

Soluble Salts

The term soluble salts refers to the inorganic soil constituents (ions) that are dissolved in the soil water. Pure water is a very poor conductor of electric current, whereas water containing dissolved salts conducts current approximately in proportion to the amount of salt present. Thus, measurement of the electrical conductivity of a soil extract gives an indication of the total concentration of soluble salts in the soil. The electrical conductivity measurement is reported in units of millimhos per centimeter (mmhos/cm), although some labs report decisiemens per

meter (dS/m). One decisiemen per meter is equal to one mmhos/cm. Soluble salt levels in the soil are important, because high soluble salts can reduce water uptake by plants, restrict root growth, cause burning of the foliage, inhibit flowering, and limit fruit and vegetable yields. Sensitivity to soluble salts differs among plant species/cultivars and their stage of growth. Seed germination and seedling growth are more sensitive to salt stress than the growth of mature plants. A soluble salt test can be useful when investigating the cause of poor plant growth, determining the suitability of a new planting site, or monitoring the quality of “black dirt” for use on landscaped areas. Relative salinity levels for different soluble salt test values and their effect on plant growth are given in **Table 4**. The relative salt tolerance of various cultivated plants is given in **Table 5**.

Table 4. Soluble salt test values and relative sensitivity levels of plants

Electrical conductivity*	Salinity level	Effect on plant growth
mmhos/cm		
0 to 2	non-saline	none
2.1 to 4	very slightly saline	sensitive plants are inhibited
4.1 to 8	moderately saline	many plants are inhibited
8.1 to 16	strongly saline	most cultivated plants inhibited
over 16	very strongly saline	few plants are tolerant

*saturated paste extract

Some soils in western Minnesota are naturally high in soluble salts (particularly sodium), but most soils in Minnesota are non-saline and soluble salt problems are the result of human activities. Excessive rates of fertilizer application and placing fertilizer too close to seeds or plant roots creates soluble salt problems. Pet urine and feces can increase soluble salts in

localized areas resulting in plant damage or death. The use of deicing salts (primarily in the form of sodium chloride) on streets and sidewalks frequently results in high soluble salt levels in adjacent areas that restrict the growth of turfgrass, flowers, and shrubs.

Table 5. Relative salt tolerance of various cultivated plants

Nontolerant (0-2 mmhos)	Slightly tolerant (2-4 mmhos)	Moderately tolerant (4-8 mmhos)	Tolerant (8-16 mmhos)
azalea	apple	beet	arborvitae
begonia	cabbage	black locust	asparagus
blueberry	celery	boxwood	juniper
carrot	creeping bentgrass	broccoli	Russian olive
cotoneaster	cucumber	chrysanthemum	Swiss chard
green bean	grape	geranium	alkaline grass
onion	forsythia	marigold	
pea	Kentucky bluegrass	muskmelon	
radish	lettuce	Nugget Kentucky bluegrass	
raspberry	linden	red oak	
red pine	Norway maple	seaside creeping bentgrass	
rose	pepper	spinach	
strawberry	perennial ryegrass	squash	
sugar maple	potato	tomato	
viburnum	red fescue	white ash	
white pine	red maple	white oak	
	snapdragon	zinnia	
	sweet corn		

Correcting Soluble Salt Problems

In soils where internal drainage is poor, prevention may be the only feasible approach for reducing salt problems. In well-drained soils, leaching with good quality water will help to correct soluble salt problems. Incorporation of gypsum (calcium sulfate) at the rate of 10 to 15 lbs./100 sq. ft. followed by leaching with good quality water can also be used. Gypsum is most effective in situations where sodium is the cause of high soluble salts. High levels of sodium in the soil will tend to disperse soil particles, resulting in poor soil structure and making water infiltration difficult. The calcium in gypsum will displace sodium and the sodium will then move (leach) out of the soil profile with irrigation water and/or rainfall. Soils high in calcium have better structure than those high in sodium. Use of gypsum on soils where sodium is not high has generally not been shown to be effective in improving soil structure. Thus, on low sodium soils, topdressing lawns with gypsum is not an effective way to improve soil structure and therefore not a recommended practice.