



Induced uneven spatial distribution of agrochemicals due to preferential flow in water repellent soils and its remediation by surfactant

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Soil water repellency is a common feature of dry soils under permanent vegetation and drought conditions. Soil-water hydrology is markedly affected by soil-water repellency as it hinders infiltration, leading to enhanced surface runoff and soil erosion. Although this phenomenon was primarily ascribed to sandy soils, it has been observed in loam, clay, and peat soils in dry and humid regions. One detrimental effect of soil water repellency on plants is the reduction of soil water availability that stems from the non-uniform water retention and flow in preferential pathways (gravity-induced fingers) with relatively dry soil volume among these paths. It was recently discovered that prolonged irrigation with treated wastewater, a widely used alternative in Israel and other Mediterranean countries due to the limited freshwater, triggers soil water repellency which invariably resulted in preferential flow development in the field. Due to climate change events, the use of treated wastewater for irrigation as a means of freshwater conservation is expected to widen, including in countries that are not considered dry.

While a vast amount of research has been devoted to characterizing the preferential flow in water repellent soils, the effect of this flow regime on the spatial distribution of salt and fertilizers in the root zone was barely investigated. Results from a commercial citrus orchard irrigated with treated wastewater that includes the spatial and temporal distribution of preferential flow in the soil profile measured by ERT will be demonstrated. The associated spatial distribution of salinity, nitrate, phosphate, and SAR in the soil profile will be shown as well. We investigated the efficacy of two nonionic surfactants application to remediate hydrophobic sandy soils both in the laboratory and field. The effect of the surfactant application to the water repellent soils in the orchards on the spatial distribution of soil moisture and the associated agrochemicals will be presented and discussed.