NITROGEN FERTILIZER EVALUATION IN SPATIALLY DERIVED SOIL EC MANAGEMENT ZONES

Brady Arthur
Texas A&M University
College Station, TX
Gaylon Morgan
Ronnie Schnell
Tony Provin
Jake Mowrer
Dennis Coker
Dale Mott
Texas A&M AgriLife Extension Service
College Station, TX

Introduction

In recent years there has been a push to develop precision nutrient management techniques for both economic and environmental benefits. Using spatial data to aid in variable rate nutrient application can reduce runoff and leaching of fertilizers as well as lower input costs. Using available technology from Veris®, soil EC, soil pH, and soil color spatial maps can be used to classify soil characteristics, such as the strong correlation between clay content and soil EC values. Therefore, a spatial soil EC map has the potential to identify nutrient management zones. Other soil characteristics highly correlated with clay content are nutrient holding capacity and water movement, which both influence residual nitrogen retention in the root zone. Since nitrogen is the most common yield limiting nutrient in corn and cotton, determining how soil EC can be related to residual nitrogen will allow producers to use the spatial maps to variable rate nitrogen fertilizers and will refine residual nitrogen recommendations.

Objectives

Determine how nitrogen management recommendations can be refined to increase nitrogen use efficiency using soil characteristics and implementing variable nitrogen rates.

Materials and Methods

Veris® 3100 was pulled across a 38 acre center pivot irrigation field in the Brazos Bottom of Burleson County, TX to produce a spatial soil EC map in 2014 (Image 1). Using this interpolated soil EC map, the field was delineated into three zones (Image 2). The mean EC values are 68.3, 43.6, and 24.4 mS m-1 for high, medium and low EC zones, respectively. Additionally, a 1.8 acre sampling grid was established in the same field with soil samples collected at one foot increments to a depth of 48 inches prior to crop planting. The soil samples were analyzed by the Texas A&M Soil Testing Laboratory for soil nitrate levels at each incremental depth. Zone differences in residual nitrogen content were compared using Tukey-Kramer HSD in JMP. At the 13 starred locations in Image 2, four row plots were arranged in a RCBD with a minimum of 3 replications in each EC zone. Nitrogen rates from 0-225 lbs/a for corn and 0-120 lbs/a for cotton were applied after crop emergence at a depth of 6 inches (Table 1). Harvest data were collected on the two inner rows. Grain moisture and weight were taken on the corn in 2014 and 2016 and was corrected to a uniform moisture of 15.5%. In 2015 and 2017 seed cotton weight was taken and 140 g sample was collected and ginned from each plot for fiber analysis.

Image 1: Veris MSP3 being used in field operation to quantify continuous soil EC and color data and timed interval pH measurements.

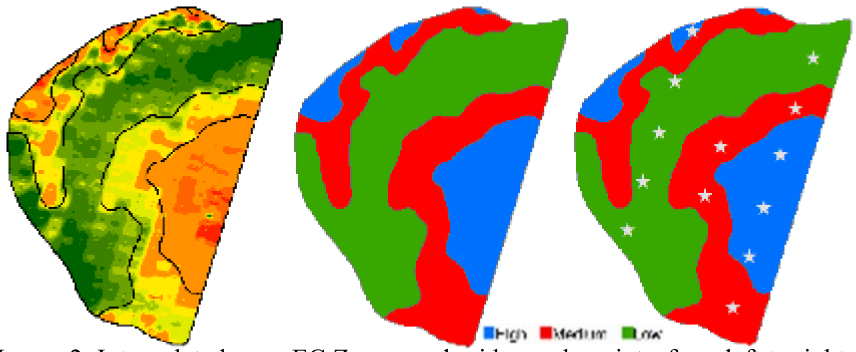

Image 2: Interpolated map, EC Zones, and grid sample points, from left to right, respectively.

Results

Comparing the residual nitrogen by depth in figures 1a-d, the higher EC zones contained more nitrate within the top 12 inches than the sandier soil. The majority of the nitrate found in the profile was below 12 inches for all three management zones in all four years. Mean residual nitrogen differences by soil type were not observed in either of the corn trials (Figure 1a and 1c). However, differences between the residual nitrogen in 2015, following the 2014 corn crop, were observed. Numerical trends in 2014, 2016 and 2017 did show the high EC zone had higher residual nitrate content than the low EC zone. When comparing yield to the total nitrogen in figures 2a-d, the yield peaked in high EC zone below the maximum amount of nitrogen in all four years. The medium EC zone showed peak yield before the maximum total nitrogen in two of the four years. The low EC zone shows a linear relationship in 2014. Figure 2a-c shows the calculated yield compared the total nitrogen and are fitted with a quadratic fit line to show nitrogen response. The response curve follows the quadratic regression model in the medium and low EC zones in corn years. The 2015 cotton yield shows that the high and low EC zones differ by less than 480 lint lbs/ acre through the range of nitrogen applied. This is likely the result of high levels of residual nitrogen that particular year. There is an inverse response to applied nitrogen in 2017 in the higher two EC zones. This could be due to in season mineralization and soil ammonium.

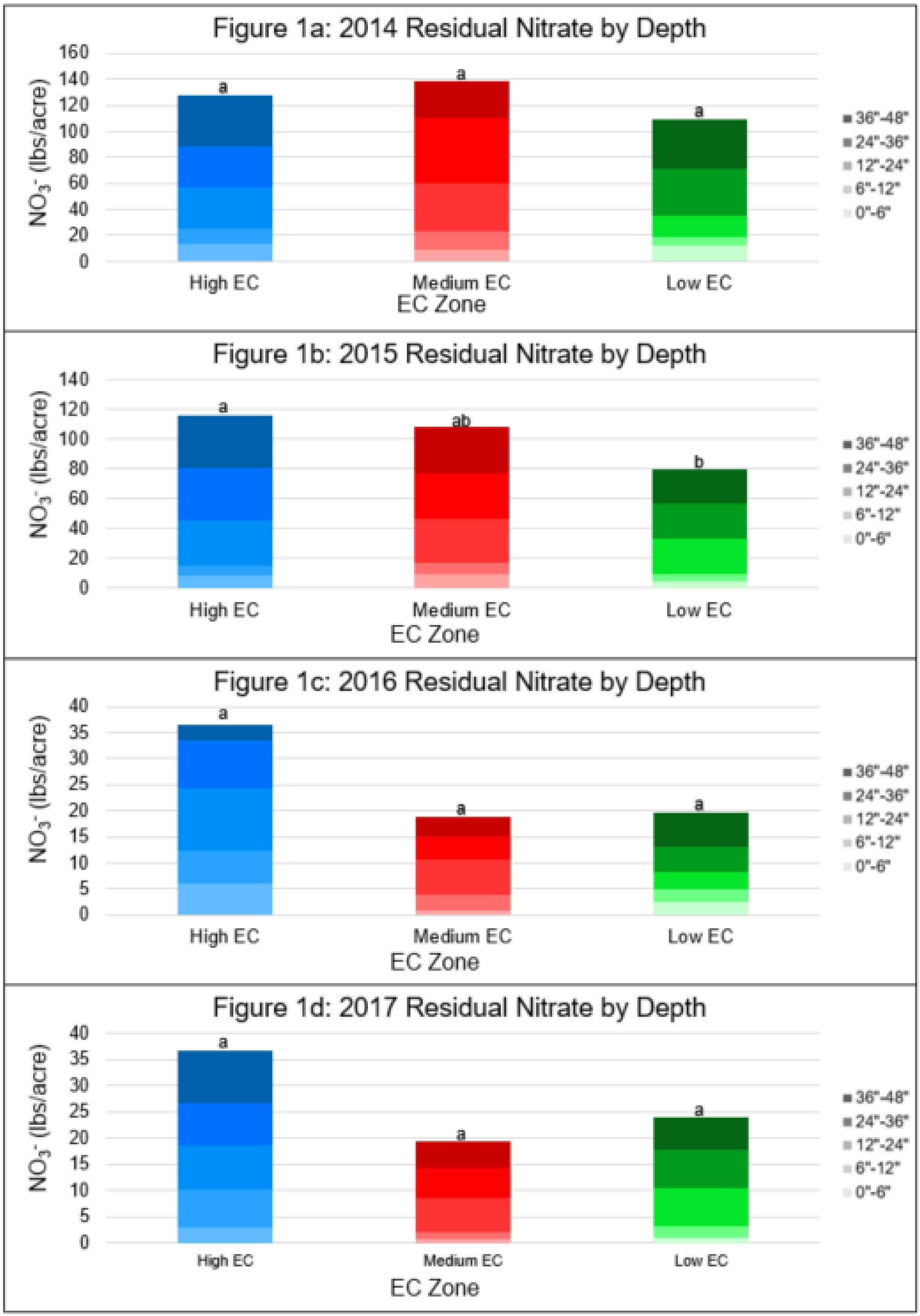

Figure 1a-d: Residual nitrate by depth in high, medium and low EC zones. Letters show statistical differences between totals.

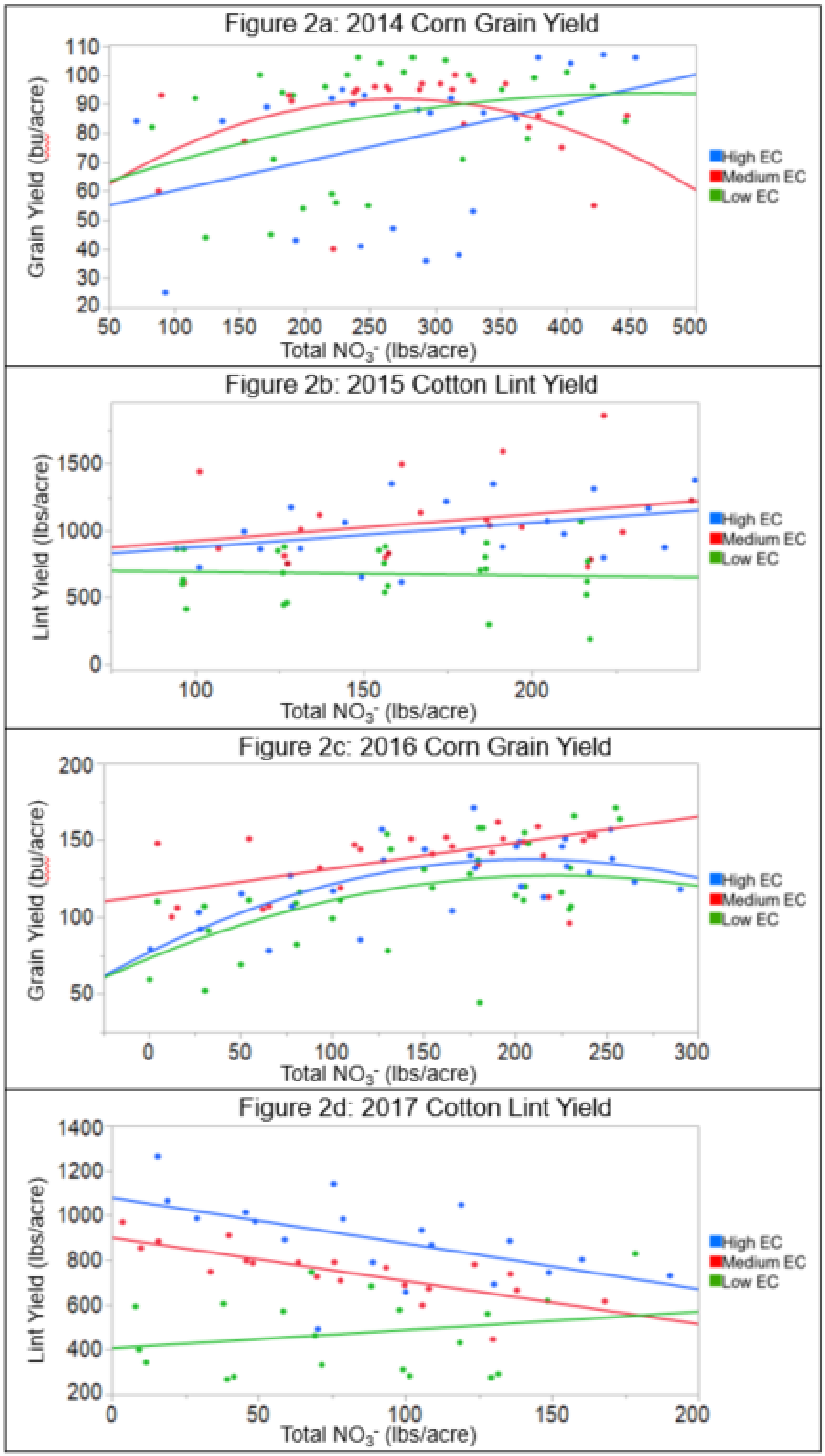

Figure 2a-d: Crop yield by the total nitrogen measured and applied in each of the EC management zone

Summary

- Areas of a field with higher mean soil EC will have a higher potential for retaining residual nitrogen that can be used for the following crop
- Using Veris® technologies to create spatial maps of fields could identify areas that have higher nutrient holding capacity and the potential for variable rate nutrient management
- As EC readings increase the rate of nutrient infiltration decreases holding residual nitrogen higher in the profile