“Remote Sensing Applications for Precision Agriculture”

Farm Progress Show

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and

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Purdue University

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Purdue remote sensing research in agriculture started in the 1966 with the establishment of the Laboratory for Agricultural Remote Sensing (LARS).

Joint efforts with University of Michigan (ERIM), University of California and USDA-ARS.

Satellites have been launched for “Communications”, “Weather Observations”, “Global Positioning”, and “Earth Observations” since early 1960s.

Projects accomplished for Agriculture: LACIE, AgRISTARS, CRSP and now Ag20/20.
So why isn’t everybody involved in agriculture using remote sensing?
Farming - 10 years ago

Basic Premise: A field was treated as a unit
> Tillage was uniform across the field
> Seeding involved one variety
> Applied one rate of fertilizer
> Applied one rate of pesticide
> Yields were estimated based on volume
Farming Today

Basic Premise: Specific variations within the field are a potential unit
• Variable tillage by soil type, relief, etc
• Adjust seed variety and rates on the go
• Adjust fertilizer rate
• Variable rate of pesticides
• Scouting accomplished by walking the fields – known variations
• Remote Sensing images through the season – scouting, nutrients, drainage, yield
• Yield maps showing variation by location
Spatial Technologies Currently Available

Global Positioning Systems (GPS)

Geographic Information Systems (GIS)

Remote Sensing

Directed Communications

Spatial Statistics
GPS Applications

• Navigation

• GIS/Mapping
GPS for Collection of Ground Reference Data

- **Grain Quality Data**
- **Leaf Tissue Nutrient Data**
- **Leaf Chlorophyll Data**

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Soil Patterns over the Purdue Agronomy Research Center

IKONOS Satellite
Space Imaging, Inc

May 24, 2000
Soil Patterns near Davis Purdue Ag Center
The rectangular field that is red in the first image, goes through several changes over the course of the growing season. What do you think those change are?

B: The square field with a hole in the lower left, changes progressively as well. How does it change? What happens to the hole?
What Spatial Resolution do You Need?

20 meter SPOT - Sept. 27, 2000

1 meter pan-sharpen IKONOS - Sept. 19, 2000

IKONOS Image provided by Scientific Data Buy (Stennis), SPOT provided through Aventis CropScience
Color Infrared Image of a Corn Field, Collected August 8, 1997 with many different types of anomalies.
Hail Damage on a Soybean Field

Regular Color Photo

CIR Photo
Site Specific Spatial Data Collection

Remote Sensing Data

GPS RTK Digital Elevation Data

GPS Soil Sampling Data

GPS Crop Yield Data

GPS Crop Growth Models

GPS Field Weather Data
Current Remote Sensing Research
at Purdue University

- Crop Yield Predictions
- Directed Scouting
- Nutrient Deficiency Detection
- Weed Detection
- Soil Management and Soil Compaction
- Crop Residue Detection
- Crop Anomaly Classification
- Assessing Crop Damage - Hail
Potential Applications of Remote Sensing depend on:

- The type and stage of crop growth
- The management levels of the grower
- The remote sensing expertise available
- The geographic area, i.e. soils, irrigation, etc.
- The timeliness of the image or data
- The value of the crop

Most applications occur when you have the right data at the right time at an affordable cost.
So What are the Barriers to Using Remote Sensing?

Availability of data

- Vendors to provide the data
- Cloud cover

Training

- Ag professionals trained to interpret the data
- Opportunities to receive the training

Costs

- Data collection
- Using the information
- Data storage
Basic Premise: If you can measure it, it’s a potential management unit

Sensors measure soil and plant characteristics to vary inputs
Crop specialty – bred for specific new characteristics
Timed release of fertilizer, chemicals, and other inputs
Variable harvest techniques

Are you prepared for tomorrow’s agriculture?