## MLRA Soil Survey Office, Redfield, South Dakota

# USDA and SDSU Study Drainage in Saline-Sodic Fields

## Purpose

Soil scientists from USDA–NRCS partnered with researchers from South Dakota State University (SDSU) to investigate the effectiveness of drainage tile to remediate and improve saline-sodic soils in South Dakota. The NRCS scientists were Lance Howe (Redfield MLRA Soil Survey Office leader); Steven Winter and Wilfredo Justiniano (MLRA soil scientists); and Craig Veldkamp (resource soil scientist, Brookings, SD).

The concentration of total salts and sodium salts has increased in the surface layer of many soils in the north-central and central regions of South Dakota. These salt concentrations have placed the soils at the tipping point of economic and environmental sustainability. Yields could be reduced on over 8 million acres in South Dakota as a result.

*Sampling crew (left to right): Steve Winter, MLRA soil scientist; Carissa Metzger, student; Mehmet Emin Budak, graduate student; Lance Howe, MLRA soil scientist; Craig Veldkamp, NRCS resource scientist; and Cheryl Reese, SDSU professor. Photo by Luke Derynck.*

## Background Information

Several interwoven issues have propelled salinity and sodicity problems to the forefront of concern. First, salinity and sodicity risks are increasing because spring rains have been increasing and thereby raising water-tables. Salt degradation starts in riparian zones but can move up slope with rising water tables. The raised water levels provided an opportunity for sodium and other salts to be transported by capillary action from ancient marine sediments to the surface. Second, because these areas are adjacent to streams, rivers, and lakes, the salinity can profoundly impact water quality.

The greatest challenges in South Dakota for restoring salt-affected soils are (1) restoring soil health and (2) revegetating the sodium-affected areas. The traditional approach to remediate a saline-sodic soil was developed in the arid, irrigated regions of the Southwestern United States. This approach includes (1) improving soil drainage, commonly by installing tile drainage; (2) adding a source of calcium, such as gypsum and lime; and (3) applying water with low electrical conductivity.

This research project investigated tile drainage for removing water and salts in saline-sodic field areas. Drainable porosity at the depth of the tile line installation had not previously been measured for soils with

salt concentrations in South Dakota. The goal of the research was to prepare management guidelines regarding tile installation in salt-affected soils. The guidelines will be used by crop consultants, farmers, and agricultural tile drain installers. Just as important as the recommendations about installing tile, the guidelines will also include recommendations about not installing tile if the drainable porosity of the soil is inhibited by sodium-affected horizons.

*MLRA Soil Survey Leader Lance Howe and Resource Soil Scientist Craig Veldkamp describing a soil profile on the Dakota Lake Plain in Brown County, South Dakota. Photo by Luke Derynck.*

## Activities

Soil profile samples were collected at two sites in August and October 2018 at Stratford and Clark, SD, respectively. NRCS supplied the soil sampling truck, which had a 4-inch diameter hydraulic soil probe. Tile had been installed during the fall of 2016 at the Stratford field and in 2014 at the Clark field. The sites were selected based on variations in geological formations and parent materials that influence soil hydraulic conductivity. Tile lines were located and flagged at each site. Soil samples were collected with the hydraulic probe at depths of 3.5 to 4.0 feet. Soil horizons were characterized by the NRCS staff in the field.

SDSU staff located the fields and tile lines and assisted in sample collection. Soil profiles were collected 6 feet away from the tile line and in the center between two tile lines. Soil profiles were stored in PVC pipes. The samples will be analyzed in winter of 2019 for electrical conductivity, sodium content, soil texture, soil bulk density, and water holding capacity. Soil samples for this chemical and physical analysis will be completed by horizon characterization.

## Key Outcomes

Farmers, crop consultants, and agricultural tile drain installers have questions regarding the effectiveness of tile to remediate and improve saline-sodic soils over time. The collaborative effort between NRCS field soil sampling and SDSU physical and chemical soil testing should provide answers to land owners who want to know if tile drainage is a sound management decision to remediate their areas of saline-sodic soils.

*Lance Howe, Steve Winter, and Craig Veldkamp describing a soil profile in an area of glacial till soils in Clark County, South Dakota. Photo by Mehmet Emin Budak.*