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Response of Decagon 10HS soil water content sensor to different porous media

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Optimizing irrigation management requires increasing the accuracy of moisture monitoring in soils or substrates, especially when it depends on electronic sensor readings. Substrates are widely used in horticulture, for growing urban ornamental plants, as well as on green roofs. Due to the lack of information about the accuracy of soil water content sensors on substrates, this research was carried out to evaluate the accuracy of the 10HS sensor (Decagon Devices Inc., Pullman, WA) to estimate soil water content (SWC) in organic substrates and mineral soil. The study was carried out at the Hydrology Laboratory of the University of Palermo. The sensors were inserted into substrates or soil in conical vessels (4 dm^3 volume), drilled at the base to measure the drained volume and covered with a transparent film to limit surface evaporation. For both the substrates (A and B) and the mineral soil (C), a known amount was placed in the vessel and compacted to a value of bulk density equal to 0.177 g cm^{-3}, 0.471 g cm^{-3}, 1.480 g cm^{-3}, respectively. The sensors were connected to a CR1000 datalogger (Campbell Scientific Inc., Logan, UT), which allowed the data acquisition and storage. The tests were conducted by wetting the samples with the progressive addition of known volumes of water (about 40 cm^3) that were evenly distributed over the sample surface. After the end of the redistribution process of water applied to the container, the sensor readings were acquired. SWC monitoring was performed until reaching the value corresponding to the field capacity. The calibration equation recommended by the sensor manufacturer systematically underestimated the values of SWC of about 5% or more when the substrate A and B were used. On the other hand, when evaluating the sensor performance in the mineral soil (C), it was observed that the errors associated with the manufacturer's equation resulted in ±5%. Therefore, for both substrates specific calibration is necessary to improve the sensor's accuracy, even accounting for the bulk density; on the other hand, for the mineral soil, the manufacturer's equation can be considered suitable.