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2006 Conference Proceedings

7-18-2006

Key Requirements for Successful Use of Moderately Saline Water for Landscape Irrigation: Southwestern Experience

S. Miyamoto
Texas A & M University - College Station

Abstracts of presentations given on Tuesday, 18 July 2006, in session 8 of the UCOWR Conference.

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S. Miyamoto

ABSTRACT

The primary objective of using moderately saline water for irrigation, including reclaimed municipal effluent, is to conserve potable water, and its impact on quality of landscapes or the costs of landscape maintenance have received lesser attention. The experience in the Southwest indicates that when salinity of irrigation water is less than approximately 750 ppm or sodium (Na) and Chloride (Cl) concentrations are less than 150 mg L^{-1}, landscape degradation caused by salts is minimal, except in areas with poorly permeable soils. When salinity or Na and Cl concentrations exceed these threshold values, however, salt-induced landscape degradation has been more frequent and intense than previously thought. This presentation outlines the types of problems encountered, and the key requirements for improving reuse practices based on the experiences in west Texas and southern New Mexico where water of elevated salinity (up to 3000 ppm) is used for irrigation.

The most common salt-induced problem appears in the form of foliar damage when broadleaf trees or shrubs are sprinkler-irrigated. When Na and/or Cl concentrations reach a range of 200 to 300 ppm, it affects most broadleaf trees and shrubs when irrigated daily or every other day. Pines and junipers are more tolerant, but may show some injuries at the Cl concentration of 300 to 500 ppm (Miyamoto and White, 2002; Miyamoto et al., 2004a and 2004b). The first major requirement for successful use of moderately saline water is to avoid sprinkling broadleaf trees and shrubs. In mature trees, this can be accomplished by converting to low trajectory or under-canopy sprinklers. However, this option may not work for shrubs and ground covers. The use of non-sprinkling type of irrigation systems, such as bubblers and drips may be needed.

Plant damage caused by soil salinization was found to occur at salinity of irrigation water as low as 600 ppm, when poorly permeable soils (such as clayey soils or upland soils containing a poorly permeable calcic horizon) are irrigated frequently. However, in well–drained sandy soils, little or no salt accumulation has occurred under prudent soil and irrigation management. With the prevailing salinity of reclaimed water in the Southwest (600 to 1500 ppm), most existing plants, except for sensitive species, can be maintained in sandy soils (Miyamoto et al., 2004a and 2004b; Miyamoto and Chacon, 2006). The second requirement for successful use includes avoiding poorly permeable soils, and practicing prudent soil and irrigation management.

When a large number of species is planted in the same irrigation unit (which is common in upscale landscape), the landscape may experience transformation towards salt resistant species, as salt sensitive types are stressed, and resistant species tend to flourish, especially when reclaimed water rich in nitrogen is used. This transformation process begins with foliar damage, then followed by excessive growth of salt tolerant species within a season, unless intervened through adjusting irrigation or increasing pruning. The control of excessive growth becomes an economic issue, as labor costs are usually higher than water bills in the maintenance of upscale landscapes with a large number of trees and shrubs. The third main requirement is to install additional flow control valves or devices so that growth rates can be better controlled.

Implementation of these seemingly simple requirements has been hindered for a number of reasons. The best record of implementation, thus successful uses of reclaimed water is usually

found at small landscapes, including private homes and cemeteries where landscape upkeeping is a priority. Although there are exceptions, implementation at large landscape managed by multiple contractors has been slower than projected. The reasons for this slow adaptation are not clear, but in part may stem from the habits and possibly low economic incentives to change. For example, fertilizer service companies continue to apply fertilizers after conversion, regardless of the need. Likewise, ground maintenance companies are usually slow to adjust irrigation systems or scheduling, even when landscape plants are growing excessively. A modified formula for landscape maintenance contract needs to be devised when reclaimed water rich in salts and nutrient is used. This contract is simply between property owners and contractors.

Public parks and school grounds have been maintained as if there was no change in quality of irrigation water. The conditions of public parks and schoolyards remain largely the same or worse after conversion. This problem is compounded by park or school ground developments which ignore the aspect of salinity control. Public parks and school sports fields are built with engineering specifications covering soil stability and strength, but not based on suitability for maintaining turf with water of elevated salinity.

Due to the difficulties in implementation, site suitability assessment often becomes an essential tool for water providers to hedge against landscape degradation. Unfortunately, site screening does not blend well with the desire to maximize the number of connections to the pending reclaimed water line. A proper balance has to be maintained here. Another option that water providers have is to provide additional water treatment or blending, especially to lower nitrate concentrations during summer months, if upscale landscape is to be irrigated.

Reuse projects are achieving the primary objective of conserving potable water, but in many cases, at the expense of landscape quality degradation caused by salts. This situation may improve in time once prudent measures, such as site suitability assessment, changes in landscape development codes and maintenance contracts, and improved management are implemented.

Additional Information

Additional information on this topic can be obtained from a companion paper (Appraising salinity hazard to landscape plants and soils irrigated with moderately saline water) or by contacting S. Miyamoto, Professor and Soil Scientist at Texas A&M Agricultural Research and Extension Center, 1380 A&M Circle, El Paso, TX 79927, (915) 859-9111, s-miyamoto@tamu.edu.

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Acknowledgement

This material is based on work supported in part by the Cooperative State Research, Education and Extension Service, USDA under Agreement No. 4280001, El Paso Water Utilities, and the Bureau of Reclamation.