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A new method to enhance rhizosheath formation

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The rhizosheath is defined as the soil that adheres to the roots by help of root hairs and mucilage. Rhizosheath maintain the contact between roots and soil improving water and nutrient uptake. Here we introduce: (1) a technique to quantify the formation of rhizosheath around the roots, and (2) a method to enhance the formation of rhizosheath around the roots. Additionally, we measured the relation between rhizosheath thickness and the carbon content and enzyme activities in the rhizosphere.

We grew lupine plants in aluminum containers (28×30×1 cm) filled with a sandy soil. When plants were two weeks-old and the soil had a water content of 30%, we stopped the irrigation and let the plants to uptake water to a soil water content of 4-5%. Thereafter, half of the plants (4 plants) were irrigated with water and the other half with water with an additive (international patent is pending). We repeated the drying and rewetting cycle three times. At the end of the third drying cycle, when plants were 40 days old and soil had a water content of 4-5%,the containers were opened and roots and their surrounding soils were gently collected. We used imaging to quantify the rhizosheath formation. The method consists of scanning the roots and the surrounding soil using the Winrhizo software. By image analysis we quantified the thickness of roots and their rhizosheath.

The plants irrigated with the additive had 63% thicker rhizopsheath than plants irrigated with water. So, the additive enhanced gelation of mucilage exuded by the roots. Carbon content and enzyme activity in the collected rhizosheath showed that the rhizosheath of plants irrigated with the additive had higher carbon content and enzyme activity than the rhizopsheath of plants irrigated with water. The new method to increase rhizosheath has the great advantage that can be easily applied to the irrigation water to improve plant uptake of water and nutrients in semiarid and arid areas.