Land Application of Industrial Effluent on a Chihuahuan Desert Ecosystem: Impact on Soil Physical and Hydraulic Properties

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Research Objectives

NMSU was asked by the City of Las Cruces to assess plant and soil responses to effluent irrigation and develop a management model for applying industrial effluent to the site. Beginning in 2002, site vegetation has been sampled for biomass and mineral concentrations and soil has been sampled for mineral concentrations. There has not yet been sampling conducted to study the influence of effluent irrigation on soil physical and hydraulic properties and the influence these properties might have on soil chemical characteristics, solute leaching, and plant stress.

Methodology

To understand the impacts of industrial effluent at the West Mesa Industrial Park land application site near Las Cruces, NM, a study of soil properties will be carried out. Parameters measured or estimated will include physical and hydraulic properties (i.e., texture, bulk density, porosity, saturated and unsaturated hydraulic conductivity, and soil moisture retention characteristics), and chemical properties (i.e., electrical conductivity (EC), sodium adsorption ratio (SAR), nitrate (NO3), chloride (Cl), and acidity/alkalinity (pH)).

Statement of Benefits Expected

Monitoring soil hydraulic and chemical properties during irrigation cycles throughout the year is expected to provide a good indication of which soil properties are potentially causing plant stress. The complex interaction among soil hydraulic and chemical properties, especially under short-term temporal variability (i.e., during irrigation cycles), is not clearly understood. Results from our studies will provide more clear understanding of these interactions, such as the relationship between saturated hydraulic conductivity, water retention, and soil chemical properties like sodium adsorption ratio (SAR) and electrical conductivity (EC). Results from computer modeling may be used to adjust current irrigation scheduling practices and control water and solute leaching at the West Mesa land application site.

Field calibration of the time domain reflectometer (TDR) sensors for measuring soil moisture content under the canopies of creosote and mesquite, and bare ground of Chihuahuan Desert soils at West Mesa irrigated with industrial effluent. (From left to right are the students and instructor of advanced soil physics 552, Spring 2006: Yoshi Ikemura, Jose Makk, Manoj Shukla (Instructor) and Michelle Mattes (Picture taken by Michael Babcock)

Field layout of the funnels for 4-point sprinkler distribution uniformity assessment for Chihuahuan Desert soils at West Mesa irrigated with industrial effluent (American Society of Agricultural Engineers standard #S330.1, 1993)