Contrasting Irrigation Application Methods for Drainage Reduction and Soil Salinity Mangement

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Principal Investigator: Daniel Munk
UC Cooperative Extension, Fresno County
(559) 456-7561
dsmun@ucdavis.edu

Executive Summary:
West side San Joaquin Valley agriculture is increasingly being impacted by poor drainage, high soil salinity and high metal concentrations in surface soils. Production yield looses of food and fiber crops resulting from these problems are staggering. Halophytes such as cotton are among the most tolerant crops that give economic returns and provide a stable income for most Westside growers, however in many areas do not escape the yield losses associated with salinity and poor drainage. Crop yield loss can occur as a result of degraded soil and water quality that can create poor plant stand establishment, low crop canopy vigor and reduced fruit load.

If current irrigation management practices continue without change, the expansion of productive lands affected by shallow water table and saline surface solid will continue to increase at a rapid rate. Implementation of approaches that incorporated practical water management alternatives that minimize the expansion of shallow water table areas are needed that are also economically feasible. In the early 1990's, Gratten demonstrated the success of alternating fresh and saline drain water to maintain soil quality in cotton and tomato rotations. High quality irrigation water was used for pre-irrigation events while low quality drainwater was used to meet the water demands of the crop later in the season. This approach successfully demonstrated management methods that help maintain surface soil quality but did not address the issue of system efficiency and source reduction, which should be linked with any long-term drainage management strategy. Irrigation practices demonstrating the simultaneous reduction of deep percolation volumes while providing effective surface soil leaching are needed in the short and medium term.

Reported by the Committee of Consultants on Drainage Water Reduction in 1988, the majority of irrigation losses to deep percolation occur during the singular pre-irrigation event where high soil infiltrations rates cause an over application of irrigation water. The incorporation of practical irrigation management tools that address reduction will only take place if they achieve at least one of the following goals:

Reduce the acreage impacted by shallow water tables. Improve surface soil salinity levels. Maintain or increase crop diversity and rotational choices. Delay the salinization on the poorly drained lands of the western San Joaquin Valley.

Future drainage reuse approaches can be optimized through the periodic displacement of salts that allow good stand establishment and early season growth. Hoffman (1980) compared the effectiveness of sprinkler and surface irrigation methods to leach salts. The study reported improved salinity movement under a sprinkler irrigation regime when compared to equivalent quantities of surface water applied. Since the release of this study, very little information is available on surface vs. sprinkler applied irrigation events and their impact on the movement of surface soil salts on western San Joaquin Valley soils. In addition to reducing deep percolation amounts through the more controlled sprinkler practices, there may be additional soil quality and yield benefits that would make this practice more widely used in the region.

Project Objectives

- To evaluate the deep-percolation and runoff characteristics of side-by-side sprinkler and furrow pre-irrigation and first seasonal irrigation events.

- To evaluate the movement and content of soluble salts under each contrasting irrigation system and assess the impact of soil quality changes on cotton stand establishment, growth characteristics and yield.
- To describe economic differences associated with management of the two contrasting irrigation systems.
- To extend information to growers that demonstrate the impact of contrasting irrigation management systems on soil salinity profiles over a two-year period.