



Salt Tolerance of Plants

Plant species vary in how well they tolerate salt-affected soils. Some plants will tolerate high levels of salinity while others can tolerate little or no salinity. The relative growth of plants in the presence of salinity is termed their *salt tolerance*.

Salt tolerances are usually given in terms of the stage of plant growth over a range of electrical conductivity (EC) levels. Electrical conductivity is the ability of a solution to transmit an electrical current. To determine soil salinity EC, an electrical current is imposed in a glass cell using two electrodes in a soil extract solution taken from the soil being measured (soil salinity). The units are usually given in deciSiemens per metre (dS/m).

Table 1 categorizes salinity into general ranges from non-saline to very strongly saline. These values are used for plant selection for saline soils. Salinity levels vary widely across a saline seep. Salinity also varies from spring to fall. Salinity usually appears on the soil surface just after spring thaw.

A high salt level interferes with the germination of new seeds. Salinity acts like drought on plants, preventing roots from performing their osmotic activity where water and nutrients move from an area of low concentration into an area of high concentration. Therefore, because of the salt levels in the soil, water and nutrients cannot move into the plant roots.

As soil salinity levels increase, the stress on germinating seedlings also increases. Perennial plants seem to handle salinity better than annual plants. In some cases, salinity also has a toxic effect on plants because of the high concentration of certain salts in the soil. Salinity prevents the plants from taking up the proper balance of nutrients they require for healthy growth.

Extensive research on salt tolerance for prairie conditions was done in 1988 (Table 2). It should be noted that crop tolerances developed for chloride-dominated soils, such as those in California, may not be applicable to crops grown on the sulphate-dominated soils typically found in western Canada.

Table 1. Salinity rating and electrical conductivity value

Soil Depth	Non-Saline	Weakly Saline	Moderately Saline	Strongly Saline	Very Strongly Saline
0-60 cm (0-2 ft)	<2 ds/m*	2 - 4 ds/m	4 - 8 ds/m	8 - 16 ds/m	>16 ds/m
60-120 cm (2-4 ft)	<4 ds/m	4 - 8 ds/m	8 - 16 ds/m	16 - 24 ds/m	>24 ds/m

* ds/m = decisiemens per metre.

The dominant salts in prairie saline seeps are calcium (Ca), magnesium (Mg), sodium (Na) cations and sulfate (SO₄) anions. If Na levels are high or not balanced with the Ca and Mg, soil tilth can also be effected. The positively charged Na cations attach to the negatively charged clay particles in the soil, causing the soil to be sticky when wet, and hard and impermeable when dry.

Table 2 gives salinity tolerance ratings for a range of plant species and a range of salinity levels. New research underway may modify the rating of some plant types. As a general rule, plants that have low drought tolerance will have low salinity tolerance.

Prepared by
Don Wentz

Table 2. Salt tolerance of various types of plants				
Salt Tolerance/ EC (dS/m)	Field Crops	Forages	Vegetables	Trees, Shrubs
Very High 20		beardless wildrye fulks altai grass levonnns alkaligrass alkali sucatan		
High 16	kochia sugar beets	altai wildrye tall wheatgrass Russian wildrye slender wheat grass		Siberian salt tree sea buckthorn silver buffaloberry
8	6-row barley safflower sunflower 2-row barley fall rye winter wheat spring wheat	birdsfoot trefoil sweetclover alfalfa bromegrass	garden beets asparagus spinach	hawthorn Russian olive American elm Siberian elm villosa lilac laurel leaf willow
Moderate	oats yellow mustard	crested wheatgrass intermediate wheatgrass	tomatoes broccoli	spreading juniper poplar
	meadow fescue flax canola	reed canary grass	cabbage	ponderosa pine apple mountain ash
4	corn		sweet corn potatoes	common lilac Siberian crab apple Manitoba maple Viburnum
Low	timothy peas field beans	white dutch clover alsike clover red clover	carrots onions strawberries peas beans	Colorado blue spruce rose Douglas fir balsam fir cottonwood aspen, birch raspberry
0				black walnut dogwood little-leaved linden winged euonymus spirea larch

Adapted from McKenzie, R.C. 1988. "Tolerance of plants to soil salinity." Pages 246-251 in *Proceedings of the Dryland Salinity Control Workshop*, Calgary, Alberta. Alberta Agriculture, Food and Rural Development, Conservation and Development Branch.