Impact of a gel conditioner and water quality upon soil infiltration

M. A. Mustafa, A. M. Al-Darby, A. M. Al-Omran, and M. Mursi

Department of Soil Science, King Saud University, P.O. Box 2460, Riyadh-11451, Saudi Arabia

Received March 28, 1988

Summary. The interactive effects of 0.0%, 0.4%, and 0.8% of a gel conditioner, Jalma, and four waters: salt solution (SS), distilled (DW), natural sewage (SW), and well (WW) waters on swelling (S), effective mean pore radius ($\bar{r}$), water penetrability (λ), diffusivity (D), and weighted-mean diffusivity ($\bar{D}$) in loamy sand and loam soil columns were investigated. The diffusivities of water in untreated soil columns were nearly independent of water quality. In general for both soils, S decreased, and $\bar{r}$, λ, and $\bar{D}$ increased with increase in water salinity and decrease in % Jalma. For the loamy sand λ of SS, WW, SW, and DW were reduced, respectively by 15%, 39%, 45%, and 55% due to the addition of 0.4% Jalma and by 15%, 52%, 69%, and 83% due to addition of 0.8% Jalma compared to untreated control. It was concluded that 0.4% Jalma is the optimum rate when sewage (EC = 1.6 dSm^{-1}) or other waters of low salinity are used for irrigation and 0.8% Jalma when well water (EC = 6.4 dSm^{-1}) is used. When the irrigation water is of high salinity (EC = 42.5 dSm^{-1}), use of this gel conditioner is not recommended. Effective mean pore radius proved to be a reliable predictor of the multiple effects of texture, % Jalma and water salinity on λ and $\bar{D}$.

Sandy soils are characterized by their low water-holding capacity and excessive deep percolation. Gel-forming conditioners may alleviate these physical constraints and eventually improve the efficiency of water and fertilizer use in these soils. The effect of one such conditioner – Jalma on the moisture retention curve of a loamy sand soil was reported elsewhere (Al-Omran et al. 1988). The present study is relevent to the second constraint.

A hydrolyzed starch polyacrylonitrile graft polymer was observed to increase surface soil swelling, decrease infiltration rates (Miller 1979), and sorptivities of some sandy soils (Hemyari and Nofziger 1981). Jalma, a super gel containing 24.5% humic acids and 3.8% polysaccharides, increased soil swelling, reduced the effective mean pore radius, and consequently reduced water penetrability and weighted-mean diffusivity of some sandy soils (Mustafa et al. 1988). In these studies the interactive effects of gel conditioners and water quality on the measured variables were not investigated. Johnson (1984) found that the maximum water-holding capacity (WHC) of some