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# Water resources under threat in citrus farms in Spain

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Most of the soil definitions mention the soil as the "the top layer of the earth's surface, consisting of rock and mineral particles mixed with organic matter". Few definitions make references to the soil services and the soil processes. However, soils allow the plant to grow via the nutrient transfer, they hold water, and they are the substrate for the roots. Within the main services of the soil system, they control the hydrological cycle. When the soil is human managed changes in soil structure, soil biology and soil composition take place. And those changes result in a reduction of the ability of the soil to hold water. A research has been conducted in intense chemically farmed citrus production in Eastern Spain to measure the impact of farming on soil water properties. Three study areas where selected where farming with citrus are 1, 5, 10, 20 and 40 years old, with no ploughing and herbicide application. No weeds or catch crops were allowed to grow and the pruned branches were removed from the field and burned. Infiltration envelopes were measured by means of Ring Infiltrometers (20 cm width, n= 10 per zone) and by means of simulated rainfall experiments at 55 mm h-1 during 1 hour in a 0,25 m2 plot with 5 measurements per study zone (Cerdà, 1996). All the experiments were carried out under dry conditions in summer (August) and winter (December-January). Soil Moisture was measured at 0-2, 5-7, 10-12, 20-22 and 30-35 cm depth in winter and summer from 2009 to 2011 in the non irrigated patch (drip irrigation is applied in the studied sites) as this is not affected by the irrigation and the fertilization.

The results show that the steady-state infiltration rates measured with ring infiltrometers were 345 mm h-1, 299 mm h-1, 233 mm h-1, 156 mm h-1 and 98 mm h-1 respectively for the 40, 20,10, 5 and 1 year for summer dry conditions. The measurements show a lower infiltration rate in winter: 146 mm h-1, 95 mm h-1, 63 mm h-1, 46 mm h-1 and 25 mm h-1 for the 40, 20,10, 5 and 1 year for wet conditions. Similar results were found under simulated rainfall experiments, although the steady-state infiltration rates were 7 times lower in average.

The soil moisture content show values extremely low in summer at surface (2.32 %) meanwhile the values in winter were of 15.43 %. The values of increased with depth and decreased the variability. The mean soil moisture for the whole period of research and the five depth studied was 10.31, 10.78, 11.54, 12.54 and 13,23 % for the 40, 20,10, 5 and 1 year old studied sites.

The results demonstrated that the agriculture soils used for intense citrus production are affected by a reduction in the soil water availability and the infiltration rates. This is contributing also to an extremely high erosion rates (Cerdà et al., 2009) which is another impact of the chemically managed citrus plantation and their impact in soil degradation and the lost of soil services. The soil moisture regime of the five research sites is similar as it is affected by the summer drought (Cerdà, 1995), however, the water available for the plants is being reduced by the soil degradation. Future research should investigate the economic implications of the lost of water and soil as a consequence of chemical farming and how the lost of services affect the income of the farmers.

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