# SOIL ELECTRICAL CONDUCTIVITY

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An excess of dissolved salts in the soil is readily detected by electrical conductivity. Salinity is a soil property referring to the amount of soluble salt in the soil. It is generally a problem of arid and semiarid regions. Electrical conductivity (EC) is the most common measure of soil salinity and is indicative of the ability of an aqueous solution to carry an electric current. Plants are detrimentally affected, both physically and chemically, by excess salts in some soils and by high levels of exchangeable sodium in others. Soils with an accumulation of exchangeable sodium are often characterized by poor tilth and low permeability making them unfavorable for plant growth.

**EC Measurement in Soil**

Soil electrical conductivity is an indirect measurement that correlates very well with several soil physical and chemical properties. Electrical conductivity is the ability of a material to conduct (transmit) an electrical current and it is commonly expressed in units of milliSiemens per meter (mS/m). Alternatively, electrical conductivity measurements can be expressed in deciSiemens per meter (dS/m), which is 100 times greater than milliSiemens per meter. The principle involved in measuring the EC is as the amount of soluble salts in a solution increases, the electrical conductivity also increases. The electrical conductivity is measured in terms of the resistance offered to the flow of current using a conductivity bridge.

**Usefulness of Soil Conductivity**

The electrical conductivity of soils varies depending on the amount of moisture held by soil particles. Sands have a low conductivity, silts have a medium conductivity, and clays have a high conductivity. Consequently, EC correlates strongly to soil particle size and texture.

**Rating of soil with reference to EC**

| **Rating** | | **$dSm^{-1}$** |
|---|---|---|
| Harmless | : | 0.0-1 |
| Injurious | : | 1.0-3.0 |
| Critical | : | > 3.0 |

**Factors affecting EC**

The conduction of electricity in soil takes place through the moisture-filled pores that occur between individual soil particles. Therefore, the EC of soil is affected by the following soil properties:

1. **Porosity:** The greater soil porosity, the more easily electricity is conducted. Soil with high clay content has higher porosity than sandier soil. Compaction normally increases soil EC.
2. **Water content:** Dry soil is much lower in conductivity than moist soil.
3. **Salinity level:** Increasing concentration of electrolytes (salts) in soil water will dramatically increase soil EC.
4. **Cation exchange capacity (CEC):** Mineral soil containing high levels of organic matter (humus) and/or 2:1 clay minerals such as montmorillonite, illite, or vermiculite have a much higher ability to retain positively charged ions (such as Ca, Mg, K, Na, $NH_4$, or H) than soil lacking these constituents. The presence of these ions in the moisture-filled soil pores will enhance soil EC.
5. **Temperature:** As temperature decreases toward the freezing point of water, soil EC decreases slightly. Below freezing, soil pores become increasingly insulated from each other and overall soil EC declines rapidly.

**Based on the E.C, ESP and SAR soils are classified as follows**

| Name of the soil | E.C( dsm-1) | ESP (%) | pH |
|---|---|---|---|
| Saline soils | >4.0 | <15 | <8.5 |
| Saline-sodic | >4.0 | >15 | <8.5 |
| Sodic | <4.0 | >15 | >8.5 |