



Effects of long-term irrigation with treated wastewater on the hydraulic properties, and the water and air regime in the root zone of a clayey soil.

Shmuel Assouline

A.R.O - Volcani Center, Institute of Soil, Water and Environmental Sciences, Bet Dagan, Israel (vwshmuel@agri.gov.il)

With increasing water scarcity, treated wastewater (TW) appears as an attractive alternative source of water for irrigation, especially in arid and semi-arid regions where freshwater is naturally scarce. However, it seems that long-term use of TW for irrigation of orchards planted on heavy soils cause to yield reduction and crop damages. In terms of water quality, TW are characterized by higher concentrations of sodium and dissolved organic content (DOC) that affect soil exchangeable sodium percentage (ESP) on one hand and soil wettability, on the other hand. The working hypothesis of this study is that long-term use of TW for irrigation of clayey soils causes significant changes in the soil hydraulic properties. Such changes might affect the water and air regime in the root zone, and the hydrological balance components at the field scale.

High-resolution field sampling determined the spatial distribution of chloride, ESP and DOC below the dripper, revealing higher salinity and sodicity, lower hydraulic conductivity, and possible preferential flow pattern linked to wettability in WW-irrigated soils. Laboratory experiments involving infiltration, evaporation, and swelling pressure measurements provide quantitative estimates of the impact of TW for irrigation on the soil hydraulic properties.

The upper soil layer of TW-irrigated plots is more affected by the impact of DOC on soil wettability, while the lower layers are more affected by the impact of the increased ESP on soil hydraulic conductivity.

Continuous monitoring of oxygen concentration at 10, 20 and 30 cm depths in the root zone near the trees and at mid-distance between trees revealed that the air regime in the root zone is significantly affected by the TW use as a consequence for the effect on the water regime.