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Soluble Salts in Soils and Plant Health

High soluble salts in the soil will compromise plant health and yield. Fertilizers are salts that contain various plant nutrients. Excessive soluble salts can accumulate in the soil when excess fertilizer is used or when fertilizer is applied repeatedly without sufficient water to leach (wash) the fertilizer (salts) through the soil. Excessive soluble salts in the soil root zone can also come from soil amendments with high salt concentrations like manure/composted manure, de-icing materials, sea-spray or flooding from seawater.

High soluble salt levels in the soil can cause plant drought stress. Water in the soil is drawn away from tender plant roots to the nearby high soluble salt areas in the soil. Without access to water plant cells dehydrate, plant stems wilt and roots can “burn” to the point of no recovery.

Plant roots will absorb some of the excess salts in the soil including that from over fertilization. If a plant does not use and metabolize the excess salt it has taken up, it will reach toxic amounts in the plant. The most common symptom of this salt stress in plants is brown (“burnt”) edges on older leaves.

To minimize high or excessive soluble salt levels:

- Avoid using fresh manure.
- Use moderation and caution when adding other soil amendments with high salt concentrations.
- Do not over fertilize. Apply only the recommend label rate of fertilizers and water fertilizer off of foliage.
- Keep de-icing materials on walkways.

To correct high or excessive soluble salt levels:

- Discontinue the use of all fertilizer until the salt levels returns to an acceptable balance that is determined by testing.
- Be certain there is adequate drainage to help move salts out of the root zone.
- Flush the soil with as much water as you can for several days. Apply water slowly so it will infiltrate into the soil and does not runoff taking topsoil with it.
- If your soil has a lot of clay and is low in calcium, apply gypsum at a rate of 10 pounds per 100 square feet and water in. Then in 6 weeks have the soluble salt level tested again. Repeat if subsequent soluble salt test is high (strongly saline).
- Determine the cause of the high salt levels and if you can avoid this situation in the future.

Interpretation of the Soluble Salt Test

Electrical Conductivity (mmhos cm ⁻¹)	Degree of Salinity	Comments
<0.80	Non-salinity	Generally safe for all plants and seedlings.
0.81 – 1.60	Very slightly saline	
1.61 – 2.40	Moderately saline	Sensitive plants and seedlings of other plants may show soluble salt injury.
2.41 – 3.20	Saline	Salt sensitive plants will show some injury.
3.21 – 6.40	Strongly saline	Salt tolerant plants will grow; sensitive plants will be severely injured by this level of soluble salts.
>6.41	Very strongly saline	Very few plants can tolerate this level of soluble salts.

Source: (1:2 (V:V) soil:water extract (Dellavalle, 1992b)

Relative Salt Tolerance of Common Landscape and Garden Plants

Plants	Non-tolerant	Slightly tolerant	Moderately tolerant	Tolerant
Vegetables	Carrot Green beans Onions Peas Radish	Cabbage Celery Cucumber Lettuce Pepper Potato Sweet corn	Beet Broccoli Spinach Squash Tomato Zucchini	Asparagus Swiss chard
Ornamentals	Azealas Begonias Cotoneaster Echinacea Pansy/Viola Rose Viburnum	Forsythia Snapdragon Petunia	Boxwood Chrysanthemum Geranium Marigold Zinnia	Arborvitae Juniper Russian olive
Trees	Red pine Sugar maple White pine	Linden Norway maple	Black locust Red oak White ash White oak	
Fruit	Blueberry Raspberry Strawberry	Apple Grape	Muskmelon	
Grasses*	Annual bluegrass Colonial bentgrass Kentucky bluegrass Rough bluegrass		Annual ryegrass Creeping bentgrass Fine-leaf fescues	Perennial rye Tall fescue Most Zoysia spp.

Source: * Adapted from Harivandi and Beard, 1998

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