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Soil water pressures in the vicinity of maize roots measured with polymer tensiometers

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In soil, the driving force for water flow and root water uptake is the gradient in total water potential (or pressure when expressed in energy per volume). Therefore, with measuring the soil water pressure in irrigated agriculture, the water application scheme can be optimized. Existing methods for measuring soil water pressure in the large range over which plants are able to take up water are complicated, inaccurate or not suitable for use in field situations. A newly developed polymer tensiometer (POT) makes it possible to measure soil water pressures, particularly in rather dry soils as also in wet soils. Direct observation of the pressure of soil water at different locations in the root-system will yield knowledge about the ability of a plant to take up water in situations with water and salinity stress.

The POT is filled with a polymer solution (rather than water), and is enclosed by a pressure transducer, that records the pressure of the solution, and a ceramic head. The ceramic consists of a solid (non-hollow) porous cone in contact with soil, with a pore size such that the ceramic remains water-saturated. The base of the cone incorporates a flat micro-porous filter in contact with the polymer solution. The filter acts as a semi-permeable membrane, being permeable to water, but not to the polymer molecules. When placed in soil, equilibrium is established between water in the soil and the polymer solution inside the tensiometer. A pressure transducer records the subsequent pressure of the osmotic polymer solution. With the POT it is possible to

measure soil water matric pressures over a range of 0 to -2.0 MPa, corresponding to matric heads (hm) of 0 down to -200 m.

To investigate plant strategies that cope with water stress, present research by the authors focuses on measuring soil water pressures in the vicinity of maize roots in three lysimeters. The lysimeters received different irrigation amounts: an optimal irrigation gift (-5 $<$ hm $<$ -2 m) and minimized irrigation to create moderate (minimum hm = -45 m) and severe (minimum hm = -80 m) water stress. Results of this experiment will be presented.

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