Proximal sensing for early detection of nitrogen deficiency in corn

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Spatial and temporal variability in soils is well documented
In the last decade, soil scientists have made significant progress in quantifying and characterizing spatial variability in soils using proximal sensing technologies.

Management Zones

- Management Zones: A sub-region of a field that expresses a homogeneous combination of yield limiting factors
- In Colorado, we have developed four techniques of delineating management zones

Soil Zones...

I. Soil Color based Management Zones (SCMZ)
II. Soil properties + past year’s yield map based Management Zones (YBMZ)
III. Soil Electrical conductivity based (ECMZ)
IV. Smart sampling + remote sensing based (SSMZ)

Based on the research conducted in Colorado*

* CSU, USDA-ARS, Centennial Ag Inc.
Precision Nutrient Management Across Soil Zones...

- has shown to enhance:
  1. overall grain yield of the field,
  2. nutrient use efficiency,
  3. net $ returns to farmers and
  4. reduces overall nutrient losses from the field.

What's the problem?

Soil Sensing + Crop Sensing

Soil sensing efforts must be coupled with crop sensing to make better and most efficient nutrient management decisions.

Previous work with Proximal Sensors:

Holland Scientific Crop Circle:

- Amber NDVI
  - Visible waveband = 590 nm
  - Near infrared = 880 nm

NTech Industries GreenSeeker:

- Red NDVI
  - Red visible waveband = 660 nm
  - Near infrared = 770 nm

Visible ~ 400 to 700 nm (G, B, R)
Near infrared ranges ~ 750nm to 1400nm
Effect of nitrogen rates on dry weight

Summary

- Fluorescence based sensor has potential to detect early nitrogen deficiency in corn
- Soil background noise is minimal
- Coupling soil and crop sensing is important for precision nutrient management

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