

SALINE SOILS

Saline soils have high enough levels of soluble salts in the soil water to negatively affect plant growth and crop yields, and even cause plant death under severe conditions (Figure 1).



Figure 1. A typical saline spot on state Highway 17 near Edmore, N.D.

- ▶ The level of soil salinity is determined by analyzing soil electrical conductivity (EC).
- ▶ Most common saline soil salts in North Dakota are sulfates of sodium, calcium and magnesium (Keller et al., 1984).
- ▶ Saline soils of the northern Red River Valley have high amounts of chlorides of sodium, calcium and magnesium (Seelig, 2000).
- ▶ After sulfates and chlorides, carbonate salts are the most common.

Effect on Plants

- ▶ The most common detrimental effect excessive soluble salts have on plants is they limit the ability of plant roots to absorb soil water through the process known as osmosis.
- ▶ Under normal conditions, soil water flows from higher osmotic potential (low salt concentration) to lower osmotic potential (high salt concentration), enabling plant roots to absorb it.
- ▶ A higher concentration of soluble salts leads to low soil water osmotic potential versus plant root cells, restricting plant water uptake (Figure 2), causing droughtlike symptoms (Seelig, 2000).

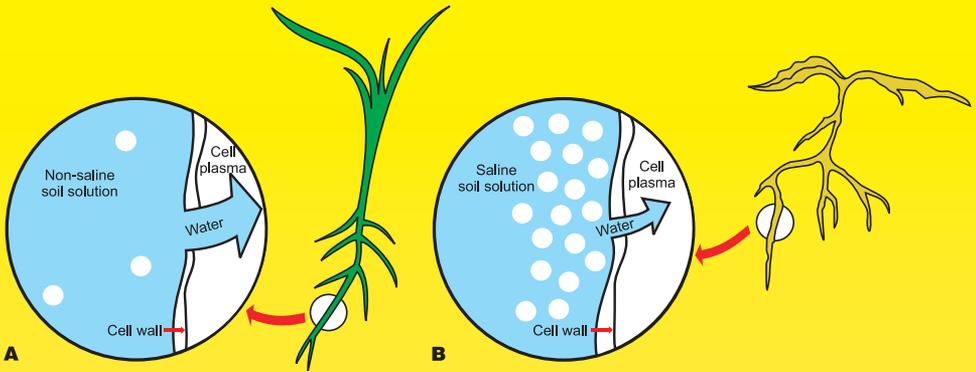


Figure 2. Excessive soluble salts causing droughtlike symptoms in plants.

Natural Causes

- ▶ Parent material of the soils
- ▶ Shallow groundwater table high in soluble salts
- ▶ High amount of rainfall leading to high groundwater table
- ▶ Saline seeps due to impermeable soil layers (high clay, coal seam)
- ▶ Upward movement of soluble salts with groundwater due to dry soil surface (excessive evaporation)

Man-made Causes

- ▶ Excessive use of irrigation water
- ▶ Use of saline irrigation water
- ▶ Fallow
- ▶ Poor use of field ditches
- ▶ Short-season crops during wet years

Rehabilitation

- ▶ Analyze the soils for soluble salt levels (electrical conductivity).
- ▶ Intercept the surrounding water seeps leading to a high groundwater table.
- ▶ Improve soil drainage.
 - Greater attention to in-field ditches
 - Greater attention to field-boundary ditches
- ▶ Lower the groundwater table.
 - Continuous cropping, including cover crops when practical
 - Growing deep-rooted and late-maturing crops such as alfalfa and sunflower
 - Installation of surface or subsurface drainage systems (Figure 3)
 - Reduce soil surface evaporation through surface mulching or cover crops.
 - Improve soil organic matter levels.
 - Start with salt-resistant crops.



Figure 3. Installation of tile drainage in progress in Ramsey County along state Highway 17 near Edmore, N.D.

(Photo courtesy of Ronald Beneda, NDSU Cavalier County Extension agent.)

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