InfoAg 2017 - Remote Sensing (Imagery) Analysis, Today and in the Future

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My Story

• Agronomist – 36 yrs.
• Owner (Integrated Ag Services) – 27 yrs.
• Part time farmer – 31 yrs.
• Business beliefs
  – Practical application of precision ag (PA)
  – Driven by ROI
Imagery Platforms

Satellite

- Economical
- Low resolution
- Cloud cover
- Convenient
Imagery Platforms

UAV

- High resolution
- User driven
- Inefficient
- Large data output
Imagery Platforms
Manned Aircraft

- Economical when mapping large groups of fields
- Manageable data output
- Less weather dependent
- Inefficient when mapping isolated fields
**Basics**

- Start with the basics to identify (geo-reference) the obvious yield limiting areas
- Liebig's law of the minimum
Liebig's Law of the Minimum

• Streaking – Row starter study
  – In-furrow with N/S (2X2)
  – Red streaks have 60 lbs. less N and no Sulfur
Liebig's Law of the Minimum

- Sulfur Deficiency
Between hybrids, notice leaf angle on each side.

Date Created: 7/10/2017 9:11 AM
Location: 40.10494 | -84.074765
UAV Target Scouting
- High Density ½ ac. grid soil sampling

- Low pH & Mg.

- NDVI confirms same general location
Compaction
Pinch Row Compaction Plus Heavy Rains = Stress on Stress
Planter Pinch Row Compaction

30K ears/ac.
180 Bu./ac.

23K ears/ac.
82 Bu./ac.
Thermal Imagery

- Models CPU Perfectly
  - Soybean Stubble
  - Early Spring
  - Average Moisture

- Models Wind Direction!
Challenges of Aerial Imagery

• Postmortem – too late for corrective action, hence the lack of interest from the grower
• It’s a therapy session – We get together and talk about all our problems
• Limited to zone creation with NO measurable data
• Increases the need for high valued resources in the field (boots on the ground)
• Speed to corrective measures are too slow
The Future of Remote Sensing Crop Modeling

• **Grower Driven!!**
  – Economic
    • Virtual yield mapping and grain marketing
    • Virtual profit mapping
      – Input decisions based on sound ROI
  – Agronomic
    • Using real data to determine size and scope of the problem
    • Models will predict problems before or as they occur (Disease outbreak)
  – Environmental
    • Treatments are applied only when needed
    • Can assess environmental risk versus economic gain
Crop Modeling

– Weather
  • Rainfall
  • Temperature (GDU or GDD)

– Agronomy
  • **Nutrients**
  • **Weeds**
  • **Insects**
  • **Diseases**
  • **Plant stand**

– Crop Condition
  • **Crop height**
  • **Stem diameter**
  • **Canopy volume**

– Crop Damage
  • Mechanical injury
  • Extreme weather events (flooding, cold, heat, hail)
  • Compaction
Profit Calculator & Imagery

- Aerial imagery is classified into management zones
- Each management zone is tagged with specific agronomic rating
- Agronomic ratings are used to refine daily yield estimates and track in-season issues
- Yield estimates are used to determine the need for corrective measures
- Yield/profitability can be accurately analyzed based on agronomy, weather, and the grain markets
MOORE’S LAW

Microprocessor Transistor Counts 1971-2011 & Moore’s Law

curve shows transistor count doubling every two years

Date of introduction
Remote Sensing Drivers – Moore’s Law

• Higher resolution data collection
• Machine learning
• Quantitative data, not zone creation
• Increase the Velocity of data
• Autonomy

Reduced cost!
High Resolution Multispectral Imagery
Machine Learning

- Quantitative Data - machine learning
- Thick Data – agronomist/grower relationship
Quantitative Data
Example: Plant Stands
Velocity of Data

The **velocity of data** increases when more uses of the data are occurring throughout the growing season.
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Velocity of Data

If the **velocity of data** is increasing, then more uses of the data are occurring between individuals throughout the growing season.

- Use data quickly to make corrective decisions
- Fast and seamless data transfer to share with many different decision tools
- Use data in modeling software many times during the growing season to validate input decisions and insure profitability (machine learning)
- Postmortem of the year’s activities to build a better plan for the next year
Autonomy
Cost Efficiency

- Lower the cost and increase the velocity of data collection by using remote sensing, machine learning, and automation.
- Allows high valued “thick data” (agronomists) to confirm and collaborate best course of action with the farmer.
Questions
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