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Below-canopy versus inter-row soil water content dynamics across a rainfed olive orchard in SW Spain

Antonio Jesús Espejo-Pérez (1), Karl Vanderlinden (2), Juan Vicente Giráldez (1,3), Aura Pedrera (2), and Encarnación Victoria Taguas (4)

(1) Dpto. of Agronomy, Hydraulic Engineering Area. University of Cordoba. Aptdo. 3048, Córdoba, Spain. E-mail: g82espea@uco.es; phone (+34) 957212241; fax (+34) 957218569., (2) IFAPA, Centro Las Torres-Tomejil, Ctra. Sevilla-Cazalla, km 12.2, Alcalá del Río (Sevilla), Spain, (3) Institute of Sustainable Agriculture. CSIC, Government of Spain. Alameda del Obispo s/n, CP 14004 Cordoba, Spain, (4) Dpto. of Rural Engineering. University of Cordoba, Apdo 3048, 14080, Cordoba, Spain

Soil water content (SWC) variations control the dynamics of most physical, chemical and biological processes across the vadose zone under water-limited climate conditions. In order to improve our understanding and capability to model these processes a full knowledge of the SWC dynamics is required. This is especially the case for olive orchards in southern Spain, subject to a Mediterranean climate, where the implementation of soil, water, carbon and biodiversity conservation strategies is of considerable interest.

Preliminary results are shown based on data from a low-cost SWC sensor network installed across a 6.3-ha mountain olive orchard, with special emphasis on below-canopy and inter-row areas. Eleven locations were chosen where 109 SWC sensors (10HS and 5TE, Decagon Devices, Pullman, WA) were installed, evenly distributed between the below-canopy and inter-row areas, at depths of 0.05, 0.15, 0.25, 0.35, and 0.45 m, depending on soil depth. The measurement frequency was 5 minutes.

Generally, lower SWC were observed below-canopy as compared to the inter-row areas. Also the drying rate was higher in the below canopy areas. These differences can be related to canopy drippings and variation in bulk density, water retention and root extraction between the two zones. During intense rainfall events, especially those occurring after the dry season, SWC increments below-canopy lagged behind those observed within the inter-row areas. These time lags increased with depth and reached up to several days. These preliminary results show great potential for monitoring SWC and assessing its spatial variability across scales in olive orchards. Differences in measured SWC dynamics across the orchard can be linked directly and explain generally observed contrasting soil process behaviour in the different orchard areas, which are of importance for assessing accurately the performance of soil and water conservation strategies at the field or micro-catchment scale.

Keywords: soil water content, dielectric sensor, olive tree