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NRCS

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This purpose of this memo is to clarify the EC_T (Electrical Conductivity threshold) levels for the forage crops listed in USDA-NRCS Tech Note 26, 'Plant Materials for Saline-Alkaline Soils. The EC_T level for alfalfa (4 dS/m), in particular, is being questioned primarily because other publications (Maas and Hoffman, 1977) (Borelli and Brosz, 1983) (Ayers and Westcot, 1976) have an EC_T of 2 dS/m listed for alfalfa. All of these publications reference research done at the US Salinity Lab in Riverside, CA. There is limited research in the northern latitudes on salt-tolerance of forage grasses and legumes; limited primarily to work done by the USDA-NRCS Plant Materials Center, Bridger, MT, Dr. H.M. 'Chris' Holms (ret.) Saskatchewan Agriculture-Regina, and Dr. Harold Steppuhn, Agriculture Canada, Semi-arid Prairie Agricultural Research Centre-Swift Current, Sask.

In most publications alfalfa is listed as 'moderately sensitive' to salts. The moderately sensitive category has EC_T levels ranging from 1.5 to 3 dS/m and EC_D (salinity level resulting in death of plant) ranging from 8 to 16 dS/m. Current research (Steppuhn et al, 2005) indicate that very few plant growth responses to salinity are linear, but rather curva-linear (sigmoid-shaped). The research indicated the plant response to increasing salinity is slow at first, then dropping off at a some-what linear slope, and then hanging on to life with little change in production as the plant reaches it's upper tolerance limit. The 2 dS/m threshold established by Maas and Hoffman was based on linear response curves and may actually be low.

The research in Montana and Saskatchewan dealt with field testing along natural salinity gradients and, in most cases, did not define threshold limits, but rather found levels of salinity that would support acceptable production levels of individual forage species. In Montana and Saskatchewan alfalfa was readily established on saline soils with EC_e levels ranging from 2 to 8 dS/m. In Holms (1983) alfalfa production was not significantly different on soils with ECs of 0-4 dS/m than those with ECs of 4-8 dS/m, only with ECs in excess of 8 dS/m was alfalfa forage production significantly reduced. Although an alfalfa study at the Bridger Plant Materials Center was set up on a salinity gradient to develop a response curve for alfalfa, no data was obtained because of untimely and unscheduled grazing. The alfalfa, however, did readily establish on ECs ranging from 2 to 8 dS/m.

In the development of Tech Note 26, the Montana and Saskatchewan research was taken into consideration when the EC_T of 4 dS/m was established rather than utilize the 2 dS/m reported by Maas and Hoffman (1977), Borelli and Brosz (1983), and Ayers and Westcot (1976). This publication makes reference to soil salinity levels and not soil water salinity levels. Most publications use a factor of 1.5 in expressing soil water tolerance levels, i.e., a soil with and EC_e of 4 dS/m would have a corresponding soil water (EC_W) conductivity of 2.7 dS/m (4 divided by 1.5= 2.7). The salinity tolerance levels exhibited in Tech Note 26 are just averages for the varied soils, salts, and climates of the northern Great Plains region. It is also geared for mostly saline soil situations and does not take into consideration sodicity interactions. Most of the dryland saline seeps and salinity impacted irrigated sites in this region have primarily calcium and magnesium sulfate/bicarbonate salts with relatively low ESPs or SARs. Irrigation with saline water has not been researched at the Bridger PMC, however, Steppuhn (2001) has experimented with fall irrigation of saline sites to be seeded with alfalfa the following spring, using subsurface water with EC_W of 4.6 dS/m. No research (with statistically analyzed data) has been done, that I am aware of, where saline or sodic water has been used for irrigation. Leaf surface damage resulting from sprinkling with saline or sodic water has not been addressed by the research community.

In a recent communication with Dr. Harold Steppuhn, he concurred that a soil EC_T of 4 dS/m was an acceptable level for alfalfa and would best represent alfalfa's response to salinity in our region. He also mentioned that with the use of sodic water for irrigation, the EC_w should be at least 2 dS/m to help counteract the affect of the sodicity.

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