



Exploring the importance of hydrophobicity in the hydrologic cycle of olive groves in Spain

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Numerous studies of Soil Water Repellency (SWR) have been reported for various forest environments, particularly after wildfires, but the understanding of SWR in agricultural lands is still rather limited. As such, in this investigation, three study areas were selected in Cordoba (Southern Spain), with conventional tillage and permanent cover crop and bare soil with herbicide and mowing, and one 40- year old abandoned olive orchard was selected in Valencia (Eastern Spain). The study covered three different soil types: Vertic, Fluvic and Calcareous. The initial hypothesis, after discussion with experts on olive cultivation was that hydrophobicity did exist in olive crops due to the lixiviation of organic compounds from the olive canopy residues, but it might not be a significant issue for the global hydrological cycle.

Samples of topsoil humidity were collected during summer and winter, and soil hydrophobicity was measured following the Water Drop Penetration Time (WDPT) method. This was done within a 1 m transect, taking the olive trunk as its centre. Two distinct zones were considered for the measurements: beneath the tree canopy as well as the open rows between tree canopies. In the three study area located in Cordoba measurements following this procedure were performed in two trees per orchard, and in five trees in study area in Valencia. The results were tested for normality using the Kolmogorov-Smirnov test. Statistical significance of the differences in average WDPT between under canopy and out of the canopy projection areas were evaluated using the Mann Whitney tests.

In the study areas located in Cordoba, measurements during early September indicated no hydrophobicity in the orchards not managed with a permanent cover crop, below or outside the olive canopy. That lack of hydrophobicity persisted in winter after the harvest. However in the orchard managed with a permanent cover crop hydrophobicity was found in summer and winter under the canopy projection and outside the canopy projection only in the summer measurements. For this orchard maximum hydrophobicity (WDPT around 27 minutes) was found under canopy in both study period hydrophobicity. Measurements in the abandoned orchard in Valencia winter time showed hydrophobicity only under the olive canopy in the majority of the olive trees (but not in all) and less intense (WDPT approximately 5 minutes) than the one measured in the hydrophobic orchard in Cordoba.

The results of this survey indicated that moderate hydrophobicity appears in some orchards and is related to un-disturbance of the soil surface and organic matter inputs controlled by the overall orchard management, preferably below the olive canopy.

Future research needs to be done to complete the measurements under different soil organic content, as well as analysing soil texture and pH in order to more comprehensively understand the importance of hydrophobicity on soil hydrology. With this done, we will be able to conclude how important is water repellency for the runoff generation.