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# Calibration and evaluation of a capacitance probe in agricultural soils in northeast Brazil

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Soil water content is an important parameter for irrigation management. Among the indirect methods to determine soil water content (SWC), there are electronic sensors, that need site-specific calibration to increase the accuracy of the measurements. In this research, a capacitance probe (Diviner 2000®, Sentek Pty Ltda., Australia) was calibrated for two agricultural soils. The experiment was carried out in a protected environment at the Federal Rural University of Pernambuco (UFRPE), Brazil. The textural classes of soils were sandy clay loam (66% sand) and sandy (95% sand). Undisturbed and disturbed soil samples were collected in the soil top layer (0-30 cm). The disturbed soil samples were initially air-dried, passed through a 4.75 mm mesh sieve, and then introduced to fill eight vessels (four replications for each soil). These vessels, equipped with drainage holes, have lower and upper diameters of 15 cm and 25 cm, respectively, and height of 22.5 cm (4.66 L). In each pot, a 5 cm layer of gravel with an average diameter of 2 cm covered with bidim® geotextile was disposed before introducing the soil. During filling, the soil was compacted to reach the same bulk density measured on the undisturbed samples (sandy clay loam: 1.54 g $cm^{-3}$ and sandy: 1.50 g $cm^{-3}$). In the center of each pot, a PVC access tube was installed. According to the manufacturer's recommendation, during calibration, the probe normalization was performed. The pots were wetted by capillary rise and, once saturated, they were placed on a bench for drainage. After this process stopped each pot was daily weighed at a fixed time (8 a.m.), and the sensor reading was acquired until when the daily mass variations became negligible. Data were used for regression analysis to fit the site-specific calibration equation and to evaluate the mean error. Linear calibration equations, characterized by $R^2$=0.931 and 0.986, were obtained for the sandy clay loam and the sandy soil, respectively. The mean errors (ME) associated with the manufacturer's equation resulted in -0.05 and -0.01 for sandy clay loam and for sandy soil and decreased after calibration. The results confirmed the suitability of the manufacturer's equation in sandy soils. On the other hand, the manufacture's equation slightly underestimated SWC, in sandy clay loam soil, especially in the range above 0.26 $m^3$ $m^{-3}$. The Diviner 2000 probe can be therefore successfully used to support irrigation management in irrigated areas with soils similar to those investigated because it is easy to operate and allows fairly accurate estimations of soil water content.