TECHNICAL NOTES

NATURAL RESOURCES CONSERVATION SERVICE – WYOMING

AGRONOMY NO. 21 **June 1, 2002**

SUBJECT: Soil Salinity/Saline Seep Species Adaptation

Excessive soil salinity can cause reduced yields of many agronomic crops. Salinity is the concentration of dissolved minerals present in water and soil. The major solutes comprising salts are the cations Na, Mg, Ca, and the anions SO_4, HCO_3, CO_3, NO_3, and Cl. Other constituents that may contribute to total salinity include Se, As, Fe, Mn, B, F, Al, Ba, Mo, Cd, Sr, Li, and SiO_2.

A number of treatments and management practices can be used to reduce the salt level in the soil. However, under certain conditions, it is not possible or not practical to attain salt levels capable of sustaining all agronomic crops. In these scenarios, the choice of a suitable salt tolerant crop represents a way to minimize economic loss caused by salinity.

Salt-affected sites are unique in that they have various levels of salinity, different kinds of salts, differences in climatic patterns, and varying soil materials. An international classification system categorizes salt-affected soils:

Saline Soils
EC > 4 mmhos/cm (ds/m)
SAR 0-12
pH <8.5
ESP <15

Saline-Sodic Soils
EC > 4 mmhos/cm (ds/m)
SAR >12
pH usually <8.5
ESP >15

Visual detection of salt affected sites is important in designing and implementing mitigating practices. One way to detect potential salt-affected sites is through vegetation. Table 1 is a list of some species common on salt-affected sites.

Table 1 – Native Plants and Introduced Weeds Commonly Found on Salt-affected Areas

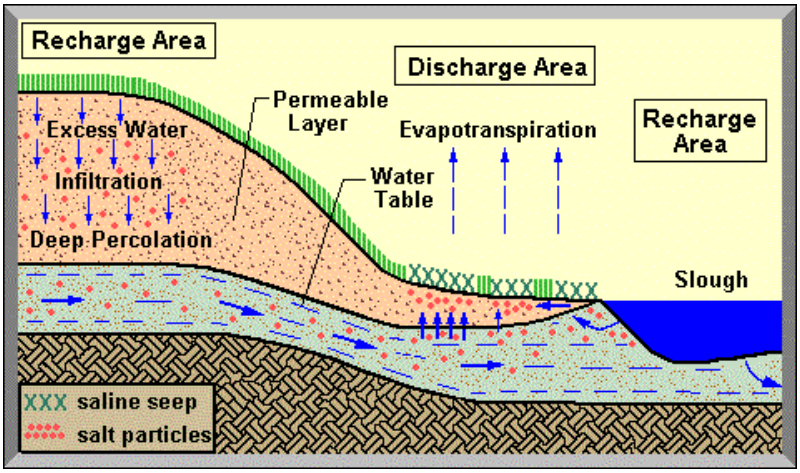
Common Name	Level of Salinization Tolerated
Curly dock	Moderate
Poverty weed	
Kochia	
Plains bluegrass	
Alkali cordgrass	High
Slender wheatgrass	
Spear saltbush	
Alkali bluegrass	
Alkali sacaton	
Foxtail barley	
Greasewood	Very High
Inland saltgrass	
Nuttall's alkaligrass	
Shore arrowgrass	
Red grasswort	

Once salt-affected areas are recognized, either by visual inspection or by the use of soil test information, it is important to also recognize and treat the recharge area. Many treatments for long-term mitigation of salt-affected areas rely on practices applied to the recharge area. Some resources to help identify recharge areas include:

- Soil Surveys – soil surveys may be used to locate gravelly or sandy soil areas upslope from the salt-affected area. These areas can serve as recharge areas and should be examined closely. Areas of 0 to 2 percent slope and depressions or closed basins can also serve as recharge areas.

- USGS Topographic Maps and Aerial Photos – These may be useful in identifying and delineating land characteristics and overland water flow patterns.

- Monitoring Wells – Wells are carefully logged noting depths too dense (clay or shale) and highly permeable (sand, gravel) zones.



Once the recharge area is identified, plant deep-rooted perennials such as alfalfa to dry the soil profile in the recharge area. If the establishment of perennial vegetation is not an option, annual cropping should be used. An appropriate fertility program will be needed to ensure successful crops.

Once the recharge area is successfully treated the salt-affected/saline seep can be treated. An electrical conductivity test must be conducted prior to attempting to effect a change in species composition. Once the degree of salinization is quantified, adapted vegetation can be planted.

Tables 1 and 2 come from Colorado State University Cooperative Extension Bulletin no. 0.505 by P.N. Soltanpour and R. H. Follett.

The tables indicate the approximate soil salt concentration, expressed as electrical conductivity of a saturated paste extract, at which 0, 10, 25 and 50 percent yield decreases may be expected. Crops in each class are ranked in order of decreasing salt tolerance insofar as possible.

Table 1 – Salt Tolerance of Field Crops

	Relative yield decrease - %			
	0%	10%	25%	50%
Crop	mmhos/cm (ds/m)			
Barley	8.0	10.0	13.0	18.0
Sugarbeet	7.0	8.7	11.0	15.0
Wheat	6.0	7.4	9.5	13.0
Safflower	5.3	6.2	7.6	9.9
Sorghum	4.0	5.1	7.2	11.0
Corn	1.7	2.5	3.8	5.9
Fieldbean	1.0	1.5	2.3	3.6

Table 2 – Salt Tolerance of Forage Crops

	Relative yield decrease - %			
	0%	10%	25%	50%
Crop	mmhos/cm (ds/m)			
Tall wheatgrass	7.5	9.9	13.3	19.4
Wheatgrass	7.5	9.0	11	15
Crested Wheatgrass	3.5	6.0	9.8	16
Barley Hay	6.0	7.4	9.5	13
Perennial Rye	5.6	6.9	8.9	12.2
Tall Fescue	3.9	5.8	8.6	13.3
Beardless Wildrye	2.7	4.4	6.9	11.0
Sweet Clover	1.5	3.2	5.9	10.3
Orchardgrass	1.5	3.1	5.5	9.6
Vetch	3.0	3.9	5.3	7.6
Alfalfa	2.0	3.4	5.4	8.8
Clover – alsike, red	1.5	2.3	3.6	5.7