

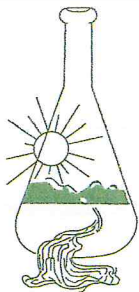
Effects of Soil-Salt on Plant Growth

This white paper reviews the soluble salt content of soil, its effect on crop production and what can be done for excessive soluble salts. As you will recall, if you put high amounts of salt on one side of a "semi permeable membrane" (plant cell membranes are semi-permeable), water will move from the side of lower salt concentration to the side with higher salt in an effort to balance the salt concentration. If the roots of a plant are placed in water with a high salt concentration the water from the plant moves into the salt water and the plant wilts. From an agricultural perspective, it should be remembered that you do not have to have a plant totally wilted and lying near dead on the ground to have a salt concentration that will effect optimal crop production. Rather, the plants may look fine, but the plant may have to use some of its nutrient energy to maintain a salt balance. This is of course nutrient energy that could be used for the crop production. From a landscaping perspective, high soil salt concentrations can result in plants that don't thrive, have burned leaves and generally poor appearance. Since different types of plants vary in their salt content and metabolism the effects of soluble salts in the soil vary with the plant variety. Table 1 shows the level of Total Dissolved Salts (TDS) which will result in a 10% decrease in optimal crop production. Additionally, Table 2 provides the approximate soil salt content that should not be exceeded for some commonly used landscaping plant varieties.

Table 1. Total Dissolved Salt Levels that Reduce Optimal Yield by 10%

Crop	TDS (ppm)
Alfalfa	2180
Almond	1280
Apricot	1280
Barley	6400
Bean	960
Corn	1600
Grape	1600
Pear	1470
Rice	2430
Safflower	3970
Strawberry	830
Sugar beet	5570
To ato	2240
Wheat	4740

*Modified from Ayres, 1977



Sunland Analytical

11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

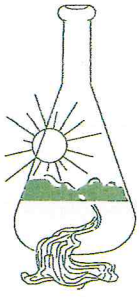
Table 2. Maximum Soil-Salt Concentrations for Landscaping Plants

Plant Variety	Maximum Tolerable TDS (ppm)
Azalea (Rhododendron)	1280
Bermuda Grass	4480
Boxwood	3200
Camellia	1280
Crape Myrtle	2240
Fescue (Grass)	3840
Gardenia	1280
Hibiscus	2240
Holly	1600
Ice Plant	6400
Indian Hawthorn	3200
Italian stone pine	5120
Juniper	3200
Kentucky Blue Grass	1600
Star Jasmine	960
Magnolia	3200
Natal Plum	5120
Oleander	4480
Oregon grape	960
Rose	1600
Yellow Sage	3200

These values are from saturation extracts of soil. Since the amount of these salt components varies with the amount of water used to extract them it is important to know that the analysis uses the saturation extraction method.

Of course, leaching is the method used to control excessive salts in the root zone. The leaching requirement is the fraction of irrigation water that must pass through the root zone to control soil salinity at a specific level. This can be determined in the laboratory (preferably Sunland Analytical) utilizing a sample of irrigation water and a sample of drain water. For more information on leaching requirement, Girsmer (Calif. Agri., 1990) has described the complexities of these requirements.

On a practical basis, leaching can most effectively be accomplished by ponding. That is creating a barrier to water runoff and allowing the water to create a pond and



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subsequently percolate through the soil profile. Thus, significant amounts of water can pass through the root zone and remove the excess salt.

No matter the source of water or the amount applied two conditions must be met for effective leaching. First, the drainage must be adequate. Unless the water can pass through the root zone no effective leaching takes place. Thus, maximizing the effect of the water applied, even rain, can be accomplished by providing good drainage. Second, the water must be of sufficient quality (low in salts) that it will remove salts from the soil. Sunland Analytical can analyze your water and soil to provide you the information to control your soil soluble salts.