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Assessing Biowaste-based Amendments for Enhancing Soil Hydraulic Properties in Arid Mediterranean Soils

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Soil organic matter (SOM) plays a significant role in modulating soil water and therefore irrigation scheduling. This relationship is especially vital in arid regions like the Mediterranean, where both SOM and water resources are scarce and increasingly threatened by the climate crisis. Soil amendments based on agricultural biowaste (e.g., compost) or byproducts of pre-existing processes (e.g., biochar) offer a cost-effective solution to boost SOM levels. However, because of this less strictly managed production process, the variability in their properties and their long-term effects on soil hydraulic behaviour, particularly after weathering, remain poorly understood. Here we compare the effect of 3 soil amendment treatments to the hydraulic properties of clay loam soil: olive tree pruning compost at 1% (C1B0), biowaste-based biochar from at 1% (C0B1), and compost-biochar mix at 1% (C1B1) against a control treatment (C0B0). Amendments were incorporated in the soil at the prescribed rates to a depth of 15 cm. To quantify the impact of the amendments in hydraulic properties of soil such as clay loam we use a modification of the hydraulic property (HYPROP2, Meter, USA) analyser (Daliakopoulos et al., 2021) after application, and 6 months after application. The assessed van Genuchten parameters are used to estimate the movement of water soil in the soil profile with HYDRUS-1D (Kool & Van Genuchten, 1991) using two distinct profiles. Simulations were validated through irrigation experiments using in-situ soil moisture measurements at 2 depths (10 and 30 cm). As shown by changes Van Genuchten parameters, results show that, compared to compost applications, biochar had a more pronounced and lasting positive effect regarding soil porosity and structure, also decreasing hydraulic conductivity and increasing field capacity. These results highlight the potential of biochar and it's mixes to improve soil water status and contribute to the reversal of desertification processes in arid Mediterranean soils.

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