrients uptake is well documented, their role in water uptake and drought tolerance remains controversial. Maize wild type and its hair-defective mutant (*rth3*) were grown in two contrasting soil textures (sand and loam). We used a novel root pressure chamber to measure the relation between transpiration rate (E) and leaf xylem water potential (ψ_{leaf_x}) during soil drying. The hypotheses were: 1) RHs extend the root-soil contact and reduce the decline in ψ_{leaf_x} at high E in dry soils; 2) the impact of RHs is more pronounced in sand; and 3) mutants partly compensate for the lack of RHs by producing longer and/or thicker roots. The $\psi_{leaf\_x}(E)$ relation was linear in wet conditions and became nonlinear as the soils dried. The nonlinearity of the relation occurred more abruptly and at less negative matric potentials in sand (ca. -10 kPa) than in loam (ca. -100 kPa). At slightly more negative soil matric potentials, soil hydraulic conductance became smaller than root hydraulic conductance in both soils. Both genotypes exhibited ca. 1.7 times longer roots in loam, but 1.6 times thicker roots in sand. No differences were observed in the $\psi_{leaf\_x}(E)$ relation and active root length between the two genotypes. Root hairs had no contribution to soil-plant hydraulics in maize in both sand and loam. These results suggest that the role of root hairs cannot be easily generalized across species and the response of root hydraulics to soil drying is remarkably affected by soil textures.