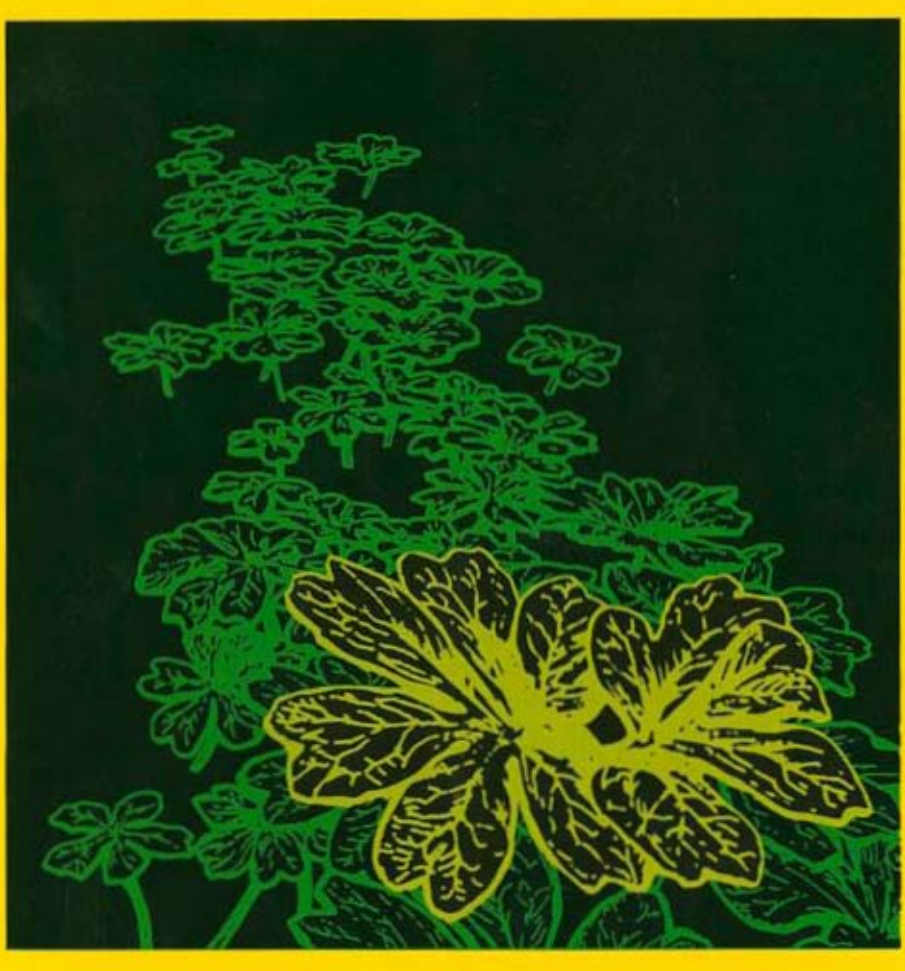
Salt Injury to Ornamental Shrubs and Ground Covers



UNITED STATES DEPARTMENT OF AGRICULTURE

HOME AND GARDEN BULLETIN NUMBER 231

PREPARED BY SCIENCE AND EDUCATION ADMINISTRATION

Contents

This bulletin supersedes Home and Garden Bulletin No. 95, *Reducing Salt Injury to Ornamental Shrubs in the West*, May 1964.

Issued July 1980

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

Salt Injury to Ornamental Shrubs and Ground Covers

Leland E. Francois, *SEA research agronomist*[1]

If the ornamental shrubs around your home exhibit leaf burn or fail to grow normally despite an adequate fertilizer and irrigation program, the trouble may be due to salinity.

Salts of various kinds are found in more soils and many are essential to plant growth. However, some soils contain an overabundance of salts, which at high concentrations can damage plants. Salts containing sodium or chloride are particularly injurious to ornamental shrubs.

How Soils Become Saline

Salts are usually carried to the soil in water. Water from rivers and wells always contains some dissolved salts. When water containing salts is used for irrigating plants, the water is taken up by the plants or evaporates from the soil surface, but most of the salt is left in the soil. Consequently, repeated light watering without drainage can result in considerable salt accumulation in the soil around the roots. The saltier the water, the faster salts accumulate in the soil.

Potted ornamentals may also be afflicted by salt accumulation. If only enough water is added to replace that lost by plant use or evaporation from the potting soil, injurious concentrations of salt will eventually occur.

Fertilizer, applied in amounts greater than necessary to meet the plant needs, can be as harmful as sodium or chloride in the soil. Adequate fertilization is necessary for healthy shrub growth, but too much causes more harm than good.

A high water table can also contribute to excess salt in the root zone. Evaporation of water from the soil causes ground water to move upward toward the surface, carrying salts into the upper soil level.

In most of the United States, rainfall normally flushes excess salt out of the root zone. In areas where the rainfall is less than 20 inches, as in many areas of the Western United States, the excess salt is likely to accumulate in damaging amounts unless preventive measures are taken.

[1]U.S. Salinity Laboratory, Riverside, CA 92502

How Salinity Affects Plants

Salinity generally causes stunting of plants. All plant parts—leaves, stems, roots, and fruits—are smaller than normal. The higher the salinity, the more the plant is stunted.

Sodium and chloride, the two elements most common in saline soils, may cause specific injury to certain plants. The accumulation of these elements in many ornamentals may cause leaf burn, premature leaf drop, or stem dieback. Salt-sensitive plants may be killed. The color illustrations show symptoms typical of sodium and chloride injury.

Salinity can injure ornamentals indirectly. The weaker shrubs may be less able to resist frost injury, disease, or insect infestation.

Salt injury is generally more severe during periods of hot, dry weather. High temperatures intensify leaf-burn injury caused by sodium or chloride. Salt also is likely to accumulate in the soil at an increased rate during hot weather. Water loss from the soil—through plant use and evaporation—is greatest then, and ordinary watering may not be heavy enough to leach salts from the root zone.

Sprinkling with saline water during the day time when evaporation is high may be potentially more injurious to ornamentals than surface irrigation. Leaves wetted by the sprinkling water absorb salts directly through their surface and injury may exceed that expected from soil salinity.

Frequent, light sprinklings with saline irrigation water should be avoided to prevent any buildup of salt on the leaf surface. When foliage is sprayed, sufficient water should be used to wash excess salts from the leaves.

Other sources of salt spray encountered in some areas include salt drift from ocean surf and deicing salts splattered on plants along streets by automobiles.

Oriental arborvitae

Chinese holly

Leaf injury typical of sodium and chloride accumulation.

Chinese hibiscus

Rose

Laurustinus

Pineapple guava

How Salinity Is Measured

Soil salinity is usually determined by measuring the electrical conductivity of the soil solution. A soil sample is saturated with distilled water, which mixes with the salt in the sample. The salt solution is then extracted from the sample and tested for its capacity to conduct an electric current. The saltier the soil solution, the greater its conductivity.

Conductivity, and hence soil salinity, has commonly been expressed in millimhos per centimeter (abbreviated as mmhos/cm). The metric unit for electrical conductivity is decisiemens per meter (abbreviated as dS/m). One dS/m equals one mmho/cm.

How much salt is represented by a conductivity of 1 dS/m? It represents about 2 level teaspoons of table salt dissolved in 5 gallons of water.

Confirming Salt Injury

If you suspect salt has injured your shrubs, it is well to confirm the cause of damage before beginning to correct it. Leaf burn and stunting are likely symptoms of a salinity problem but they may also be caused by drought.

To determine whether the damage is caused by salinity, you may want to have your soil and irrigation water tested. Leaf samples may also need to be tested at times to confirm a salinity problem. Your county agricultural agent or State Agricultural Experiment Station can tell you where to have these tests done.

Be sure that the soil sample taken is representative of the soil mass in which the roots are growing. Samples from ridges or surface soil where salts tend to accumulate may not give a true representation of the root area.

Plant Selection Is Important

Proper shrub selection can mean the difference between success and failure in landscaping when irrigating with saline water. The more saline the irrigation water is, the fewer the number of plants available for selection. The following table presents the salt tolerance of 41 shrubs, trees, and ground covers tested at the U.S. Salinity Laboratory, Riverside, Calif.

Common name	*Botanical name*
High Tolerance (Soil salinity no higher than 10 dS/m)	
Croceum Iceplant	*Hymenocyclus croceus*
Purple Iceplant	*Lampranthus productus*
Rosea Iceplant	*Drosanthemum hispidum*
White Iceplant	*Delosperma alba*
Ceniza	*Leucophyllum frutescens*
Brush cherry	*Syzygium paniculatum*
Bougainvillea	*Bougainvillea spectabilis*
Natal plum	*Carissa grandiflora*
Good Tolerance (Soil salinity no higher than 8 dS/m)	
Aleppo pine	*Pinus halepensis*
European fan palm	*Chamaerops humilis*
Rosemary	*Rosmarinus lockwoodii*
Spindle tree	*Euonymus japonica*
Blue dracaena	*Cordyline indivisa*
Oleander	*Nerium oleander*
Weeping bottlebrush	*Callistemon viminalis*

Common name	*Botanical name*

Moderate Tolerance
(Soil salinity no higher than 5 to 6 dS/m)

Spreading juniper	*Juniperus chinensis*
Pyracantha	*Pyracantha fortuneana*
Thorny Elaeagnus	*Elaeagnus pungens*
Oriental arborvitae	*Platycladus orientalis*
Indian hawthorn	*Raphiolepis indica*
Japanese black pine	*Pinus thunbergiana*
Dodonaea	*Dodonaea viscosa*
Xylosma	*Xylosma congestum*
Japanese boxwood	*Buxus microphylla*
Yellow sage	*Lantana camara*
Glossy privet	*Ligustrum lucidum*

Poor Tolerance
(Soil salinity no higher than 3 to 4 dS/m)

Compact strawberry tree	*Arbutus unedo*
Laurustinus	*Viburnum tinus*
Chinese hibiscus	*Hibiscus rosa-sinensis*
Heavenly bamboo	*Nandina domestica*
Japanese pittosporum	*Pittosporum tobira*
Algerian ivy	*Hedera canariensis*

Very Poor Tolerance
(Soil salinity no higher than 2 dS/m)

Southern yew	*Podocarpus macrophyllus*
Glossy abelia	*Abelia grandiflora*
Photinia	*Photinia fraseri*
Rose	*Rosa*
Chinese holly	*Ilex cornuta*
Pineapple guava	*Feijoa sellowiana*
Oregon grape	*Mahonia aquifolium*
Star jasmine	*Trachelospermum jasminoides*
Pyrenees cotoneaster	*Cotoneaster congestus*

If the soil salinity exceeds the limits given in the table, injury such as severe leaf drop, leaf burn, and/or stunting will usually occur. Shrub size makes little difference in warding off the injury.

Frost, heat, smog, and drought tolerances should also be considered in selecting shrubs suitable for your area. All of these environmental factors can weaken the plant and thus make it less able to withstand the detrimental effects of salinity.

Reducing Soil Salinity

To reduce soil salinity to a level that your shrubs can tolerate, irrigate heavily. This will leach the accumulated salt down into the soil below the root zone.

How heavily you irrigate will depend upon how saline the soil is and the depth of soil to be leached. If you excavate a shallow basin around the plant, and water the plant within that basin, then you will be able to judge the depth of the water entering the root zone. In general, for each foot of soil to be leached—

- 6 inches of irrigation water will leach out about one-half of the salt.
- 12 inches of irrigation water will leach out about four-fifths of the salt.
- 24 inches of irrigation water will leach out about nine-tenths of the salt.

Remember though that the salinity of the water in the soil can never be less than the salinity of the irrigation water.

After the soil salinity has been reduced to a tolerable level for your shrubs, continue to apply extra water periodically when irrigating to prevent a new buildup of salt. The saltier the irrigation water and the more salt sensitive the shrubs, the greater is the amount of water needed for irrigation. The following table is a guide to the depth of water required for maintaining a safe level of soil salinity when 3 inches of water are lost by evaporation and plant use. During hot summer months, this loss of water could be expected every 10-12 days.

Care must be taken if heavy irrigations are required, because too much water can be as harmful to the plant as the soil salinity. This is particularly a problem with poorly drained soils.

Poor drainage may sometimes be caused by excess sodium which can be removed by adding gypsum to the soil. The soil-test report should tell you if the soil contains too much sodium and should give directions for correcting the problem.

If drainage is poor and excess sodium is not the cause, installation of drain tile may be necessary to remove the salt-laden water from beneath the root zone.

Example

When growing Aleppo pine, soil salinity should not exceed 8.0 dS/m, according to the plant selection table. The irrigation guide shows that when irrigating with 1.0 dS/m water, a total of 3.4 inches of water must be applied to keep soil salinity from exceeding 8.0 dS/m. If drip irrigation is used, the same total amount of water should be applied over the 10- to 12-day period as would be applied with a single flood or sprinkler irrigation.

Irrigating Ornamental Shrubs:

Guide to depth of water required for maintaining safe level of soil salinity

Salinity of irrigation water (Conductivity in dS/m) ⇩	Maximum soil salinity tolerated by shrubs (Conductivity of saturated extract in dS/m) ⇨ 10	8	6	4	2
	Required depth of irrigation water to provide adequate leaching and to replace 3 inches of water lost by evaporation and plant use.				
0 (rain water)	3.0	3.0	3.0	3.0	3.0
0.5	3.2	3.2	3.3	3.4	4.0
1.0	3.3	3.4	3.6	4.0	6.0
2.0	3.8	4.0	4.5	6.0	—

Important Points to Remember

- Confirm that the damage is from salinity and not from some other cause.
- Select the right shrubs for your conditions.
- Leach with enough water periodically to prevent salt accumulation.
- Plants can withstand salinity better when healthy—so fertilize adequately and control insect pests.