

# Ag20/20

## NASA's Agricultural Program: A USDA/Grower Partnership

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## ***Mission***

- *Enhance the near term socioeconomic benefit of NASA's Earth Science investment to the American taxpayer*

## ***Goal***

- *Apply NASA Science and technology results to improve decision making (in terms of quality, cost, and/or timeliness) for critical issues of national importance*
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# What is Ag2020?

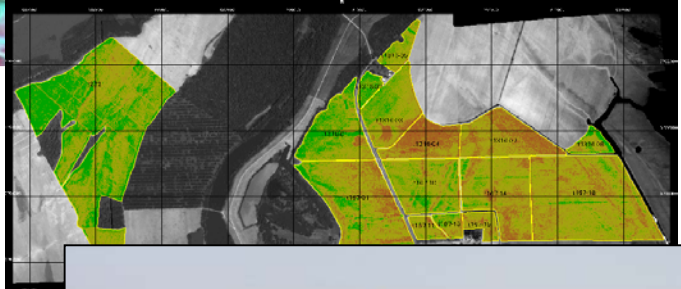
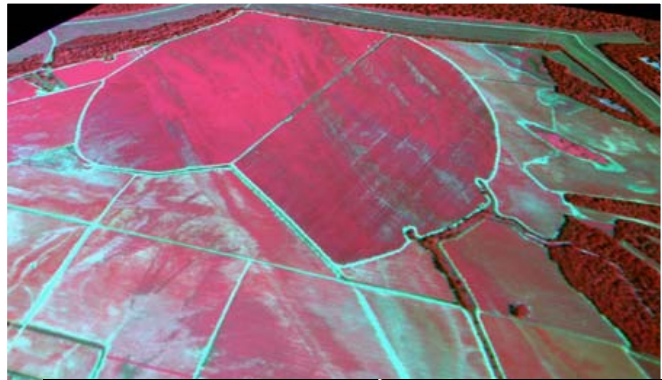
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- Partnership between USDA, NASA, and four national commodity associations
  - Driven by information needs of U.S. farmers
  - Focused on utilization of earth science and remote sensing for decision-making
  - Oriented toward economically viable operational solutions
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# Ag2020 Objectives

The purpose of Ag20/20 is to accelerate the use of remote sensing and other geospatial technologies on the farm to:

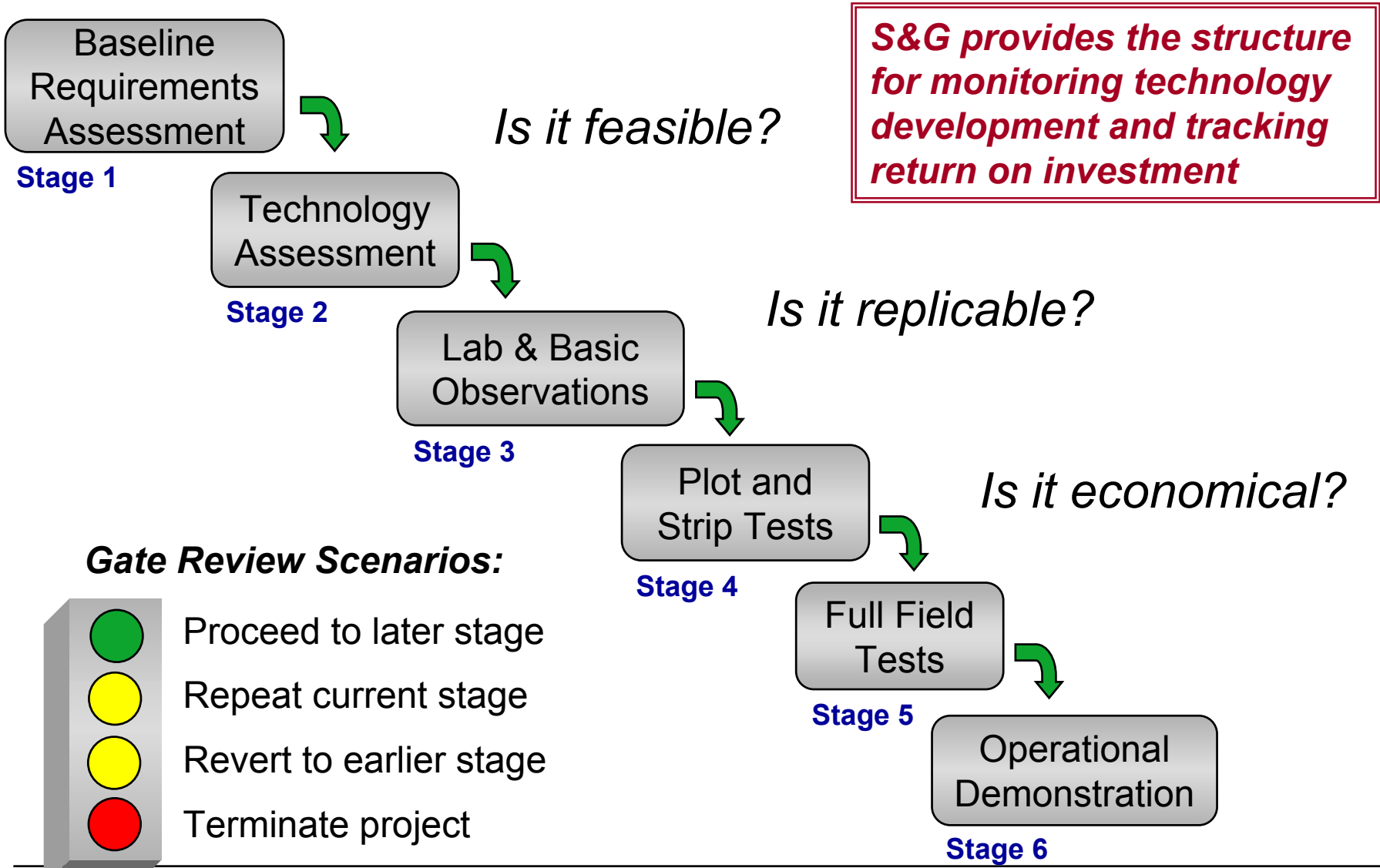
- ***Increase the production efficiency of the American farmer***
- ***Reduce crop production risks***
- ***Improve environmental stewardship tools for agricultural production***



***Remote Sensing Enables Precision Farming***  
***Farming by the Field Becomes Farming by the Foot***

# Stage & Gate Model

## Ag20/20 Product Validation



# Transition to Operations

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*When do we know when we're done?*

*How do we aid adoption?*

- On-farm validation (technical and economic) of tool against performance objective
  - Technical documentation (cookbooks) to describe methodology, specifications, and results
  - Link to commodity groups to educate growers directly (Beltwide workshop)
  - Link to ag industry groups (e.g., NAICC) that work for growers and set standards
  - Link to Cooperative Extension as objective adviser to local farming community
  - Popular press and farmer word of mouth
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# The Ag2020 Partnership

## Grower Associations

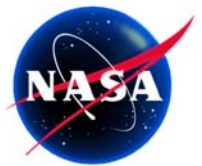
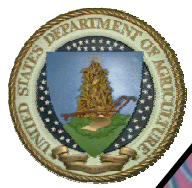


Requirements  
Field Sites  
Evaluation

Ag2020

Ag Mandate  
ARS Research  
Extension Network  
Land Grant Education

ESE Science & Data  
V&V Capability  
Science Data Purchase



USDA

NASA

## **Roles of the Commodity Associations in Ag2020**

- Identify on-farm requirements
  - Assist in establishing research priorities
  - Identify locations/cooperators for field testing
  - Evaluate annual field tests and other research results
  - Provide outreach/education opportunities
  - Serve on Ag20/20 management and technical teams
  - Assist in linking with agribusiness community
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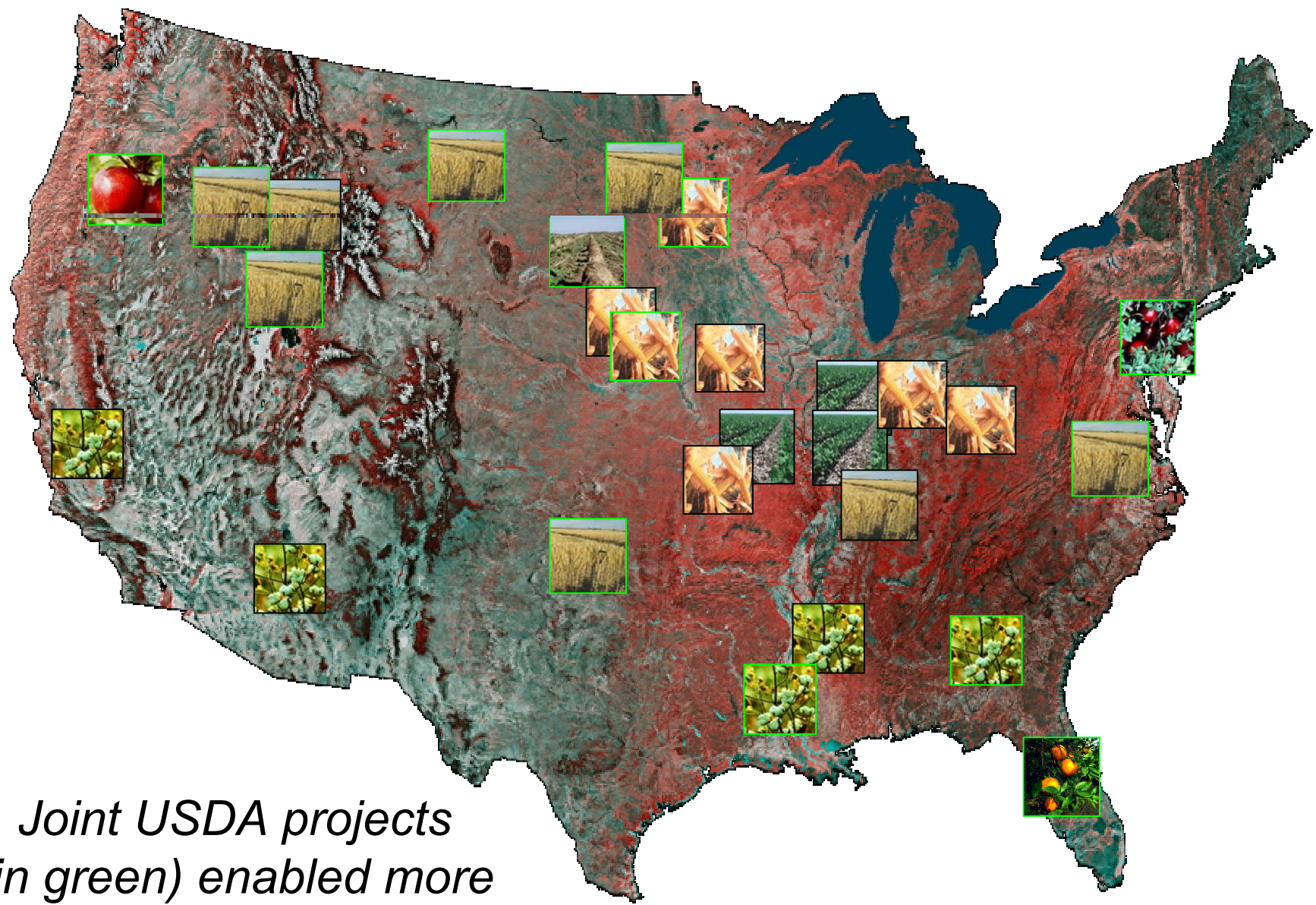


# Focus on Requirements

*Requirements taken from 1999 grower workshop provides framework for AG2020 R&D agenda...*

	<b>Priority</b>	<b>Objective</b>
<i>Priorities common to all four crops</i>	<b>Nutrient application</b>	Optimal allocation of fertilizer to reduce input costs and improve production efficiency.
	<b>Weed scouting/ herbicide application</b>	Effective weed detection and management to reduce herbicide costs and inputs.
	<b>Insect scouting/ insecticide application</b>	Effective insect management to reduce pesticide costs and inputs.
	<b>Irrigation/ soil moisture information</b>	Optimization of soil water resources and improved management of irrigation water.
<i>Additional top three priorities</i>	<b>Yield</b>	Development of tools to (1) optimize yield and (2) predict/forecast yield for marketing decisions.
	<b>Soil characterization</b>	Identification of soil management zones for improved decision-making.
	<b>Vigor/stress detection</b>	Determination of crop response to varying field and weather conditions to improve decision-making process.
	<b>Grain quality</b>	Characterization of grain-quality factors (oil, protein, etc.) for appropriate harvest and market decisions.
	<b>Next season preparation</b>	Assessment of physical properties of fields after harvest to support planning of upcoming crop.

# Ag20/20 Project Sites for 2002



*Joint USDA projects  
(in green) enabled more  
nationally focused program*

## Spatially Variable Insecticide for Tarnished Plant Bug Perthshire Farms, Mississippi Delta

### Research Question:

If plant bugs are attracted to vibrant cotton and vibrant cotton is detectable through RS, can RS be used to prescribe insecticide?

### Benefits

- Decrease insecticide costs while maintaining insect control
- Minimize environmental impacts
- 40-50% savings potential for insecticide while maintaining yield level



# 2001 Results - Cotton

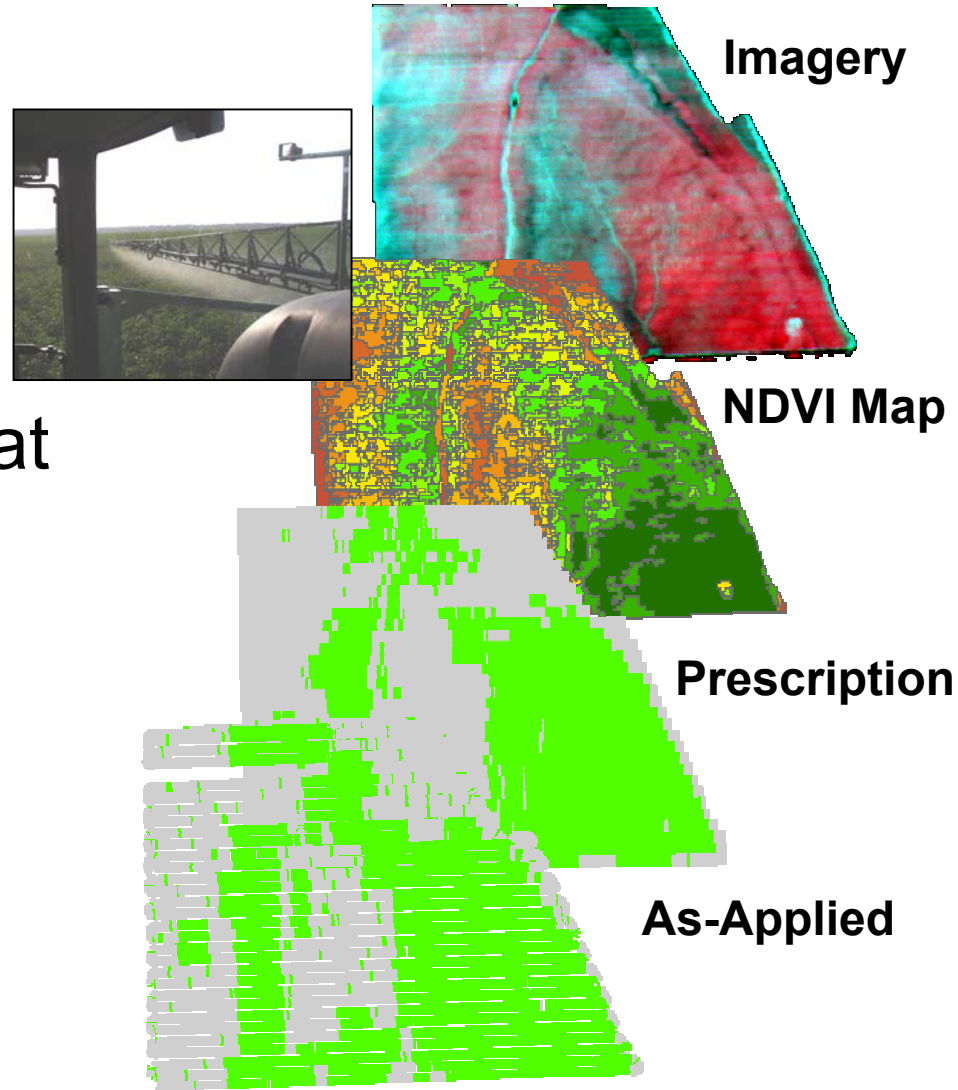
Project: Spatially Variable  
Insecticide

Location: MS Delta

Focus: Use NDVI derived  
from multispectral  
imagery to predict habitat  
for Ligus plant bug

Results: Insect control &  
yield maintained using  
40% less insecticide

**Cost Savings – 34%**



# 2001 Ag2020 Projects - Soybeans

## Variable Rate Herbicide Using Remotely Sensed Imagery

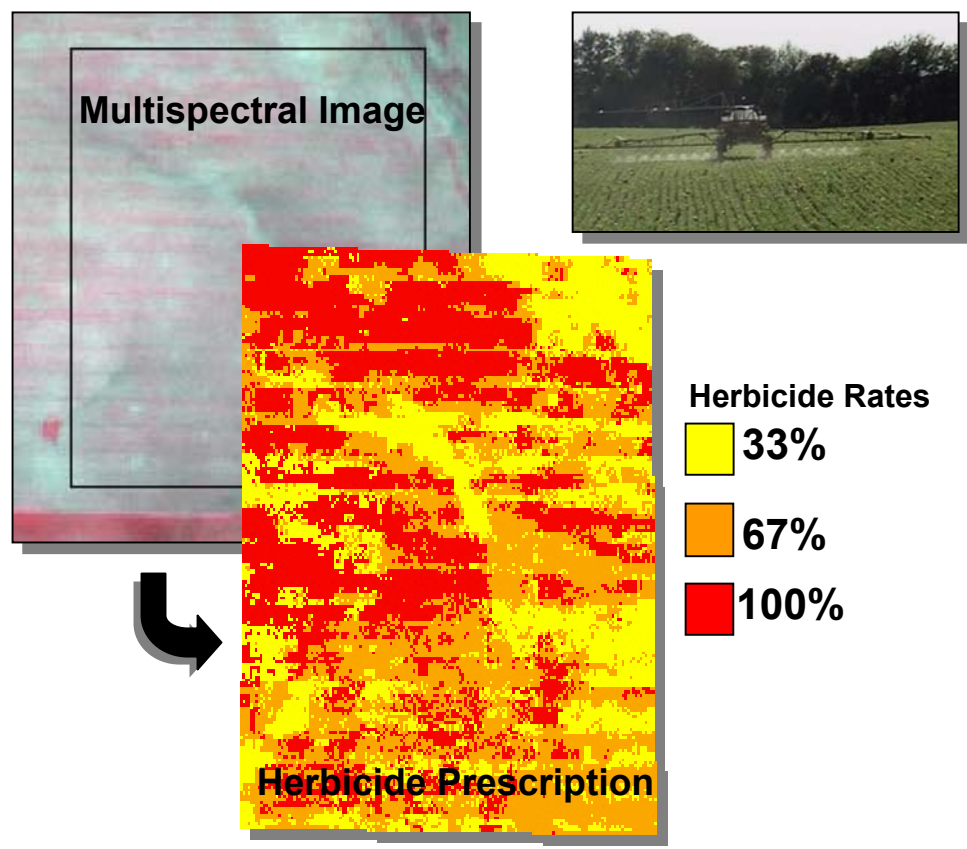
Location: Scattered Acres Farms, Mansfield, IL

Participants: ITD-Spectral Visions  
University of Illinois  
United Soybean Board

Issue: \$6B spent on herbicides in 1999  
Studies show fields up to 94% weed free

### Objectives:

1. VR herbicide usage will be less than conventional
2. Weed control equal to that of blanket sprays
3. No yield loss



**2001 Field Test showed cost savings of up to \$2.73/acre with no yield loss using 30% less herbicide**

## Imaged-Based Scout Maps

Location: 6 Fields near Champaign, IL

Team: ITD-Spectral Visions  
Agricultural Soil Mgmt.  
University of Illinois  
USB  
NCGA

### Objectives:

- Determine the effectiveness of using remotely sensed imagery for crop scouting
- Devise a protocol and delivery system for using digital images, maps and scouting forms on pocket computers



### Approach:

- *Crop scouts provided with PDA equipped with GIS and GPS*
- *Imagery and derived products loaded onto PDA for scouting*
- *Crop anomalies identified in imagery and locations tagged with GPS*
- *Scouting field forms created to eliminate paperwork*
- *Wireless link to central database for real time updates*

# 2001 Results - Midwest

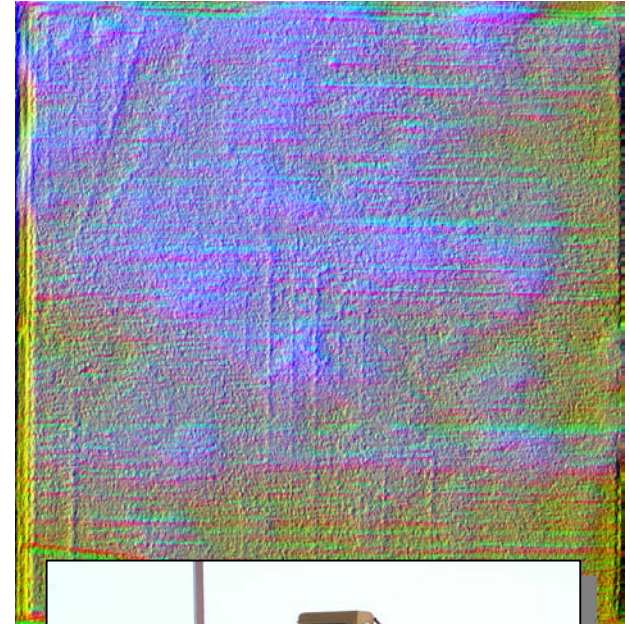
Project: Drainage Tile Mapping

Location: Illinois

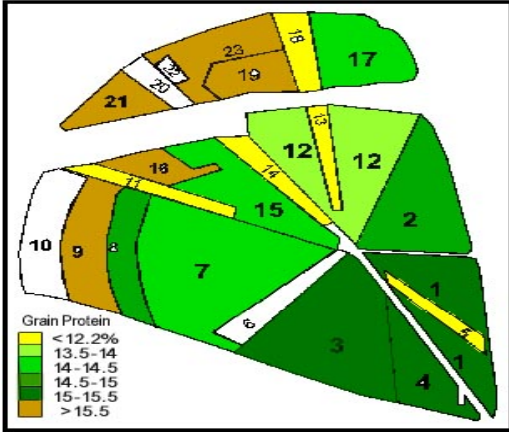
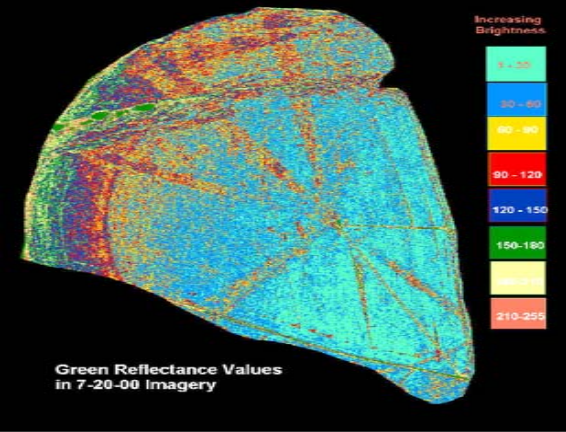
Focus: Use panchromatic imagery after rain to map location of drainage tiles

Results: Simple enhancement of pan imagery mapped tiles in tilled fields to **77-86% accuracy**

2002 – Use NASA thermal data to map older tiles



## Modeling and Validating RS & Terrain Data for Precision Agriculture



Lead: Dr. Dan Long

Partners:  
South Dakota State Univ.  
University of Minnesota  
University of Georgia  
Resource 21

Funding: 3 Years  
\$800K

### Commodity:

Wheat (MT), Corn (MN), Sugar Beets (SD), and Cotton (GA)

### Topics:

- Nutrient Management (all)
- Yield/Quality prediction
  - Yield response in cotton
  - Protein/Yield response in wheat
  - Starch/Yield in corn
  - Sucrose in sugar beets



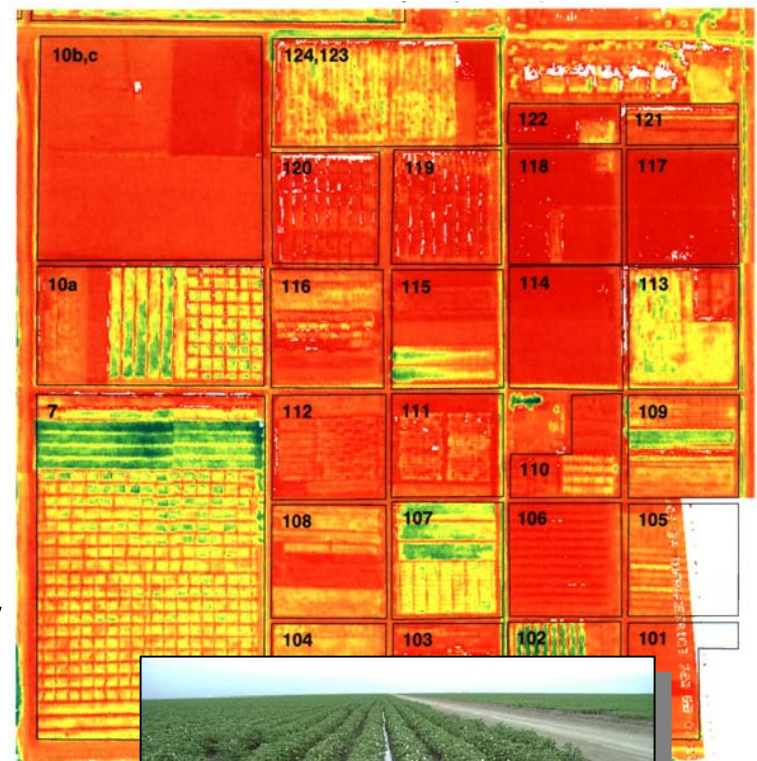
# New Project for 2002

Focus: Irrigation Management

Locations: USWCL-Phoenix  
Sheely Farms-CA

Purpose: Expand on USDA research to understand operational requirements for TIR-based irrigation management using ESE data

Benefit: Improved water use efficiency and quality



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# Remember, Ag20/20...

- Is an applications development and research program driven by **grower requirements**
  - Is focused on developing only **economically viable** solutions
  - Seeks to deliver large-scale field tests **annually**, not in a decade
  - Allows for **grower evaluation** of projects, results, and program direction for each growing season
  - Is **judged** success or failure by the **growers**
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