

The studying effect of soil clay content and bulk density on moisture measuring accuracy by TDR

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ABSTRACT:

Time domain reflectometry has been used for measuring water content in soil that in this method water content is measured based on the relationship between water content and dielectric constant (K). The aim of this research is to compare of the TDR measurements and gravimetrically determined soil water content and determine the relationship between soil water content obtained from these two methods based on mathematical equations (linear, quadratic and cubic) for five soil texture (Clay, Sandy Clay Loam, Loam, Sandy Loam and Sandy) in 15 moisture ranges. Also the other objectives of this study were to investigate the influence of soil bulk density and clay content on TDR measurements. Soil samples were taken from five areas with different textures (sand, sandy loam, loam, sandy clay loam and clay). All physical properties of the soil, including clay, silt and sand contents were specified. The impact of soil bulk density and clay content on the accuracy of TDR is an undeniable fact. The high amounts of clay and low amounts of Soil bulk density caused an underestimation of water content. The multivariate linear regressions equation obtained from data is ($R^2 = 0.98$):

$$\theta = 0.121 + 0.160\varepsilon - 0.137 \frac{\rho_b}{\rho_s} - 0.001\% \text{clay} + 0.000029\% \text{silt}$$

where ' θ ', is the volumetric water content, ' ε ' is the soil dielectric constant, ' ρ_b ' is the soil bulk density (g cm^{-3}), ' ρ_s ' is the soil density (g cm^{-3}), '% clay' is the percentage of clay-sized particles, and '% silt' is the percentage of silt-sized particles ($P < 0.01$).

Keywords:

Bulk density, clay content, soil moisture, soil texture and TDR