On-Farm Applications of Soil Health Principles

Chandler Gruener and Naeem Kalwar (Extension Soil Health Specialists)

This presentation will introduce new NDSU Soil Health team members (Chandler Gruener and Carlos Pires), team goals, key soil health principles and soil health issues facing North Dakota producers.

This presentation will go into the following details:

Soil Health Principles and Indicators

Presentation will outline the four key soil health principles of minimizing disturbance, maximizing biodiversity, maximizing soil cover, and maximizing living roots. Participants will also hear about key soil chemical, physical and biological properties.

Soil Salinity and Sodicity (What Are These Issues and Steps for Remediation)

Soil salinity and sodicity cost North Dakotans millions of dollars ($70 to $300/acre) every year by converting fertile areas into unproductive. Salinity is caused by excess levels of water-soluble salts and salts compete with seed and plant roots for water (called 'osmotic effect"). Sodicity is caused by sodium (Na^+) that attracts clay and humus soil particles and detach/break them away from soil aggregates (called "dispersion"). That reduces the size of soil aggregates and pores leading to dense soil layers. These issues are not new and have been reported in 1960s in NDSU Extension publications.

Best way to diagnose and remediate salinity and sodicity is to zone sample the affected areas, three to four-feet deep in 12-inch increments. Soil samples then should be analyzed for EC, SAR, pH, Ca, Mg, Na, K, Cl, SO4, CO3 and HCO3 by using "saturated paste extract method" and CEC (only for the 0-12-inch depth) by using "sodium saturation and ammonium extraction method". Once sodicity is established, if economically feasible, soil amendments such as gypsum, beetlime can be applied followed by establishment of either salt-tolerant annual crops (barley, oats and sunflowers) or perennial salt-tolerant grasses.

Summary of Soil Results of Producer Unproductive Areas (2016-2023)

Average EC (dS/m) levels of 436 producer samples was 10.56, 8.56, 8.25 and 8.09 for the 0-12, 12-24, 24-36 and 36-48-inch soil depths. Average SAR for the same number of samples and depths was 14.40, 12.61, 12.18 and 11.92. These soil samples were taken from 14 counties in SE, NE, Central NW and SW parts of the state.

Changes in Soil Salinity and Sodicity on a Tile-drained Field (2014/2015-2024)

Soil EC levels decreased 50-64% in 2016 under optimum rain (24.91-inches) and drainage conditions versus 2014 (11.88-inches). However, in 2017, EC levels increased versus 2016 due to dry weather (10.24-inches) despite tiled land. Main reason for that is increased evaporation under dry weather leading to increased capillary rise of groundwater, salts, sodium etc. towards topsoil and that tiles only intercept free gravitational water and not the capillary water. Soil sodicity on the other hand has mostly been unchanged. That could be due to lack of rain leading to reduced solubility of soil amendments. In addition, tile drained water did add dissolved salts, sodium causing sodicity, total nitrogen, nitrate-nitrogen and other contaminants to the surface water resources.

Soil Health Indicators

You can measure many indicators to see improvements in your soil health. They will hear about different measurement methods and the first step to creating measurable changes. The key is to reduce erosion to build soil health so you can see the changes you are working towards.