DEFINING NITROGEN MANAGEMENT ZONES WITH APPARENT ELECTRICAL CONDUCTIVITY (EC) MAPPING

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Introduction

The use of apparent electrical conductivity to map the variation in fields has been around for several decades (Corwin and Lesch, 2003) and several studies have shown that there can be a statistically significant correlation between EC and various soil physical, chemical, and biological properties (e.g., Corwing and Lesch, 2003; Johnson et al., 2003). However, there isn't a clear or standardized use of apparent EC to develop N management zones within a corn field. What we will describe here is a simple approach to using apparent EC data, with targeted soil sampling, to identify with soil properties are the best upon which to alter N rates within a field.

Approach

One farm field in 2013 is used for this case-study and is located in Rock County, WI. In the spring of 2013 apparent EC mapping and targeted soil sampling were conducted by C3 (now a division of Trimble Navigation Ltd.). Twenty soil samples were collected in the field and analyzed for Maps were developed for each soil variable based by equally distributing the data into three categories of low, medium, and high (i.e., the lowest ⅓ of the values are in the low category and the highest ⅓ of values are in the high category). This is a bit of an arbitrary approach, but useful for this simple exercise. Two soil properties were used for this exercise, soil organic matter and depth to root restriction. The categories for soil organic matter (0 to 12 inches) were: 0.5 to 1.6 (low), 1.6 to 3.5 (medium), and 3.5 to 4.7 (high). The categories for depth to root restriction were: <28 inches (low), 28 to 38 inches (medium), and >38 inches (high).

Prior to corn planting, field length N rate strips (1,200 ft long) were applied at rates of 0, 60, 110, 135, 160, 185, 210, and 235 lb-N/ac, each replicated three times. Field length strips were used in order to ensure each N rate overlapped with each soil category.

Preliminary Results

When averaged across all N rate strips, no significant yield increases were determined above 110 lb-N/ac. But when the N response was graphed for each soil organic matter category (low, medium, and high), not only were different maximum yields achieved, but different optimum N rates were observed for each category (Fig. 1). The agronomically optimum N rate for the medium soil organic matter category was about 120 lb-N/ac, but was closer to 160 lb-N/ac for the low soil organic matter category (Fig. 1).

The relationships between N rate and yield were even stronger when split out among differences in depth to root restriction (Fig. 2), as noted by larger R^2 values. However, it doesn't appear that the agronomically optimum N rate is very different between the medium and low category of depth to root restriction.

While a more thorough analysis will be presented, it is clear that use of apparent EC, coupled with field length N rate strips has tremendous value in identifying which soil properties are controlling yield and response to N on a field by field basis. Additional analysis is needed to best assign values to each soil category.

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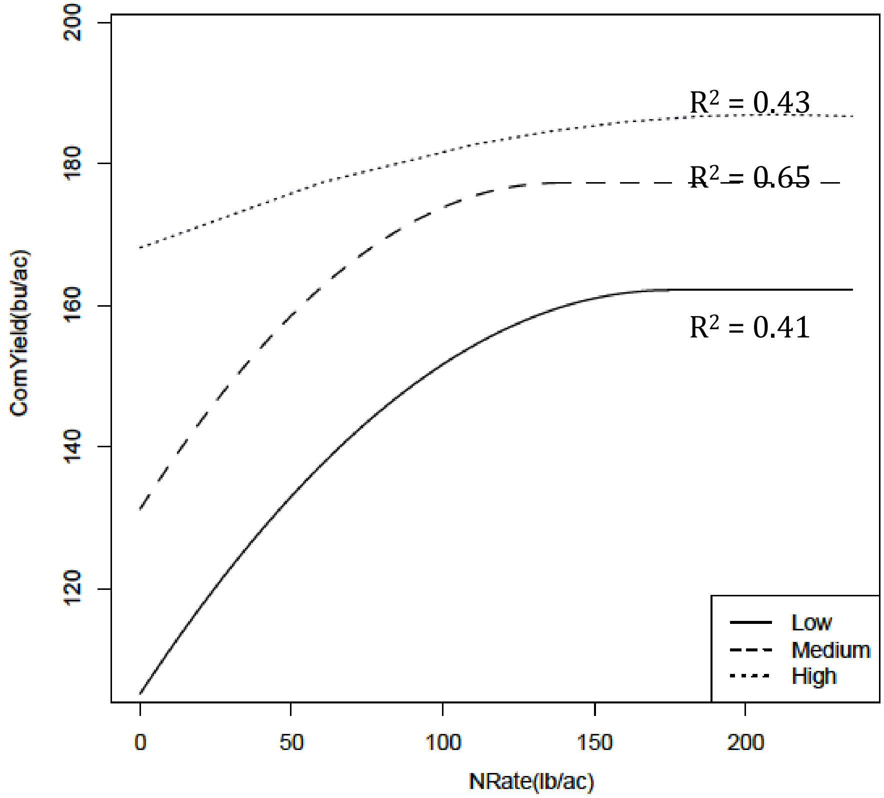

Figure 1. Nitrogen response curves for three categories of soil organic matter.

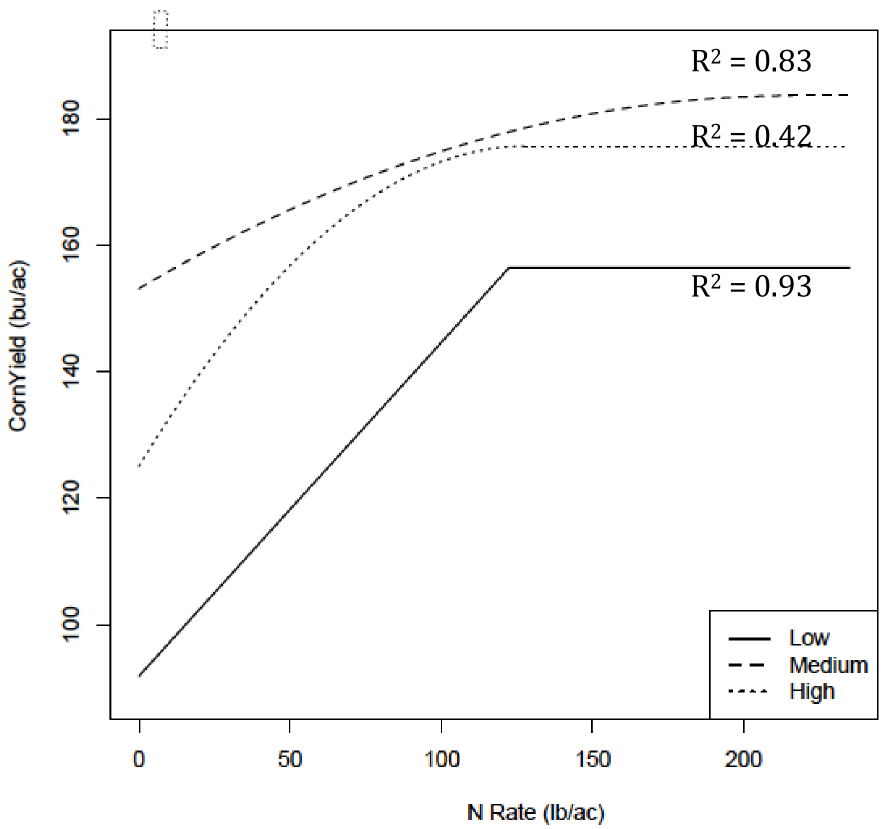

Figure 2. Nitrogen response curves for three categories of depth to root restriction (DRR).