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Chloride Distribution In North Dakota Soils

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Small grain crops have been shown to respond to chloride fertilization on soils with low chloride levels. Many soils in North Dakota are naturally low in chloride. Typically these soils are well drained and are not associated with low spots in fields or shallow water table areas. **The amount of chloride fertilizer needed to correct this nutrient deficiency can be determined by a soil test.** Producers need to be aware of the chloride status of their fields to maintain efficient production levels.

Not all North Dakota soils are low in chloride. This publication outlines areas in the state where chlorides are generally thought to be abundant. Other areas have a greater potential for chloride deficiencies. Abundant chloride in the soils can be related to any of three factors:

1. Chloride levels are high in soils derived from or associated with marine geologic deposits (Maianu et al. 1987).

2. Chloride levels are usually adequate in saline soils.

3. Chloride is usually adequate in soils with a shallow water table and in low spots below long slopes.

The North Dakota map, Figure 1, identifies areas that are likely to have high chloride. The areas delineated contain soils that are derived from shallow glacial till that overlie marine sediments or soils developed where these sediments are exposed in the landscape.

High chloride content in thin glacial till can be attributed to marine sediment mixing at the till-sediment contact during ice movement. Figure 2 identifies an area in Grand Forks County with a high chloride content that occurs because of groundwater discharge from buried marine

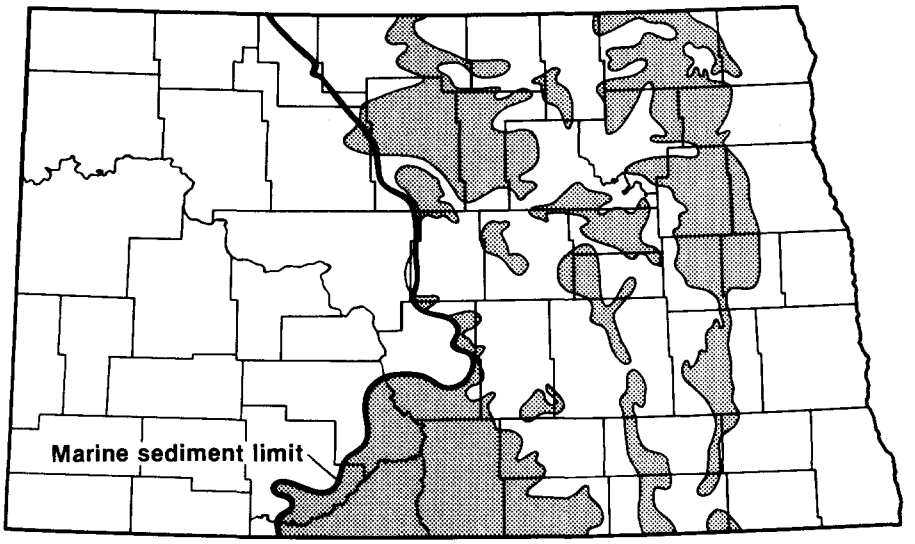

Figure 1. Areas that have marine sediments at or near the surface in North Dakota (after Bluemle, 1971).

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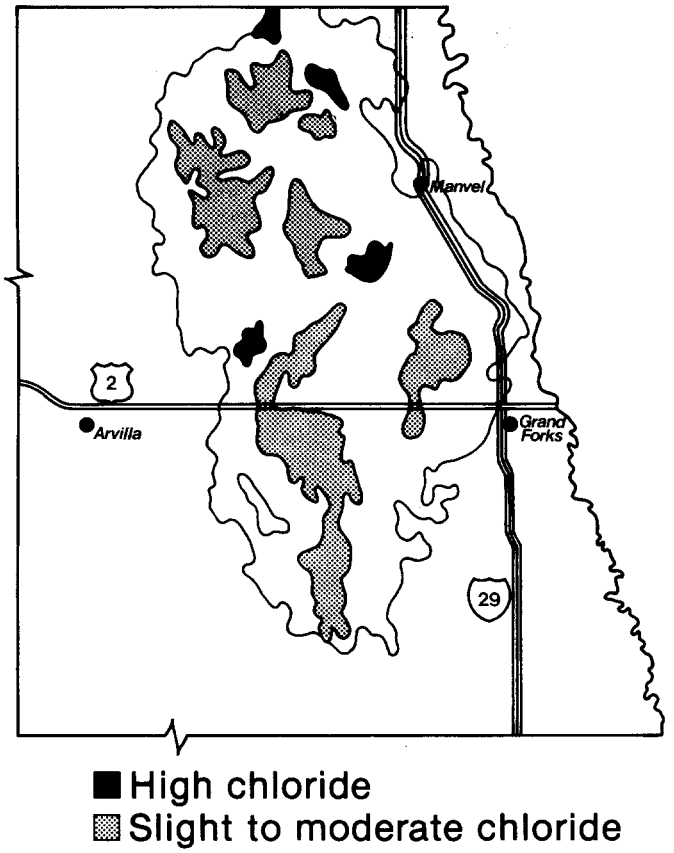

Figure 2. Areas of high chloride saline areas in central and eastern Grand Forks County.

sediments. These areas are scattered throughout North Dakota.

Groundwater discharge areas that create saline or alkaline lakes such as Long Lake in Kidder County or Kelley Slough in Grand Forks County have large surrounding areas that are high in chloride.

Chloride movement in soils is rapid compared to most other soil constituents. Chloride is easily leached out of soil and moves downward with water movement. Figure 3 illustrates a cross-section based on observation of a slope in Renville County that has a small temporary drained wetland. Chloride levels are low in the soil profile in the upland but are high in till below the soil, illustrating leaching of the chloride. The chloride was high in the soil profile associated with $CaC0_3$ (lime or calcite) and $CaS0_4.2H_20$ (gypsum) near the margin of the small wetland. This illustrates the concentration of salts, including chloride, by evaporation. A similar relationship has been observed around saline seeps. The direction of water movement is from the pond and the upland. In these sites chloride moves in response to the water movement. Similar chloride movement patterns were observed in Slope, Hettinger, Nelson, Stutsman, Grand Forks, Cass, Ramsey, Bottineau, Cavalier, Pembina, and McHenry Counties. The general pattern is that the upper slopes will likely contain little chloride compared to lower slopes.

Sources Of Information

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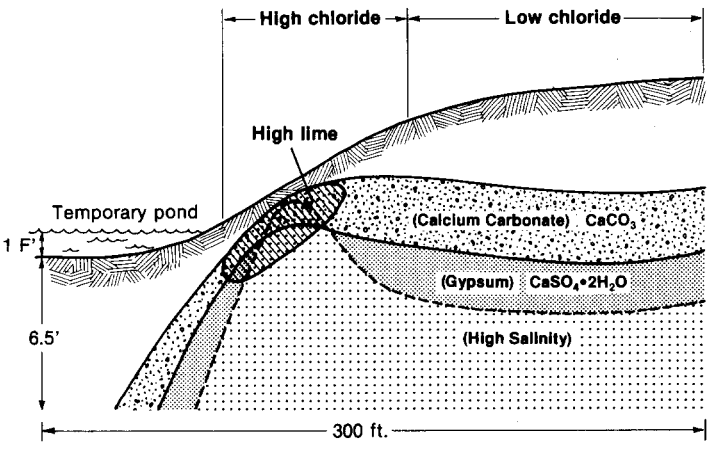

Figure 3. A cross-section of a hillslope in Renville County, ND with the $CaC0_3$ (lime); $CaS0_4 \cdot 2H_20$ (gypsum), and relatively saline zones indicated. Chloride is expected to occur in the saline areas near the base of long slopes. The saline areas occur around both drained and undrained wetlands.

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