

Agronomy No. 4

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Subject: PLANTS AND SOIL TEST FOR SALINE ALKALINE SOILS

Saline seeps and their associated saline-alkaline soils are increasing throughout the state of Wyoming. As soil salinity increases, the cropland is no longer productive, supporting only salt-tolerant weeds. Planting salt-tolerant plant materials on saline seep discharge areas will not itself control the growth of a seep; however, salt-tolerant plants aid the reclamation process. The excess subsurface water originating in the recharge area must first be controlled with permanent, deep-rooted plant cover, an intensive cropping system, or other management techniques. Salt-tolerant forage plants established on discharge areas will compete with weeds, utilize excess soil moisture, and stabilize the soil surface against wind and water erosion.

Substantial acres of heavy, poorly drained, irrigated and subirrigated soils along the major river drainages are also becoming salinized. Restricted drainage and poor irrigation water management have led to the loss of agricultural land. In some areas, salt accumulation may be too great to leach or dilute adequately enough to return this land to crop production, necessitating a permanent, salt-tolerant plant cover.

The most salt-tolerant forage species (listed in order of their relative salt tolerance) that are commercially available are as follows:

Beardless wildrye [Leymus triticoides (Buckl.) Pilger]. A strongly rhizomatous, native grass that is capable of spreading into extremely saline soils where it failed to establish from seed. Because of seed dormancy, it is imperative that the seed is planted in late fall to provide a cold, wet stratification treatment prior to germination.

Tall wheatgrass [Thinopyrum ponticum (Podp.) Barkworth & Dewey]. Tall wheatgrass is a tall-growing, coarse stemmed, late maturing grass. This introduced grass is best grown in pure stands to avoid management problems related to its relative palatability. This grass has excellent seedling vigor and is capable of establishing quicker than most other forage grasses.

Russian wildrye [Psathyrostachys juncea (Fisher) Nevski]. Russian wildrye is a long-lived, drought-resistant grass that is vigorous and persistent once established. Because of its heavy root growth, this grass is very competitive with other species as well as with itself. Stands are often open, leaving a lot of soil exposed. This plant has exhibited excellent establishment on saline seeps that are drying up, but it cannot tolerate the high water table of active seeps.

Altai wildrye [Leymus angustus (Trin.) Pilger]. This deep-rooted, introduced grass is capable of extracting soil moisture from depths in excess of 10 feet. Because of the rooting ability and salt tolerance, altai wildrye is adapted for use in both saline seep discharge and recharge areas. This grass matures early and has excellent fall regrowth.

Slender wheatgrass [Elymus trachycaulus (Link) Gould ex. Shinners]. Slender wheatgrass is a short-lived, shallow-rooted, native bunchgrass capable of withstanding

periodic flooding as well as extended drought. Its seeding vigor and rapid establishment make it a very competitive species during the first 2 years of a planting. It is often used in mixtures to provide initial cover and stabilization as the slower, long-lived species establish.

Tall fescue (*Festuca arundinacea* Schreb.). Tall fescue is a long-lived, perennial bunchgrass introduced from Europe. This grass yields well on poorly drained, moderately salty soils. It produces an abundance of basal leaves and an extensive shallow root system, making it a very good soil stabilizing plant.

Every saline-affected site is unique in the kind and amount of salts, soil type, available soil moisture, and climatic conditions. Prior to any seeding attempts in saline-alkaline soils, soil samples (at least surface 6") should be taken to determine the salinity level or any nutrient deficiencies. Soils with electrical conductivity (E.C.) greater than 25 mmhos/cm, or with Sodium Absorption Ratios (SAR) in excess of 12 in high salinity soils or in excess of 25 in low salinity soils, should not be seeded until chemical amendments, leaching, and /or drainage has reduced the sodium and salinity hazard

It is impractical to recommend a universal mixture covering all variables at all site. Species not only vary in their salinity tolerance, but also in their ability to withstand a high water table or drought conditions. Table 1 graphically displays salt tolerance and available soil moisture preference of the major forage species, comparing them with the salt tolerance of the primary agronomic crops of Wyoming. The extremes that each species will tolerate vary with each cultivator and for each specific planting site; however, this table compares the relative salt tolerance of all commercially available species. Most of these species can be seeded by themselves or in combination with two or three additional species, depending on the site. Beardless wildrye and tall wheatgrass are by far the most salt-tolerant species on wet area (a water table at or within 3 feet of surface). Because of their extensive root systems, Russian wildrye, tall wheatgrass, and alтай wildrye are quite drought tolerant, and perform best on the drier saline sites (water table below 3 feet and 12" to 18" annual precipitation). Slender wheatgrass has good salt tolerance on both wet and dry sites, but since it is relatively short-lived, it should only be included in mixtures for quick establishment and cover; but you cannot count on it to persist over the long term. On moderately saline sites, crested wheatgrass, pubescent wheatgrass, and intermediate wheatgrass can be used on the dry sites, white tall fescue and western wheatgrass are best adapted to the wet sites. On seeps that are just developing, i.e., there is moderate to low salinity with excess soil moisture prohibiting normal cultivation, 'Garrison' creeping foxtail and/or tall fescue can be utilized. There are no commercially available legumes that will establish in very strongly saline soils, although there are legumes presently being evaluated for their salinity tolerance.

On large sites, soil analyses can help to delineate varying salinity levels, allowing specific mixes to be seeded on the appropriate site. On small areas (less than 2 to 3 acres), a more diverse mix can be utilized, allowing each species to establish in the area for which it is best adapted. Commercially available cultivars are listed in table 2.

Although the saline-seep discharge areas and other salinesubirrigated sites are not traversable during much of the year, it is imperative that there is weed control and seedbed preparation, whether it be mechanical or chemical. Weed competition and heavy trash are the biggest obstacles in the seeding and establishing plant materials on saline sites. Late fall is usually the only time that these sites are saline sites. Late fall is usually the only time that these sites are safely traversable. Seeding should be done in the late fall or during a snow-freeze period in winter. The seed should be in the ground, ready to utilize early spring precipitation (which dilutes surface salts), increasing the probability of germination and establishment. The planting depth should be between one-fourth and one-half inch, seeded into a firm seedbed.

TABLE 1. Soil salinity at which various forage and crop species can be established under good soil-moisture and seedbed conditions.

FIELD CROPS														
Barley	:	---	:	:	:	:	:	:	:	:	:	:		
Sugar beets	:	---	:	:	:	:	:	:	:	:	:	:		
Wheat	:	---	:	:	:	:	:	:	:	FIELD CROPS	:	:		
Oats	:	---	:	:	:	:	:	:	:	:	:	:		
Corn	:	---	:	:	:	:	:	:	:	:	:	:		
FORAGES (WET)*														
Beardless wildrye	:	---	:	:	:	:	:	:	:	:	:	:		
Tall wheatgrass	:	---	:	:	:	:	:	:	:	:	:	:		
Slender wheatgrass	:	---	:	:	:	:	:	:	:	:	:	:		
Tall fescue	:	---	:	:	:	:	:	:	:	:	:	:		
Western wheatgrass	:	---	:	:	:	:	:	:	:	:	:	:		
Strawberry clover	:	---	:	:	:	:	:	:	:	:	:	:		
Creeping foxtail	:	---	:	:	:	:	:	:	:	FORAGES (WET)*	:	:		
Meadow brome	:	---	:	:	:	:	:	:	:	:	:	:		
Cicer milkvetch	:	---	:	:	:	:	:	:	:	:	:	:		
Orchardgrass	:	---	:	:	:	:	:	:	:	:	:	:		
FORAGES (DRY)*														
Russian wildrye	:	---	:	:	:	:	:	:	:	:	:	:		
Tall wheatgrass	:	---	:	:	:	:	:	:	:	:	:	:		
Altai wildrye	:	---	:	:	:	:	:	:	:	:	:	:		
Slender wheatgrass	:	---	:	:	:	:	:	:	:	:	:	:		
Crested wheatgrass	:	---	:	:	:	:	:	:	:	:	:	:		
Pubescent wheatgrass	:	---	:	:	:	:	:	:	:	:	:	:		
Intermed. wheatgrass	:	---	:	:	:	:	:	:	:	:	:	:		
Smooth brome	:	---	:	:	:	:	:	:	:	FORAGES (DRY)*	:	:		
Sweetclover	:	---	:	:	:	:	:	:	:	:	:	:		
Birdsfoot trefoil	:	---	:	:	:	:	:	:	:	:	:	:		
Alfalfa	:	---	:	:	:	:	:	:	:	:	:	:		
ELECTRICAL CONDUCTIVITY	2	4	6	8	10	12	14	16	18	20	22	24	26	28
(mmhos/cm @ 25% C)														
SALINITY HAZARD	Low		Medium		High				Very High					

\* Wet areas defined as irrigated or having a water table at or within 3 feet of the soil surface. Dry areas defined as having water table deeper than 3 feet below the surface and receiving 12"-18" annual precipitation.

TABLE 2. Recommended seeding rate and commercially available cultivars of the most salt-tolerant forage species.

Common Name	Available Cultivars
Beardless wildrye	Shoshone
Tall wheatgrass	Alkar, Orbit, Jose, Largo
Russian wildrye	Vinall, Sawki, Mayak, Swift, Cabree, Bozoisky-Select
Altai wildrye	Prairieland
Slender wheatgrass <u>1/</u>	Revenue, Primar
Tall fescue	Kenmont, Fawn, Goar, Alta
Western wheatgrass	Rosana, Rodan, Arriba, Barton, Walsh
Creasted wheatgrass	Fairway, Parkway, Nordan, Hycrest, Ephraim, Summit, (P-27 Siberian wheatgrass)
Creeping Foxtail	Garrison, Retain
Strawberry clover	Salina, O'Connors
Birdsfoot trefoil	Tretana. Leo, Empire
Cicer milkvetch	Lutana, Monarch
Alfalfa <u>2/</u>	numerous

1/ Slender wheatgrass is relatively short-lived and should be planted in mixtures only.

2/ Alfalfa is best adapted for establishment on the periphery of a saline discharge area or in recharge areas.