Site-Specific Management of Cotton Using Remote Sensed Imagery within a Conservation Tillage System

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Overview

- **Motivation**
- **Objectives**
- **Project site and methodology**
- **Results**
- **Final Thoughts**

Motivation

- **Irrigation technology for small, irregular shaped fields and rolling terrain**
  - **Water usage**
  - **Sustain cotton production**
  - **Pressure compensated SDI tape**
- **In-season management**
  - **Early detection of crop stress**
  - **Irrigation issues**
- **Integration of technologies for site-specific management**

Objectives

Evaluate

- **cotton production on rolling terrain irrigated with SDI in conjunction with cover crops, and**
- **the use of Thermal Infrared Imagery (TIR) for in-season detection of cotton response.**

Test Site

- **15 acre field located near Belle Mina, AL**
  - **Tennessee Valley Extension and Research Center (TVREC)**
- **Decatur silt loam and silt clay soils**
- **Slope - 1% up to 6%**

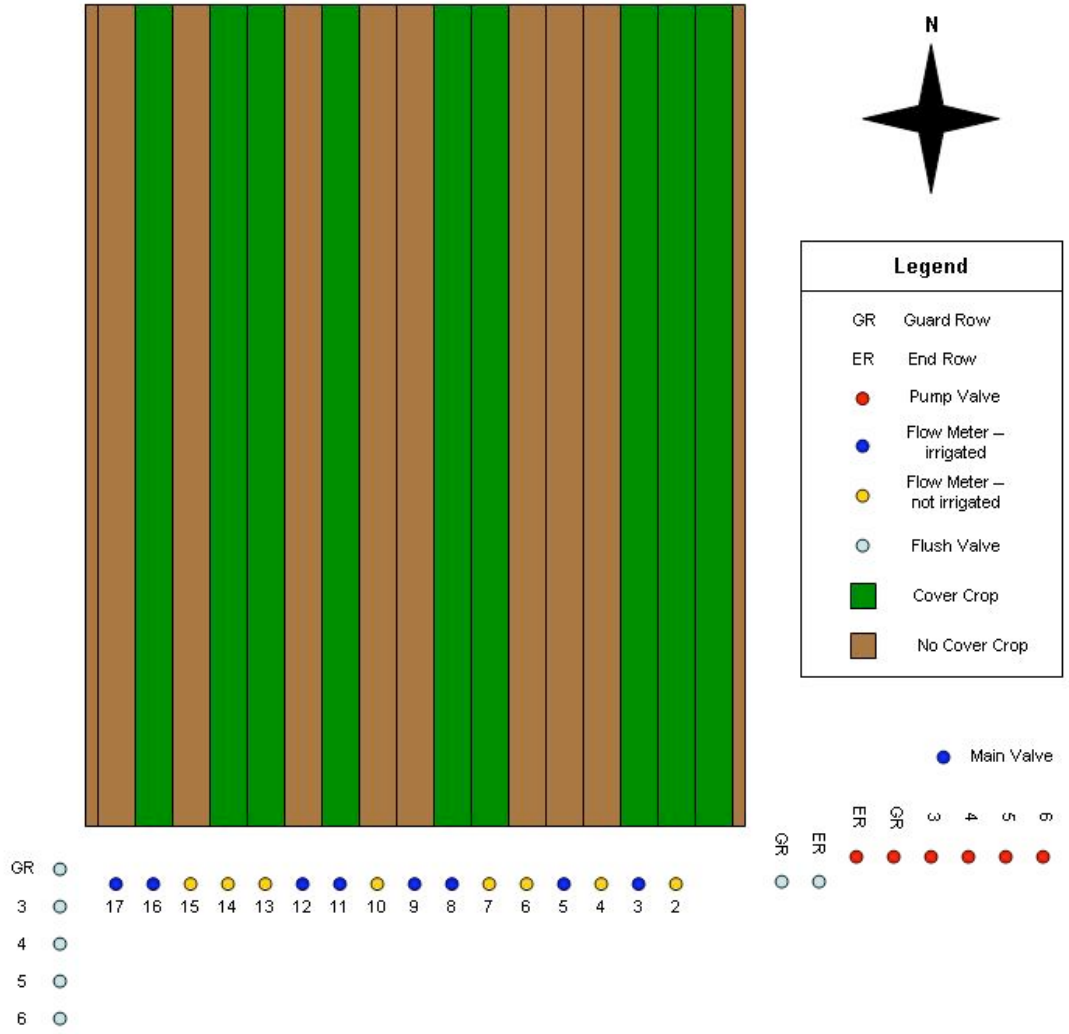
Layout and Management

- **SDI System**
  - **1250-ft runs on 80-inch spacing**
  - **Installed at nominal depth of 13 inches**
  - **90% pan evaporation adjusted for canopy**
  - **Wireless flow meters per plot**

- **Cotton**
  - **40-inch row spacing**
  - **Tape located between alternating inter-rows**
  - **RTK auto-guidance used for field operations**
  - **Collected cotton quality samples at harvest**

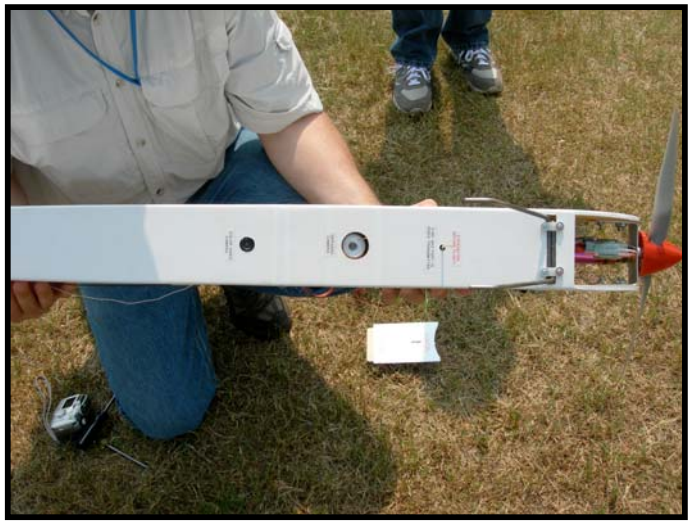
Experimental Design

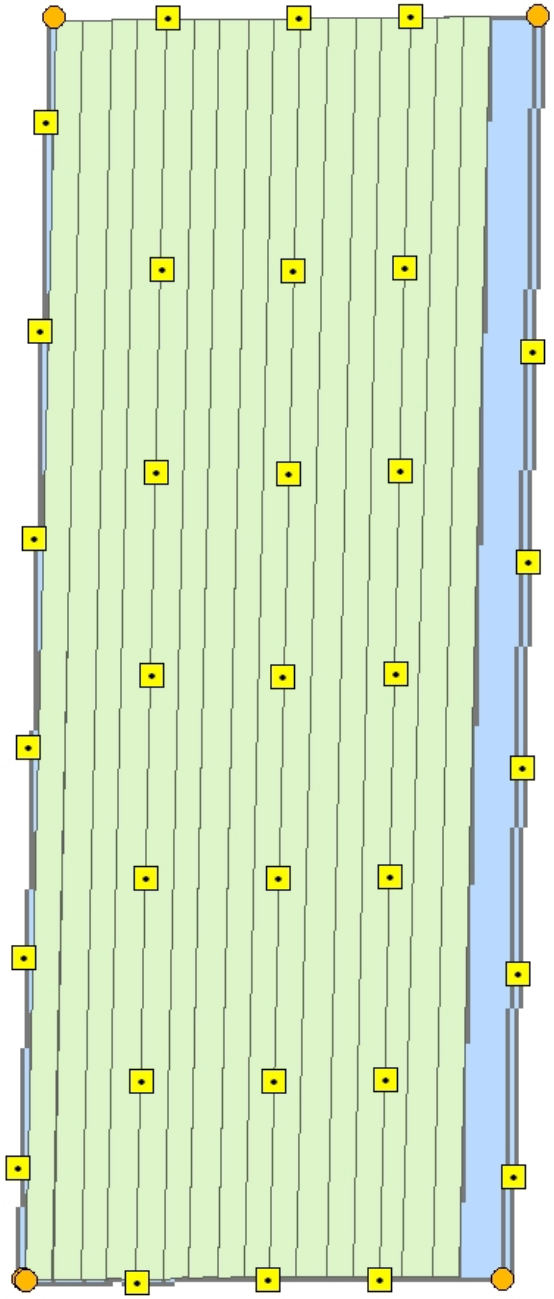
- **Randomized block**
  - **Irrigated vs Non-irrigated**
  - **Cover vs No-cover crop (Rye)**
- **4 treatments with 4 replications**
- **26.7 ft by 1250 ft plots**

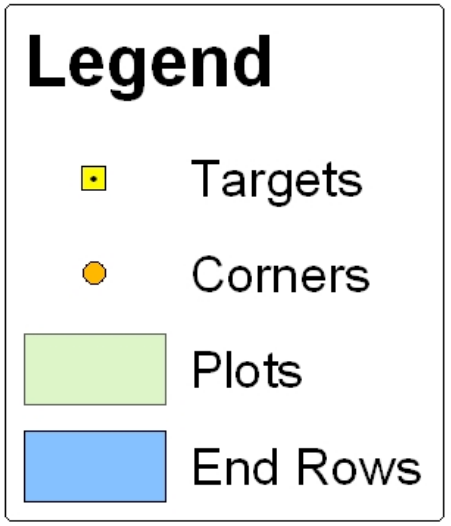


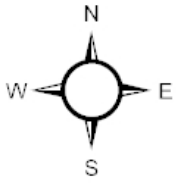
Remote Sensed Data

- **UAV equipped with a TIR sensor**
  - **Records emittance 7-14 µm**
  - **0.5-m resolution**
- **Collected data on July 18, 2006**
  - **Cotton was between 1st and peak flower**
  - **Percent canopy ranging from 15% to 72%.**
- **Ground truth data collected at 48 locations**
  - **Stomatal conductance**
  - **Soil moisture content**
  - **Crop residue cover**
  - **Canopy closure**






Legend
Targets
Corners
Plots
End Rows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Yield Results

Treatment	Yield - Seed Cotton (lbs/ac)
Irrigated / Cover	2853 [a]
Irrigated / No-Cover	2396 [b]
Non-Irrigated / Cover	1098 [c]
Non-Irrigated / No-Cover	941 [c]

Mean yields with similar letters indicate they are not statistically different at the 90% confidence level.

Quality Results

Treatment	Mic.*[1]	Strength (g/Tex)*	Uniformity (%)*	Length (in)*
Irrigated / Cover	4.4 a	28.5 a	83.5 a	1.1 a
Irrigated / No-Cover	3.9 b	28.0 a	82.8 b	1.1 a
Non-Irrigated / Cover	4.1 b	26.1 b	81.8 c	1.0 b
Non-Irrigated / No-Cover	4.1 b	25.2 c	81.2 c	1.0 b

* Mean yields with similar letters indicate they are not statistically different at the 90% confidence level.

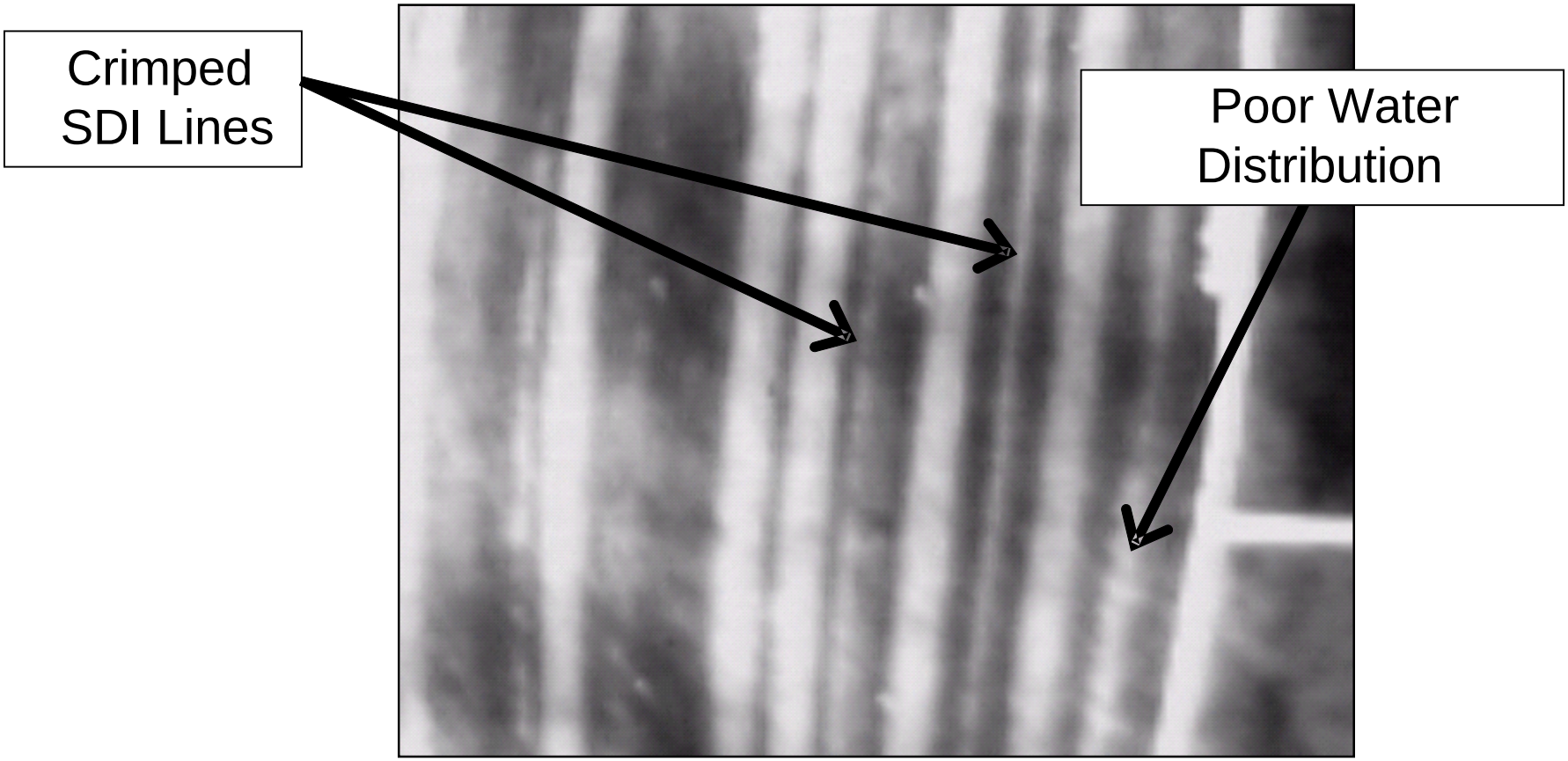
[1] Values between 3.5 and 4.9 are not discounted at the gin.

Remote Sensed Imagery Results

- **Irrigation management on canopy closure was most significant**
  - **40% on irrigated treatments**
  - **26% on non-irrigated treatments**
- **Greater canopy closure on cover treatments.**
- **TIR emittance correlated well with canopy cover (r = -0.44, alpha < 0.05) and stomatal conductance (r= -0.48, alpha < 0.05).**

Pearson Linear Correlation Coefficient to evaluate relationships.

SDI Issues



Yield losses up to 35% compared to adjacent rows for crimped tape.

Final Thoughts...

- **Cover crops and SDI providing yield benefits**
- **RTK auto guidance is needed for installation and field operations**
- **High resolution TIR data can help manage SDI systems.**
  - **Identify issues in a timely fashion**
  - **Provide a management tool**
- **Study is being continued**

Questions

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USDA-CSREES

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