SOIL HEALTH & LAND MANAGEMENT

NDSU EXTENSION SERVICE

SALT REMOVAL USING TILE DRAINAGE IN THE RED RIVER VALLEY

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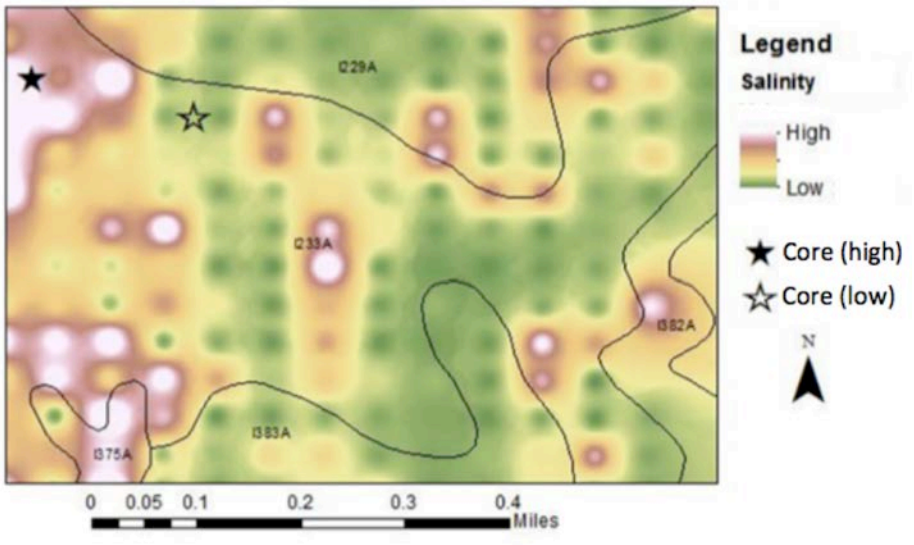
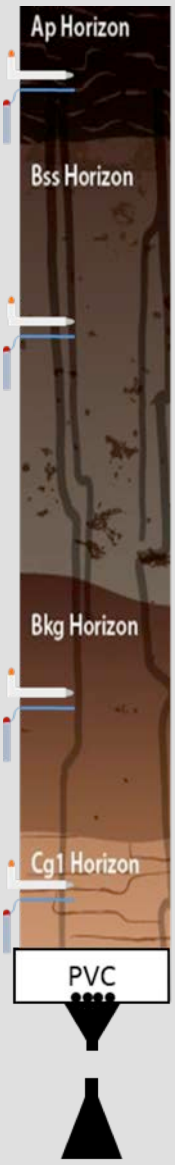
Salinity management boils down to water management, making tile drainage a popular management strategy in North Dakota. Tile drainage reduces salinity in the rooting zone in two ways: 1) by incepting and removing water carrying salts from the rooting zone above the drains, and 2) cutting off the rise of ground water containing salts from below the drains, preventing further salinization of the rooting zone. But how much salt does tile drainage remove from the field? This question has been asked by numerous farmers who have invested or are looking to invest in tile drainage. In this project associated with the Soil Health and Agriculture Research Extension (SHARE) Farm, salt removal from high clay soils managed with conventional tillage in the Red River Valley (RRV) was quantified.

A Veris salinity map was completed at the SHARE Farm to identify areas of relatively high ($EC_{1:1}$ 4.5 mmhos/cm) and low ($EC_{1:1}$ 0.7 mmhos/cm) salinity (figure below). Intact soil cores (8" in diameter by 4' deep) were then collected from these areas and transported back to the lab at NDSU.

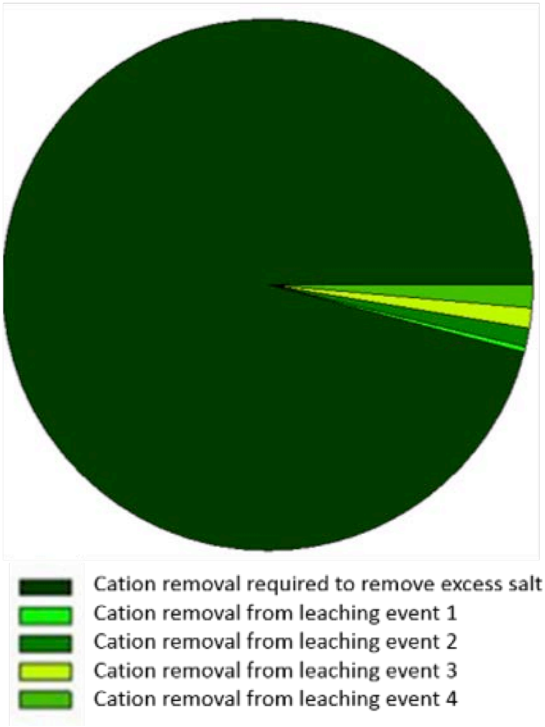


Annual wet-dry cycles, indicative of climatic conditions in North Dakota, were simulated by applying 6" of water to the surface of the soil core and then allowing them to dry. Water that ran out the bottom of the cores was collected (see side bar on next page) and analyzed for calcium, magnesium, sodium, potassium, sulfate and chloride (all components of the salts we have in North Dakota). A total of four leaching events (24" simulated wet-dry cycles) were completed on the cores.

Lab setup: Intact cores collected from the SHARE Farm were set up with instrumentation and a collection system at the bottom of the core. Water collected after running through the core was analyzed to determine salt removal from the soil.



After four leaching events, a limited amount of salt was removed from the high salt cores (figure below). Each "slice of the pie" indicates the salts removed during a leaching event, with the dark green area indicating the total amount of salts required for the high salt cores to achieve low salt core levels suitable for the production of any crop without limitations. A total of 94 leaching events would be required to reduce salt levels from an EC of 4.5 to 0.7 mmhos/cm, which means 564" of precipitation with 94 wet-dry cycles.



Salt removal from high clay soils under typical management (chisel plow + field cultivator) in the RRV is limited because water flow from the surface to the tile lines is primarily through "fracture flow". To explain, soils in the RRV typically shrink when dry and swell when wet. Water flows quickly through the large fractures that develop when the soils are dry and is very limited when the soils are wet and those fractures are closed. Because of this fracture flow, there is not a lot of time for the water to come in contact with salts and dissolve them into the soil water that flows down to the tile lines.

To improve salt leaching in tile drained fields, we recommend that management practices which improve water infiltration and break up hard pans be used. These practices include no-till and using cover crops in rotation.