

## **The Effect of Irrigation Water Electrical Conductivity and Sodium Adsorption Ratio, and Soil Texture on ThetaProbe Accuracy in Sistan Region**

### **Abstract**

Knowledge of soil moisture content (SMC) as an important soil physical property is of great importance in proper irrigation planning and better performance of irrigation systems. One of the direct methods for SMC measurement is the gravimetric method, which is a labor and time intensive job. Alternatively, the ThetaProbe device could provide a fast and indirect way for measuring volumetric SMC. In this method, SWC measurements are based on ThetaProbe response to changes in the soil dielectric constant. Technological advancements have helped scientists to detect a relationship between the humidity and dielectric constant of the materials. The special feature of water has caused its dielectric constant to be much higher than the other materials. It can be said that the dielectric constant of the soil mainly controlled by SWC. As SWC increases, soil dielectric constant increases and vice versa. In this study, in order to evaluate the effect of irrigation water electrical conductivity (EC) and sodium adsorption ratio (SAR), and soil texture on accuracy of SWC measurements by ThetaProbe, an experiment was conducted as a factorial design with three replications. The experiment was conducted with four levels of EC (0.5, 3, 6 and 9 dS/m) and SAR (2, 8, 14 and 20) of irrigation water and three different soil textures including silty loam, loam and sandy loam in greenhouse conditions and in the 144 pots. After irrigation, the amount of SMC in the range of FC to PWP was measured by gravimetric method and ThetaProbe device. The obtained results were plotted against each other for each treatment. The results showed that the ThetaProbe device may overestimate SMC for most cases. Based on the results obtained in this study, EC of irrigation water had a significant effect ( $p \leq 0.01$ ) on SWC readings in all three soil textures while irrigation water SAR had a significant effect ( $p \leq 0.01$ ) on SWC readings in just loam and sandy loam textures. The clay amount had also an effect on the accuracy of SWC measurements, such that the higher accuracy was achieved sequentially in sandy loam, silty loam and loam textures having a clay percent of 19.12, 19.32 and 23.08, respectively. A comparison of various device calibration methods revealed that special calibration functions have the highest accuracy for estimating the SWC while the functions provided by the device manufacturers may result in the lowest accuracy of SWC estimation. Roth et al. function performed better than the special calibration functions in silty loam texture, only.

**Key words:** Soil moisture, dielectric constant, soil texture, electrical conductivity, sodium adsorption ratio, ThetaProbe, calibration functions.



University of Zabol  
Graduate School  
Faculty of Water and Soil  
Department of Water engineering

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**Supervisors:**

Ph.D. P. Afrasiab

Ph.D. M. Delbari

**Advisor:**

S. Ghaedi

**By:**

H. Balabadi

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