Comparisons of Soil ECa Maps to an Order 1 Soil Survey for a Central Iowa Field

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Historically, National Cooperative Soil Surveys have been a satisfactory tool for a variety of land management applications. However, these surveys were designed for management decisions made at the field level, over areas of several acres. In a world that is growing increasingly concerned with using the earth's resources to their fullest potential, there is a growing demand for more accurate, faster, and labor efficient practices in soil mapping (Lund and Christy, 1998; Batte, 2000). Apparent electrical conductivity (ECa) mapping is a technique that is being evaluated for its usefulness in soil mapping practices. Soil conductivity mapping is a relatively inexpensive and labor efficient operation (McNeil, 1980). Information that can potentially be derived from this measurement includes depth and texture of soils, water content, salinity, clay content, nutrient levels, organic matter content, and cation exchange capacity (Olson, 2000; Sudduth et al., 2001).

The EM-38 is a commercially available instrument manufactured by Geonics Limited (Mississauga, Ontario, Canada). There are other EC instruments available, but the EM-38 has been widely used in agriculture and can be attached to a nonconductive trailer and pulled or hand carried across the area to be surveyed. It functions by producing an electromagnetic field at one end of the instrument. This electromagnetic field induces an electrical current in the surrounding conductive materials (i.e., soil). The electrical current generates a secondary electromagnetic field that is measured by a receiving coil at the other end of the EM-38.

There is a possibility that GIS-based soil conductivity mapping could aid or streamline traditional soil survey, allowing farmers to maximize crop placement, irrigation practices, fertilizer usage, and overall crop production. A study was initiated in Iowa to evaluate the similarity of maps created by ECa survey. The objectives of this study were to compare ECa to an Order 1 soil survey and evaluate whether the tool be a viable for future use in mapping.

Materials and Methods

The study area is a 38.74-acre field in Boone, the Sorenson Field. Soils are derived from loess primarily Hapludolls with lesser amounts of Endoaquolls.

A Yamaha Mule towed the EM-38 in a nonstop 5 mi h⁻¹. The EM-38 was linked to a GPS unit that collected ECa data every 3 seconds. Data were ArcGIS 9.0.

An Order 1 soil map was created for the field using transects spaced 50 m apart. Soil samples followed with deeper sampling in selected locations.