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Does the lack of root hairs alter root system architecture of Zea mays?

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Root hairs are one root trait among many which enables plants to adapt to environmental conditions. How different traits are coordinated and whether some are mutually exclusive is currently poorly understood. Comparing a root hair defective mutant with its corresponding wild-type we explored if and how the mutant exhibited root growth adaption strategies and as to how far this depended on the substrate.

Zea mays root hair defective mutant (rth3) and the corresponding wild-type siblings were grown on two substrates with contrasting texture and hence nutrient mobility. Root system architecture was investigated over time using repeated X-ray computed tomography.

There was no plastic adaption of root system architecture to the lack of root hairs, which resulted in lower uptake in particular in the substrate with low P mobility. The function of the root hairs for anchoring did not result in different depth profiles of the root length density between genotypes. Both maize genotypes showed a marked response to substrate. This was well reflected in the spatiotemporal development of rhizosphere volume fraction but especially in the strong response of root diameter to substrate, irrespective of genotype.

The most salient root plasticity trait was root diameter in response to substrate, whereas coping mechanisms for missing root hairs were less evident. Further experiments are required to elucidate whether observed differences can be explained by mechanical properties beyond mechanical impedance, root or microbiome ethylene production or differences in diffusion processes within the root or the rhizosphere.