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Advances in Determining Soil Matric Potential Using an Engineered Porous Ceramic and Dielectric Permittivity

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Soil water potential is a key parameter for determining water availability for plant growth, water flow, and soil stability. Although an in situ measurement of matric potential has been the focus of considerable research over the years, existing solutions still have many draw backs such as necessary routine maintenance, limited longevity, individual calibration requirements, high cost, and small measurement range. The objective of this research was to develop a sensor that could be used in the field to accurately measure soil water potential without the limitations noted above. The sensor, which consists of a dielectric sensor sandwiched between porous ceramic, was tested over a range soil types, electrical conductivties, and temperatures to calibrate and characterize its output. Data show consistent calibration curves between sensor output and actual soil water potential over a variety of soil textures and electrical conductivities. Although temperature showed an effect on sensor output, it was small compared to overall sensor output. Likewise, salt effects were not visible in saturated matrices up to 10 dS/m. Data suggest the sensor will be an effective and robust tool to determine in situ soil water potential.