Impact of Natural Clay Deposits on Water Movement in Calcareous Sandy Soil

A. M. AL-OMRAN
M. I. CHOUDHARY
A. A. SHALABY
M. M. MURSI

Soil Science Department
College of Agriculture
King Saud University
Riyadh, Saudi Arabia

In a laboratory experiment, four concentrations of two natural bentonite clay deposits (commercial Bentonite and Aquagel) were applied to study their impact on water movement in a sandy calcareous soil. Cumulative infiltration (D), advance of wetting front (Z), and available water content (AWC) were measured for untreated and treated soils mixed with 1, 2, 3, and 4% of Bentonite or Aquagel. Cumulative infiltration (D) increased with increase in time in all of the treatments. The data tested fitted the Kostiakov equation ($D = kt^n$), giving highly significant correlation ($r > 0.95$) for all of the treatments. A marked decrease in D, k, and n values were observed with increasing concentrations of both of the clay deposits. This trend was more pronounced with Aquagel than Bentonite. Data on advance of the wetting front fitted the empirical power equation ($Z = at^b$), showing high correlation values ($r > 0.95$) for all treatments. Advance of wetting front was markedly affected by the type and the concentration of clay deposit applied. Z decreased and the constants a and b decreased with increasing concentrations of clay. Available water content (AWC) increased with increasing concentrations of Bentonite and Aquagel. The percentage increases over untreated soil were 6.66, 7.92, 8.33, and 13.33 when amended with 1, 2, 3, and 4%, respectively, of Bentonite whereas, for Aquagel the respective increases were 37.7, 51.8, 86.1, and 90.4%. This is attributed to higher clay content and the water absorbance characteristics of Aquagel. Aquagel labeled as high-grade bentonite was more effective in controlling water movement in the soil and markedly increased the AWC of a sandy soil.

Keywords available water, bentonite, cumulative infiltration, wetting front

The productivity of calcareous sandy soils is limited by low water holding capacities, high infiltration rates, high evaporation, low fertility levels, and low organic content. The use of organic and chemical amendments could improve the chemical and physical properties of these soils. Sewage sludge along with other organic wastes is commonly used as soil amendments. Also, synthetic soil conditioners were used to improve some soil physical properties and productivity

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Address correspondence to Dr. A. M. Al-Omran, Professor of Soil Physics, Soil Science Department, College of Agriculture, King Saud University, P. O. Box 2460, Riyadh 11451 Saudi Arabia. E-mail: rasoul@ksu.edu.sa