Investigation and Collection of Plant Materials from Saline Sites in West-Central Texas

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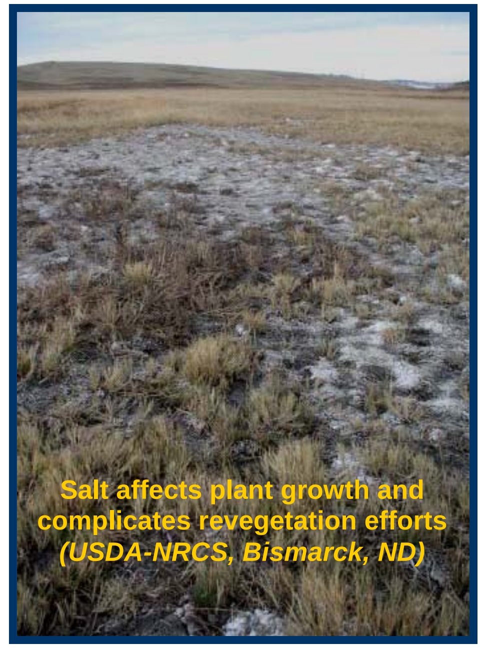
Introduction

The Central National Technology Support Center (CNTSC) and Texas Natural Resources Conservation Service (NRCS) are working jointly on a study to identify saline tolerant plants. Soil salinity is one of the major factors threatening plant growth and productivity. Varying levels of soluble salts limit plant establishment and complicate revegetation efforts to restore landscapes to a productive condition and to protect them from further degradation from wind and water erosion. Salinity affects plant growth both physically and chemically by inducing osmotic stress, ion toxicity, and nutritional instability (Rhoades and Miyamoto, 1990). Salt tolerant plants have the ability to minimize these effects by producing a series of anatomical, morphological, and physiological adaptations (Gould and Shaw, 1983). Grasses, woody plants, and agriculture row crops are grown on salt affected soils for food, fiber, and beautification because of their unique ability to minimize the negative effects of the salt on productivity (Miyamoto et al., 2004; Rhoades and Miyamoto, 1990). Adaptation, growth, and production of these plants are defined by climate, soils, growing conditions, and salt tolerance.



Salt affects plant growth and complicates revegetation efforts *(USDA-NRCS, Bismarck, ND)*

The Plant Materials Program of the USDA-NRCS has been actively pursuing the collection and evaluation of plants through its Plant Materials Centers (PMC) for reclamation of salt affected areas. These plant species were often collected from natural plant stands on known saline soils. Following a systematic process of evaluation and selection these plants were released by the PMCs for commercial production. The James E. "Bud" Smith PMC, Knox City, Texas, recognizes the need for plants to remediate saline areas in parts of Texas and southwestern Oklahoma. Plants are needed to provide vegetative cover for saline soils susceptible to wind and water erosion, and provide secondary benefits such as wildlife habitat. Alkali sacaton (*Sporobolus airoides* cv. 'Saltalk') is an example of a native grass released by the PMC for saline reclamation in parts of Texas and Oklahoma (Alderson and Sharp, 1994).

Several State specialists in North Dakota, Colorado, Utah, Nevada, California, Montana, Oklahoma and Texas have expressed a need for better guidance in the maintenance and treatment of salt affected areas. These NRCS Specialists are concerned with areas that are marginally affected and still present some potential for productive use from an agricultural perspective. The objective of our investigation of saline sites in west-central Texas was to identify and collect promising plant species occupying these sites, and determine if there is potential for the plant to be used for conservation cover, wildlife habitat, and critical area treatment, as well as offer a viable alternative for the management of marginally affected saline and sodic soils. Plants collected from saline sites will be evaluated by plant scientists at the James E. "Bud" Smith PMC.

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Collecting soil samples for EC measurements.

Procedure

Ten sites were randomly selected in west and west central Texas using Web Soil Survey to locate sites with an electrical conductivity (EC) of 2 to 4 dS/m (http://websoilsurvey.nrcs.usda.gov). These sites included the counties of Nolan, Mitchell, Scurry, Howard, Garza and Knox. A minimum of one sample was collected per county; however, multiple collections were made if plants and conditions permitted. At each site, mature seed was hand-collected from 15-25 plants and placed in a paper collection envelope with appropriate documentation for distinguishing collections along with a GPS waypoint to accurately identify the site. Seed samples were air-dried and sent to the PMC where they received an accession number for future evaluations. A soil sample was collected in the same vicinity to a depth of ~ 6 inches. Soil samples were placed in soil sampling boxes and sent to the soil testing laboratory at Oklahoma State University, Stillwater, Oklahoma for (EC) analyses using procedure in USDA-Handbook 60. Collection of seed and soil samples from the 10 sites occurred 5-9 October 2009.

Results and Discussion

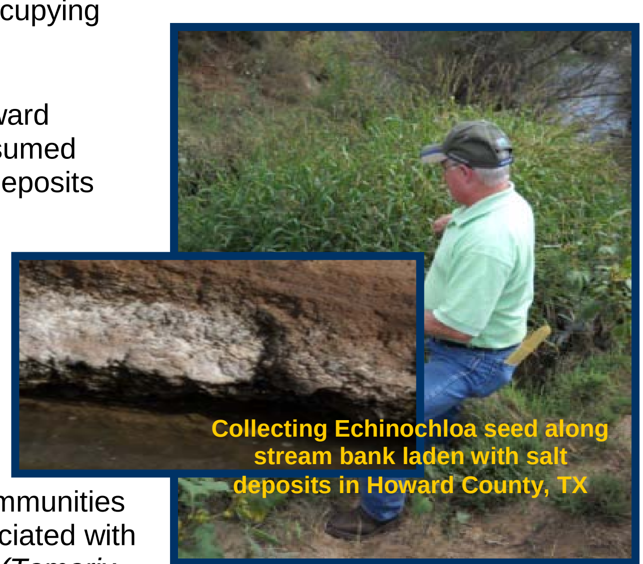
Most of the sites investigated had natural saline seeps according to the soil survey and plant species known to have salt tolerance. The highest EC readings were generally associated with sites that had been impacted by drilling activities. A summary of the soils information (series, texture, EC) and plant species collected from each site is presented in Table 1. The EC readings ranged from a low of .56 dS/m in Howard County to a high of 11.7 dS/m in Scurry County.

Collecting vine mesquite seed in Nolan County, TX

Vine mesquite (*Panicum obtusum*) occurred on virtually every site in the 6 counties investigated, and particularly in the low areas where a higher soil moisture accumulation potential is likely. This agrees with the site adaptation of this species which is reported to occur in low depressions or in natural drainage areas (Leithead et al., 1976). Vine mesquite is not known for having much salinity tolerance as documented in controlled research studies (Beauchamp et al., 2009) and in plant information databases (USDA-NRCS, 2006). In contrast, results from this investigation indicate that vine mesquite can occupy sites with low to moderately high salinity (Table 2). These general guidelines indicate EC $\geq$ 8 dS/m restricts plant growth; however, our observations found vine mesquite growing in the low areas of Site 7 and 10 in Scurry and Knox County, respectively, was vigorous and producing abundant seed. Dominant grasses at Site 6 were vine mesquite and alkali sacaton (*Sporobolus airoides*). These grasses exhibited poor vigor with extremely low numbers of mature seed. Poor plant condition may have been caused by a combination of high EC (8.63 dS/m) and drought which may have restricted seed fill and development. Consequently, no seed was collected at Site 6.

Eragrostis spp have varying levels of salinity tolerance ranging from low to moderate. Most of the literature reports *Eragrostis* spp. is sensitive to salinity with a reported EC threshold of 2 dS/m http://www.ussl.ars.usda.gov/pls/caliche/SALTT42B; http://ucce.ucdavis.edu/files /filelibrary/5505/20068.pdf). Interestingly, the EC of Site 9, in Garza County where the *Eragrostis* was collected, was 7.06 (dS/m). Additional plant samples will be collected in September 2010 to positively identify which species of *Eragrostis* is occupying Site 9.

The *Echinochloa* seed collected from Site 3 in Howard County was from vigorous plants growing in a presumed saline condition because of the highly visible salt deposits accumulated along the edge of the streambank. Consequently, *Echinochloa* spp. is known for their saline tolerance (Maas, 1993) and abundant seed that is utilized by waterfowl, upland game birds and non-game birds (USDA, 2006).


Collecting Echinochloa seed along stream bank laden with salt deposits in Howard County, TX

Summary and Conclusion

Investigation of saline sites in west-central Texas provided interesting results relative to the plant communities occurring on these sites. Plant species often associated with high saline soils such as alkali sacaton, salt cedar *(Tamarix* spp) and common bermudagrass (*Cynodon dactylon*) were found at many of the sites investigated. Surprisingly, vine mesquite, which is considered to have low to no salinity tolerance, may have a high tolerance to salinity. Soil tests for EC show that vigorous stands of vine mesquite were growing on sites with an EC >8 dS/m. Lovegrass, which is also considered a plant sensitive to salinity, was growing abundantly on a site in Garza County with an EC of 7.06 dS/m. A total of 6 seed collections of vine mesquite were sent to the James E. “Bud” Smith PMC, Knox City for additional evaluations with 65+ other vine mesquite collections assembled by the PMC in 2009. The PMC will plant these collections in the greenhouse in March 2010 and transplant seedlings in the field during May 2010 for comparative evaluations. Collections of alkali sacaton, lovegrass, barnyard grass, and white tridens were also sent to the PMC for future testing.


Vine mesquite may prove to be a viable plant for saline reclamation in parts of TX and OK. Additionally, the seed of vine mesquite is utilized by quail and dove in late fall (Leithead et al.,1976)

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Table 1. Location, soil, plant species collected and electrical conductivity (dS/m) of sites in west and west central Texas, 5-9 October 2009.

Site	County	Soil	Species	Seed collected	EC (dS/m)[1/]
1	Nolan	Potter Clay	vine mesquite (*Panicum obtusum*)	Yes	0.84
2	Mitchell	Cobb-Miles fsl	vine mesquite	Yes	0.73
3	Howard	saline alluvial	alkali sacaton (*Sporobolus airoides*)	Yes	3.89
	" "	" "	barnyard grass (*Echinochloa* spp)	Yes	N/A[2/]
4	" "	" "	vine mesquite	Yes	0.56
5	" "	" "	white tridens (*Tridens albescens*)	Yes	0.59
6	Scurry	Colorado loam	vine mesquite[3/]	No	2.67-8.63
7	Scurry	" "	vine mesquite	Yes	11.7
8	Scurry	" "	vine mesquite	Yes	N/A
9	Garza	Mobeetie fsl	lovegrass (eragrostis spp)	Yes	7.06
10	Knox	Wichita clay loam	vine mesquite	TBC[4/]	8.36

[1/] electrical conductivity; [2/] seed collected from plants growing along streambank laden with salt deposits; [3/] sporadic stands of vine mesquite and alkali sacaton;[4/] seed to be collected at a later date.

Table 2. General guidelines for plant response to soil salinity[1/].

Salinity (ECe, dS/m)	Plant response
0 to 2	mostly negligible
2 to 4	growth of sensitive plants may be restricted
4 to 8	growth of many plants is restricted
8 to16	only tolerant plants grow satisfactorily
above 16	only a few, very tolerant plants grow satisfactorily

[1/] https://extension.usu.edu/files/publications/publication/AG-SO-03.pdf

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