USING REFLECTANCE SENSORS TO PREDICT NITROGEN NEEDS OF COTTON

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Objectives

1) Develop on-the-go N recommendations based on analysis of the reflectance sensor readings.
2) Determine the sensor model, height, and wavelength that give the best prediction for sidedress N.
3) Determine the best growth stage for sensor-based sidedressing

Relevance

There is great spatial variability of N in the soil. Cotton fields that receive a blanket rate of nitrogen, ignoring the variability, will have areas of excessive growth. This unnecessary growth raises production cost by delaying crop maturity, increasing insect pressure, and possibly increasing the quantity of growth regulator and defoliant needed. A variable-rate application of nitrogen will resolve that problem and may also reduce the amount of nitrogen applied, which will save farmers money. Although there is a need for rapid and easy methods of nitrogen status detection in cotton, little research has been done to use sensors for on-the-go application of N in cotton.

Methods

- Location: University of Missouri Delta Center and Rhodes farm.
- Three trials each year in fields with different soil textures: sandy loam, silt loam, and clay.
- N treatments:
    1. Rates 0 to 200 lbs N/ac.
    2. Most treatments received 50lbs N /acre at planting and 0 to 150 lbs N/ac at early square.
    3. Some treatments received N application at early flower.
- Sensors used: Cropscan passive sensor (Cropscan), Crop Circle active light sensor (Holland Scientific), and Greenseeker active light sensor (N-Tech).
- Readings taken at 3 growth stages: early square, mid square and early bloom.
- Sensor readings taken at 3 different heights: 10”, 20”, and 40”.
- Analysis to relate optimal N rate to sensor readings:
    1. Regression used to describe yield response to N rate.
    2. Optimal N rate calculated from the response functions.
    3. Optimal N rate regressed against sensor readings to determine the bet sensor model, and wavelength, and growth stage.

Results

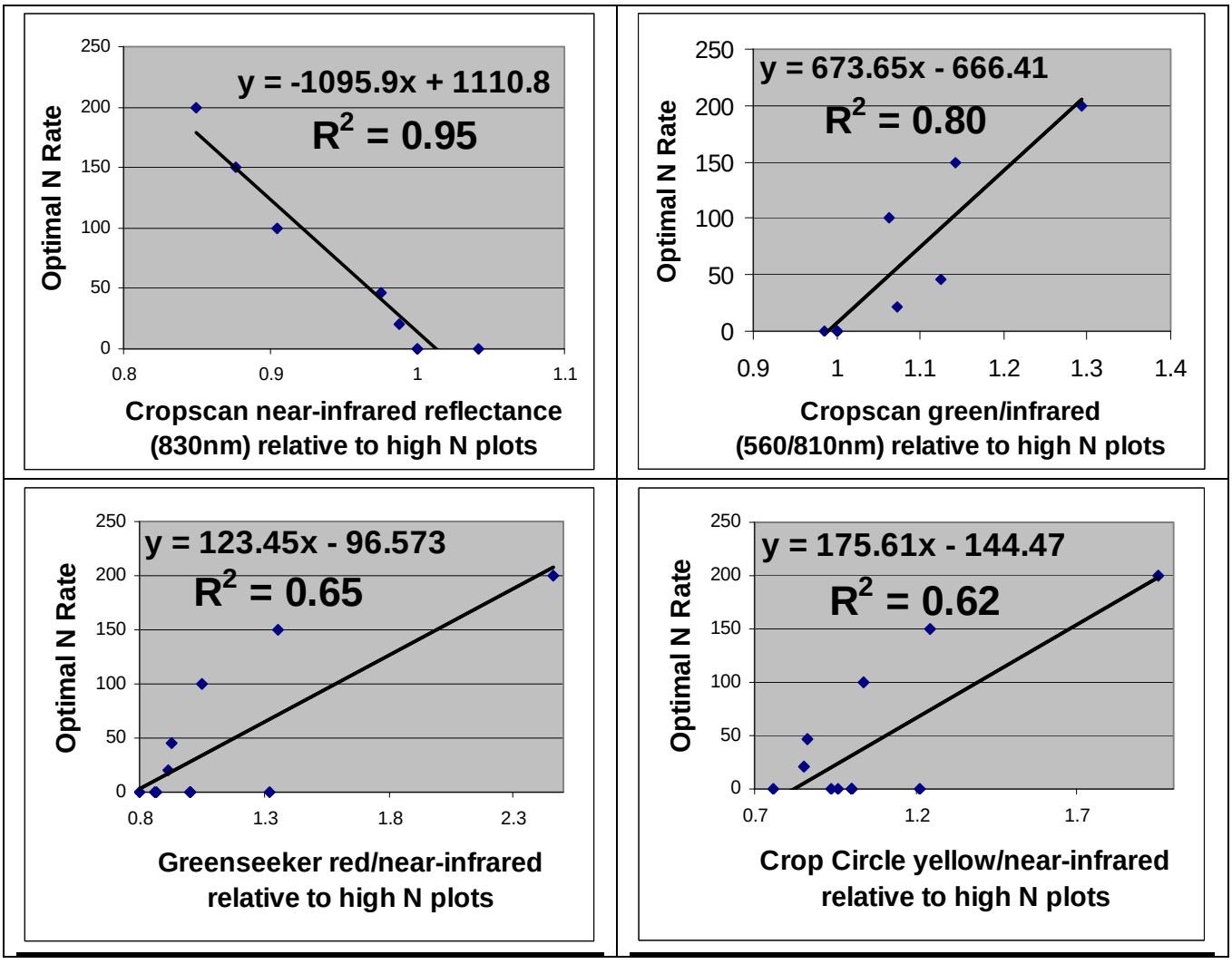
Growth Stage

June 22 & 23 (early square stage)

- Correlations generally low.
- Good results with crop circle at 10” height; maybe a fluke.

July 6 & 7 (mid square stage)

- The results were promising for mid-square recommendations
- Strong relationships to N rate.
- The effect of N status on reflectance is more obvious later in the season.



July 17&18 (early flower stage)

- Correlations of sensor readings to optimal N rate were about the same as the mid square stage.
- Equations were also generally similar, so it may be possible to use the same prediction equation from mid-square to early flower stages.

Sensor Type

- All three sensor types appear to be useful at mid square and early flower.
  - strong correlations with optimal N rate.
  - especially Visible/NIR ratios.

Height Above the Canopy

- All three heights had strong relationships to optimal N rate.
- 20" seems to work more often that 40" or 10".

Conclusions

- Reflectance sensor readings related well to optimum N rate.
- Potential for accurate on-the-go prediction.
- All three sensor types appear to be potentially useful.
- Mid square or early flower seem to be the best stages for accurate sensor-based sidedressing.
- All three heights appear to be okay for predicting N need, but 20" appears to be the most reliable.

PROCEEDINGS OF THE

THIRTY-SEVENTH NORTH CENTRAL EXTENSION-INDUSTRY SOIL FERTILITY CONFERENCE

Volume 23

November 14-15, 2007
Holiday Inn Airport
Des Moines, IA

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Published by:
International Plant Nutrition Institute
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Brookings, SD 57006
(605) 692-6280
Web page: www.IPNI.net