Using Forages and Livestock to Manage Drainage Water in the San Joaquin Valley

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Executive Summary

We are developing a livestock-based forage production system to use saline drainage water in the western San Joaquin Valley (WSJV) of California. Our goal is to use salt tolerant forages such as Bermuda grass and salt tolerant annual crops like wheat to provide a year round supply of high quality forages suitable for economic average daily weight gains in cattle or sheep, or for sale to dairy farms. If livestock production can be based on the reuse of saline drainage water, it will transform drainage from an environmental burden into an economic asset, reduce dramatically the amount of water that must be disposed in evaporation ponds, and provide a model for other areas of the San Joaquin Valley and beyond.

Current practices for the disposal of saline drainage water in the WSJV are not sustainable. Without an improved means of disposing of saline drainage water, increasing amounts of valuable farm land will become salt impaired, suffer declines in productivity, and be lost to agriculture. Public policy emphasizes disposal of saline drainage water within the SJV, but restricts the means. The disposal of this water is problematic and costly. Disposal occurs most commonly as drainage to groundwater where natural conditions allow or to evaporation ponds where not. Fewer than three thousand acres of evaporation ponds exist. However, there are at least 750,000 acres of land in the western SJV that are adversely affected by the presence of shallow or perched groundwater, and which require subsurface tile drainage to remain productive. One acre of pond serves approximately 10 acres of artificially drained land. If all lands with shallow water tables were drained, approximately 80,000 acres would be needed for evaporation ponds, far more than now available. Because drainage waters may contain trace metals such as Se, Mo, Ar, and B that are toxic to shore birds and waterfowl, the expansion of evaporation ponds is unlikely.

Neither the agronomic nor economic feasibility of drainage water reuse systems have been evaluated satisfactorily. Both careful empirical measurement and modeling are necessary to characterize the performance of a crop-livestock system and to extend restuls broadly to other locations. Research on this systems approach to drainage water reuse will be carried out by a multi-disciplinary, and multi-institutional team of soil, crop, animal, and social scientists. Our research facility is located at Wetlake Farms along the wetern edge of the old Tulare Lake bed in Kings County. The site is being developed based on funding from the Prosser Fund, and previous support from the Salinity/Drainage Program. Some of the clay soils farmed are among the most saline in the WSJV and need subsurface drainage to remain productive. Until the site at Westlake Farms was developed, no suitable location has been available to University and USDA personnel to carry out research on the many complex, inter-related issues associated with drainage water reuse. With the development of a site with isolatable, instrumented plots (each 8.5)

acres), and the demonstration is now possible, including but not limited to that proposed here.

The site has undergone initial assessment and geo-referenced mapping for electrical conductivity (Fig. 1, not shown here), organic matter, and initial soil physical properties, particularly hydraulic conductivity, based on a grant from the U.C. Kearney Foundation for Soil Science. A georeferencing system accurate at the sub-meter level is being used for all sampling activities so that data can be integrated and changes followed and modeled over time. Because an entire forage-livestock system is the object of study, there are several inter-related objectives. In turn, within each objective, the opportunity to test a number of basic and applied hypotheses about the site's variability, and anticipated changes over time in soil and crop characteristics provide the chance to develop new methods to study and monitor large-scale farming systems projects. Several approaches to modeling variable soil processes at the field scale also are new and emphasized in the work proposed here.

Diverse types of information must be integrated to evaluate the feasibility of forage and livestock production based on drainage water use, so there are several objectives: 1) Measure the rates of biomass accumulation, forage quality (including trace element and cation content of the crops being evaluated). 2) Evaluate livestock performance and health when grazing or feeding forages grown with saline water containing trace elements. 3) Quantify crop water use and volumes, and the accumulation of nutrients and trace elements. 4) Model soil physical and chemical processes and changes in these properties. 5) Integrate water quality, soil, forage yield and quality data, livestock growth requirements, and farm management constraints in a multiple goal programming model to broaden the project's results.