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Osmotic tensiometers: Performance under laboratory conditions

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Measuring water potentials is important for optimizing the water application scheme in irrigated agriculture. With a newly developed osmotic tensiometer (OT) it is possible to measure matric potentials over a range of 0 to -2.0 MPa; this corresponds to a matric head of 0 to -200 m. The osmotic tensiometer consists of a solid porous ceramic in contact with the soil, which encloses a chamber containing a polymer solution rather than water. The range over which the osmotic tensiometer can measure covers the range of soil water potential values over which plants are able to take up water (0 to -1.5 MPa). Direct observation of the potential of soil water at different locations in the root-system will yield knowledge about the ability of a plant to take up the water in situations with water and salinity stress.

The objective of our study was to investigate the performance of osmotic tensiometers in laboratory settings for both wet and dry soil.

Osmotic tensiometers, conventional tensiometers and TDRs were placed in the evaporation container that was filled with repacked sand (1% clay, 2% silt and 97% sand). Initially the soil was wetted uniformly, then left to dry out, and when soil matric potentials dropped below -2.0 MPa the soil was wetted uniformly again. Soil samples were taken to calibrate TDR measurements and relate TDR data to the pF-curve.

Results show the osmotic tensiometers are able to measure soil water potentials in

both wet and dry soils, have fast response times to changing water potentials, and need calibration for temperature variations.

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