2062

Instrumenting Large Soil Columns for Salinity and Trace Element Transport Studies

P.J. Shouse[1], S. Goldberg[1], T.H. Skaggs[1], and D.L Suarez[1]
[1] *USDA ARS George E. Brown Jr. Salinity Laboratory, Riverside, CA, pshouse@ussl.ars.usda.gov*

1 INTRODUCTION

Verifying physical and chemical process models is an arduous task, field experiments are expensive and lab experiments maybe unrealistic. One alternative is to use large, well-instrumented soil columns. The advantage of soil columns is that we have more control over the experimental conditions, compared to field studies. The major disadvantage is that soil columns, no matter how large, may not represent reality. The purpose of this study is to instrument large soil columns in order to verify chemical transport models for salinity and trace element studies.

2 MATERIALS AND METHODS

2.1 *Soil columns*

Twelve PVC pipes (0.45 m id and 1.97 m tall) have been selected for the experimental units. We have filled the columns with three distinct soil layers (clay loam, silty clay, and sandy loam) that represent idealized soil profile field conditions of the Broadview Water District in the San Joaquin Valley in California. The first layer is a clay loam with 32% clay. This layer is 1.0 m deep and has instruments placed at four depths (0.15 m, 0.3 m, 0.68 m, and 0.85 m). The second layer is a 0.3-m thick silty clay layer with 42% clay content. There are instruments imbedded at two depths 1.10 m and 1.20 m. The third layer is a sandy loam with 8% clay, and is 0.5-m thick. The third soil layer has instruments at 1.45 m and 1.65 m. The bottom 0.17 m of the column houses a vacuum candle drainage system with an envelope of fine sand. The vacuum drainage system can be regulated to control the bottom boundary conditions.

2.2 *Instruments and measurements*

Each soil layer is instrumented with soil solution samplers, time domain reflectometer probes (TDR), tensiometers and temperature probes. Solution samplers will be used to sample soil solution periodically to analyze solution chemistry. TDR probes will be used to measure soil water content and soil bulk electrical conductivity. Tensiometers will be used to measure soil water pressure head. Temperature probes will be used to measure soil temperature. The instruments (except solution samplers) are electronic and can be read multiple times per day. Figure 1 shows a schematic diagram of a typical instrument cluster.

In: Proceedings of the International Salinity Forum, Managing Saline Soils and Water: Science, Technology, and Soil Issues. April 25-27, 2005. Riverside, CA pp:147-149.

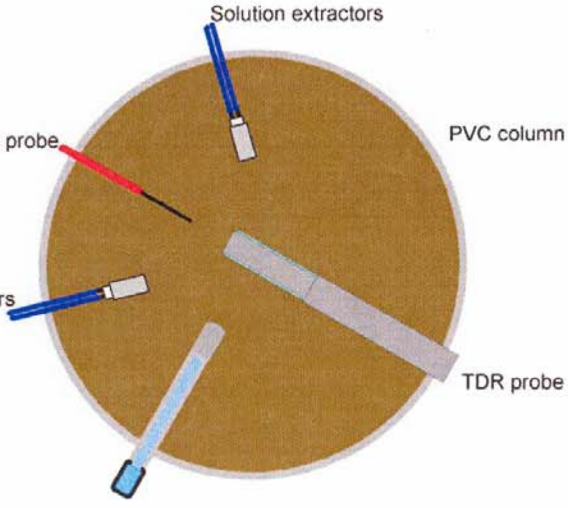

Figure 1. Schematic of Instrument cluster.

2.3 *Soil initial conditions*

Soil physical and chemical characterization included hydraulic properties, bulk density, particle size distribution, cation exchange capacity, pH, electrical conductivity (EC), sodium adsorption ratio (SAR), exchangeable sodium (ES), and boron adsorption isotherms

3 SELECTED RESULTS

3.1 *Initial soil properties for first layer*

Table 1. Chemical properties

pH_e	EC_e (dS/m)	CEC (meq/100g)	SAR	ES (meq/100g)
8.3	1.84	40.1	4.5	7.6

Table 2. Physical properties

Bulk Density (Mg/m^3)	Sand (%)	Silt (%)	Clay (%)
1.25	42.2	25.1	32.7

Table 3. Hydraulic properties

θ_s (cm^3/cm^3)	θ_r (cm^3/cm^3)	α (1/cm)	n	λ	K_s (cm/d)
0.0855	0.4805	0.015	1.42	-0.65	26

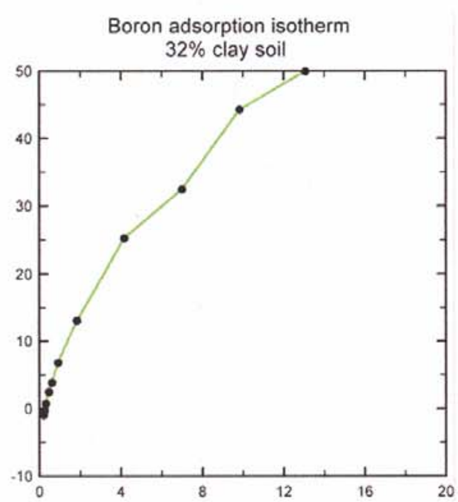

Figure 1. Boron adsorption isotherm for top soil layer of the soil columns