PRECISION AGRICULTURE PRESENTATIONS

Precision Agriculture Approaches To Nutrient Management Of Cotton

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Precision agriculture technologies have developed rapidly in the last 10 years, and have also dropped in price considerably. Cotton is an intensively managed crop that is a prime candidate for precision agriculture approaches to nutrient management. These include management zone based soil sampling and fertilizer application, remote sensing based fertilizer management, yield monitoring and spatial statistics. Management zones can be based on soil type and or landscape position. Global positioning system (GPS)-referenced electrical conductivity (EC) maps can greatly aid the producer in identifying soil type and or yield zones. The remote sensing approach of canopy level spectral reflectance can determine need of inseason N in irrigated cotton. Accounting for spatial covariance in yield data can give better estimates of the effects of fertilization and thus aid profitability.

Variable-rate fertilization

The current commercially available variable-rate fertilization systems for ground applicators cost only about $ 3000. These consist of a controller, servo/variable-rate valve, flow meter, ground speed radar. Also required is a palmtop computer (~ $ 350) or tablet computer ($2000), software (~ $ 500), and GPS ($100 to $2500).

Several years of study in West Texas, LEPA-irrigated cotton indicates that reduction/savings in P fertilizer can be achieved with variable-rate P management compared to single, blanket-rate approaches, without hurting lint yields (Bronson et al., 2003). Our research assessing variable-rate N shows little reduction in N fertilizer use compared to blanket-rates of N. However, after a year of two of variable-rate N management, greater lint yields were observed with variable-rate compared to blanket-rate N (Bronson et al., 2006).

Management zone approach

The key to making variable-rate fertilization profitable is to keep down soil sampling and soil analyses costs. This usually entails “zone-based” soil sampling, based on soil texture, landscape position, EC maps, or and or yield maps (Bronson et al., 2005; Ping et al, 2006). Below is an example of an EC map made with a Veris 31200 system. High EC is usually related to high clay, which in turn usually indicated greater soil fertility and yields (Bronson, et al., 2005).

Remote sensing approach

Remote sensing of canopy reflectance has great potential to guide in-season N fertilization in irrigated cotton. This can be done by aircraft or satellites, but our research in West Texas has focused on ground-based measurements. Our early work was based on sensors that measured spectral reflectance of natural light. The disadvantage of this is that readings are restricted to within 2 hours of solar noon, and to cloudless days. Recently, several inexpensive (~$3000) sensors with their own built-in, active light sources have been developed. Typically, these sensors measure canopy reflectance at two wavelengths, one visible waveband (eg. green, red, or amber) and one near infrared waveband). Visible reflectance is highly correlated with N status of the leaf, and NIR reflectance relates to biomass, plant height and or leaf area (Chua et al., 2003; Bronson et al., 2005). In practice we calculate a ration of the NIR to visible waveband reflectance. These ratios can predict need of in-season N fertilization or fertigation, when the ratio in the area of interest falls less than 95 % of the ratio in a well-fertilized reference area. Our research has demonstrated that savings of 10 to 25

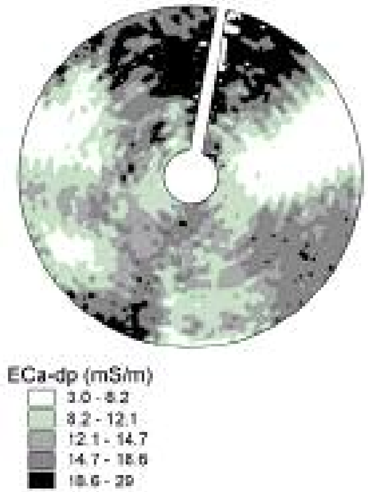

Figure 1. Electrical conductivity on 120- acre cotton field in Cotton Center, Hale County, Texas

% in N fertilizer applications can be achieved with remote-sensing based N fertilization of irrigated cotton, compared to soil test based N management, without reducing lint yields (Chua et al., 2003).

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