Can Forages be used to Manage Retired Farmland and for Saline Drainage Water Management?

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Executive Summary

An effective way to manage and reduce the volume of saline drainage water within the San Joaquin Valley is to use it for crop production, particularly salt-tolerant forages. Retired farmland can be used for pastures and hayfields, in the process reducing the amount of saline drainage water that must be managed, and providing alternative pastures for ranchers who otherwise must graze their cattle in the Sierra Nevada mountains during the summer. Alternatively, forge can be used for the growing hay market or as a cellulosic source of biomass for energy production. We have demonstrated that moderately saline water can be used as the primary irrigation source for Bermuda grass (*Cynodon dactylon* (L.) Pers) while simultaneously reclaiming a severely salt-affected site (Kaffka et al, 2004). At a severely salt-affected site in Kings County near Stratford, soil salinity in the upper profile (0' to 24"; 0 to 60 cm) has decreased over the 1999 to 2004 period, while drainage and other waste waters have been used to irrigate Bermuda grass pastures (Corwin et al, 2005). Beef cattle have been grazed yearly without adverse health effects while gaining weight at economic levels. Leaching fractions measured over the 2001 to 2003 seasons have been less than 10% of applied water. Most indications are that the reuse of moderately saline waters for irrigation of a salt tolerant grass could be sustainable (Kaffka et al, 2004, 2002).

Bermuda grass forage quality during this period has been measured, and yields and intake by livestock estimated under the varying grazing pressure achieved by the farmer-cooperators of the project. Despite a lack of any observed effects of trace elements on the health and growth of cattle in our experiments so far, the accumulation of trace elements at potentially toxic levels

remains a possible limitation for the use of pastures and hay crops in managing saline drainage waters. Uncertainty about trace element uptake and the longer term consequences of B accumulation in soils on the productivity of reuse sites remains a limitation to the use of forages and drainage water in the long term.

The research site in Kings County used for these studies has areas with elevated levels of B and Mo in soils and drainage water, but unlike some other areas in the western San Joaquin Valley (WSJV), Se is deficient. To address concerns about trace element accumulation and the effects of B in particular, we propose to add additional B, Se, and Mo to plots located in areas at the site with differing background salinity to provide a wider range of these trace elements in soils than occur at the site naturally. Surface soil salinity (EC_e) varies from approximately 6 to > 30 dS m^{-1} at the site. Our objectives are to assess quantitatively the capacity of Bermuda grass to accumulate these trace elements as a function of pasture productivity, salinity, and trace element content and to determine whether salinity or B or some interaction between them limits crop growth under field conditions. There is little systematic information of this sort in the literature upon which to base reasonable predictions about forage productivity and quality performance under variable field conditions. Such information is essential to help make the widespread use of saline drainage water a feasible means of managing salinity in the San Joaquin Valley and to certify retired farmlands can be used for this purpose.

In general, a better estimate of potential grass productivity and a more precise understanding of the influence of salinity, trace elements and fertility on forage quality is needed to predict the potential productivity and livestock carrying capacity of pastures irrigated with saline water on salt affected sites,. We propose to measure the response of Bermuda grass to different rates of trace elements applied to locations with varying salinity at our field research site in Kings County. This will allow other farmers and agency personnel to plan for the use of pastures and hay fields as a means of managing saline drainage water elsewhere in the San Joaquin Valley, and at other locations where such problems exist, including on retired farm lands. This work will compliment a new effort on our part to create a simulation model and better quantify both water use and forage yield and quality as function of water use under reuse conditions. This project is being funded by the California Department of Water Resources. Results on trace metal and salinity interactions can be added to the simulation model to improve its use for prediction and management purposes.