



Soil Electrical Conductivity

Objectives

- ▶ Define: electrical conductivity, cation-exchange-capacity, dS/m, EC_e method, $EC_{1:1}$ method, saline soil, sodic soil, anion, cation, nitrification, denitrification
- ▶ Explain the role of electrical conductivity in soil health
- ▶ List and describe inherent factors that affect soil electrical conductivity
- ▶ Describe the necessity and factors of salinity management
- ▶ List and describe problems related to electrical conductivity
- ▶ Describe how electrical conductivity affects soil function
- ▶ Measure soil electrical conductivity and interpret results

Definitions



Anion: A negatively charged ion.

Cation: A positively charged ion.

Cation-Exchange Capacity (CEC):

Capacity of soil to exchange cations.

Soils with high clay or organic matter content have a higher CEC than those soils low in clay and organic matter.

Denitrification: Conversion and loss of nitrate nitrogen to atmosphere in various gas forms, due to lack of oxygen when soil becomes saturated with water.

dS/m: Unit of measurement for electrical conductivity of soil in deciSiemens per meter.

Definitions

EC_e Method: Standard accepted laboratory method for soil EC testing using a saturated paste extract.

EC_{1:1} Method: Soil EC testing method using a 1:1 soil-water mixture that must be adjusted for soil texture.

Nitrification: Conversion of ammonium compounds in organic material, or fertilizer into nitrites and nitrates by soil bacteria, making nitrogen available to plants.

Nitrogen Oxides: Family of nitrogen gases that can be generated by human activities and released to the atmosphere.

Definitions



Saline Soil: Soil with a high content of soluble salts and negatively affect soil processes, productivity and overall soil health.

Sodic Soil: Soil with a high content of salt and poor structure. Water infiltration and drainage is prevented.

Soil Electrical Conductivity: A measure of the amount of salts in soil.

Soil Electrical Conductivity



- ▶ Soil electrical conductivity affects yields, crop suitability, plant nutrient availability and soil microorganism activity such as emission of greenhouse gases and respiration.
- ▶ Excess salts hinder plant growth by affecting the soil-water balance.
- ▶ Arid and semi-arid climates naturally have a higher salt content.
- ▶ Salinity is influenced by humans through cropping, irrigation and land management practices.

Inherent Factors Affecting Soil EC: Climate

▶ Climate

- ▶ Salts are more easily flushed through soil located in areas of high rainfall
- ▶ Salts are flushed below the root zone into groundwater or streams
- ▶ Salts accumulate in soils found in dry areas

Inherent Factors Affecting Soil EC: Mineral Content

- ▶ Mineral Content
 - ▶ Salts come from the weathering of minerals and rocks found in soil

Inherent Factors Affecting Soil EC: Texture

- ▶ Soil Texture
 - ▶ Clay with high cation-exchange capacities have high electrical conductivity
 - ▶ Clay with lower cation-exchange capacities have low electrical conductivity
- ▶ Salts can't leach through restrictive layers and therefore accumulate

Managing Soil EC: Cropping

- Cropping
 - Leave crop residue to add organic matter and to limit evaporation
 - Low organic matter + poor infiltration + poor drainage + saturated soil + compaction = Increased EC and a decrease in the soil's ability to buffer

Managing Soil EC: Irrigation

- Irrigation
 - The salinity of water affects the salinity of soil
 - Extra water can help flush salts from the soil

Managing Soil EC: Land Use

- Land Use
 - Ensuring that the least amount of compaction and erosion occur improves soil EC



Managing Soil EC: Application of Fertilizer/Manure/Compost

- Application of Fertilizer/Manure/Compost
 - Monitoring of municipal waste is necessary
 - Nitrogen increases salinity

Soil Function and EC

- ▶ As EC increases, soil microorganism activity decreases, affecting respiration, residue decomposition, nitrification and denitrification
- ▶ Sodic soils have poor soil structure and poor infiltration or drainage as well as increased toxicity
- ▶ EC indirectly indicates the amount of water and water-soluble nutrients available for plant uptake