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Effect of Olive mill wastewater spreading on soil wettability and acidity under different season in a semi humid area: A field study in Bait Reema - West Bank - Palestine

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Olive mill wastewater (OMW) is generated seasonally in large amounts during the olive oil production in Palestine, and it is often disposal of in uncontrolled manner into the open environment. OMW has a high amount of phototoxic compounds, high salinity and acidity and therefore is challenging when disposed on soil. The objective of this study was to study the persistence and degree of water repellency during different season of OMW application in soil samples (0–5 cm deep), and to elucidate how extent this phenomenon is associated with soil acidity, to analyze the relationships between soil water repellency and environmental factors including, temperature and moisture and to describe the seasonal variation in the phenol concentration of the soil.
In order to understand how climatic conditions at the time of OMW disposal affect the development of soil water repelleny in field, soil acidity and phenol content in soil, we conducted a field study in Bait Reema village in the West Bank – Palestine. The study site is characterized by 1.5 m thick brown rendzina and has an annual average rainfall of 550 mm. On an extensively used olive orchard field, we implemented 16 plots (2.5 x 3.5 m). OMW application (14 L / m2) was conducted either in winter, spring or summer on two replicate plots distributed randomly among the 16 plots. To test the effect of soil moisture on the persistence of OMW effects, we implemented an OMW application in summer on two additional plots, but kept those plots moist before and after OMW application until start of the rain season. For each of the treatment variants, we implemented two control plots which were treated in the same way as their counterparts, but with tap water. Soil samples (0-5 cm) were collected after 2 days, 3 weeks, 6 weeks, 3 months, 6 months , 9 months, 12 months , and 18 months. pH was determined and analyzed in aqueous soil extracts (1:5), the total phenol content was determined by using Folin–Ciocalteu's reagent, soil water repellency was measured in the field by using the water drop penetration time (WDPT) for control and treated plots.
Persistence and intensity of water repellency varied between different times of OMW application. While all control plots remained wettable during the whole year, OMW induced water repellency in all treatments. A high initial WDPT on the (wet) field following OMW winter application rather indicates limitation in hydraulic conductivity than water repellency, but repellency developed gradually during the hot summer time following OMW application (spring and summer plots) and the extent of hydrophobization was strongest in the dry summer application plots, intermediate in the spring application plots and weakest in the moist summer application. Water repellency in all treatements disappeared during the first rain season following OMW.
pH was s reduced by OMW application and resulted in significant soil acidification. Soil pH was initially reduced by up to 0.5 pH units. In addition, we found the high initial phenol concentration on the (wet) field following OMW winter application indicates limitation in infiltration rate, while it was higher in summer OMW application when compared to spring OMW application.

Keywords: Olive mill wastewater, Tap water, Water drop penetration time, Acidity, Total phenol.