Geophysical Research Abstracts, Vol. 9, 08602, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08602

Effluent irrigation effects on seal formation and soil loss under simulated and natural rainfall

M. Lado (1) and M. Ben-Hur (2)

(1) Area of Soil Science, Faculty of Sciences, University of A Coruna, Spain (mlado@udc.es), (2) Institute of Soil, Water and Environmental Sciences, the Volcani Centre, ARO, Israel (meni@volcani.agri.gov.il)

Shortage of fresh water resources is one of the main problems in many areas of the World, and it is expected to be worsened due to climate change and increasing pressure on water resources. Therefore, it is necessary to find alternative sources of water, especially for irrigation in agriculture, which is one of the activities with the highest water consumption. One of the alternatives that are becoming more popular in the last years is the use of treated sewage (effluent) for irrigation.

This study focuses on the effects of long-term effluent irrigation on soil chemical properties, seal formation, and soil loss under both simulated and natural rainfall. For the rainfall simulation study, two Israeli soils were used: a sandy soil and a clay soil, with smectite as the dominant clay. Soil samples were collected after the irrigation season from plots which were irrigated either with fresh-water or effluent for more than 10 years. The runoff and soil loss were determined by means of a rotary disc rainfall simulator. Simulated rainfall was applied to (i) air-dried or (ii) prewetted soils. The samples were exposed to a simulated rainstorm of 85 mm of deionized water with an intensity of 42 mm h^{-1}. Samples of the leachate were collected at various times during the rainstorm, and sodium adsorption ratio, dissolved organic matter and clay content were measured. The response of the two soils to the previous effluent irrigation was different. In the sandy loam, the previous effluent irrigation had a significant effect on the seal formation when the soil was exposed to rainfall: the decrease of infiltration rate (IR) due to seal formation took place earlier, the final IR was lower and the soil loss higher than in the fresh-water irrigated soil. Conversely, no differences were found between the infiltration curves, the final IR and the soil loss of both effluent and fresh-water irrigated samples of clay soil. The different behaviour of the infiltration

rate and soil loss in sandy and clay soils are related to the effect of effluent irrigation in clay dispersion. The previous irrigation with effluent in the sandy loam increased clay dispersion, while in the clay soil its effect in clay dispersivity was negligible. In the clay soil, the dissolution of $CaCO_3$ released Ca which could replace the excess of exchangeable Na induced by effluent irrigation, reducing the soil ESP to its natural level and, consequently, clay dispersion to a level similar to that in the FW-irrigated soil. Field studies using runoff plots under natural rainfall, conducted in similar soils, showed results analogous to those of the rainfall simulations, which revealed an aggravation of seal formation in non-calcareous soils due to small increases of ESP caused by effluent irrigation.