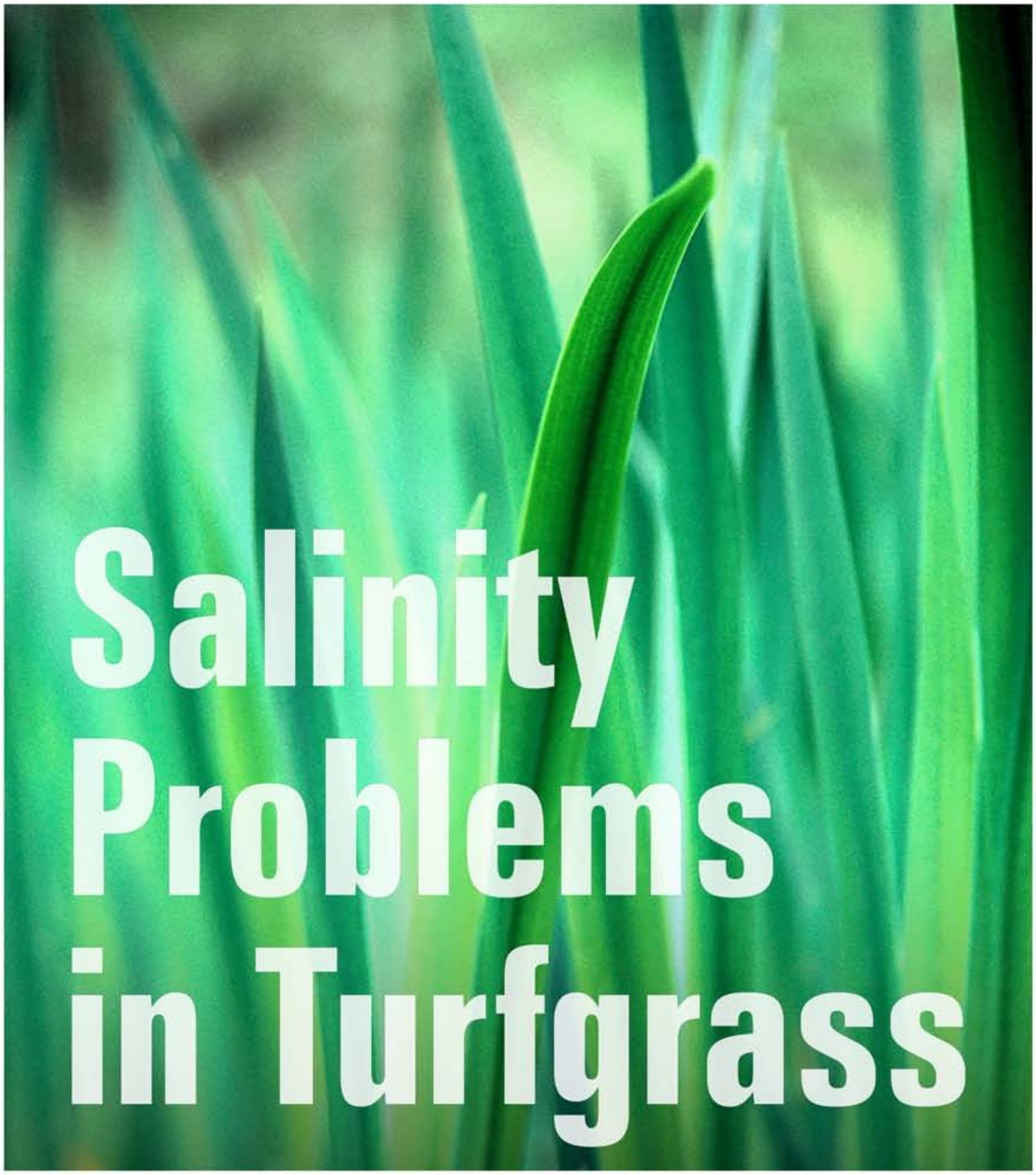

Salinity Problems in Turfgrass

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Soluble salts in soil can restrict plant growth. Salinity problems in turfgrass can be difficult to diagnose and to manage. Wyoming soils often contain enough soluble salt to make it a serious problem when establishing and maintaining a lawn. This bulletin focuses on salinity and suggests ways to manage saline soils for turf.

Soluble salts usually consist of carbonates, bicarbonates, sulfates, chlorides, and nitrates combined with calcium, sodium, magnesium, potassium, and other minerals. They accumulate from fertilizers, irrigation water, and the natural breakdown of soil minerals. In arid regions like Wyoming, salts accumulate in the upper soil layer because annual precipitation is not sufficient to move them below the root zone. When present, impervious soil layers, such as clay hardpans, can also stop the downward movement of these salts even in moist soils.

A high level of soluble salt reduces water intake by plant roots. The plant is subjected to drought conditions even when soil moisture is adequate. The plant is unable to take up sufficient water and reduced growth or death may occur.

Salinity (salt content) is not the same as the pH of soil. pH is a measure of acidity or alkalinity of a soil. The salts themselves are usually pH neutral, meaning they are neither extremely acidic nor extremely alkaline; however, acidic or alkaline soils may both contain high salt levels. Also, care must be taken not to confuse a salinity problem with a sodium problem (sodic soil). Only a soil test can tell the difference between the two conditions and each requires a different management strategy.

Salinity can be measured by the electrical conductivity (EC) of a water extract of saturated soil. It is reported in deciSiemans per meter (dS/m) or in millimhos per centimeter (mmhos/cm). The saltier the soil (or the more saline), the greater its conductivity and the higher the number will be. The general classification of salinity is as follows:

EC (dS/m or mmhos/cm)	Interpretation
0 to 2	Negligible salinity
2 to 4	May restrict growth of very sensitive plants
4 to 8	Growth of many plants will be restricted
8 to 16	Only tolerant plants will grow well
Above 16	A few very tolerant plants will grow satisfactorily.

Sodium in Soil

A sodic soil is one in which sodium (Na^+) levels are considered too high for optimum plant growth. Many horticultural plants are highly sensitive to excess sodium in soil and irrigation water.

Too much sodium in soil means less than optimum plant growth. When sodic soils are wet, they become sticky and do not allow water to percolate down into the soil profile. When sodic soils are dry, they tend to clump together in hard clods, making the soil difficult to work.

Excess sodium also inhibits plant uptake of other nutrients. Plants will take up sodium before they take up calcium, magnesium, and other positively charged nutrients. This leads to nutritional imbalances within the plant and sub-optimal growth.

Using irrigation water with high levels of sodium in it may turn a good soil into a poor one. A sodic situation may soon develop.

A non-saline sodic soil has high sodium levels but few dissolved salts. A saline soil contains high levels of soluble salts, high enough to interfere with plant growth and development. A saline-sodic soil contains high levels of both sodium and dissolved salts.

How do you know if you have sodic, saline, or saline-sodic soil? Have a soil test run.

What to do about soil salinity problems

Most turfgrasses will grow well if the soil EC is 4 or less. Higher EC readings require either reducing salt levels in the soil by leaching or by implementing management strategies to minimize salt accumulation.

High salt levels in soil can be reduced by leaching. Leaching is the application of large amounts of water to dissolve the salts and move them down through the soil below plant roots. Water that is low in salts and sodium should be used. The soil must be porous enough to allow the salt-laden water to move down below the root zone. Tile drains or open ditch drains may need to be installed if subsurface drainage is poor.

Leaching works well before seeding a new lawn, laying sod, or on an established lawn. If the area is new and hasn't been seeded or sodded, leach only if erosion will not be a major problem. If the soil is bare and sloping, leaching may not be possible.

Having a soil test done before installing a new lawn is always best, especially since young grass seedlings tend to be more sensitive to high salts than older, larger turf plants. For further information on how to seed or sod a new lawn, check bulletin B-1129 *Landscaping: Turf in Wyoming*.

The amount of water you apply for leaching depends on the salt reduction needed and the normal root depth. Six inches of good quality water will leach out about one-half of the salt as it moves through a foot of soil. Twelve inches will remove about fourth-fifths of the salt. Grass roots often reach at least one foot deep so lower the EC to a tolerable level in the upper foot of soil. Remember that soil salinity cannot be lowered to a level below the EC reading of the irrigation water. If you have saline irrigation water, you may need to find a different water source. Always analyze water from new wells before using for irrigation.

Occasional leaching is a good practice after the initial high-salt level has been reduced. It may be necessary once or twice a year. The frequency depends on the sensitivity of the crop, the amount of regular irrigation, the salt content of the irrigation water, etc. Do not regularly overwater. It wastes more water than periodic leaching.

Grasses vary in their tolerance to soluble salt. When the EC cannot be reduced below 4, choose and use those kinds which are more tolerant. Information on salt tolerance is incomplete at this time. General information on species tolerance is given in Table 1.

Table 1: Approximate salt tolerance of turf species

Tolerance	Maximum dS/m or mmhos/cm*	Turf type
High	20-30	Fults alkaligrass
	8-16	Creeping bentgrass
Moderate	6-12	Creeping red fescue
	12	Wheatgrasses
	8-10	Tall fescue
	8	Perennial ryegrass
	8	Blue grama
	6	Buffalograss
Low	4	Kentucky bluegrass
	4	Chewings fescue
	4	Sheep fescue
	4	Hard fescue

*Note: growth may be decreased by 50 percent or more at these soil EC levels.

There are differences between cultivars within the species listed above. You may find selection of specific cultivars helpful in obtaining the desired tolerance. Relative tolerance of some cultivars is given in Table 2.

Bicarbonates

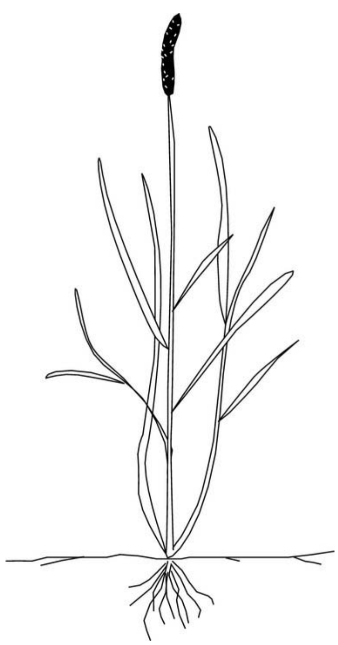
Bicarbonates (HCO_3^-) occur naturally in most water supplies. Sodium bicarbonate, or baking soda, is a common bicarbonate that can exist as a solid. Calcium and magnesium bicarbonates exist only in solution. Bicarbonates can interfere with uptake of other nutrients essential for plant growth. Evaporation and plant uptake of water leave carbon dioxide (CO_2) and lime ($CaCO_3$) behind. Carbon dioxide goes off into the air and the insoluble lime is left in the soil. Nutrient imbalances occur and plant growth is inhibited.

How about tall fescue and perennial ryegrass?

Most tall fescue cultivars are considered to have good tolerance to salts. Perennial ryegrasses offer moderate to good resistance to salts in the soil. For specific cultivars recommended for Wyoming, check UW CES bulletin B-1129 *Landscaping: Turf in Wyoming* at (http://www.uwyo.edu/CES/PUBS/Horticulture/Horticulture_Publications_Main.htm).

Table 2. Relative salt tolerance of turfgrass cultivars

	Relative tolerance		
Species	**Better**	**Fair**	**Poorer**
Creeping bentgrass	Arlington Seaside		Penncross
Fine fescues	Dawson Golfrood	Illahee Rainier Ruby	Durar Jamestown Pennlawn Scaldis Wintergreen
Kentucky bluegrass	Nugget Parade	A-34 (Bensun) Aquila Baron Birka Cheri Fylking Majestic Newport Park Sydsport Touchdown Victa Windsor	Adelphi Bonnieblue Glade Merion Pennstar Prato Vantage



It is difficult to compare cultivars of different species. Generally, the Kentucky bluegrasses are more salt tolerant than the fine fescues. Two exceptions are fine fescue cultivars Dawson and Golfrood, both of which show better salt tolerance than other fine fescues.

Do not add salt to your soil

Some widely used soil amendments are believed to be helpful in reducing soil salinity. Several are actually harmful. Adding lime, gypsum, wood ashes, or sulfur to saline soil will not reduce the problem. These compounds contain chemicals which actually add salts to the soil. Never use them unless they are recommended by a soil testing laboratory. Even the fertilizer needed for good growth consists of chemical salts. You should use fertilizers with a low salt index per unit of nutrient applied whenever possible. This partial salt index for several common sources of nitrogen is given in Table 3. Use the fertilizer with the lowest partial salt index whenever the material is suitable.

Table 3. Partial salt index of several nitrogen sources

Fertilizer	Formulation	Relative salt content per pound of nitrogen (partial salt index)
Ammonium sulfate	21-0-0	3.3
Ammonium nitrate	33-0-0	3.2
Urea	45-0-0	1.6
Sulfur-coated Urea	32-0-0	NA
Ureaformaldehyde	38-0-0	0.3
IBDU (isobutylidine diurea)	31-0-0	0.2