Improvement of Corn Yield and Sensor Reading Relationship with Consideration of Crop Height

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ABSTRACT

Corn was grown in a nitrogen rate study with six N rates and four replications. Two active-optical sensors, the Greenseeker (TM) and Holland Crop Circle (TM) were used to collect imagery readings of the plants in each plot at both the 6-leaf stage and again about 2 weeks later. Corn grain was harvested and the grain yield was compared to sensor measurements at each date to construct and algorithm of in-season estimate of yield (INSEY). On the same dates as imagery was collected, a corn height measurement was recorded using a tape measure. Multiplying the sensor reading and the corn height measurement together usually resulted in a stronger relationship with yield and a better INSEY estimate than sensor reading alone.

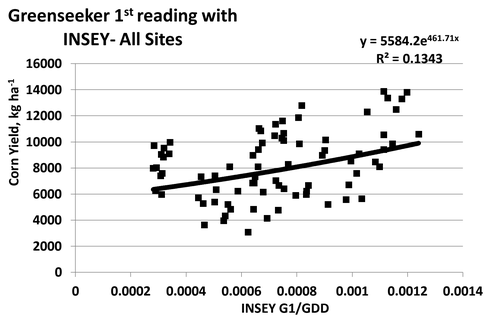
INTRODUCTION

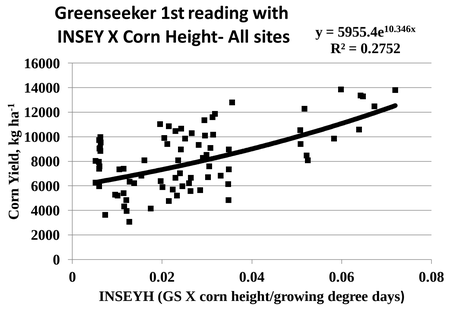
- Nitrogen use efficiency (NUE) for world cereal production is averaging 33% (Raun and Johnson, 1999).
- Active-optical crop sensors have been shown useful in predicting corn yield early in the growing season.
- NDVI is useful in estimating 2-dimensional biomass, such as in wheat and grasses.
- Multiplying canopy height and NDVI improved estimation of sugarbeet canopy biomass and sugarbeet canopy N content (Franzen 2002).
- Greenseeker (Trimble) uses NDVI measurements and the Holland Crop Circle sensor uses both NDVI and Red Edge NDVI. The red edge tends to be a proxy for 'greenness' or plant health.
-Since corn grows in both width and height, corn height might be an added measurement that would result in better relationships with corn yield and from this in-season N requirements.

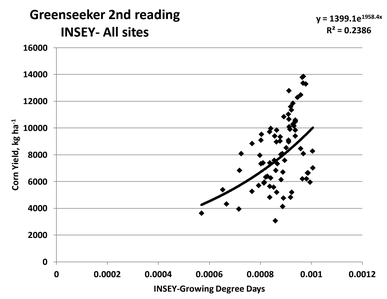
OBJECTIVES

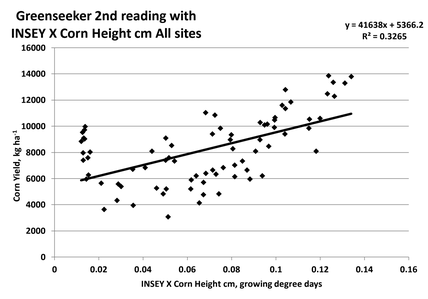
Determine whether addition of corn height improves the relationship of sensor reading with yield.

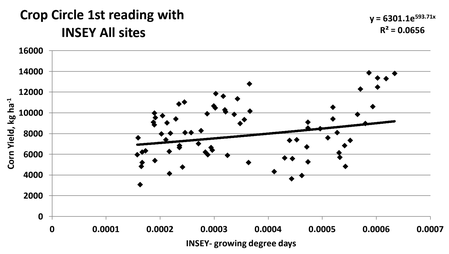
RESULTS

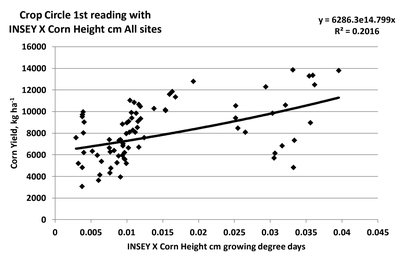


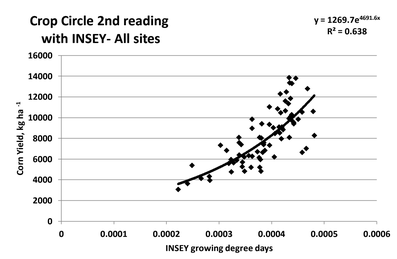


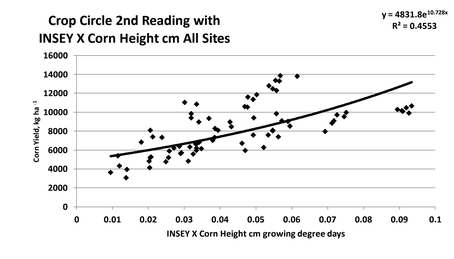


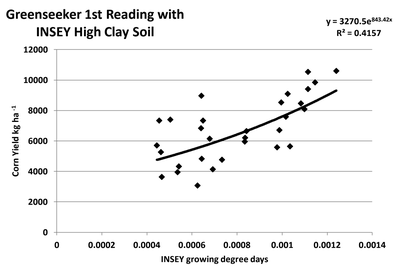


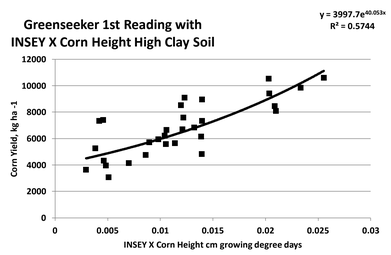


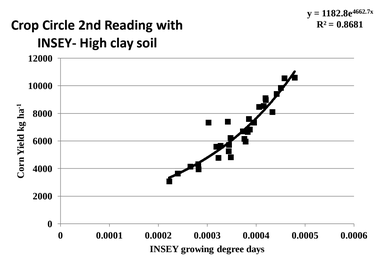


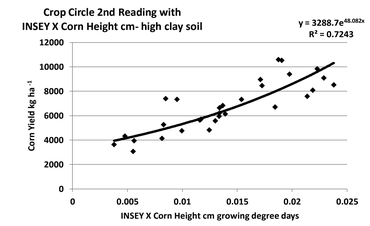


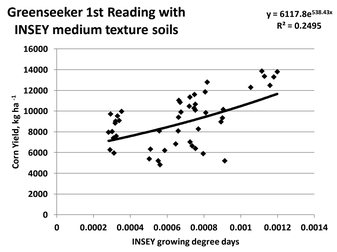


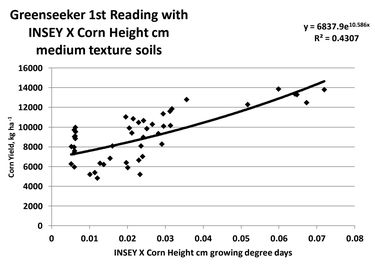


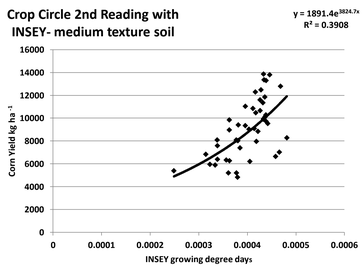


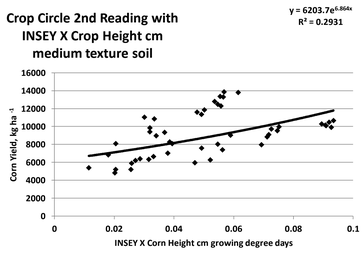












MATERIALS AND METHODS

Location and Treatments

- 13 dryland sites were selected in 2011 on cooperator fields in North Dakota.
- Six nitrogen treatments: 0-N check (control), 45 kg N/acre, 90kg N/ha, 135kg/ha N/ha, 179kg N/ha, and 224kg N/ha applied as ammonium nitrate granules within 1-5 days of planting.
- Experimental design: Randomized complete block design with four replications.
- Plot size: 20'x 10'
- Soil was sampled to 60 cm depth for residual nitrate-N preplant.
- P &K applied, if sampled found deficient.

Crop History & Soil Texture

- The previous crop, tillage history, and surface-subsurface soil texture were considered in grouping sites for N response after harvest and during the growing season.

Sensor Readings

- Greenseeker (N-Tech Industries, distributed through Trimble) and Holland Scientific Crop Circle Sensor-470 were used for the study.
- Greenseeker emits two bands visible and near infrared as below:

  NDVI= (NIR – VIS)/(NIR+VIS)

- Crop Circle-470 emit three bands visible, red edge, and near infrared so two wavelength ratio were as below:

  NDVI (as above)

NDVI red edge = (NIR – RED EDGE)/(NIR+RED EDGE)

- Approximately 45 readings /row from each plot were taken with each sensors The NDVI values were averaged for each plot as well as for each treatment.
- Both sensors, Crop Circle-470 and Greenseeker were used at 5-8 leaf stage and about 10 days to 14 days .

SUMMARY

- Crop height was most useful for the Greenseeker NDVI sens
- The Crop Circle relationship was improved at the first senso reading, but not the second.

REFERENCES

Franzen, D.W., G. Wagner, and A. Sims. 2003. Application of a ground-based sensor to determine N credits from sugarbeet. *In* p. 119-123. 2003 Sugarbeet Research and Extension Reports. Vol. 34. Sugarbeet Research and Education Board of Minnesota and North Dakota. Fargo, ND.

ACKNOWLEDGEMENTS

Thanks to the North Dakota Corn Council,
IPNI
and Pioneer Hi-Bred International
for their support of this project