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Comparison of natural (olive mill wastewater) and synthetic surfactant for soil water repellency mitigation in the Mediterranean region

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This study explores, for the first time, the potential effectiveness of olive mill wastewater (OMW) as an alternative to industrial surfactants in decreasing soil water repellency. The OMW was characterized by high concentrations of short-chain fatty acids, mainly butyric, propionic and acetic, which contributed approximately to 1/3 of the organic load. It was applied diluted (1:1 with freshwater) in an agricultural field in NE Greece affected by water repellency, at a rate of $\sim$ 4.3 L/m^2. For comparison, a commercial soil surfactant was used according to the instructions of the manufacturer (0.8 mL/m^2). The use of commercial surfactant was very efficient in decreasing water repellency immediately after application. The number of wettable samples (WDPT $<$ 5 s) increased to $\sim$ 50% (compared to 13% for the control soil) seven (7) days after treatment application. Diluted olive mill wastewater (50%) did not show any improvement in soil wettability immediately after application, but gradually was comparable effective to the surfactant treatment. The number of wettable samples showed a continuous increase from 13 to 25 and 54% after 7, 22 and 37 days from OMW application. In conclusion, OMW was found to be effective in decreasing soil water repellency. This suggests the potential of OMW as a natural surfactant. Its longer-term effects, however, have yet to be established. It is demonstrated that the short-chain fatty acids present in OMW play a critical role towards its surface-active properties.

Keywords: Olive mill wastewater; short-chain fatty acids; biosurfactant; natural surfactant; water repellency mitigation.