Precision Farming Technologies Overview

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About Me

- Oklahoma Native
- Precision Nutrient Management Extension Specialist (since 2008)
  - Work: On the go VRT Fertilizer to Basic Nutrient Management (N,P,K,pH)
  - Crops: Wheat, Canola, Corn, Sorghums, Sesame, Soybean, Cotton, Sunflower, Bermudagrass
  - Teach Sr. level Nutrient Management and Precision Ag Courses at OSU
Info Ag 2013

- Record Attendance
- Top Three Topics
  - #1 Variable Rate Planting Hybrid and Pop
  - #2 Unmanned Aerial Vehicles
  - #3 Agriculture Apps
The Most Important Thing

- The one thing to ALWAYS remember about Precision Ag, or Ag in General.

It is Almost IMPOSSIBLE to get two people to agree on how something should be done.
How often will two nutrients follow the same trend in a field.

A. Always
B. 75%
C. 50%
D. 25%
E. Never
Variability 101

- In many cases data collection is biased.
  - Zones whether it is soil, yield, or EC based.
- The user has to accept certain assumptions.
- Variability has no limits. Treating variability does
Correlations

- Using 1 factor to determine other factors
Nutrient Perfection

- From the Eyes of a Soil Fertility guy.

http://tiago hoisel.cgso ciety.org/gallery/866688/
Perfection P & K

- Immobile P and K
  - Rate Studies in each zone
Understand the Benefits and Limitations of Soil Testing

Broad sweeping recommendations

Recommendations are Conservative in both directions

Will recommend only when likely to respond

Rate will ensure maximum yield for the majority
Perfection N

- Mobile Nutrients N, S, B
- Yield Driven!!
  - Make determinations based off Environment and Plant measured in Season
Understand the Benefits and Limitations of Soil Testing

- Nitrogen levels in soil are not static
  - Soil test in August not always relevant in March.
- Dependent upon environment and yield level
- Multiple yield potentials in the field
- Recommendation based on Averages.
Perfection N

- Fields are highly variable
  - Why apply flat field rate
  - Why apply even zone level rate
Zone Methods
Acceptance
   - You are forcing lines in a natural environment
Zones should not be stagnant if problem solving is occurring.
Tackle the big issues with zone delineation
Redrawing lines

- Inherent errors when
- Basing sampling locations on one variable then redrawing lines based on new samples.
Grid

- Independent Layers created
- But unless producer is willing to apply nutrients independently there is little reason to spend the $.
- Next question, grid size.
Survey Question

- What is the proper grid sample size:
  A. 10 ac
  B. 7.5 ac
  C. 5 ac
  D. 2.5 ac
  E. 1 ac
Turning data into decisions

- The GIS Package is your friend.
  - To each there own.
- Make it yours. Choose your Nutrient recommendations based on
  - Region
  - Goals
- Your limits are based on
  - Sampling
  - Equipment
  - Transfer of data to equipment
Yield Maps

- Identifying Yield Potential and Yield Stability
- What can you do with it?
  - Identify soil properties....
  - Identify yield levels and nutrient removal
  - Variable rate seeding and variable rate N for starters
Where is the profit made in this field by using VRT.
FIGURE 19.3. Map of grain yield (A), map of grain protein concentration (B), and map of critically low protein indicating areas where nitrogen could be deficient for yield (C).
FIGURE 19.5. Maps of nitrogen removed (A), nitrogen deficit (B), and N required (C). The map of N required can be exported from Surfer as an ESRI Shape File for input to a task controller for variable rate application.

Protein and Yield
Yield Stability

Methods (Via Chad Godsey of Godsey Precision Ag.):
- Created 90’ by 90’ grids and averaged the yield data points within the cell for each year.
- Calculated normalized yield for each cell for each year.
  - Normalized yield = Cell average/entire field average
- For example in Field 3 in 2006 the lightest color red cells were less than 90% of the field average.
- Then averaged the cells for every year I had yield data to determine a yield stability and classified each cell as:
  - Low (<90% of field average)
  - Average-low (90-95% of field average)
  - Average (95-105% of field average)
  - Average-high (105-110% of field average)
  - High (>110% of field average)
- Depending on the stability classification I then assigned a seeding rate for example on Field 3 I assigned seeding rate as follows:
  - Low - 27,000
  - Avg-low – 30,000
  - Avg – 32,000
  - Avg-high – 33,000
  - High – 34,000
- Some fields were very consistent so the entire field got 32,000 with the exception of a few cells where populations check strips got placed.
Field 3; Yield Stability 2006-2009

Population Strips. These will be evaluated with yield monitor.

Field 3; Seeding Rate 2010
Variable Rate Seeding Population
- What is the right rate
- How is it determined
- Is it static over environment and Yrs

Variable Hybrid
- Work horse vs Race Horse
- Limitation?
  - Equipment
Optical Sensors

- Satellite, Aerial, Ground based
- Two Targets
  - Soil or plant
- Soil Color
  - Texture and Organic Matter
- Plants
  - Biomass or Health
VRT based on imagery

- Herbicide, Pesticide, Regulators, Defoliants.

Currently the standard is:
  - Identify the rate for the low area
    - Ex Cotton Defoliation 2^{nd} pass,
    - Low LAI .25 oz AIM/ac
  - Identify the rate for the high area
    - High biomass full rate AIM 1.6 oz/ac
On the go Defoliant

![Graph showing the relationship between NDVI Value and Rate of AlM oz/ac.](image-url)
Optical Sensor and N

- Two primary approaches on Crop Sensors
- Three curve styles
- Yield Prediction, Response Prediction
  - Yield and Total Nitrogen need both vary
- Response Prediction
  - Yield and Total Nitrogen need does not vary, but Fertilizer N does.
Curves

![Graphs showing the relationship between NDVI Target and N Rate.](image)
- FAA, Resolution, Battery, Pilot
- Consulting Group bought 4, crashed 3
The Sooner Tree House
Thank you!!!

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