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Does root architecture influence the formation of rhizosheath?

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With the ever increasing global population, the agricultural sector is put under increasing pressure to intensify crop production, causing widespread soil degradation that ultimately decreases productivity. Enhancing the interaction between crops and the soil may improve resource acquisition. Fine roots are believed to be of most importance in acquiring water and nutrients, but their functional complexity is often veiled by an arbitrary diameter classification. The rhizosheath is the part of soil that is most strongly bound to the roots. While root hairs appear to be critical in promoting rhizosheath development, the role of fine roots has attracted little attention.
This study used two root hairless mutants, one of barley (brb) and one of maize (rth3) along with their respective wild types (WT), to assess the capacity of different root types to bind soil particles to the root system (assessed as rhizosheath weight). The three genotypes were grown in a sandy loam soil and periodically harvested during vegetative development. Rhizosheath weight was the dried weight of the soil adhering to the whole root system after being excavated from the soil. Axile and lateral roots were classified according to their distinctive diameters and linear regressions assessed which root types best explained the variance in rhizosheath weight.
When standardised by root length, the WT genotypes formed considerably more rhizosheath (4-fold in barley, 3-fold in maize) than the mutant genotypes lacking root hairs. However, pooling the data from all harvests demonstrates that the length of lateral and axile roots outweighed the influence of root hairs. For barley, lateral root length explained the most variance in the rhizosheath data whereas axile length was the best indicator for maize. It is not yet clear why root type has varying effects on rhizosheath formation in the two species. Although root hairs are important in rhizosheath formation, other root types also need to be considered.