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Growing turf on salt-affected (alkali) sites

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Quick Facts

A salt problem often is indicated by a white or yellow-brown crust (salt) on the soil surface.

Kentucky bluegrass is seldom successful in areas where salts concentrate.

Use perennial ryegrass, fine fescue, tall fescue, wheatgrass and alkaligrass for home lawns where salt levels inhibit Kentucky bluegrass growth.

Saline and sodic soils need to be managed differently. These are best identified by a soil test.

Soil salts are best reduced by improving internal drainage and then watering heavily to help flush salts below the root zone.

Frequently, high levels of soluble (saline) salts in the soil cause problems in Colorado lawns. Leaching salts and the use of salt-tolerant grasses often can remedy this problem. In those instances where the irrigation water used is high in soluble salts or exchangeable sodium, a salt-tolerant grass may be the only solution to the problem.

Turfgrasses

Grass subjected to high soluble salt levels can suffer from root damage, more disease problems, and poor drought resistance. Kentucky bluegrass, the most commonly-used grass in Colorado, does poorly where salt levels are high (greater than 6 mmhos/cm). An inexpensive, simple soil test will determine the salt level in the soil, enabling the home owner to select the best grass species for the salt-affected site. Less familiar, salt-tolerant

grasses for home lawns are perennial ryegrass, tall fescue, red fescue, wheatgrass, alkaligrass, and bermudagrass. Perennial ryegrass and alkaligrass are fine-textured and should be mowed, fertilized, and watered like a Kentucky bluegrass lawn. Turf-type tall fescue and crested wheatgrass often look coarser and lighter green than Kentucky bluegrass. They require less fertilization than bluegrass and do not form thatch. Bermudagrass is an aggressive, creeping sod-former that does best in the warmer areas of Colorado. It greens up late in the spring (May) and turns brown with the first hard frost in the fall (see Table 1).

When subject to high salt levels, grass can suffer root damage that results in increased drought kill and crown and root disease problems. With the same conditions, Bluegrass can turn blue-gray, which indicates drought stress due to excessive soil salts dehydrating the plant's roots even in moist soils.

If the quality of the irrigation water is unknown, or is suspect, check it for soluble salts and sodium. Avoid irrigation water with a sodium absorption ratio (SAR) exceeding 10.

Higher Quality Grasses for Salty Sites

Salty sites can be planted with a single species, or mixes of different salt-tolerant grasses. In low

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Table 1: Approximate salt tolerance of turfgrass species.

Turfgrass Species	Salt Tolerance* (mmhos/cm)	Growth Habit
Kentucky Bluegrass	3-6	sod-forming grass
Buffalograss	3-6	sod-forming grass
Blue grama	5-6	bunch grass
Smooth brome grass	6-8	sod-forming grass
Perennial ryegrass	8-10	bunch grass
Tall fescue	8-10	bunch grass
Red fescue	8-12	sod-forming grass
Crested wheatgrass	8-12	weak sod-forming grass
Bermudagrass	16-18	sod-forming grass
Fults' alkaligrass	20-30	bunch grass

* Salt levels above which noticeable plant growth reduction and management problems normally occur; mmhos/cm is an expression of the salt content of the soil. This number increases as the salt content of the soil increases, and is easily determined by a soil test.

salt areas, Buffalograss and blue grama can be planted together, but do not mix with other grass species. These are warm-season grasses that green in May and brown with the first hard frost in the fall. Do not use them above 6,500 feet elevation.

Bermudagrass also is a warm-season grass and should be planted by itself. It performs best in the southeastern and warmer western areas of Colorado, but can be used successfully in most parts of Colorado below 6,500 feet elevation. Brome grass, tall fescue, and Crested wheatgrass can be planted with each other, or alone. They do not blend well with the finer-textured grasses like ryegrass or bluegrass. Plant perennial ryegrass only when the lawn will be intensively managed, it will not persist under low maintenance. Red fescue provides a dark green, fine-textured lawn and prefers drier soils. Alkaligrass looks like red fescue, but does best where it is well-watered.

Do not confuse the turf-type tall fescues with the older forage-types such as Alta, Fawn, Goar, Kenmont, Kentucky-31, and Kenwell. The newly developed cultivars generally are darker green, have finer and smoother leaves, and are more tolerant of shade than older cultivars. The new turf-types include Mustang, Bonanza, Jaguar II, Rebel Jr., Rebel II, Apache, Olympic, Falcon, Maverick II, Arid, Crossfire and Shortstop.

Grasses with moderate to good salt tolerance are available in some nurseries and garden centers. If a mix contains grasses of different salt tolerance, grasses unable to tolerate the salts in the soil will die out. Grasses that are resistant to that particular salt level will survive.

When a small seed such as bluegrass, is premixed with a larger seed (i.e. perennial ryegrass) and applied with a typical homeowner-type seeder, the rye "floats" to the top. As this mix is spread, the smaller seed at the bottom of the hopper is spread first. This results in a lawn with bluegrass in the first area seeded, and perennial ryegrass in the last area seeded. When applying a mix of grasses of differing weights and sizes, it is best to purchase and apply them separately.

Grasses for Naturalized or Low Maintenance Areas

Select grasses for infrequently mowed, fertilized, and irrigated areas on the basis of salt tolerance, if the soil is salty. Wheatgrasses (tall, western, and crested), red fescue, and tall fescue all do well if left unmowed. They will become clumpy and look less "turf-like" under reduced maintenance, but will persist and provide a good soil cover. Without irrigation, these grasses become dormant during extended drought. Brome grass can be used alone or with the above species if soil salt levels are only moderately high. Where salt levels are relatively low, blue grama and buffalograss (both native to Colorado) are excellent choices for naturalized or low maintenance lawns. Never plant Kentucky bluegrass and perennial ryegrass where reduced maintenance practices are used. They will not persist without regular mowing, fertilization and irrigation.

Internal Drainage

Washing salts off the soil surface is not sufficient to prevent damage to grass roots. Internal drainage usually needs to be improved to allow the leaching of the salts below the root system of the grass. Sometimes a layer of clay in the soil will prevent proper drainage. Breaking through such layers can increase drainage and the downward movement of salts.

Table 2: Good quality water needed for salt reduction.

Amount of water	% Salt reduction
6 inches	50%
1 foot	80%
2 feet	90%

"White alkali" (soluble salts) seen in many areas of the state are chlorides, sulfates, carbonates and sometimes nitrates of calcium, magnesium, potassium and other minerals. These salts are mostly soluble. They can be leached out of soils with good internal drainage when good quality irrigation water is used. Good drainage and good irrigation water can provide a permanent solution to high soluble salt problems. (See Table 2.)

Soluble salts generally are serious in heavy soils where adequate drainage does not exist. Adding good quality organic matter at the rate of 3 to 6 cubic yards per 1,000 square foot area, and thoroughly mixing this with the existing soil to a depth of at least 6 inches, can improve drainage. Avoid, however, the excessive use of cow or steer manure because it may be high in salts. Feedlot manures generally contain more salt than dairy manure (see 7.222, *Soil-the key to successful gardening*). Horse manure, while often contaminated with weed seed, often is mixed with straw, hay or wood chips. These materials resist rapid decomposition and consequently improve internal drainage longer than cow manure or other fine materials.

Adding sand as a soil amendment to loosen clay soils is seldom recommended. Sand mixed with heavy clay soil frequently sets up like concrete. However, a sandy soil may be used as topsoil provided good subsurface drainage exists. Partially mix topsoils with the subsoil to prevent the reduced drainage that often occurs when soils are layered.

For white alkali, the addition of gypsum is not recommended. A high percentage of white alkali in Colorado is gypsum (calcium sulfate). The addition of gypsum only increases the concentration of gypsum in the soil, increasing the salt problem (see Service in Action 0.503, *Salt-affected soils* and 0.504, *Management of salt- and sodium-affected soils*).

In some cases, the installation of a tile drain system needs to carry salty water to a drainage ditch or sump. In other instances, gravel or coarse sand filled trenches may be used to help move salt-laden water off a problem site.

A high water table, 48 inches or less below the surface, can aggravate a soluble salt problem and create a hydraulic connection with the soil surface. This allows the pumping of soluble salt to the soil surface. If an outlet is available, use a tile drain system to reduce a high water table problem. In addition, place a layer of coarse sand above the water table and below a layer of good, sandy soil to stop upward water and salt movement. Then plant grass in the sandy soil. Impervious barriers of plastic, blacktop and concrete placed under lawns and above the water table have been suggested as a possible solution to this specific problem. However, these have caused serious problems of salt build-

up resulting from improper fertilization and poor quality water.

In many instances, it may not be practical to amend, drain and leach the soil for bluegrass; however, a salt-tolerant grass may provide an acceptable solution. This is especially true where a lawn is in a low, poorly drained area where a high water table exists, or when salt moves from an unlined irrigation ditch into a lawn area. There are some areas in Colorado where the combination of high salts and heavy clay soils preclude the planting of any turf variety without excessive costs.

Sodic Soils Differ

Sodic soils (black alkali) contain an excess of sodium and are very difficult to manage. They often need to be amended, perhaps with gypsum, before planting any turfgrass species. Leaching sodic soils that contain a high salt level will deteriorate drainage and create a worse problem than the original one. Before leaching, always test the soil by a reputable lab to determine if such amendments as gypsum are required. Leach the soil only after the addition of a required amendment, never before.

A soil test through a private laboratory or the Colorado State University Soil Testing Laboratory can determine whether you have a saline (white alkali) and/or sodic salt problem. A soil test to determine salt levels can save time, effort and money by helping determine the best adapted grasses, especially in those instances where a white alkali or sodic soil problem is suspected. Soil test bags and information sheets are available from all Colorado State University Cooperative Extension county offices.