"Remote Sensing Applications for Precision Agriculture"

Farm Progress Show

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History Lesson

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

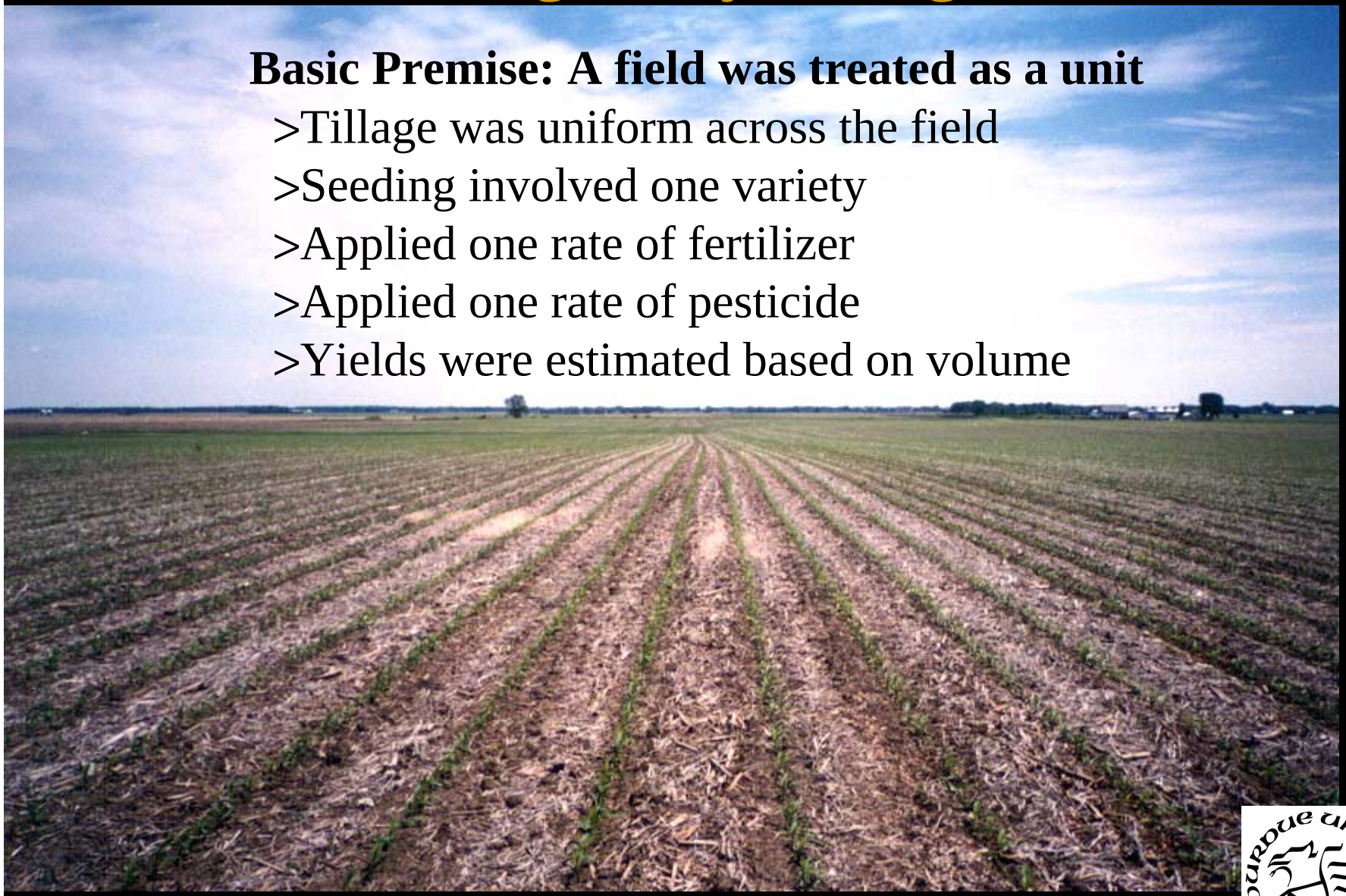
Joint efforts with University of Michigan (ERIM), University of California and USDA-ARS.

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

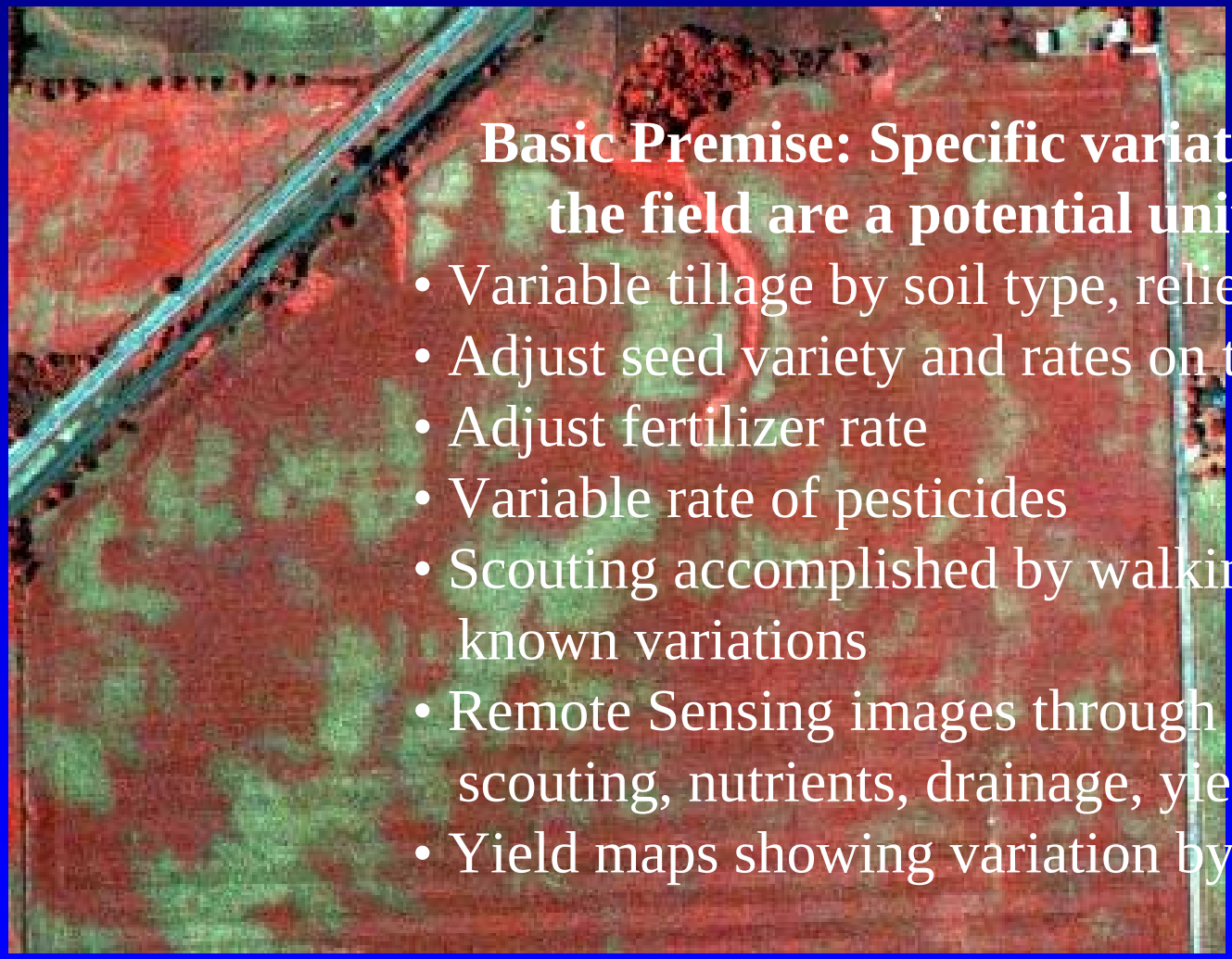
>Seeding involved one variety

>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

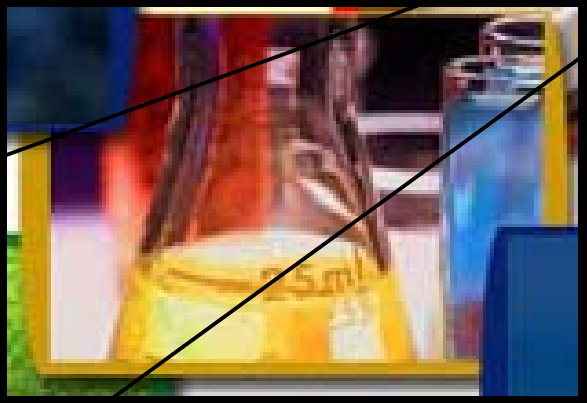
- GIS/Mapping

GPS for Collection of Ground Reference Data

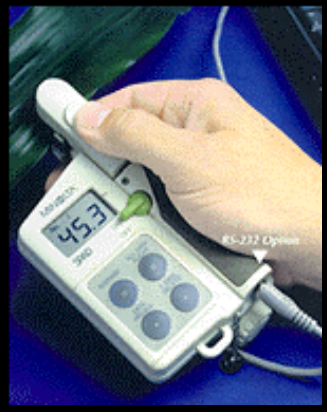
Grain Quality Data

Shape	Point
Longitude	-87.00513257
Latitude	40.48378643
Wp_id	32
Labno	34308F
Field	FIELD 81
Sample	28
N	2.02
P	0.17

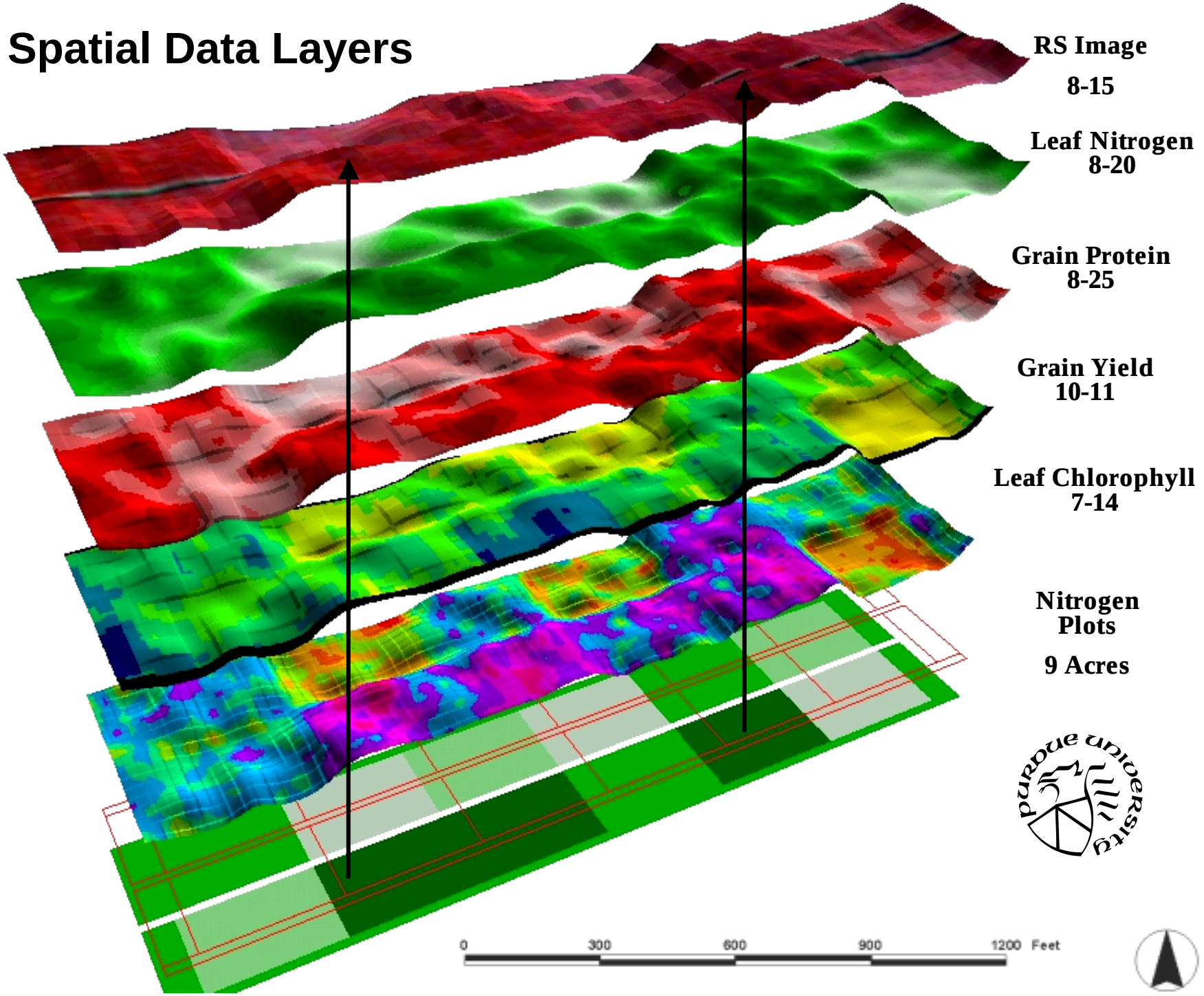
Leaf Tissue Nutrient Data



Leaf Chlorophyll Data



GIS: Spatial Data Layers

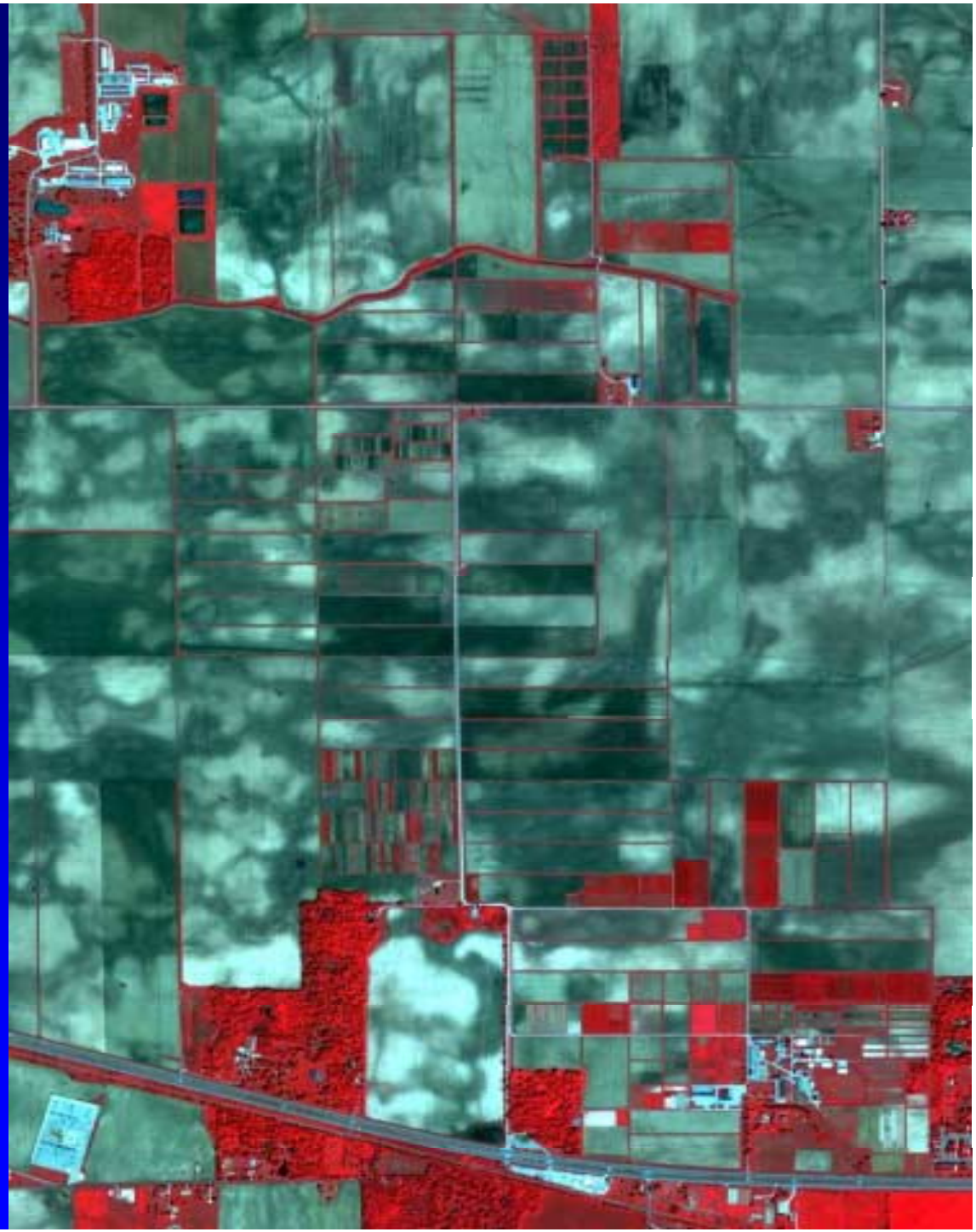


Soil Patterns over the Purdue Agronomy Research Center

IKONOS Satellite

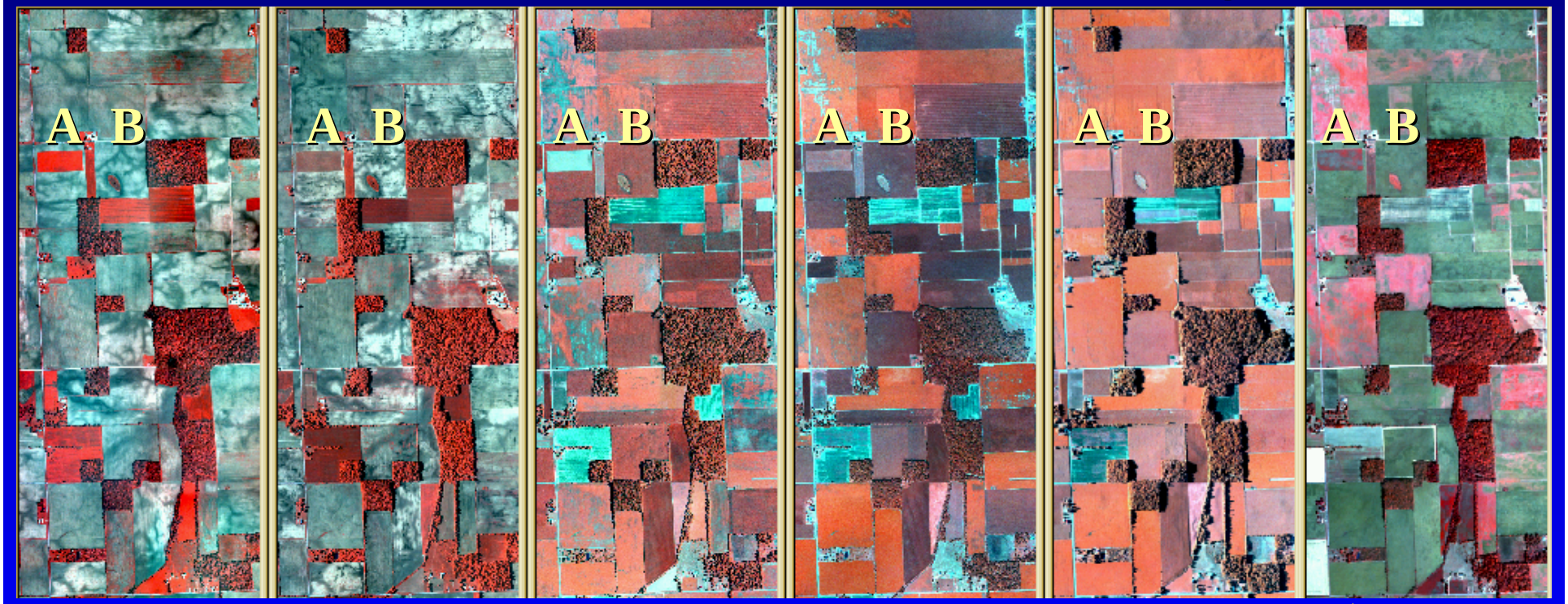
Space Imaging, Inc

May 24, 2000



Soil Patterns near Davis Purdue Ag Center

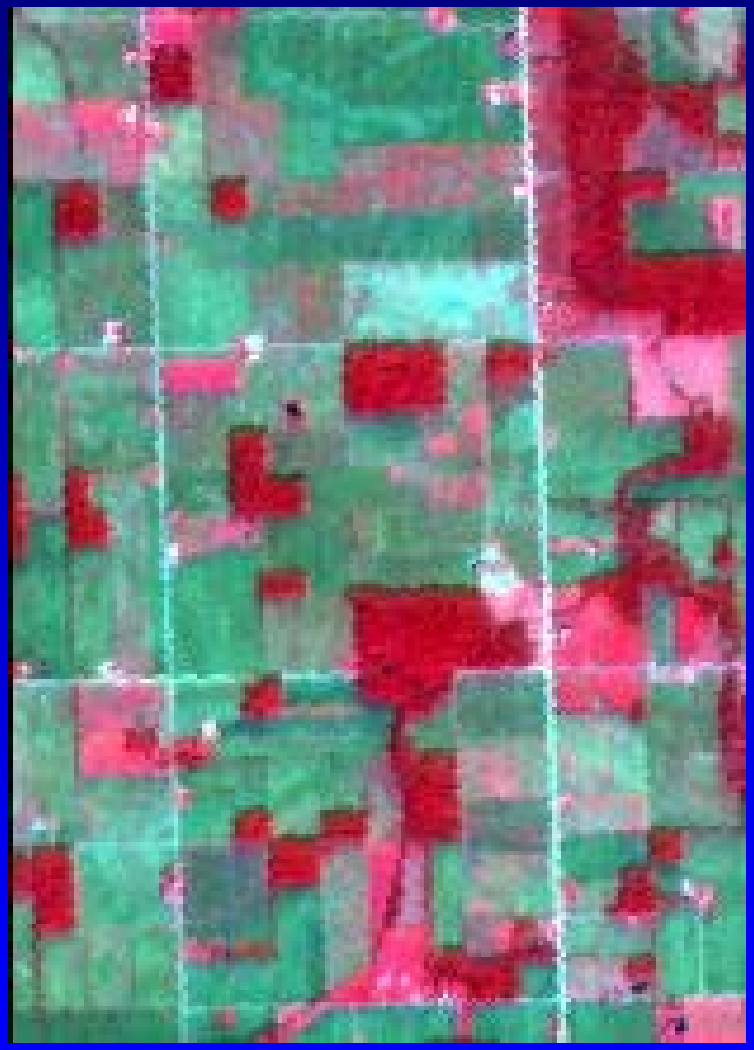
The Crop Calendar (weekly changes)



A: 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?

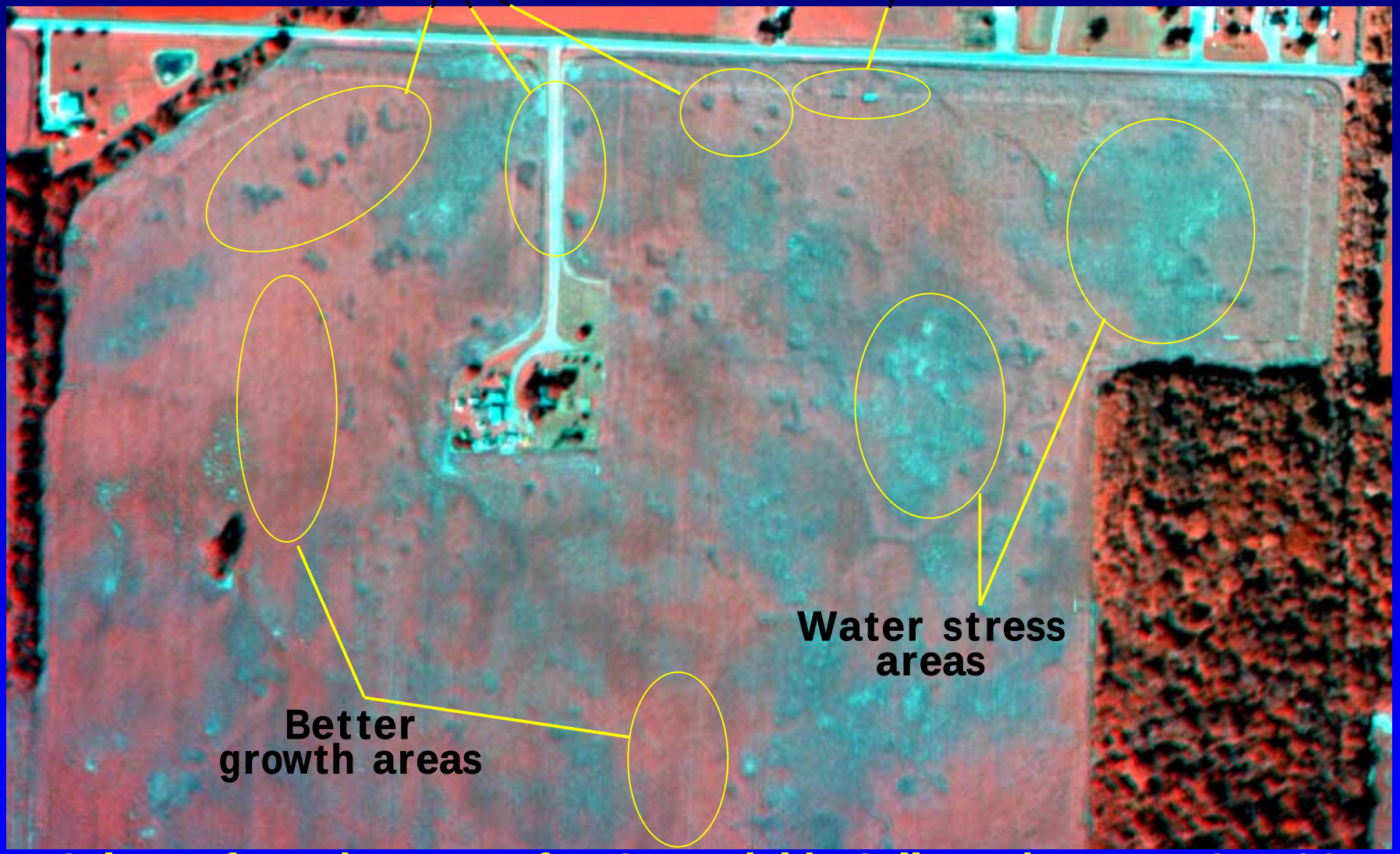
What Spatial Resolution do You Need?



20 meter SPOT - Sept. 27, 2000

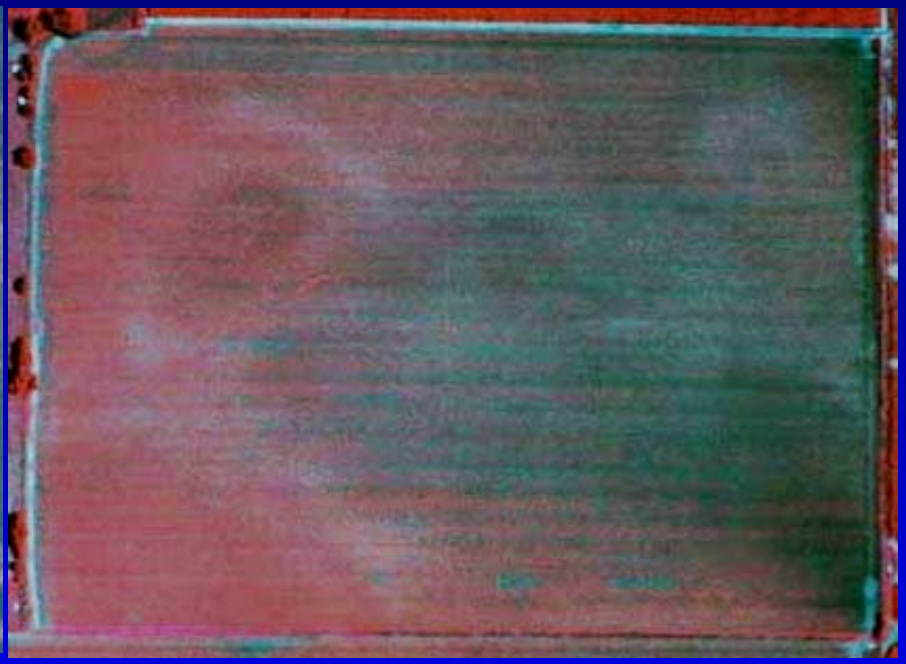
1 meter pan-sharpen IKONOS - Sept. 19, 2000

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

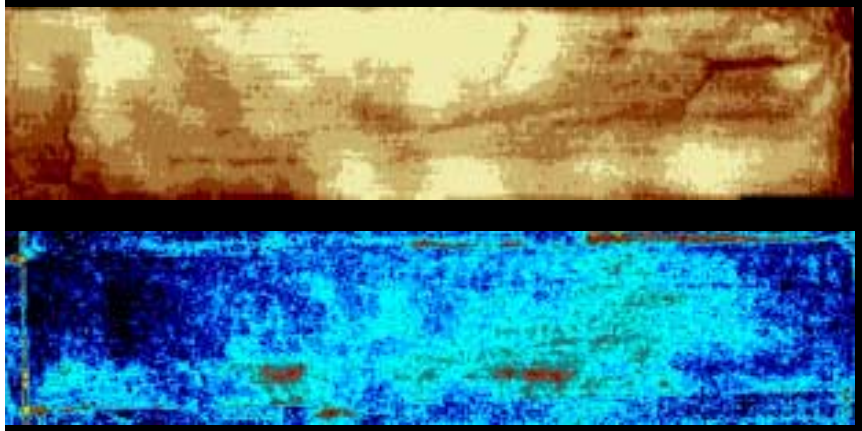


Regular Color Photo

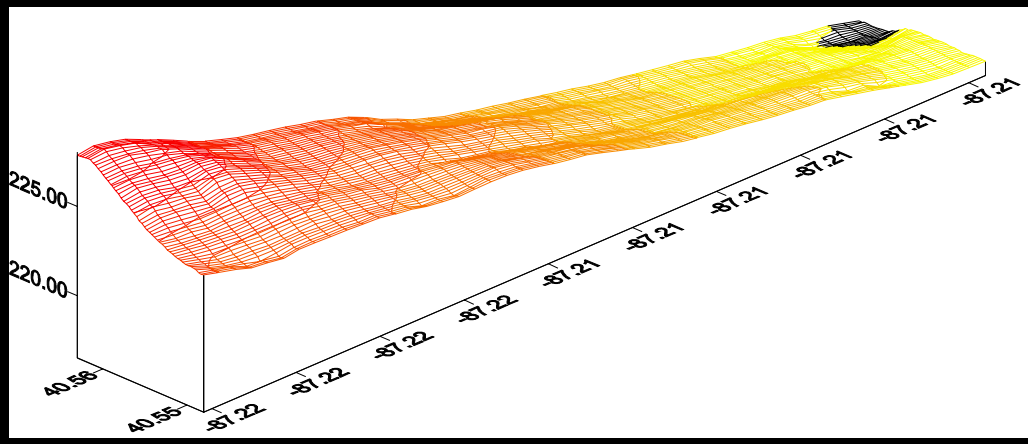
CIR Photo

Site Specific Spatial Data Collection

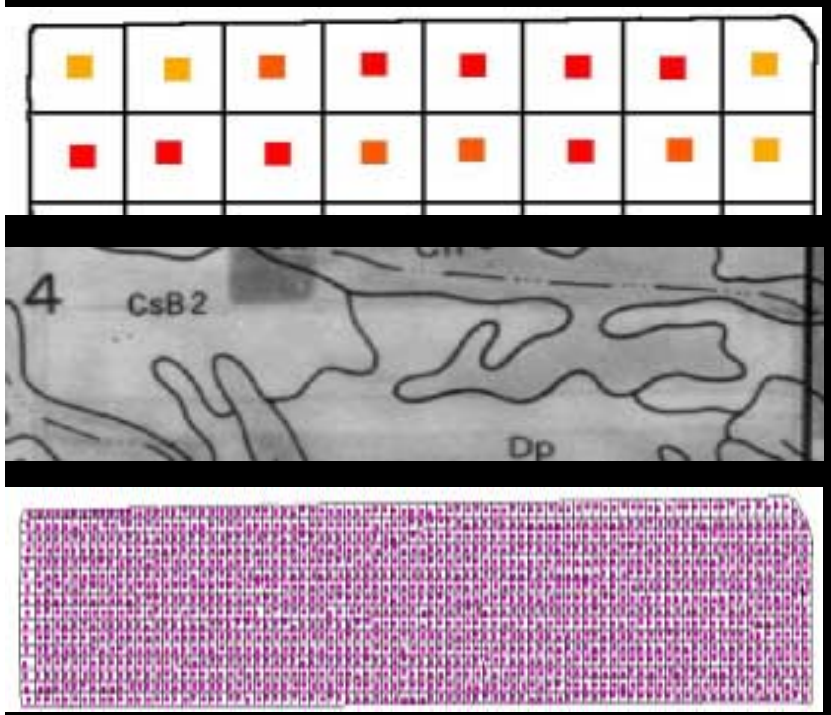
Remote Sensing Data



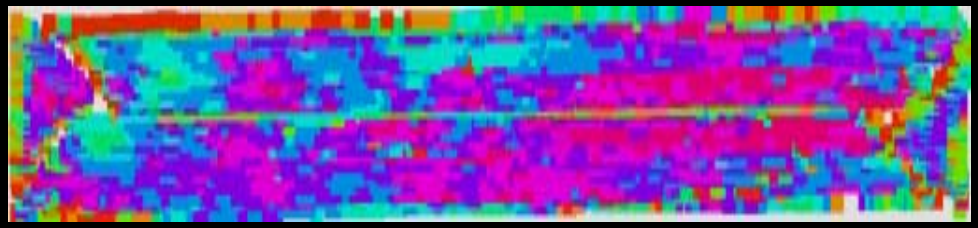
GPS RTK Digital Elevation Data



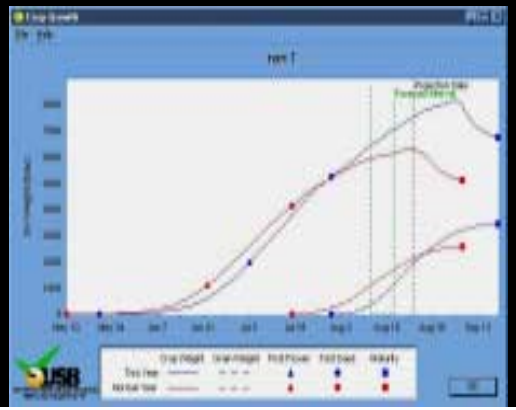
GPS Soil Sampling Data



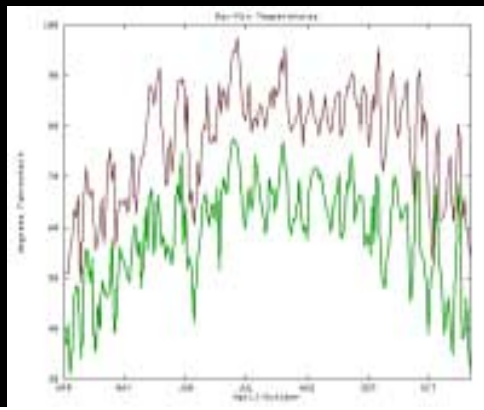
GPS Crop Yield Data



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
  - Venders 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

Farming Tomorrow

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?