Bermuda Grass Yield and Quality in Response to Different Salinity and N, Se, Mo and B Rates in West San Joaquin Valley

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Bermuda grass production in the saline soils of California's western San Joaquin Valley can be an effective way to manage saline drainage water. Current indications from this study suggest that this practice is sustainable.

An effective way to manage saline drainage water within the San Joaquin Valley is to use it for crop 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. At a sodic-saline 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. Beef cattle have been grazed yearly without adverse health effects while gaining weight at economic levels. Leaching fractions measured over the 2001 to 2004 seasons have been less than 10% of applied water. All indications are that the reuse of moderately saline waters for irrigation of a salt tolerant grass is sustainable.

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. Because grazing pressure and management have varied each year depending on the number of cattle placed on the pastures and length of grazing season, estimates of pasture productivity are confounded with grazing management. Pasture fertilization also has varied, but has generally been less than 100 kg /ha. To estimate the potential productivity and livestock carrying capacity of pastures irrigated with saline water on salt affected sites we studied the influence of salinity and fertility on potential grass productivity and forage quality. We are measuring the response of Bermuda grass to different rates of N fertilizer at our field research site in Kings County and in a greenhouse trial at UC Davis (Figure 1).

Figure 1. Greenhouse trial at UC Davis.

On the field we selected sites with approximately average root zone salinity (0-60 cm) of 7 (S1), 14 (S2) and 21 (S3) dS/m. The same soils were used to grow Bermuda grass on the greenhouse trail. The fertilization rates were equivalent to 0 (N0), 300 (N1) and 600 (N2) kg N/ha. Soils from these sites were also collected in 60 cm deep containers and transported to UC Davis, then planted with common Bermuda grass and irrigated with saline water. Containers are being used to provide more exact control of irrigation and to allow weekly measurements of growth rates and phenological development. At the field site,

exclusion cages were placed in the pastures to keep grazing cattle from disturbing the experiment at each of the three sites and each set of cages was fertilized with N similar to the pot experiment. While work is on-going at both the field and greenhouse sites, preliminary results obtained from the first harvest in the greenhouse site (Table 1 and Figure 2) show a clear effect of salinity and N on the yield and quality of the forage.

Table 1: Bermuda grass Yield and Quality: Greenhouse trial.

Treatment	Weight (gr)	Leaves (%)	Stems (%)
S1N0	27.03	56.73	43.28
S1N1	23.60	58.23	41.78
S1N2	34.30	54.08	45.93
S2N0	33.28	50.78	49.23
S2N1	21.53	51.88	48.13
S2N2	33.30	51.15	48.85
S3N0	24.63	55.28	44.73
S3N1	19.88	56.35	43.65
S3N2	19.28	58.10	41.90

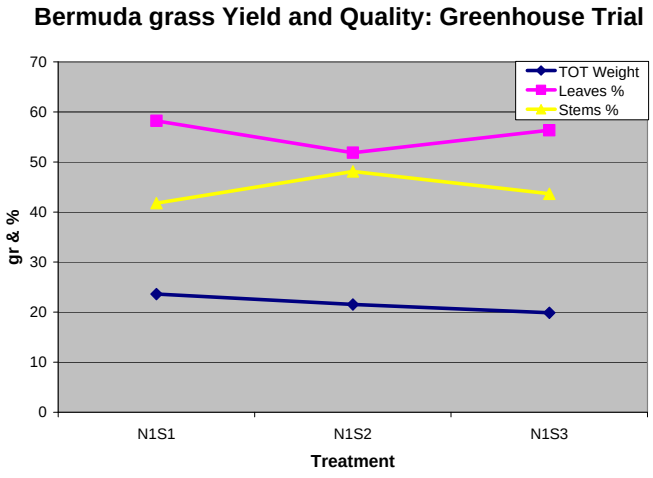

Figure 2. Average weight (gr) and proportion of leaves and stems (%) of the treatments

Despite a lack of any observed effects of trace elements on the health and growth of cattle in our experiments, 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. The research site in Kings County used for these studies has areas with elevated levels of Mo in soils and drainage water but unlike some other areas in the western San Joaquin Valley, Se is deficient. In the 2008 growing season, we will add Se, B and Mo to subplots within each N treatment main plot to provide a wider range of these trace elements in soils than occur at the site naturally. The same conditions will be replicated on the greenhouse trial. Samples collected in 2007 are being analyzed for trace element content and will be used as a baseline for comparison. This will allow for a systematic assessment of the capacity of Bermuda grass to accumulate these trace elements as a function of pasture productivity, salinity, and trace element content. 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 as a means of managing salinity in the San Joaquin Valley feasible.

Professional Presentations

Alonso, Maximo and Stephen Kaffka, Modeling Bermuda grass yield and quality in the western San Joaquin Valley of California, American Society of Agronomy, 2007 International Annual Meeting, New Orleans, LA, November 2007.

Alonso, Maximo, Dennis Corwin, Stephen Kaffka, and John Maas, Modeling yield and quality of Bermuda grass irrigated with saline drainage water, Salinity Forum 2, Adelaide, Australia, March – April 2008.

Collaborative Efforts

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