

EXAMINATION OF TOPOGRAPHY AND SOIL HEALTH PROPERTIES AND THEIR RELATIONSHIP TO CORN YIELD STABILITY IN CENTRAL IOWA AGRICULTURAL FIELDS

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ABSTRACT

Croplands in the North Central region are managed for high crop yields that are stable across years and fields. Nevertheless, yields fluctuate from year to year. Moreover, the magnitude of these fluctuations can vary across the field such that yield in some portions of the field is relatively stable and relatively variable in other portions of the field. Previous research has found that yield stability can be partially explained by topographic variables, but potential relationships between yield amount, yield stability, topography and soil health indicators are poorly understood. The objective of this research is to explore the relationship between corn yield stability, topography, and soil health properties in conventionally managed central Iowa agricultural fields. Collaborating with independent growers, five fields with variable yields and topography were selected for this study. The participating growers provided 3 to 12 years of spatially resolved corn yield history from combine yield monitors. Using ArcGIS Pro 3.1.0, yields were standardized for each year and the fields were analyzed on a 10 m x 10 m grid for average yield and standard deviation of yield (yield stability) across years. A three-meter digital elevation model, derived from LiDAR data, was used to analyze each field for topographic variables including aspect, slope, hillslope position, and topographic wetness index. Based on the yield and topographic parameters, 200 soil sampling points were identified for each field and five 0-15 cm soil cores were collected at each point. One homogenized soil sample from each point was analyzed for potentially mineralizable nitrogen, potentially mineralizable carbon, potentially oxidizable carbon, water holding capacity, ACE Protein, C:N, total carbon and total nitrogen. Results indicate that topographic variables, specifically slope and hillslope position, have a strong correlation to average yield and yield stability across all fields in this study. Soil health parameters however were inconsistent in their correlation to yield. None of the soil health parameters had a significant correlation to average yield or yield stability consistently across fields analyzed in this research.