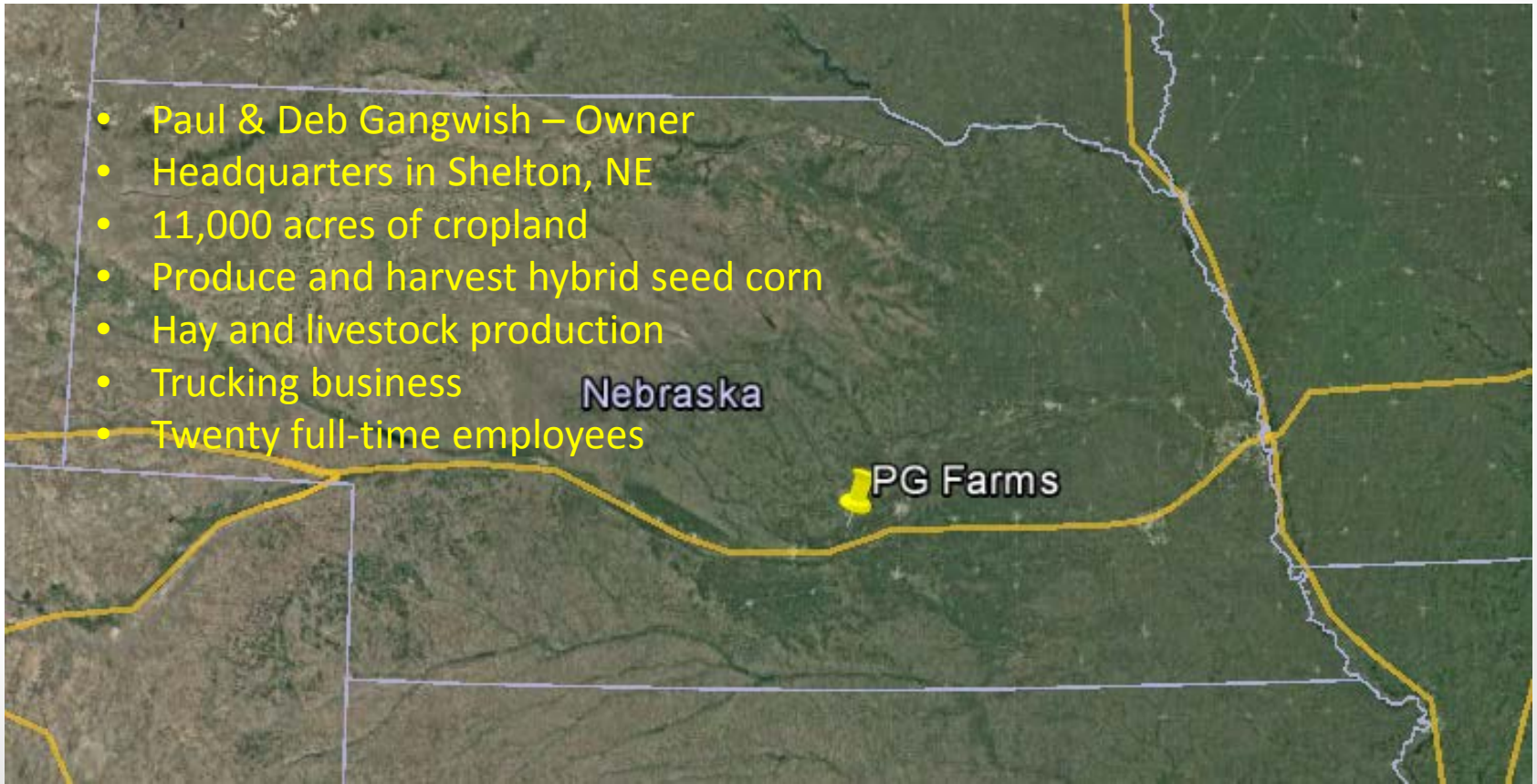
A Consultant's Perspective on Efficiency Improvements with Precision Nutrient Management

John Shanahan - Agronomist with PG Farms



- Paul & Deb Gangwish – Owner
- Headquarters in Shelton, NE
- 11,000 acres of cropland
- Produce and harvest hybrid seed corn
- Hay and livestock production
- Trucking business
- Twenty full-time employees

About Myself

- Agronomist-PG Farms 2016 -
- Agronomist-DuPont Pioneer 2010 - 2016
- Research Agronomist-USDA-ARS & Univ. of Nebraska 1998 - 2010
- Extension Specialist-Colorado State University 1982 - 1998

John Shanahan

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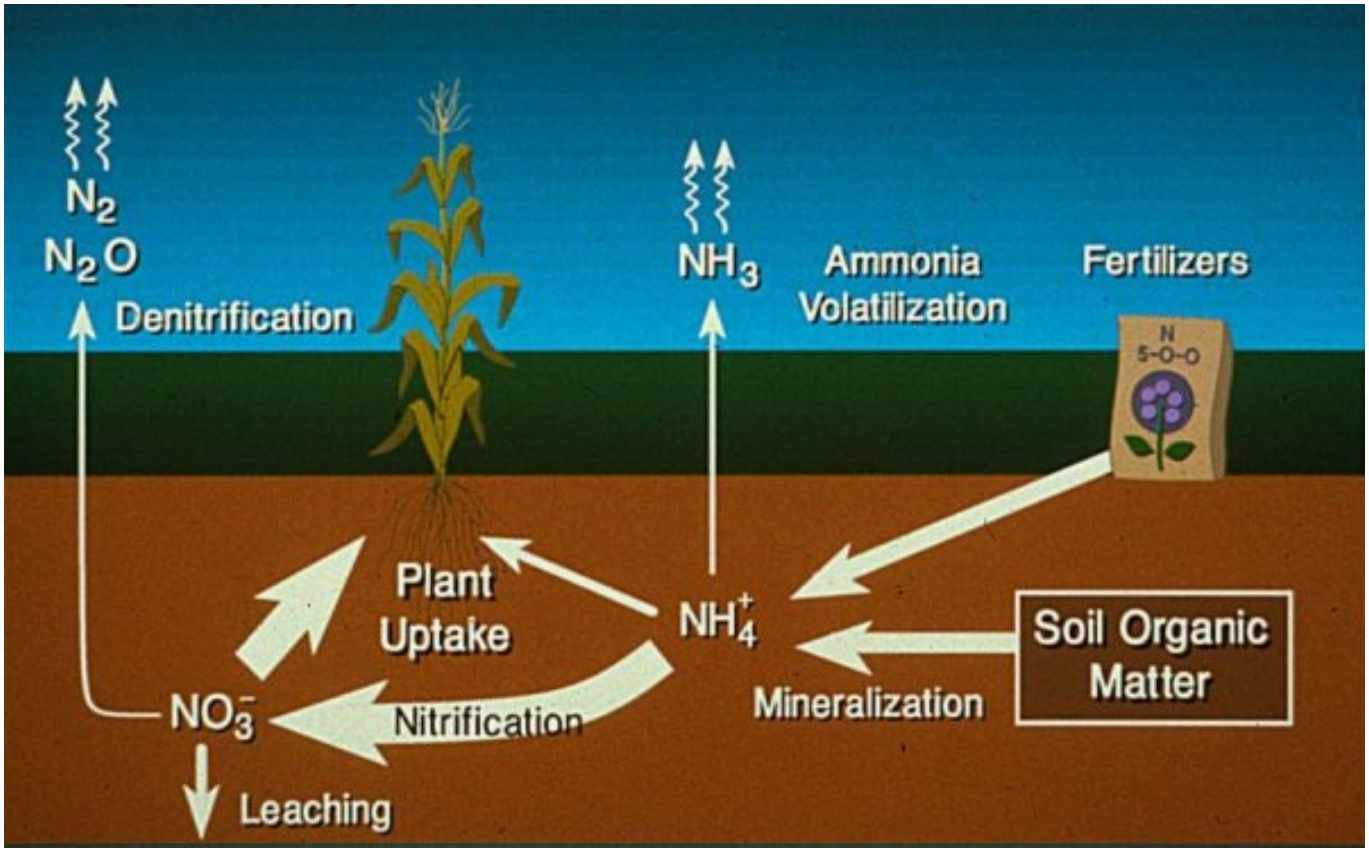
Nitrogen Management Challenge

- Nitrogen (N) fertilizer management is among most uncertain aspects of modern corn production
- Because soil N varies dynamically in response to the interaction between soils and weather, optimal N rates for any year or location in a given field varies widely
- As a result, N is often inadvertently over- and under-applied, reducing profitability

$$N_2\,(g) + 3\,H_2\,(g) \rightleftharpoons 2\,NH_3\,(g)$$ Haber–Bosch process

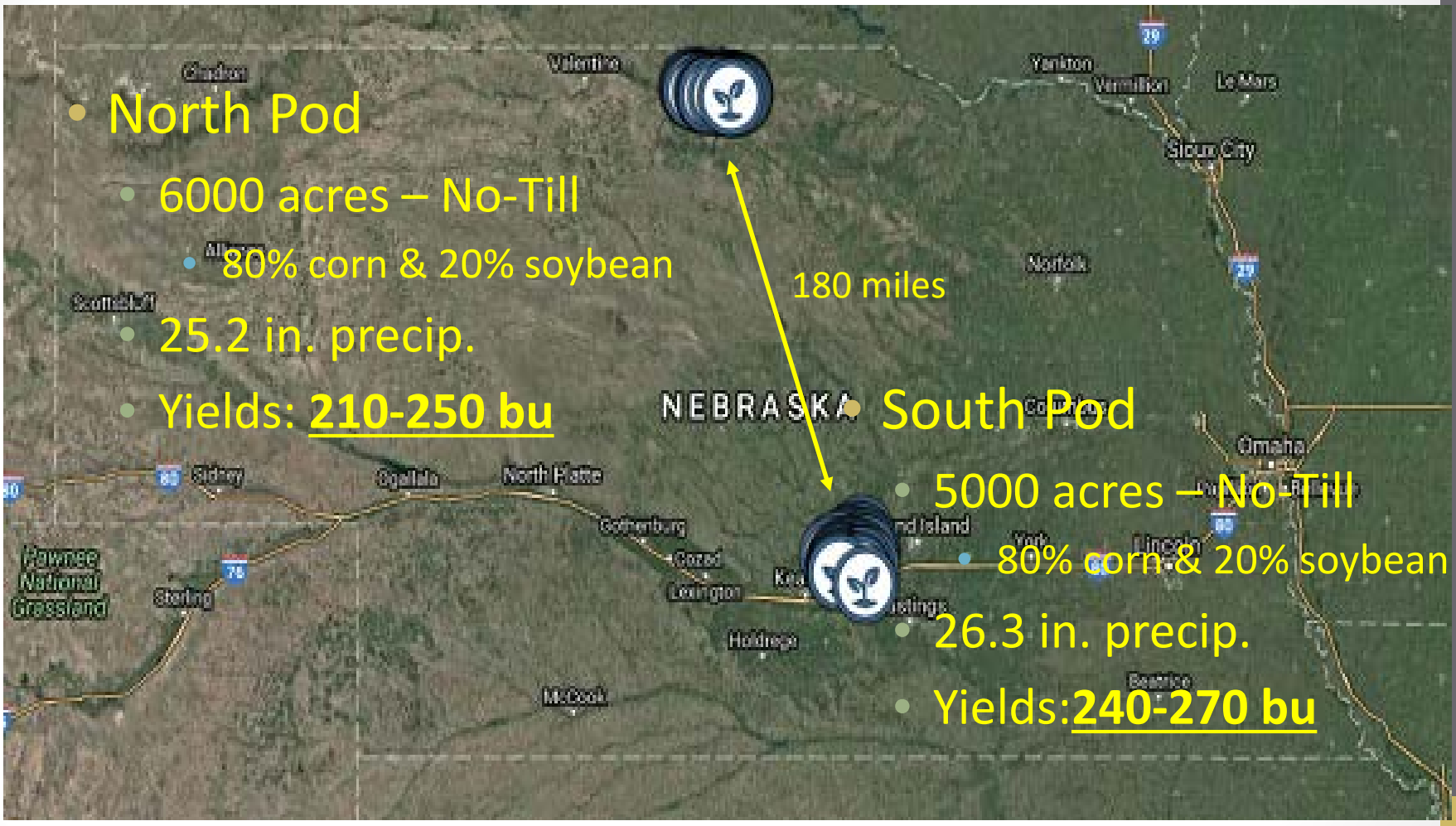
Consumes 40% of energy budget for corn production

Nitrogen Cycle



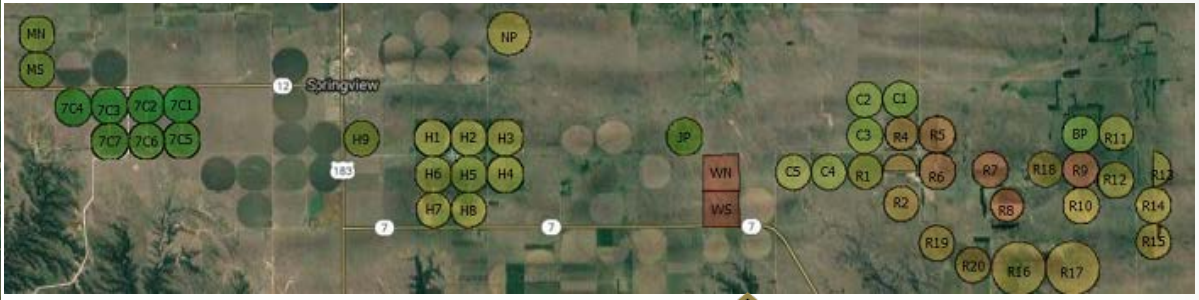
- Key to improving N management may involve less reliance on **large preplant N applications at uniform rates** and greater dependence on **split applications of spatially variable N rates**

PG Farms Enterprise



South Fields

North Fields



- South Farm Soils:
  - Level to rolling terrain
  - pH: 6-8
  - **Silt loam soil types**
  - **O.M.: 1.5-2.5%**
  - **CEC: 15-20 meq/100g**

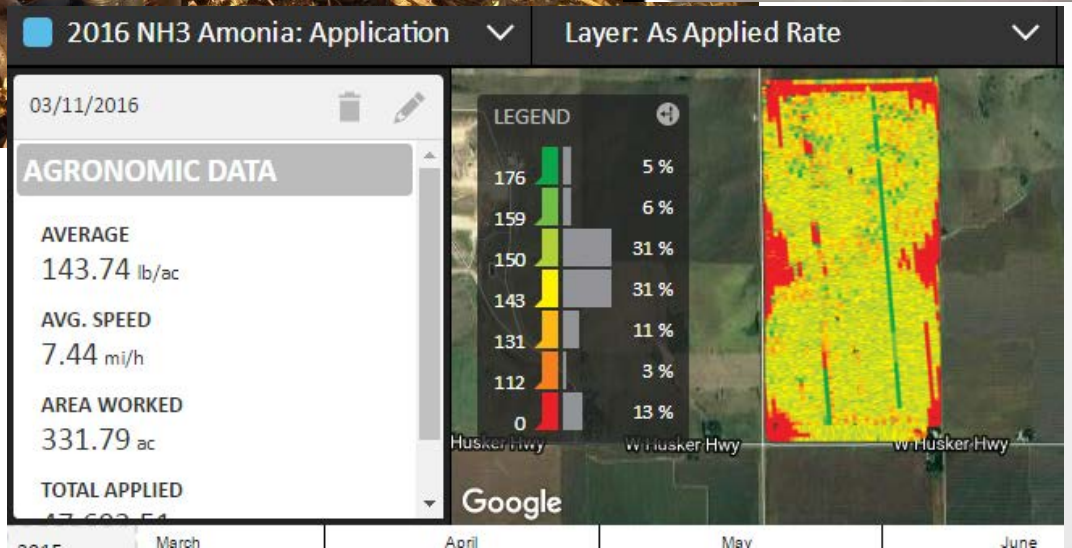
- North Farms Soils:
  - Level to rolling terrain
  - pH: 6-8
  - **Sandy loam soil types**
  - **O.M.: 0.5-1.5%**
  - **CEC: 5-15 meq/100g**

N Applicator: Exactrix W/ Precision Control

(24 rows, 15” intervals)

Anhydrous ammonia
10 – 34 – 0
Ammonium thiosulfate

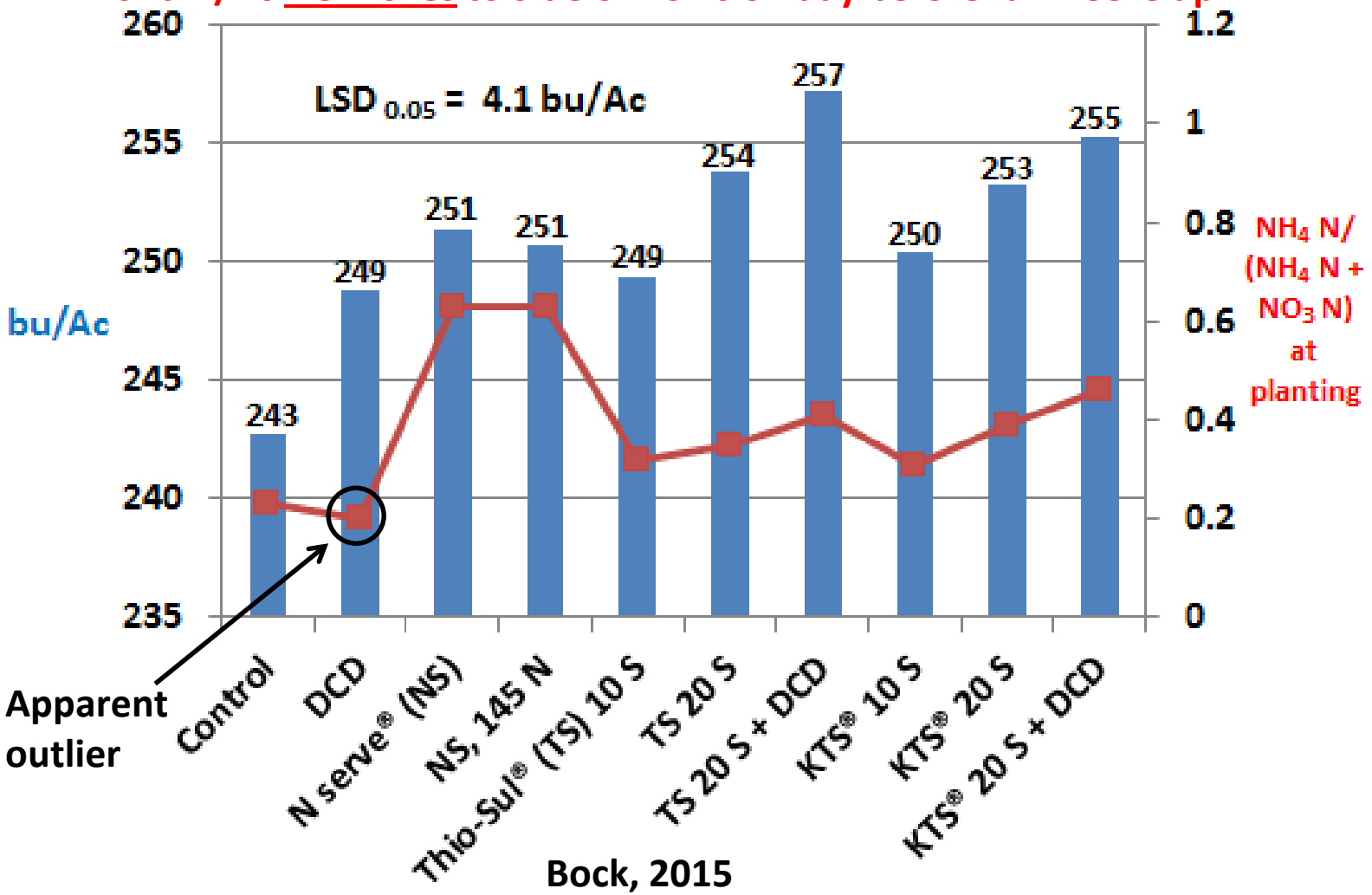
JD 2630 Monitor



www.exactrix.com

No-Till Corn After SB--2014-2015

170 lb N/Ac 4.5 inches to Side of Rows on day before fall freeze up

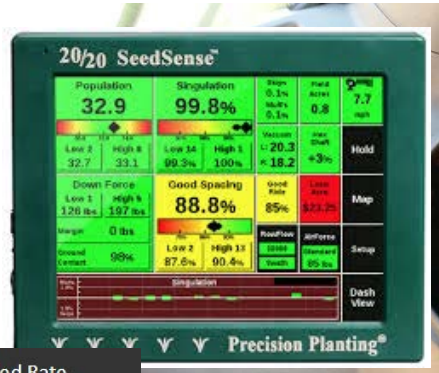


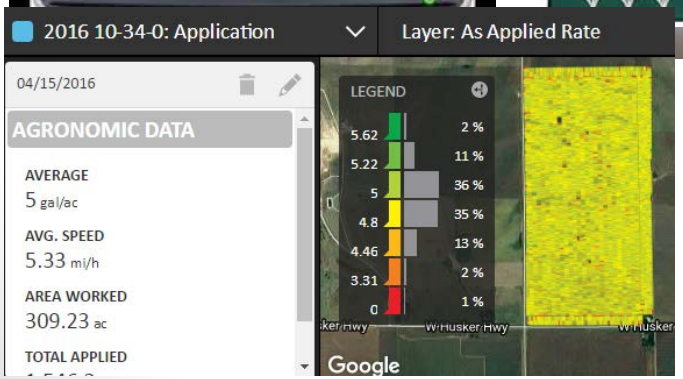
Bock, 2015

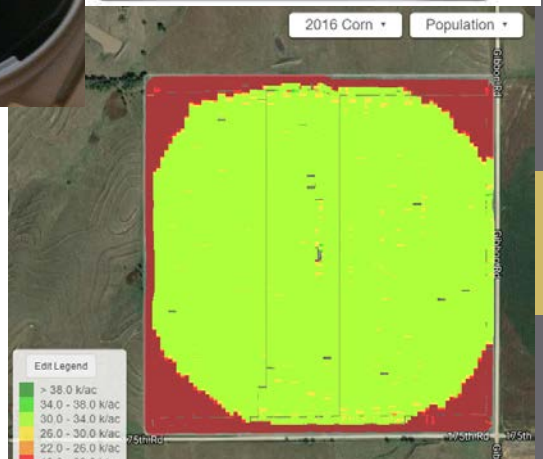
Planters- W/ Precision Fertilizer and Seed Control

JD 2630 Monitor

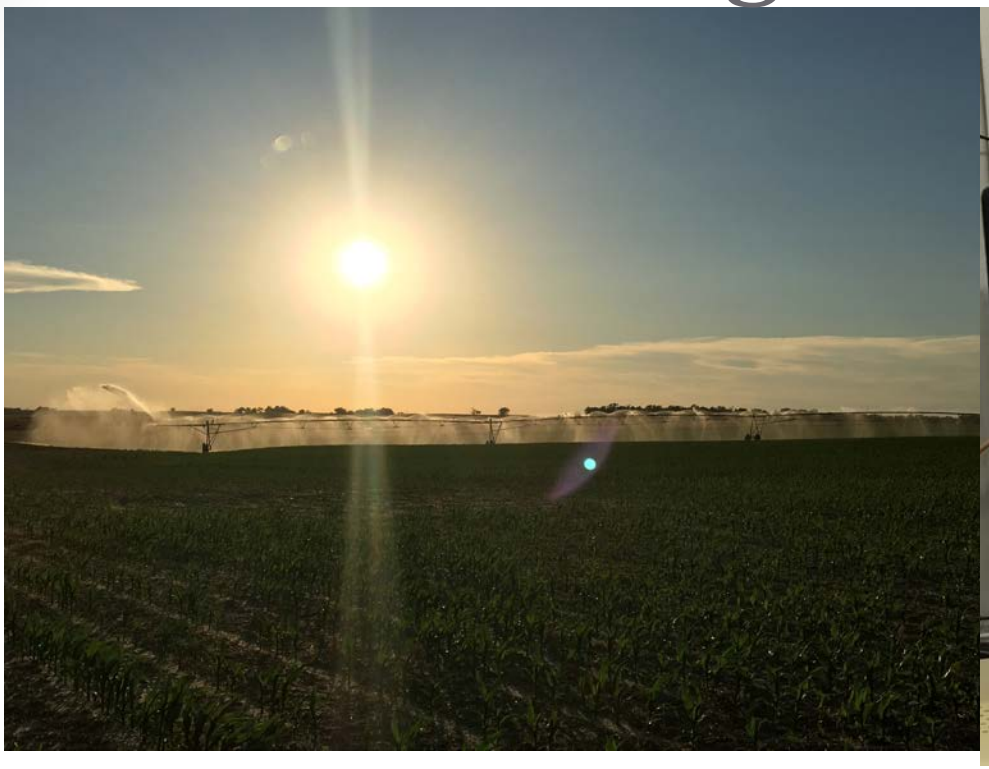
FieldView Drive

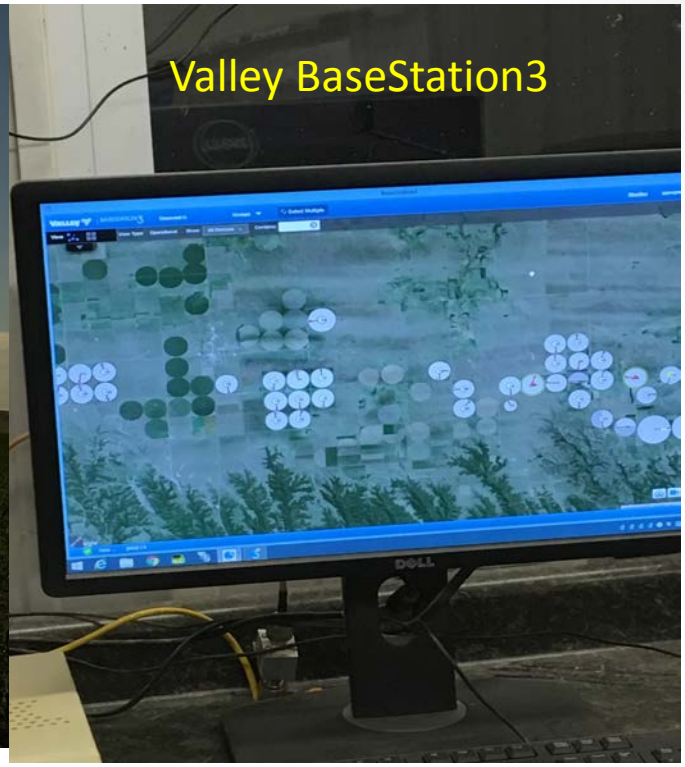






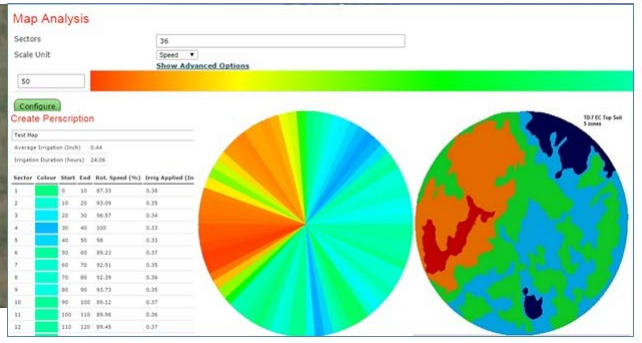
Precision Irrigation Control



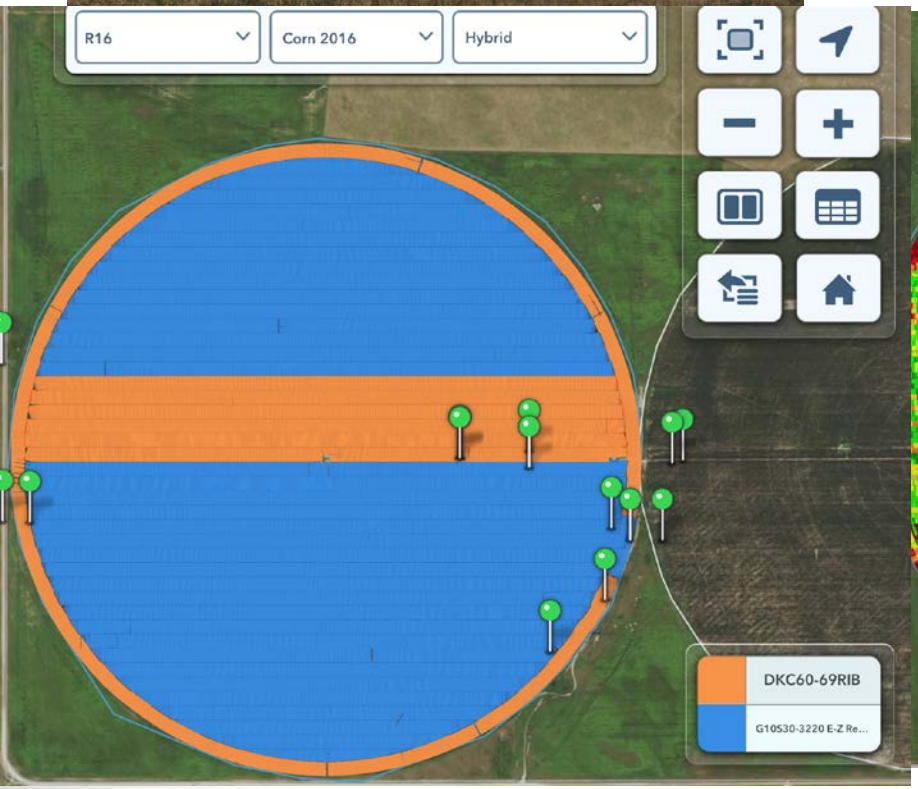


Water, Nitrogen and Pesticide Application

Manage for Spatial Variability

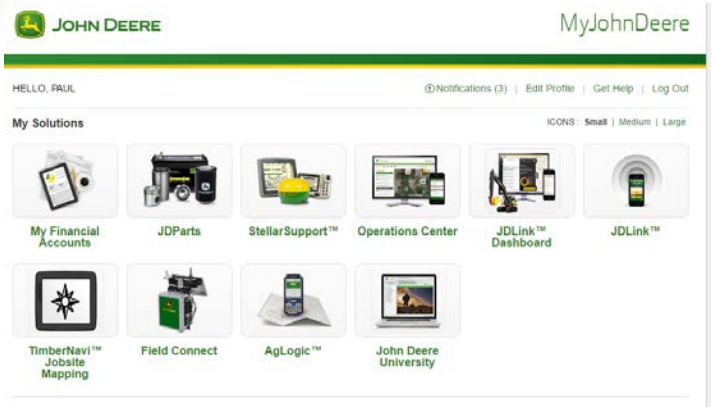


Combines- W/Precision Yield Mapping



Precision Apps Reviewed

John Deere- Op Center

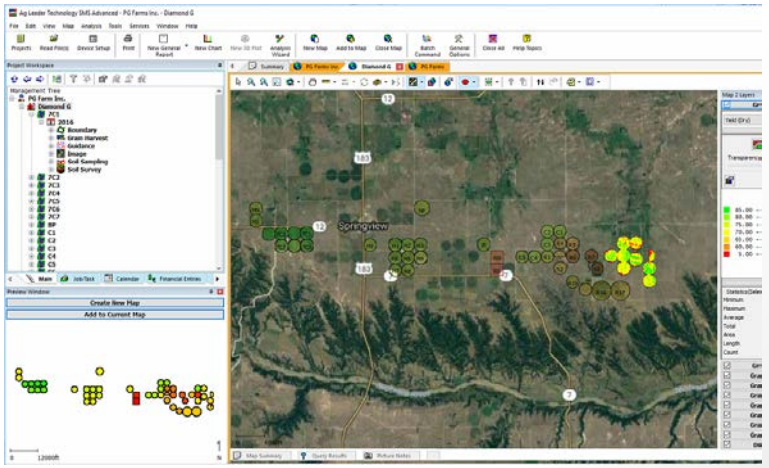


Climate Apps

Irrigation

Satellite Imagery

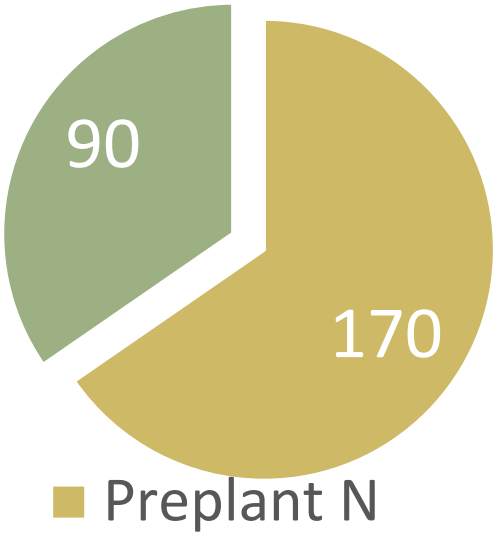
AgLeader SMS Advanced

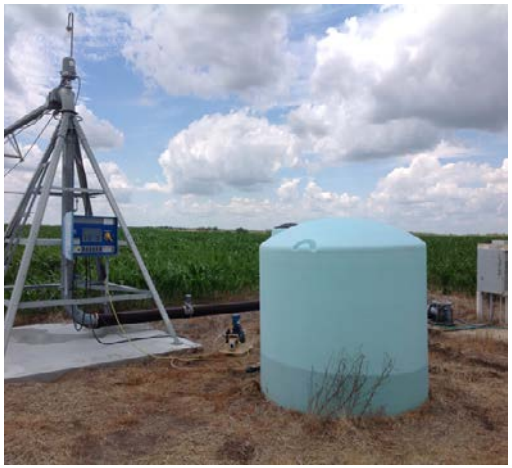


Nitrogen Management Plan

South Farm

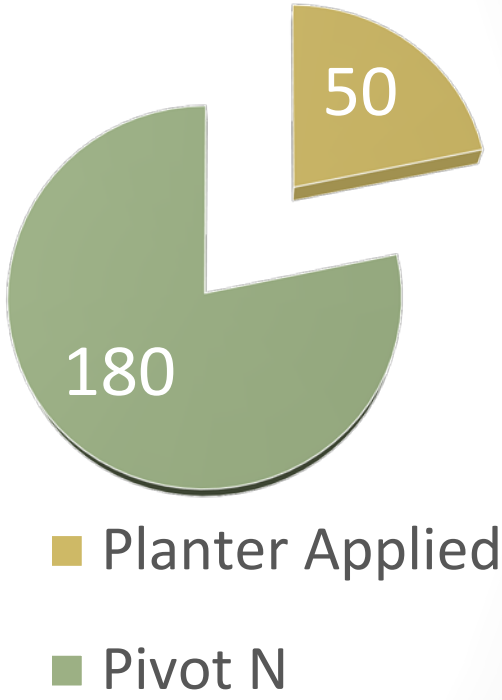
Applied N (260 lbs/acre)





North Farm

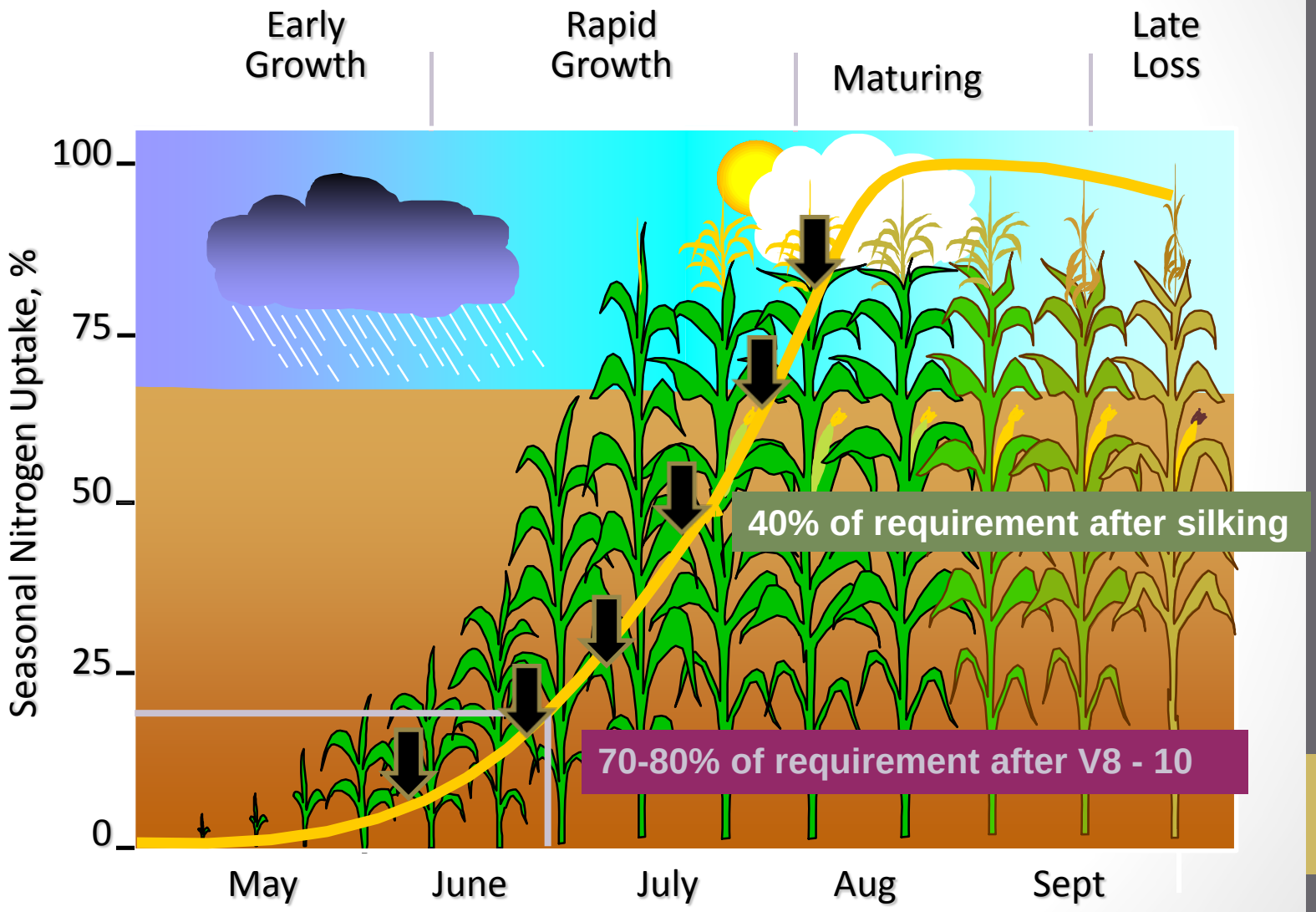
Applied N (230 lbs/acre)



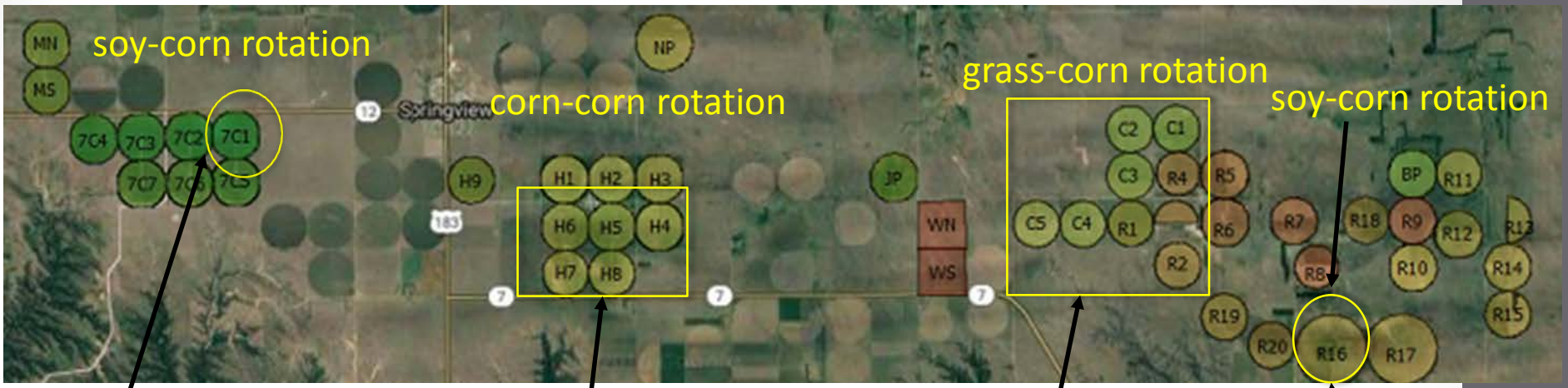
3 applications - 30 lbs/acre
@ V10, V14 & VT

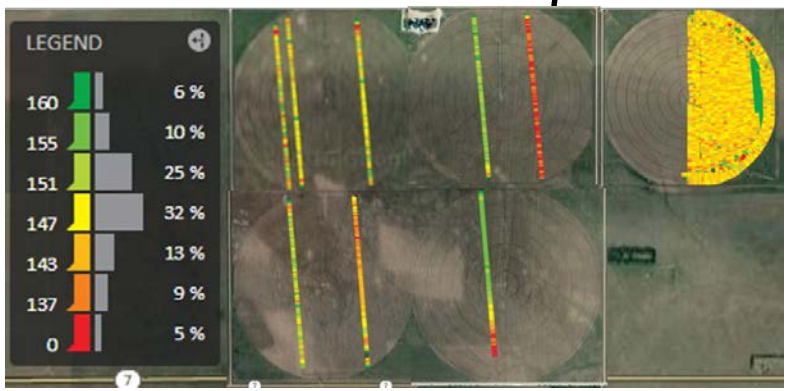
6 applications - 30 lbs/acre
@ V3, V5, V8, V14, VT, R1/R2

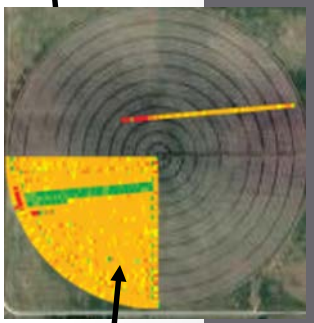
Goal - Maintain Season-Long Supply of N

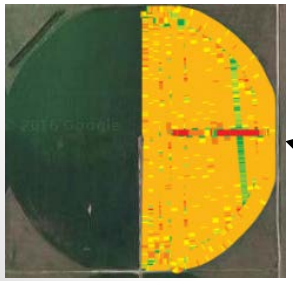


Evaluating N Management Plan



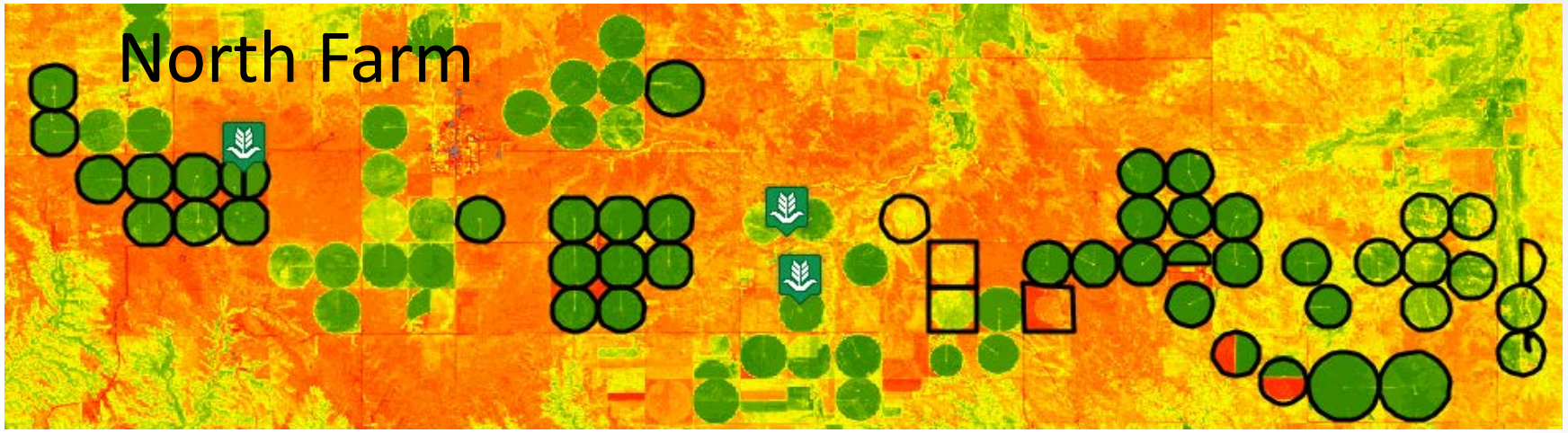


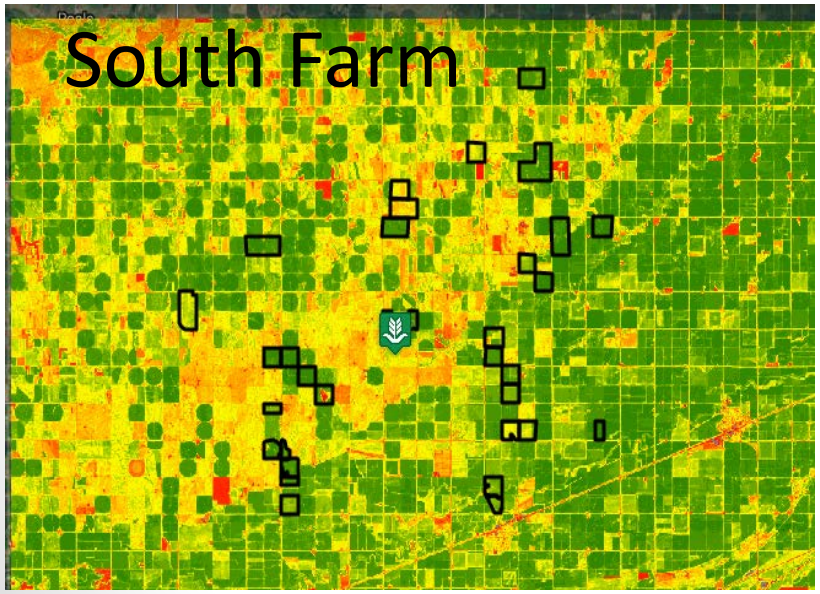




100 lbs N/acre Preplant Applied Ammonia

Monitoring Vegetative Health Using Satellite Imagery from Farmshots





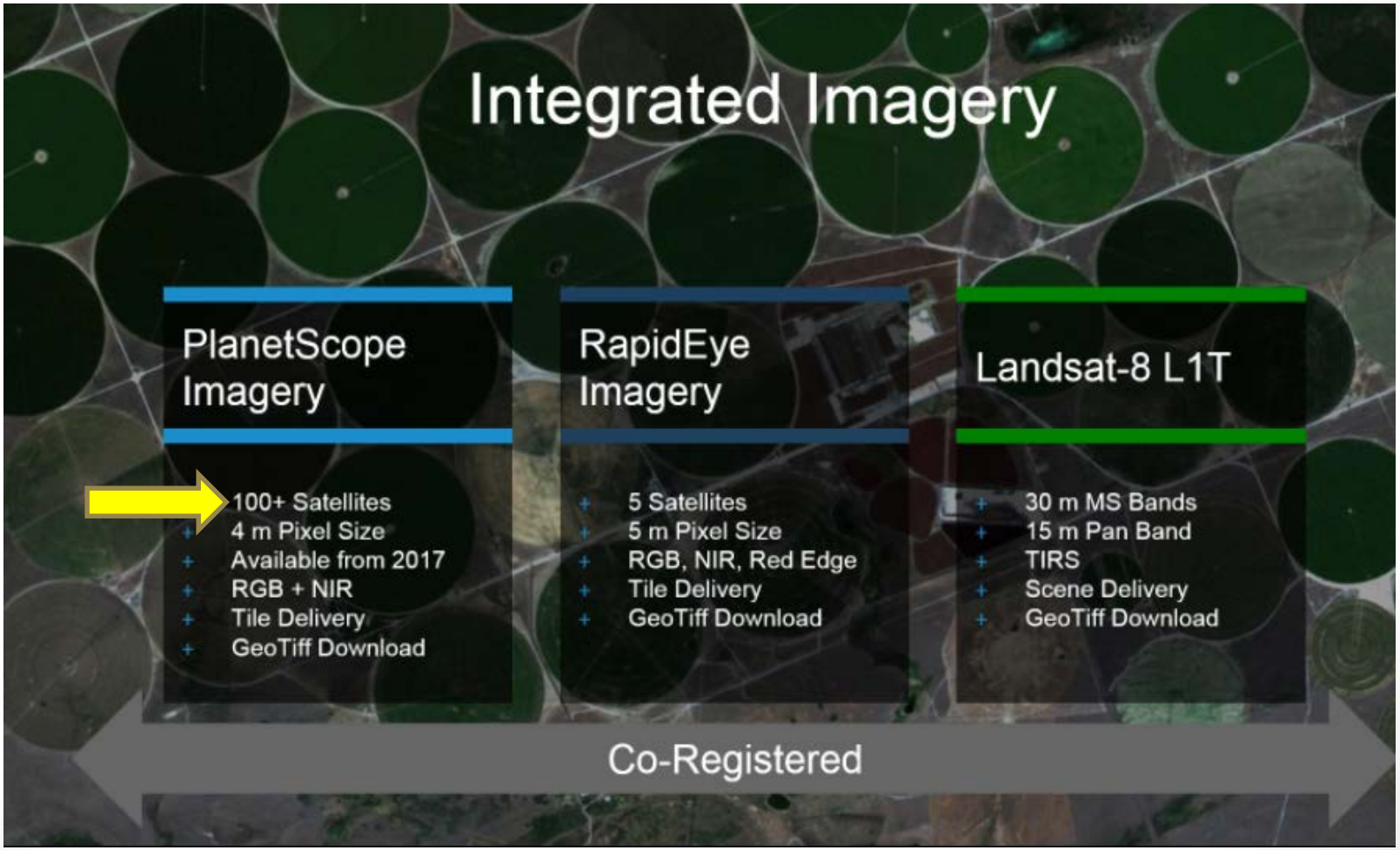
Imagery Sources

LANDSAT
LANDSAT-8
USGS • NASA

planet.

Rapid Eye:5-band multispectral image (**blue, green, red, red edge, near-infrared**)

Planet Labs in 2017



Remote Sensing Basics

CROP INSIGHTS

DUPONT PIONEER

Use of Remote Sensing Imagery for Improving Crop Management Decisions

by Bob Gunzenhauser[1] and John Shanahan[2]

Summary

- Remote sensing is collecting reflected light information from objects like crop canopies using remote platforms such as satellites, aircraft or ground-based platforms.
- In a 2013 pilot program, DuPont Pioneer is providing remote sensing imagery services to growers through Pioneer® Field360™ services.
  - In-season imagery from RapidEye is provided by Satshot, a national distributor.
  - This imagery can be displayed from a mobile device such as an iPad® or other tablet and can be used for directed field scouting.
- Images can be used to develop management zone-directed soil sampling schemes, validating hybrid tests or evaluating other agronomic practices on your farm.

Introduction

Remote sensing is defined as collecting information about objects (e.g., soil or crop surfaces) from remote platforms like satellites, aircraft or ground-based booms. This practice

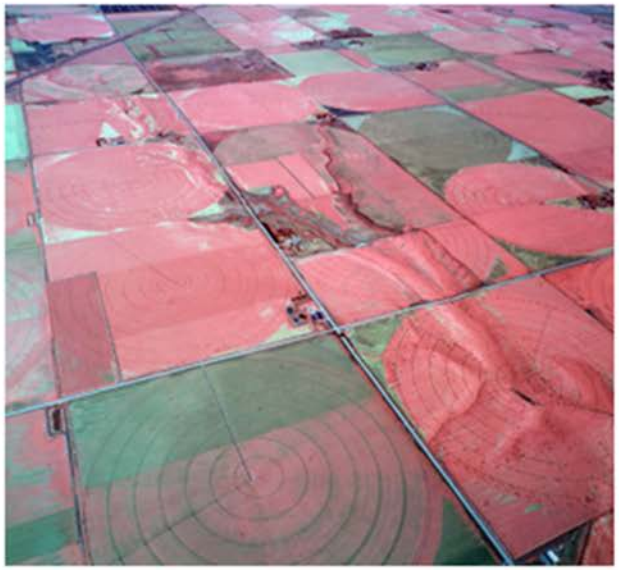
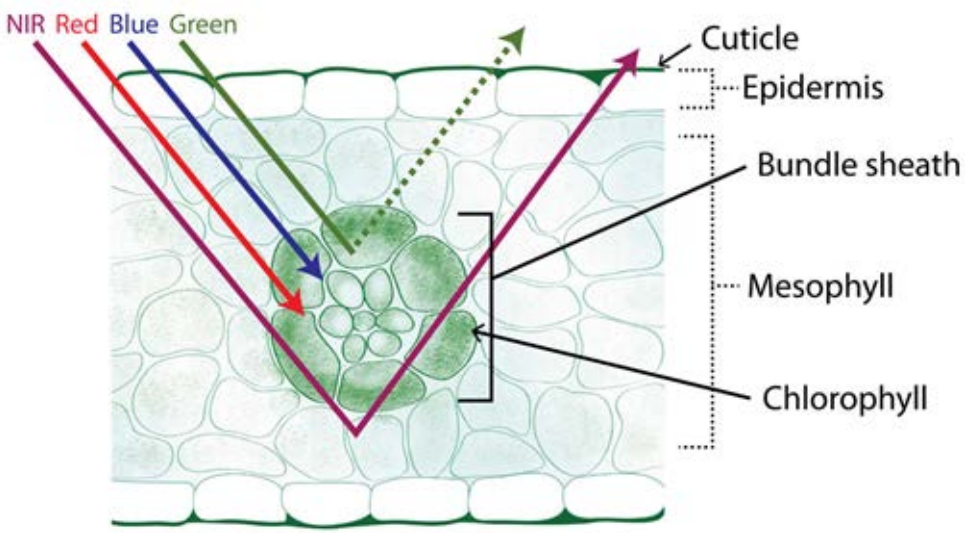


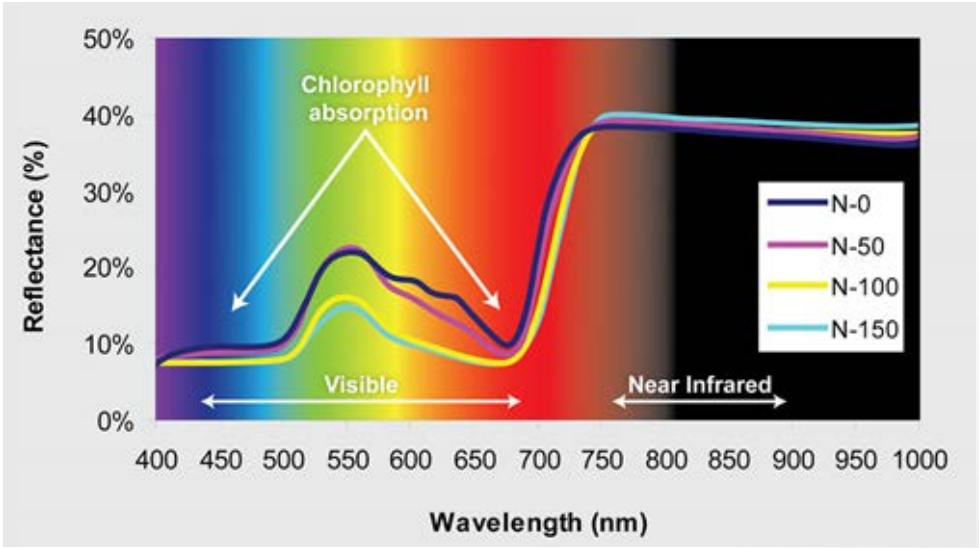
Figure 1. Aerial color-infrared image depicting spatial variation in crop vigor for several fields. Images courtesy of Cornerstone Mapping (www.cornerstonemapping.com).

Remote Sensing Basics



NDVI = (NIR - Red) / (NIR + Red)

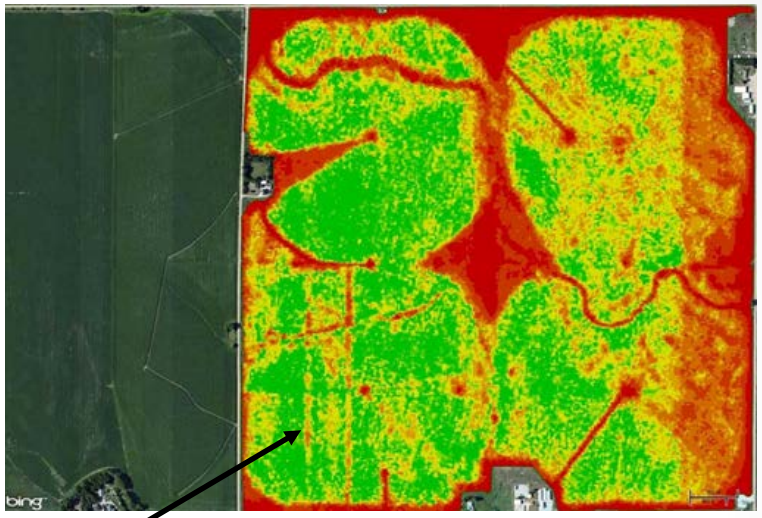
NDRE = Substitute Red Edge Band



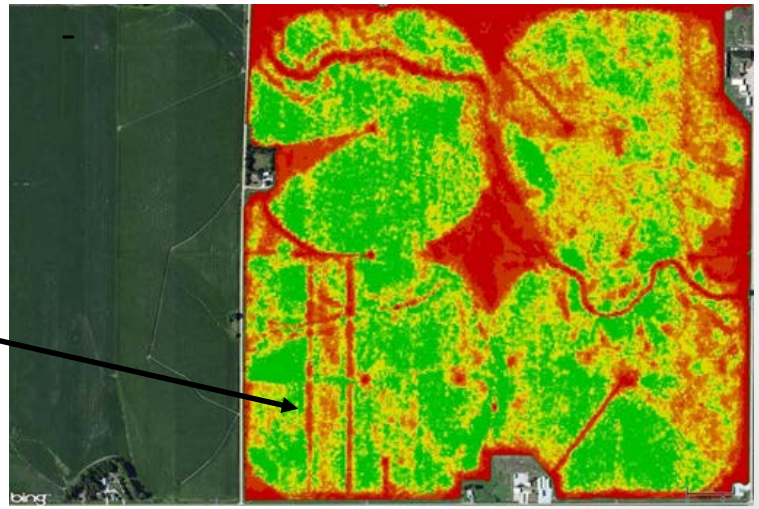
Identifying N Stress with Remote Sensing

Photo taken on July 12, 2013, depicting nitrogen stress for 24-row strips receiving only 25 lbs/acre of preplant N (corn on right).

NDVI Image-Rapid Eye-July 12th

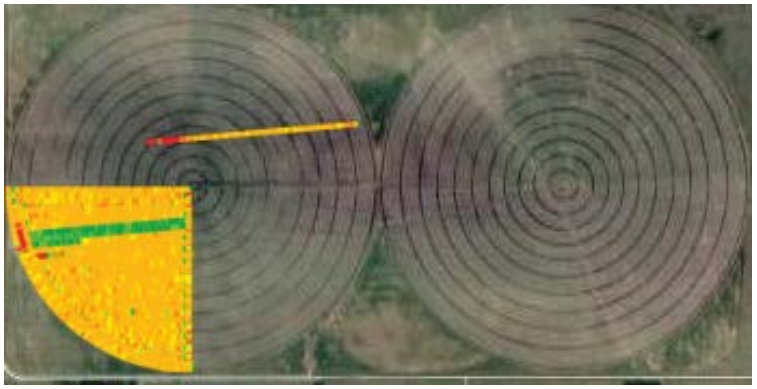


Red Edge Image - Rapid Eye-July 12th

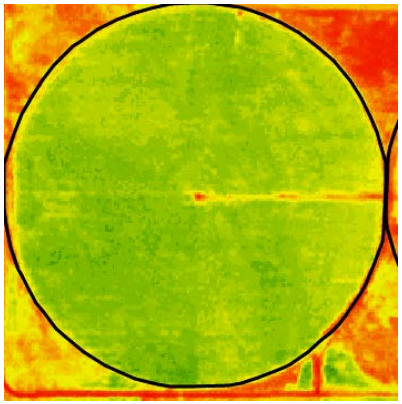


Season-long Monitoring of N stress

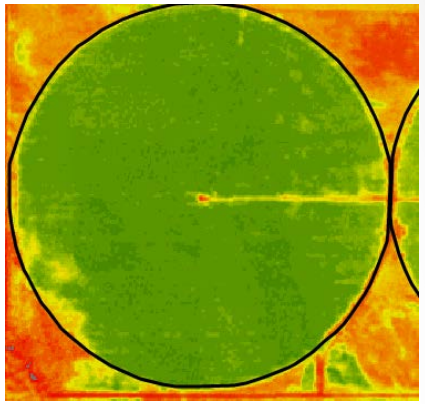
R16 Field



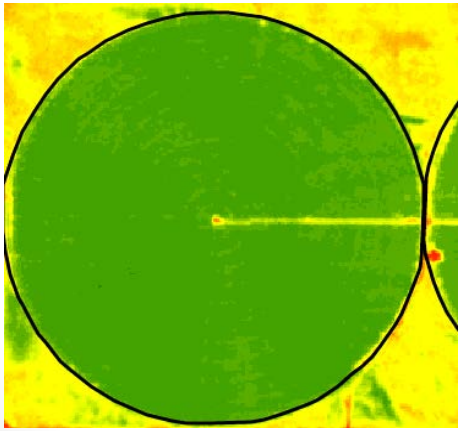
NDVI – June 23



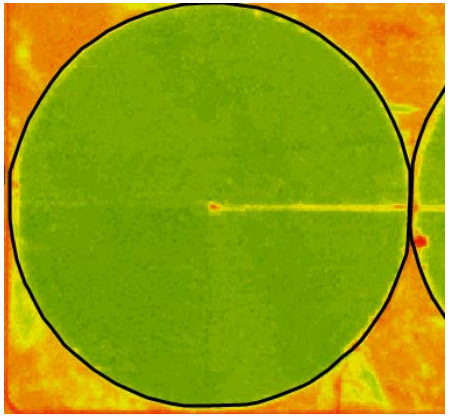
NDVI – June 28



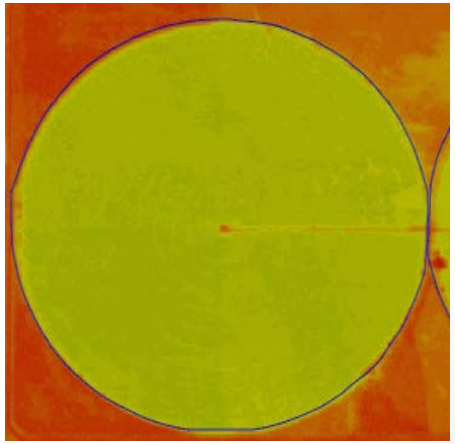
NDVI-July 12



Red Edge-July 12



Red Edge-July 31

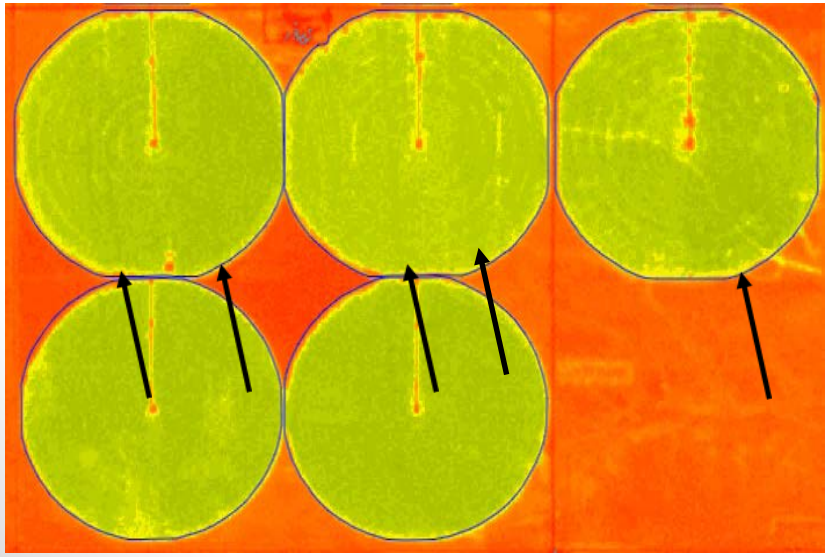


High *Low*

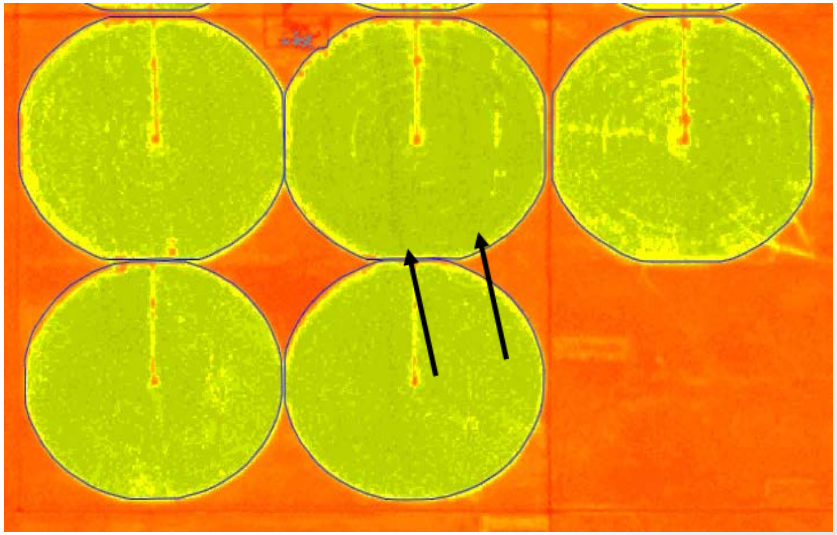
Imagery from Harris Fields

Imagery collected across entire farm encouraged us to make all 6 of planned in season N applications, including at R2

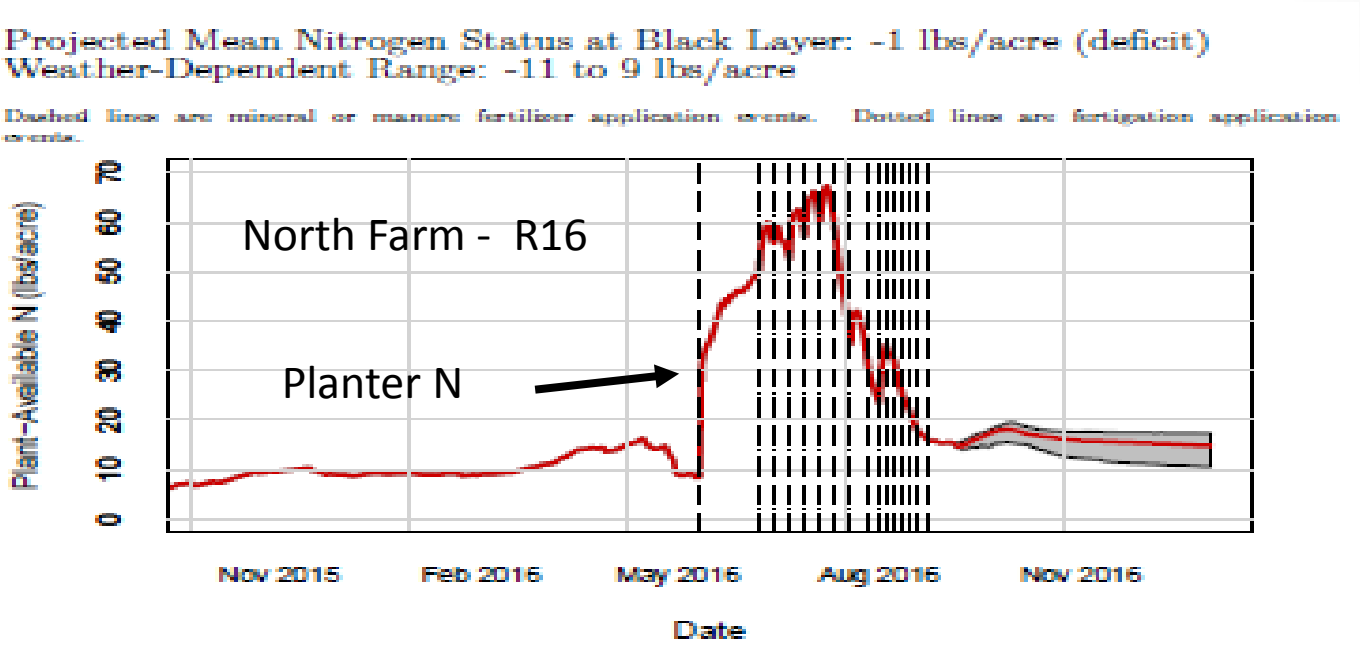
Red Edge – July 12

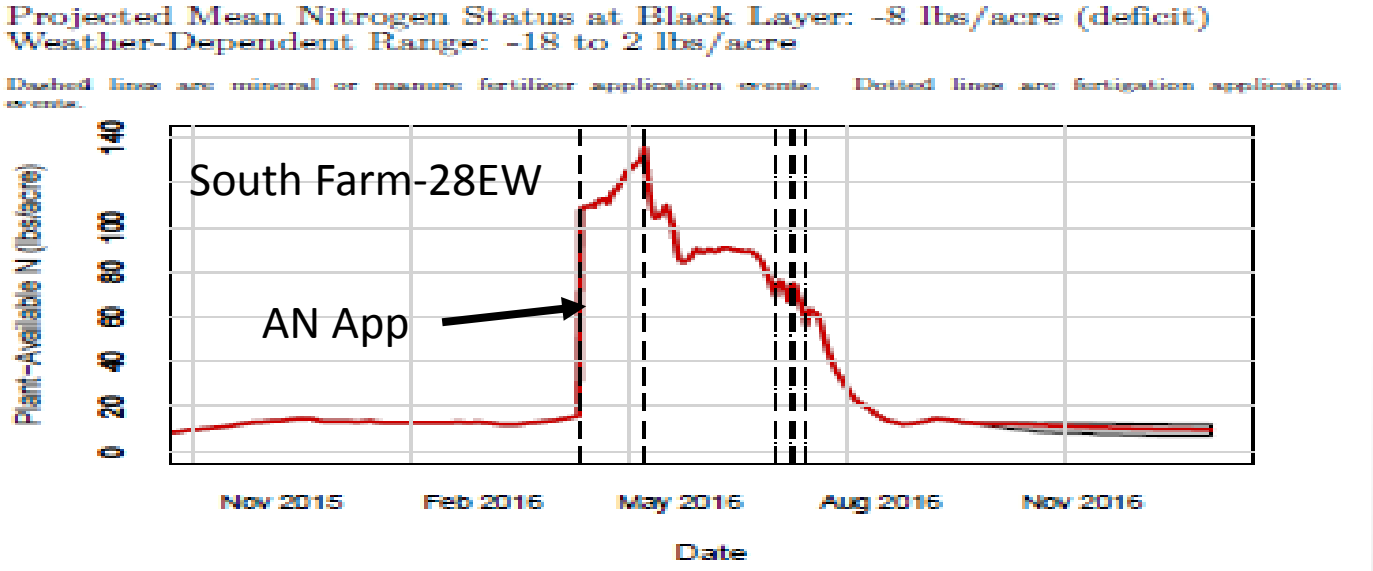


Red Edge – July 31



Climate N Advisor Report: North and South Farms

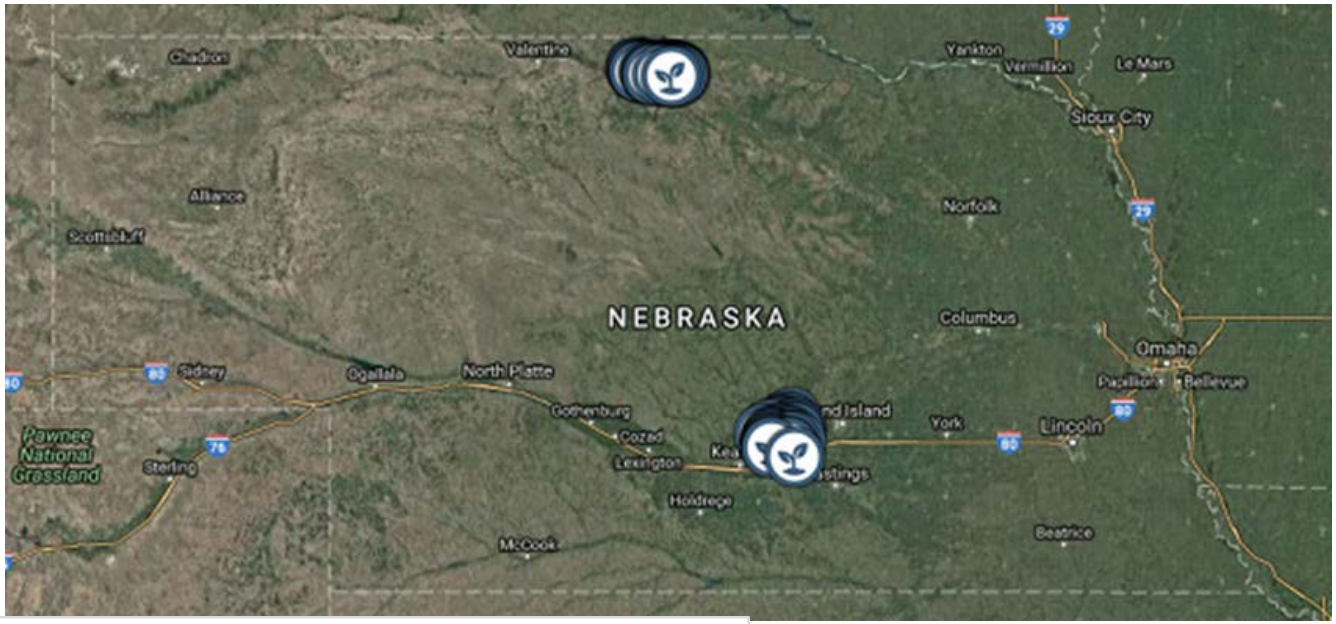


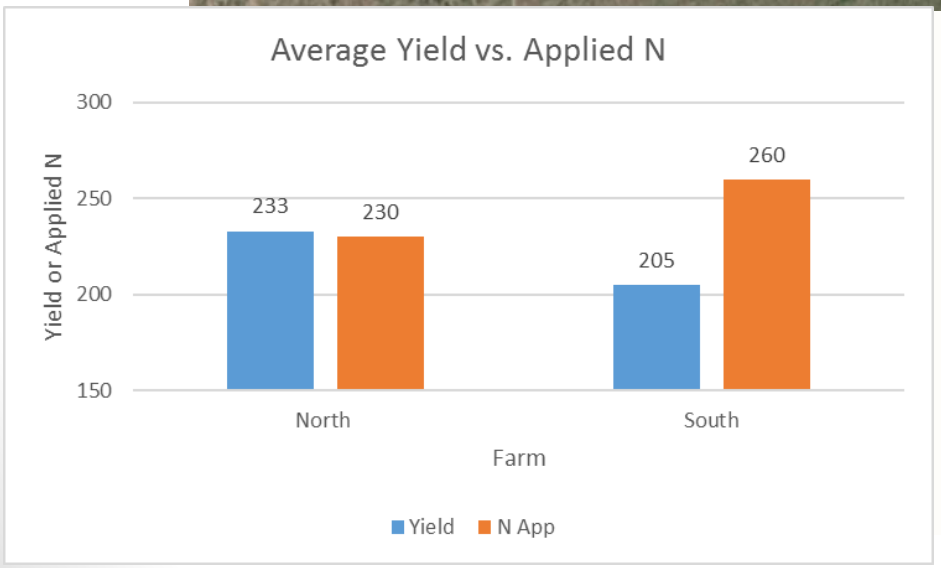


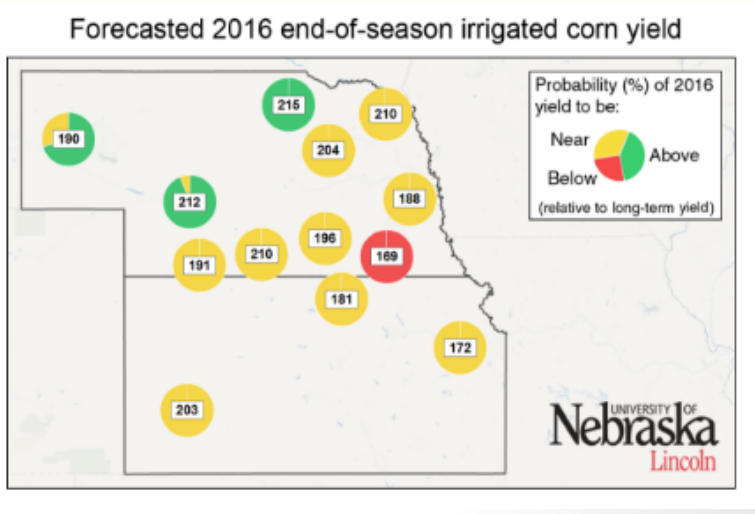
July 21, 2016

"North Farm"

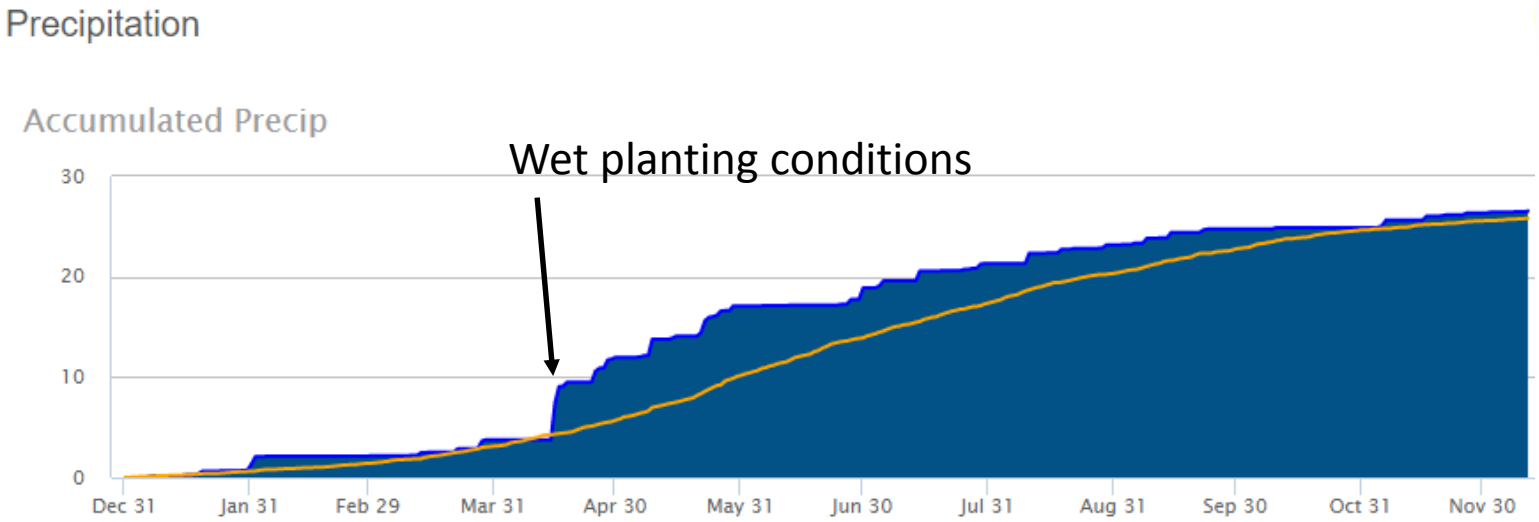
Average Yields: North vs. South

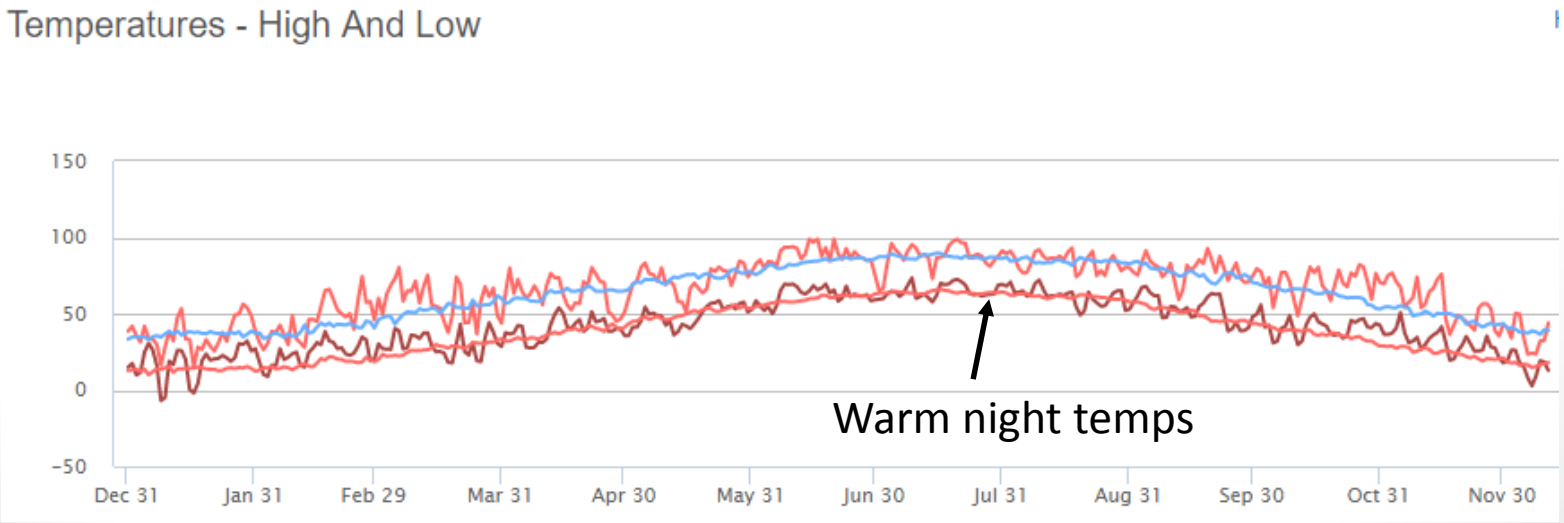




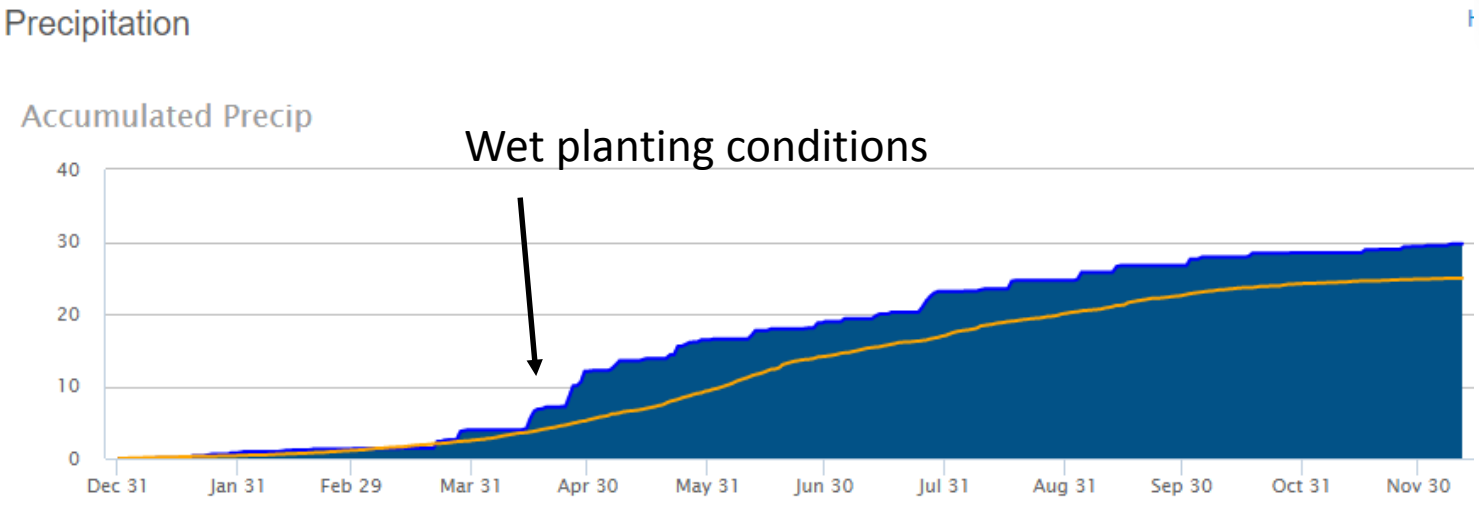


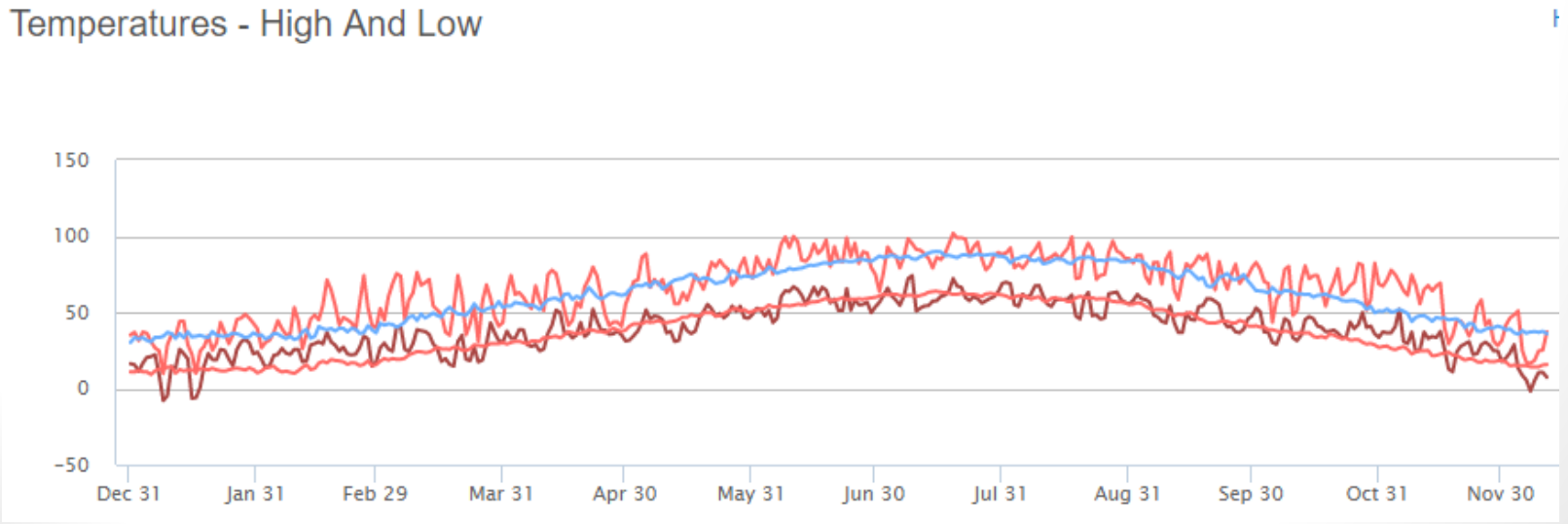
Weather - South Farm



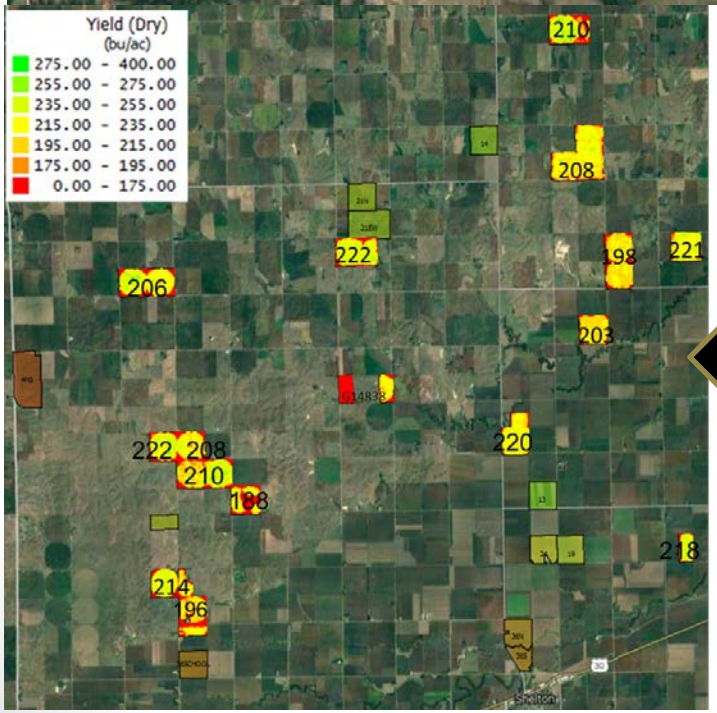


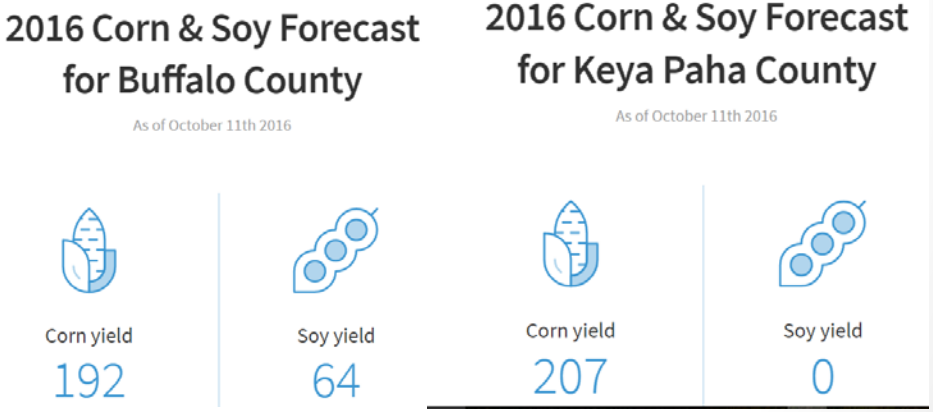
Weather - North Farm





Yield Maps: North vs. South





Descartes Labs forecasts of global commodity crop production

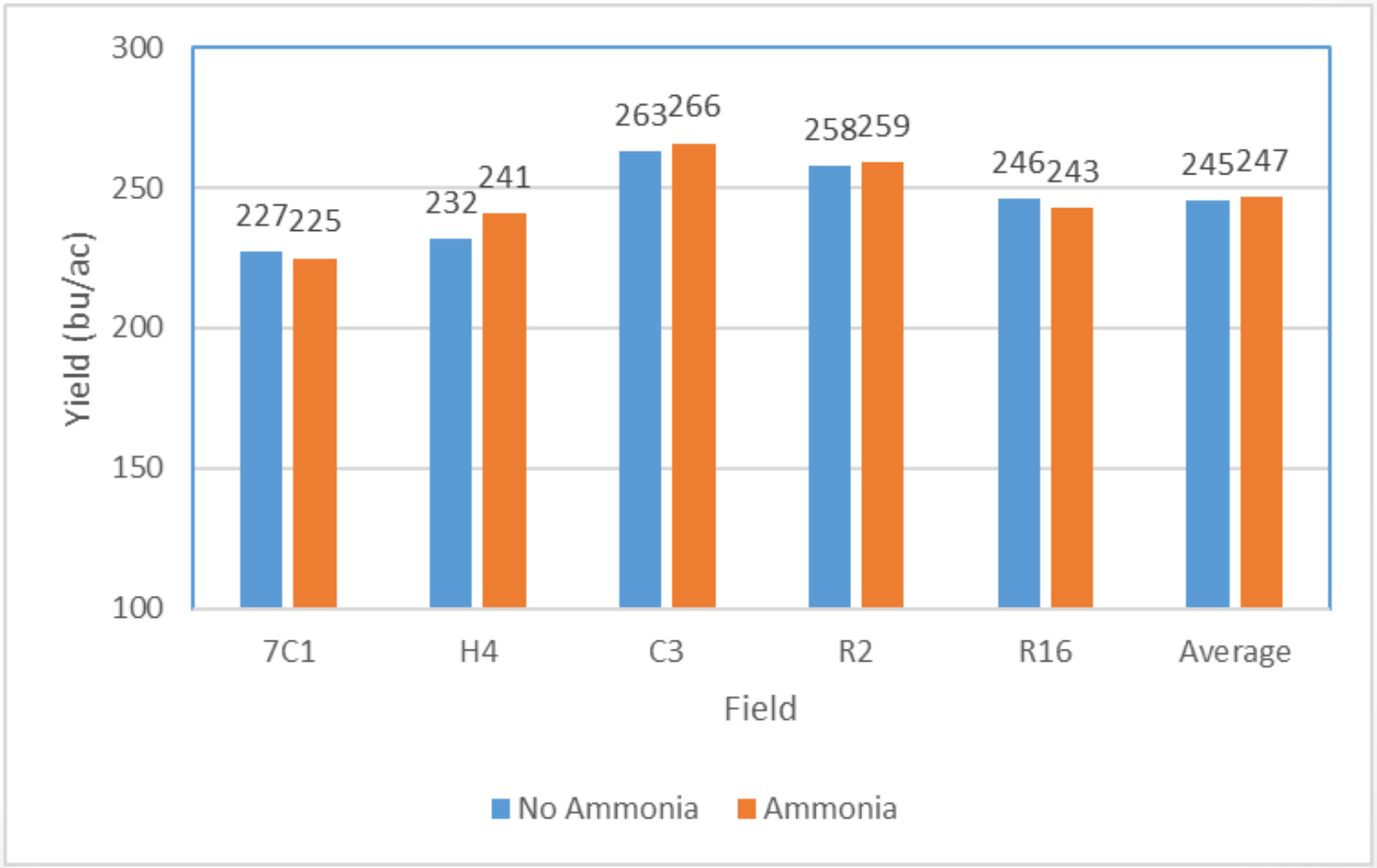
Comparison of Ammonia Strips Using Fieldview Reporting Tool

North Farm – R2 Field

- Ammonia

+ Ammonia

Yields for All Ammonia Strip Trials



Summary/Needs

- Imagery was helpful in scheduling N application, especially at north farm
  - However, more frequent image delivery is critical
  - Should possess red-edge band
- Precision Ag Apps were helpful in summarizing yield results from on-farm trials
  - But better integration between apps needed
- N recommendation tools show promise
  - But more proof of performance needed


Thanks You
Questions?