Sugarcane Remote Sensing, Yield Mapping, and Variable Rate Lime Research

R.M. Johnson, R.P. Viator, W.H. White, M.P. Grisham, and E.P. Richard, Jr.
USDA-ARS-SRRC
Sugarcane Research Unit
Houma, LA USA

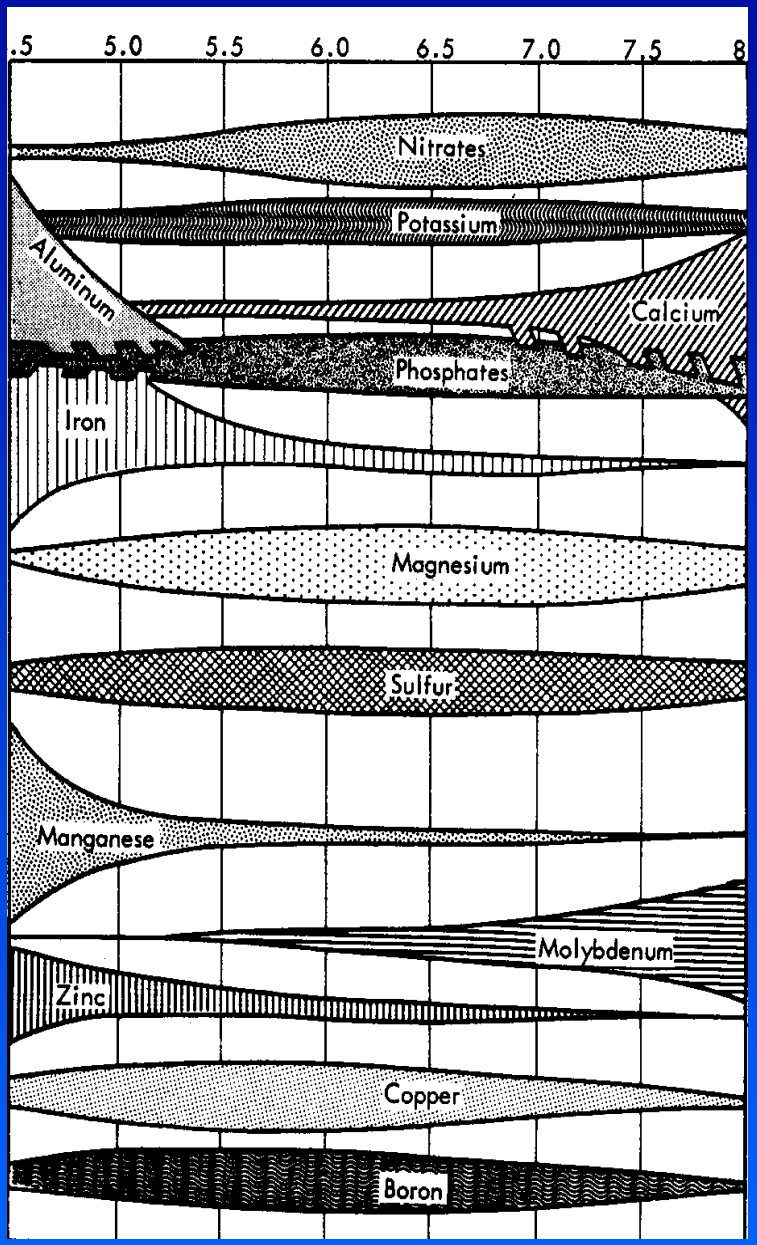
VR Lime Research

R. Johnson, H. Viator and E.P. Richard, Jr.
USDA-ARS-SRRC
Sugarcane Research Unit
Houma, LA USA

Benefits of an Active Liming Program

- Reduction of aluminum and manganese toxicity.
- Correction of Magnesium Deficiencies.
- Enhance activity of soil microorganisms.
- Improve activity of soil applied herbicides.
- ***Improve fertilizer use efficiency by maximizing nutrient availability.***

Effect of Soil pH on Nutrient Availability



Determine the optimum lime rate and method of application to maximize return.

- Determine the lime requirement to raise soil pH to 6.5
  - SMP Buffer method (current A&L LA procedure, & KY, OK)
  - AE Buffer method (used by Al, FL, GA, SC, TN)
  - Woodruff Buffer method (used in MS).
- SMP (0-3½ T/A), AE (0-3 T/A), Woodruff (0-1½ T/A)
- Application Methods: Uniform, VR, No-Lime Control
- 36 plots, 7 rows wide by 285 feet.
- Lime applied using a variable rate fertilizer spreader.
- Each plot harvested in 50-ft. sections, utilizing a chopper harvester and weigh wagon equipped with a billet-sampler.

Gralyn Farms VR Lime (Effect of Lime Requirement Method)

Lime Req.	Tonnage (T/A)	TRS (lb/T)	Sugar (lb/A)
SMP	39.3a	230.4b	8995a
AE	39.0a	236.9a	9149a
Woodruff	39.9a	234.4ab	9268a
LSD (5%)	NS	4.7	NS

Gralyn Farms VR Lime (Effect of Lime Application Method)

Lime Req.	Tonnage (T/A)	TRS (lb/T)	Sugar (lb/A)
VR	39.7a	234.2a	9220a
Conv.	39.1a	233.8a	9054a
LSD (5%)	NS	NS	NS

Summary of Lime Requirement Study

- AE & Woodruff Lime Requirement methods increased TRS compared to SMP, while reducing total lime applied.

- VR application numerically increased tonnage, TRS and sugar yield compared to uniform application, while reducing total lime applied.

Yield Monitor Testing

- Harvest Master equipped with an Ultra-sonic Detector
- Ouachita Fertilizer is the Local Rep (Kody Louvierre)
- Yield Monitor: Ellendale Plantation

- Calibrate with weigh wagons and truck weights.
- Load Monitoring, Yield Mapping, Field Acreages (Acres/day).

- Results for loads were not consistent.
- Field acreage results were valuable.

- Options: New Sensor, Randy Price (LSU/KSU) yield monitor (optical sensor).

- We may need to “re-evaluate” the yield monitor situation. Why do we really want a yield monitor ? If its just for load monitoring, other technologies (Case) may be available.

- Yield maps may also be created using other methods (Remote Sensing).

Remote Sensing Applications for the Louisiana Sugarcane Industry

R. Johnson, R. Viator, M. Grisham, W. White and E. Richard.

USDA ARS

B. Montgomery, M. Peterson

In-Time® Making Precision Pay

S. Seamon, B. Millet, A. Orgeron

HELENA

W. Jackson, H Waguespack

American Sugarcane League

B. Viator, C. Viator

Calvin Viator Consultants

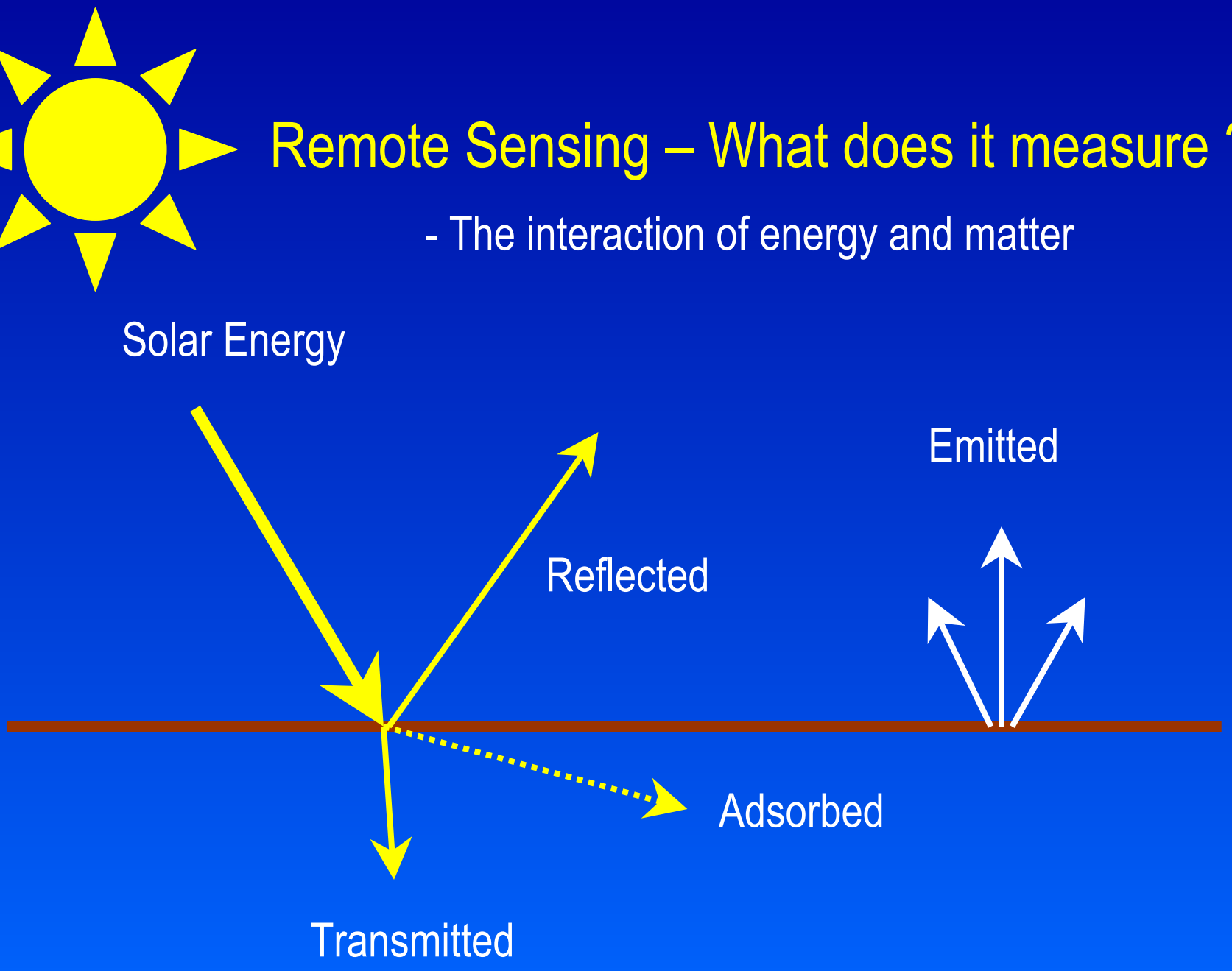
Remote Sensing - Definitions

- **Remote Sensing** is “the science of acquiring, processing and interpreting images that record the interaction between electromagnetic energy and matter.”

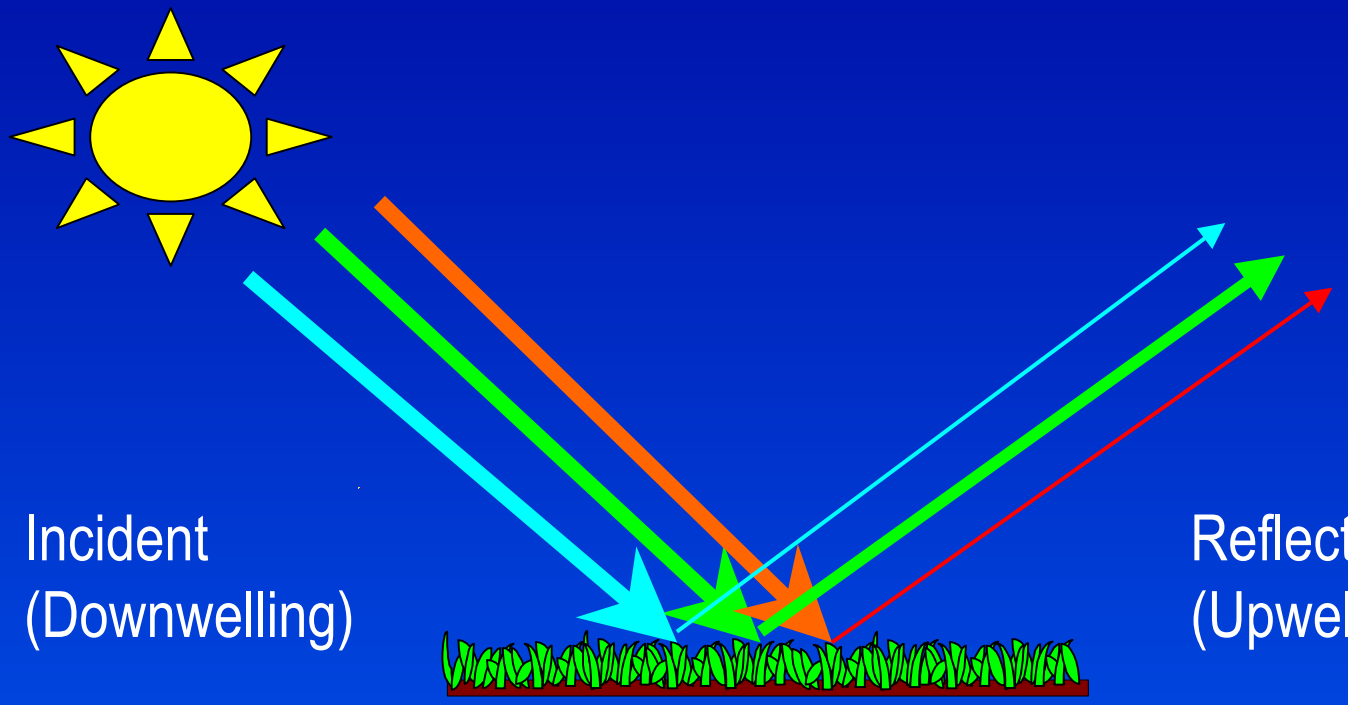
- "**Remote Sensing** is “defined as the acquisition of information about an object without being in physical contact with it.”

Remote Sensing – What does it measure ?

- The interaction of energy and matter



Leaf Reflectance



Measuring both incident and reflected radiation simultaneously allows for correction of atmospheric effects (i.e. clouds)

Collecting Leaf Reflectance Data in the Laboratory

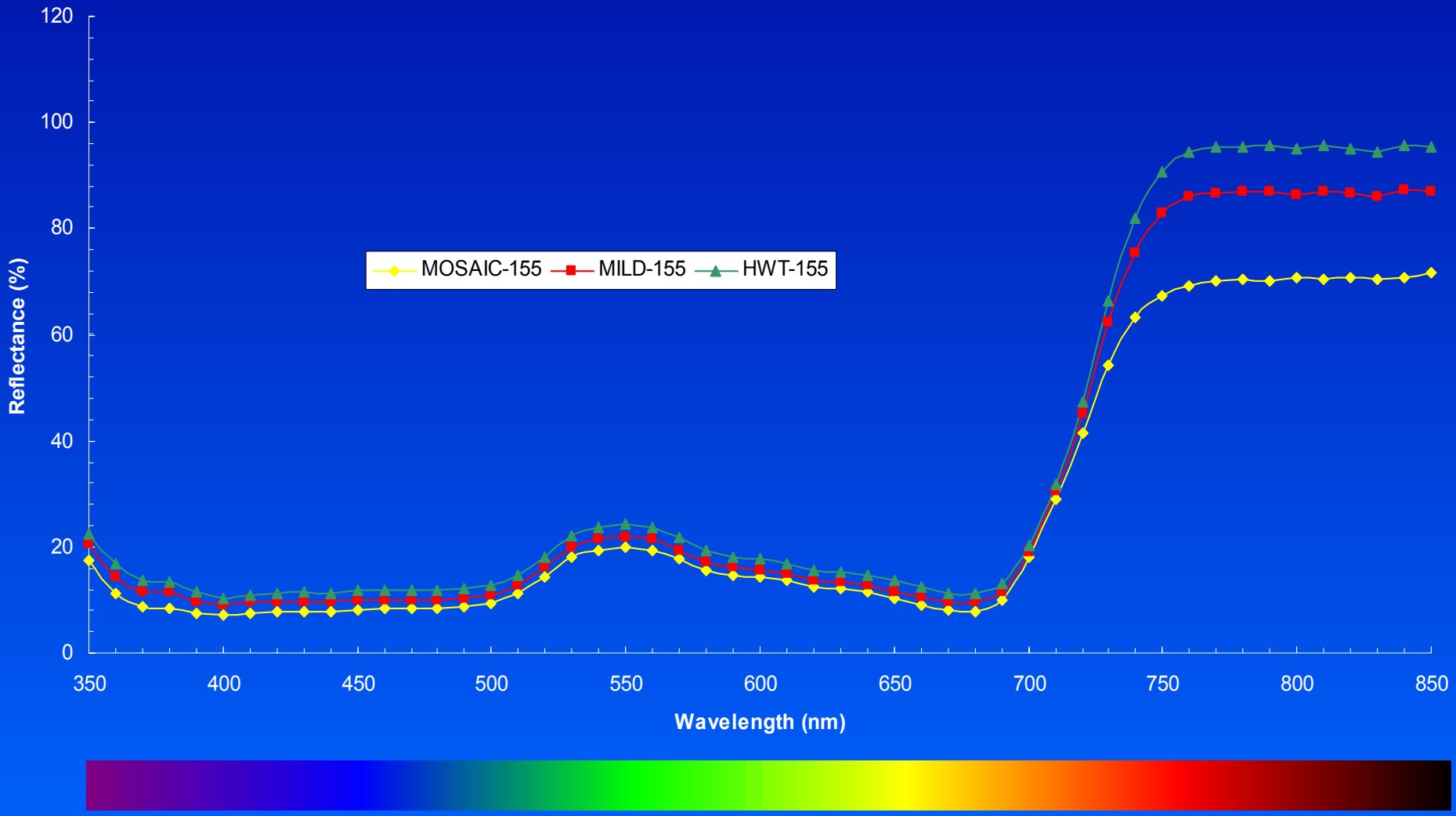
Single Input Mode

500 W Halogen Light Source.

Collecting Leaf Reflectance Data in the Field

Dual Input Mode

Mosaic Leaf Reflectance
CP44-155



Aerial Remote Sensing Studies

- Objective: Determine if aerial biomass imagery can be used to: 1) estimate cane and sucrose yields, 2) identify stress from insect damage, plant diseases, or weeds and 3) discriminate varieties.
- Imagery acquired by InTime (Cleveland, MS) on November 6, 2006.
- Elevation: 12,000 ft.
- Resolution: 2 meters.
- Field-of-View: ~ 2 miles.
- Data format: geo-referenced image files (jpeg) and scouting reports (pdf).

Remote Sensing of Sugarcane Biomass

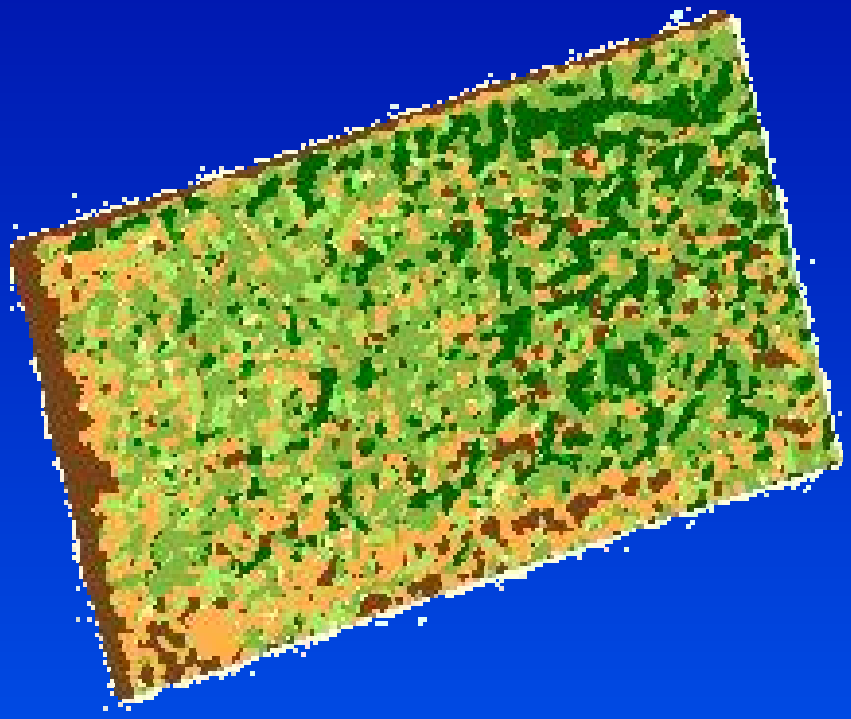
- Field Sites:
  - **Biomass**
  - Magnolia Plantation: HoCP 96-540 (39 acres, 1st), L 97-128 (13 acres, 1st).
  - Ellendale Plantation: HoCP 96-540 (44 acres, PC), L 97-128 (39 acres, PC)

  - **Biomass and Sucrose**
  - Gonsoulin Farms: HoCP 96-540 (13 acres, PC)

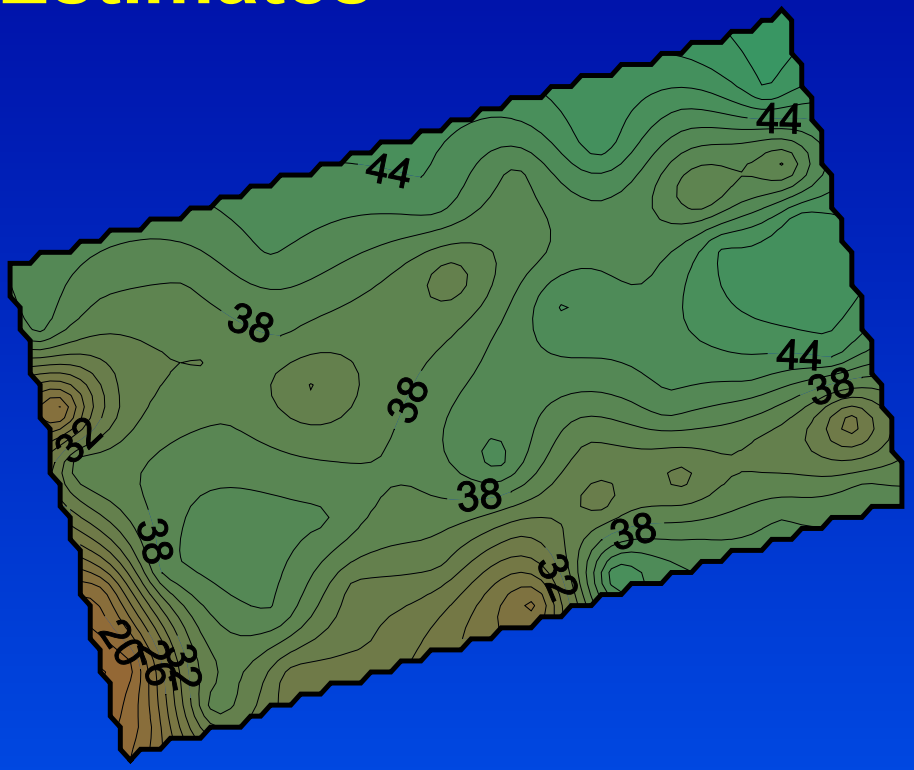
  - Plots (100-ft) were harvested with a weigh wagon equipped with a billet sampler.

  - Yield maps constructed using geostatistics.

Magnolia Plantation, L97-128 (1st Stubble) Biomass Estimates



Remote Imagery

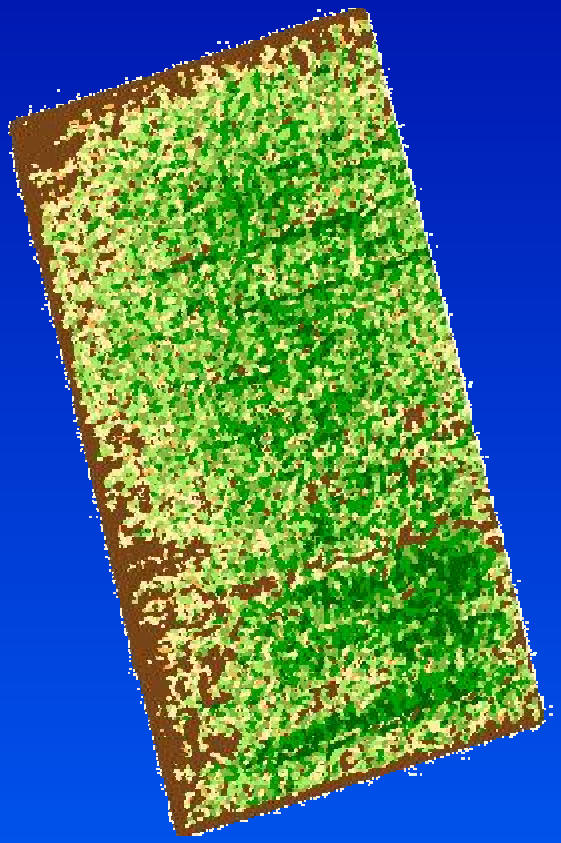


Actual Weights

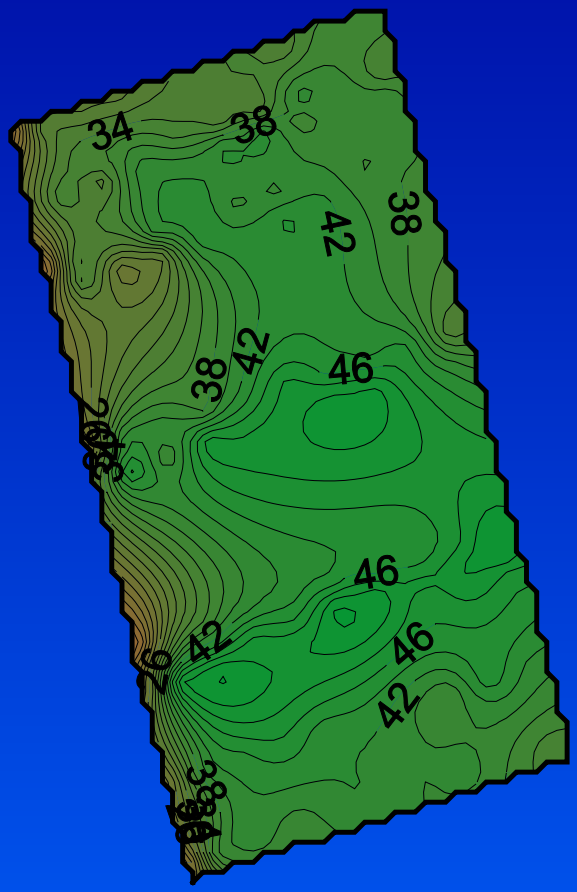
Range: (16 – 51 T/A)

Mean: 38 T/A

Magnolia Plantation, HoCP 96-540 (1st Stubble) Biomass



Remote Imagery



Actual Weights

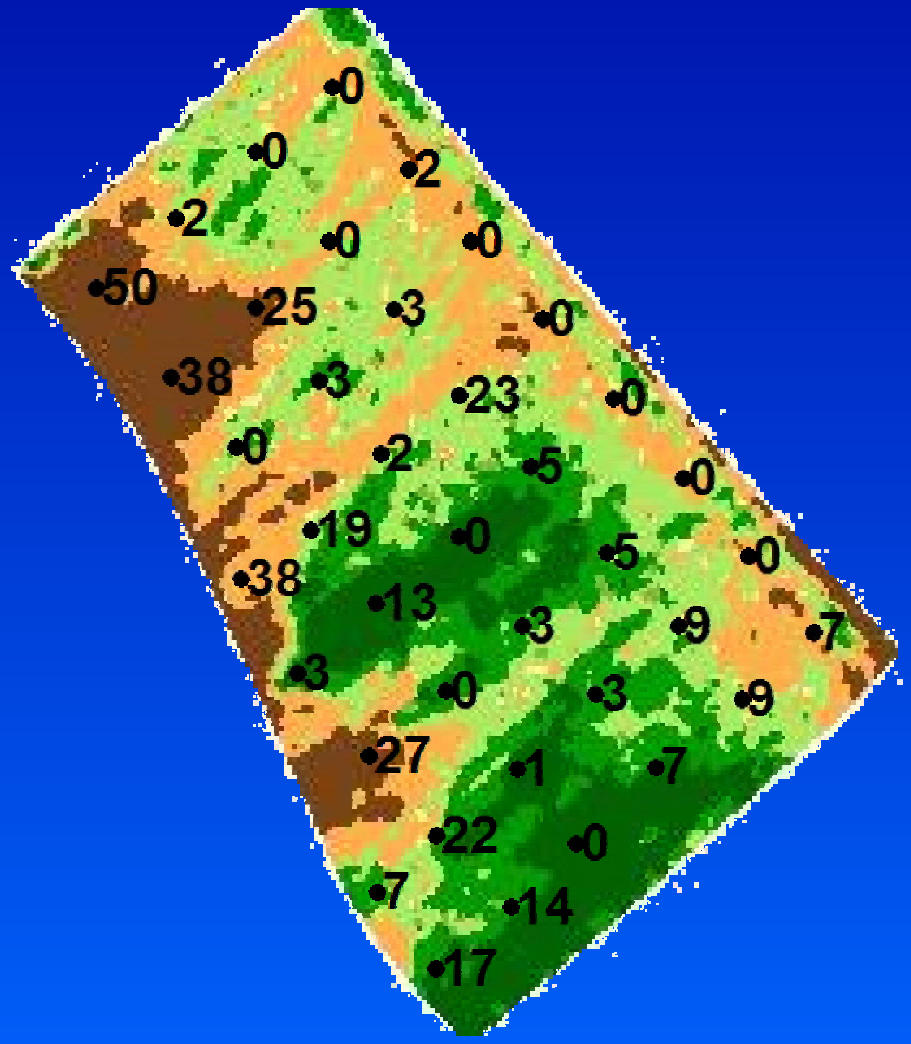
Range: (12 – 52 T/A)

Mean: 40 T/A

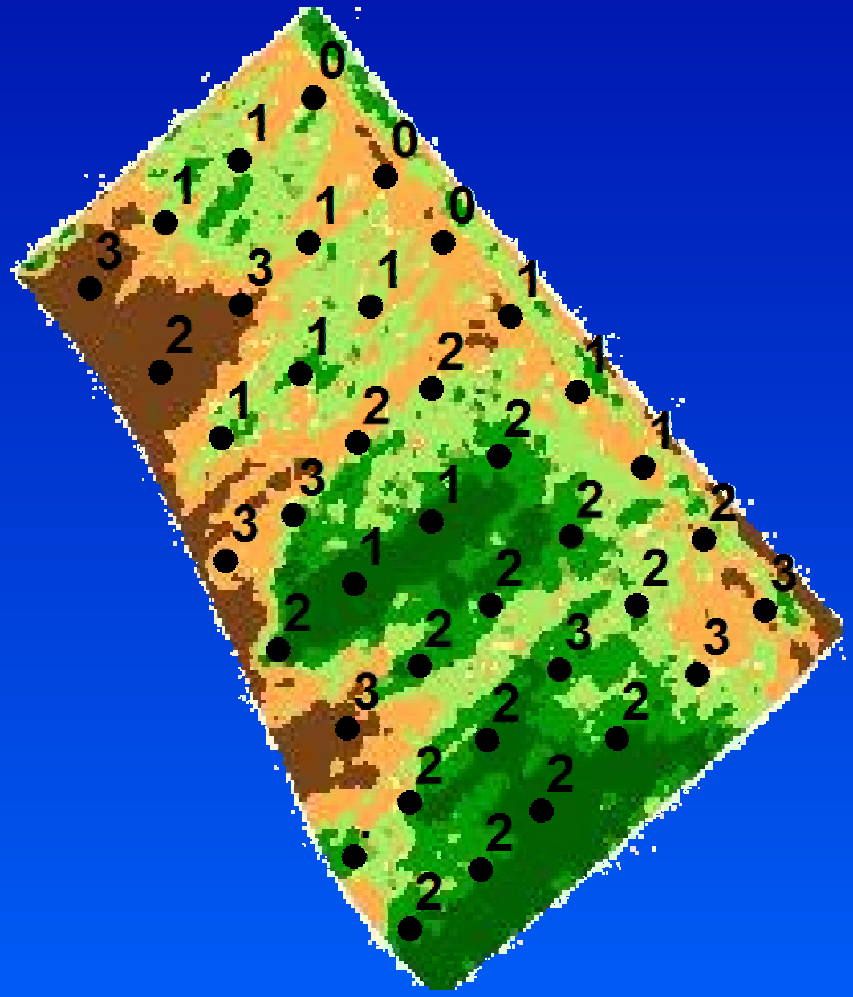
Remote Sensing of Insect Damage

- Two sites in Centerville, LA
  - Shady Side (13 acres, HoCP 96-540 & L 97-128, PC, 1/3-acre grid)
  - Micheud (36 acres, HoCP 96-540 PC, 1-acre grid)
- Data: Soil samples, tiller counts, deadhearts, armyworm rating.
- Data analyzed using GIS

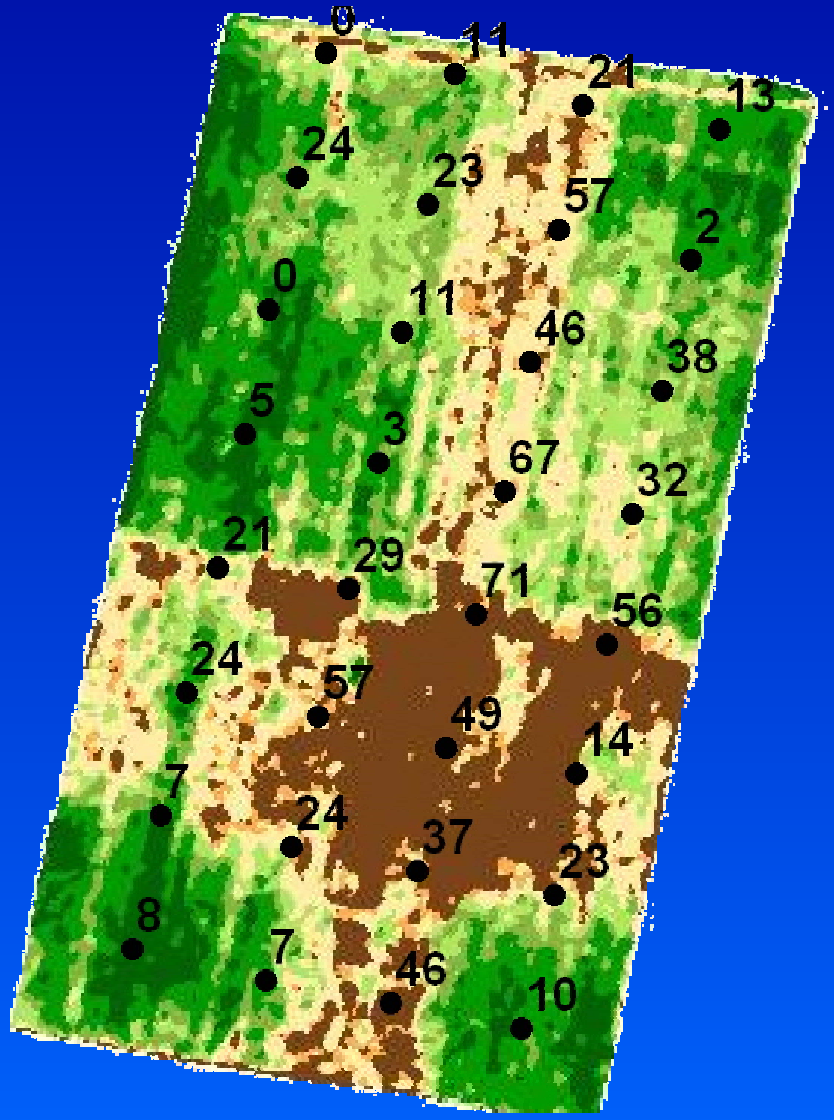
Shady Side Aerial Imagery
Deadhearts (%)



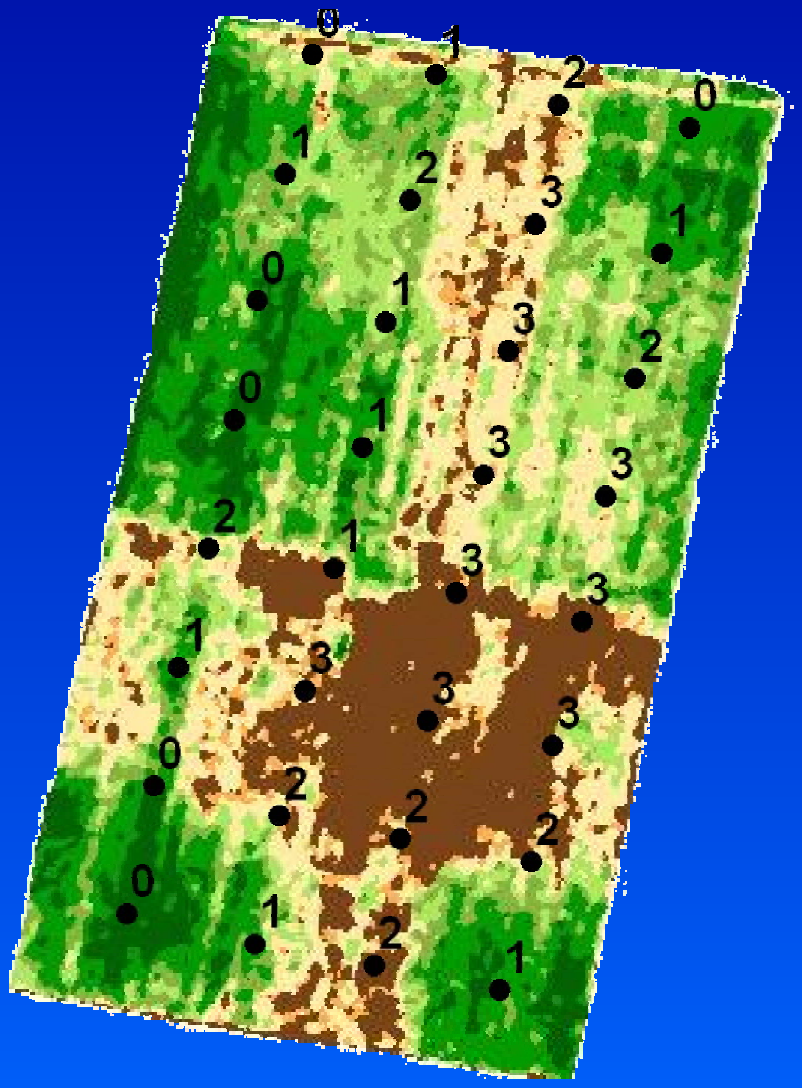
Shady Side Aerial Imagery
Armyworm Rating



Micheud Aerial Imagery
Deadhearts (%)



Micheud Aerial Imagery
Armyworm Rating



RS Summary

- Aerial Imagery was effective at predicting biomass variability in 1st stubble HoCP 96-540 and L 98-128.

- Aerial Imagery may be helpful in identifying areas affected by borers or armyworms. This information could be potentially used to develop scouting maps that may increase insect scouting efficiency.


Questions ?