Understanding Spatio-Temporal Variability of Soil Moisture Measurement with Aquaflex and Time Domain Reflectometry

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For management of agricultural water, accurate soil moisture (SM) determination is an essential component. Two objectives of this study were: (1) to understand spatio-temporal variability of SM measurements using multiple length TDR probes and aquaflex; and (2) to couple TDR and aquaflex SM readings for improving water balance studies in non-weighing lysimeters. TDR probes with 200-, 500- and 900-mm lengths were installed vertically adjacent to the aquaflex and lysimeters for monitoring SM contents without disturbing natural water fluxes in the lysimeters.

Both TDR and aquaflex responded to wetting and drying events, with varying SM measurements both vertically and horizontally, due to variations in soil types at different locations. The amplitudes of the daily fluctuations in SM measurements were noticeably higher for 200- and 500-mm TDR and aquaflex. However, 900-mm TDR showed only minor fluctuations in SM values indicating pasture water uptake dominates in the top 500-mm soil profile. These results indicate the importance of multiple length TDR to assess root water uptake for improving irrigation management.

Twenty lysimeters and an aquaflex installed 125-m away from the lysimeters were utilized to derive a relationship between crop coefficient of pasture (Kc) and plant height (h in cm). When the same aquaflex soil moisture values were used in the water budget equations for data from 20 lysimeters, the coefficient of determination (R2) for the Kc – h relationship was 0.43, which increased to 0.66 when aquaflex SM values were adjusted for each lysimeter using corresponding TDR readings. For rotational grazing systems, Kc derived from the improved Kc – h relationship would save on average 10% irrigation compared to when Kc derived from the original Kc – h relationship. This implies improved monitoring of SM at different locations in the farm, is essential to improving water budget studies aimed at quantifying actual irrigation requirements.