# Site Specific Management (PA) to Further Enhance Livestock and Perennial Grass-Based Peanut/Cotton Cropping Systems

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# Bahiagrass Peanut-Cotton Cropping System

***(Paspalum notatum* Fluegge*)***




## (B-B-P-C)

# Widespread Interest

Allen, V.G., M. T. Baker, E. Segarra, and C. P. Brown. 2007 - southwestern

Franzluebbers, A.J. 2007. - southeastern

Russelle, M.P., and A.J. Franzluebbers. 2007. -southeastern

Russelle, M.P., M.H. Entz, and A.J. Franzluebbers. 2007. - north-central

Sulc, R.M. and B.F. Tracy. 2007 - midwestern

Kirschenmann. 2007

Katsvairo, T.W., D.L. Wright, J.J. Marois, D.L. Hartzog. J.R. Rich, and P. J. Wiatrak. 2006 - southeast

Clark, E.A. 2004.

Rodriguez Kabana - Nematodes

Several folks in diseases – Francis Tsigbey

- **“Benefits At Every Turn” – Amanda Huber, Peanut Grower Magazine**

**Successes mostly in soil health and pest management**

Passionate

- **Elkins, C.B., R.L. Haaland, and C.S. Hoveland. 1977**

**Yield**

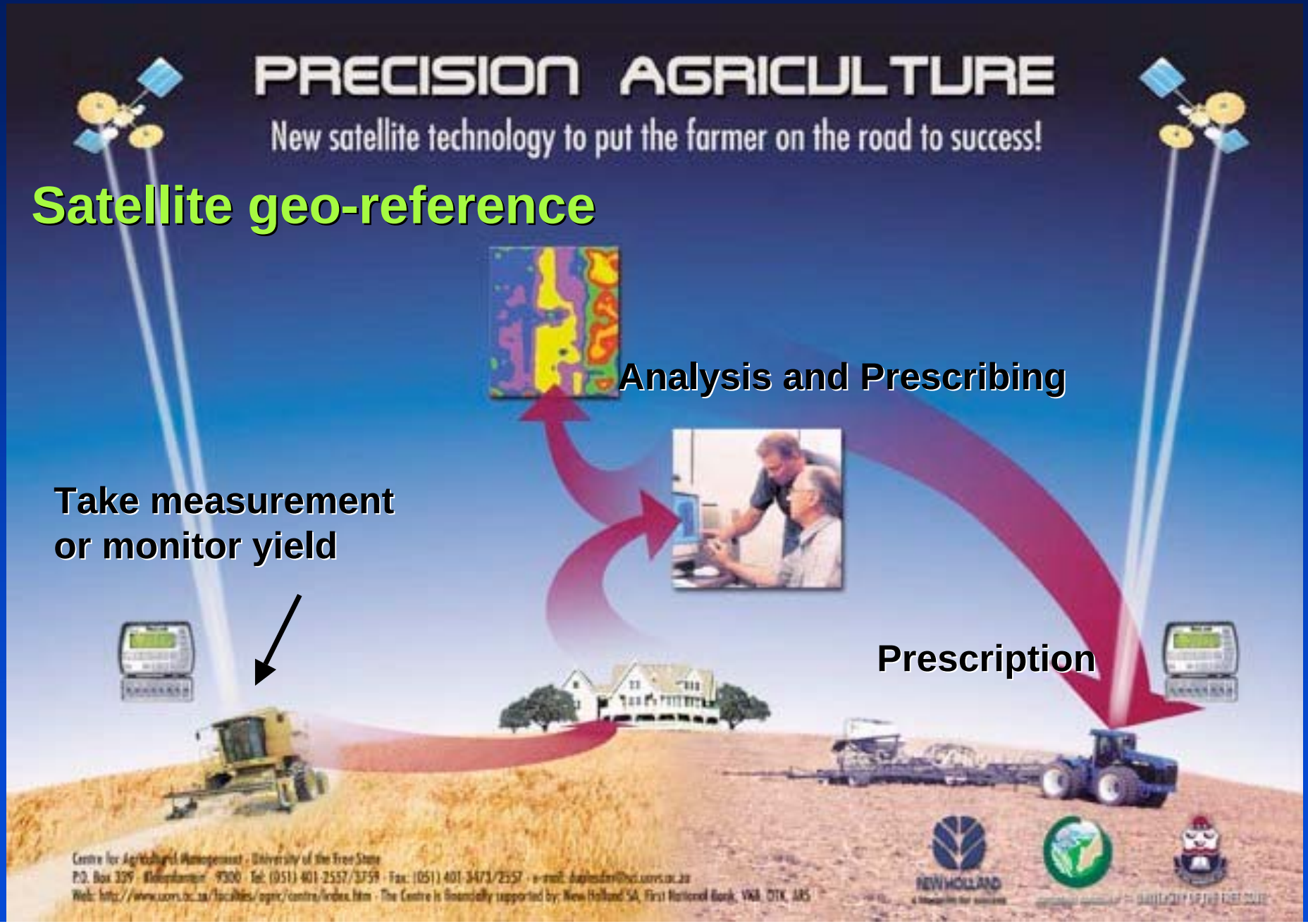
**Penetrate compaction zone**
**Bigger roots**
**Nutrient recycling**
**Water infiltration**
**Disease control**
**Nematodes**
**Weeds**

# What is Site-Specific Management?

- **"Site Specific management** is a concept relying on the existence of *in-field variability*. It requires the use of new technologies, such as global positioning (GPS), sensors, satellites or aerial images, and information management tools to assess, understand and manage variations."

**GPS units enable easier collection of data and in turn data is more readily available.**

# Site-Specific Management Concept



# Site-Specific may Include Many Components

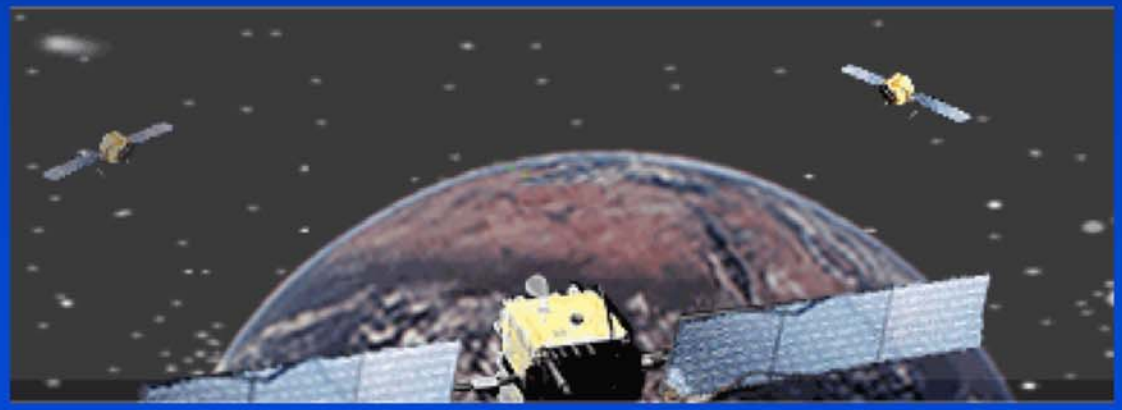
- Yield monitoring
- variable fertilizer and lime rates
  variable organic amendments
- variable seeding rates
- differential hybrids
- variable pest control

# (Good old days)

## Integrated Crop/Livestock Practices

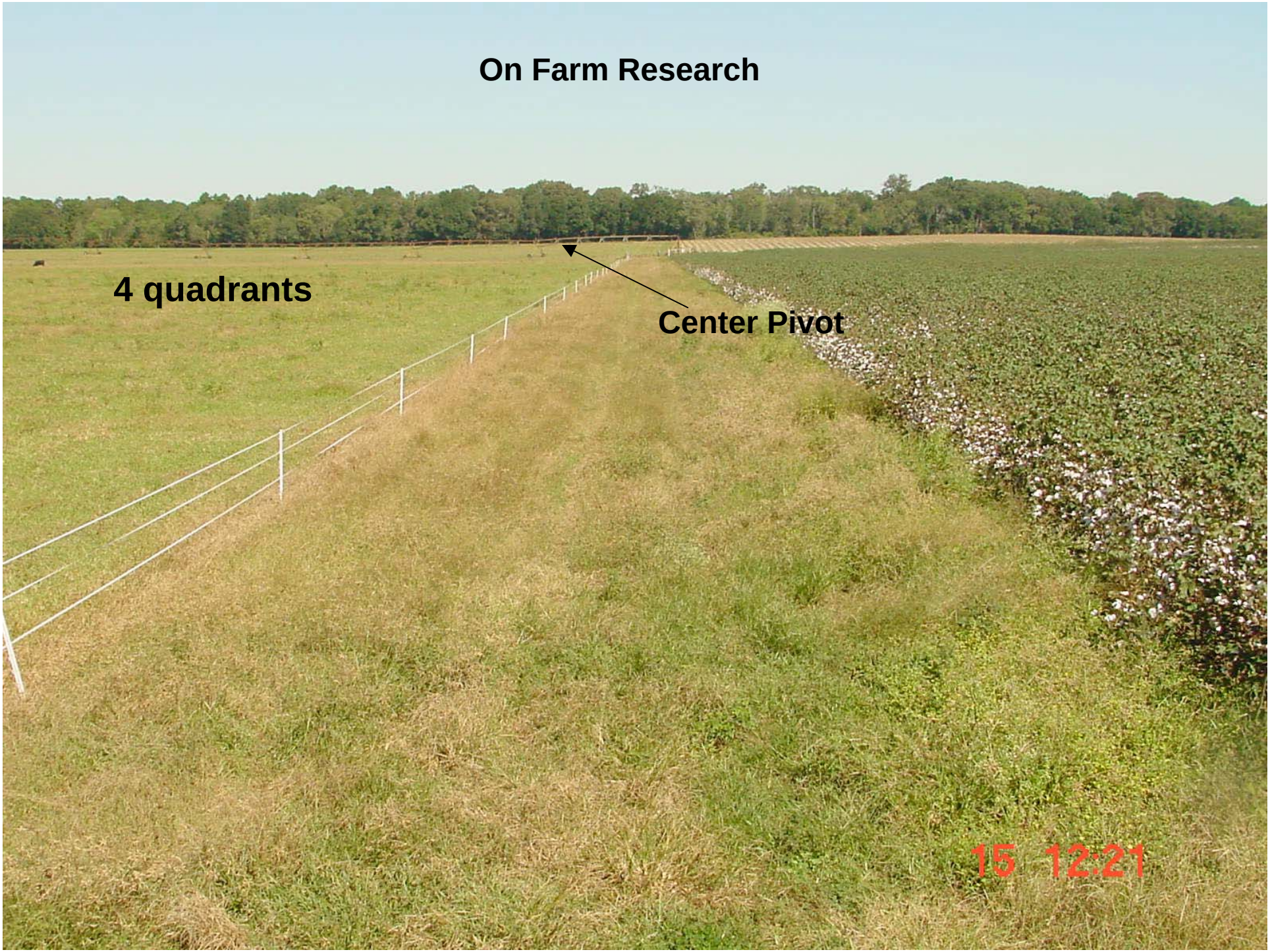
## and

## Site-Specific Management



**Targeted field scouting based on remotely-sensed images**
**Targeted pesticide application from remotely-sensed images**
**On-the-go pest evaluation**

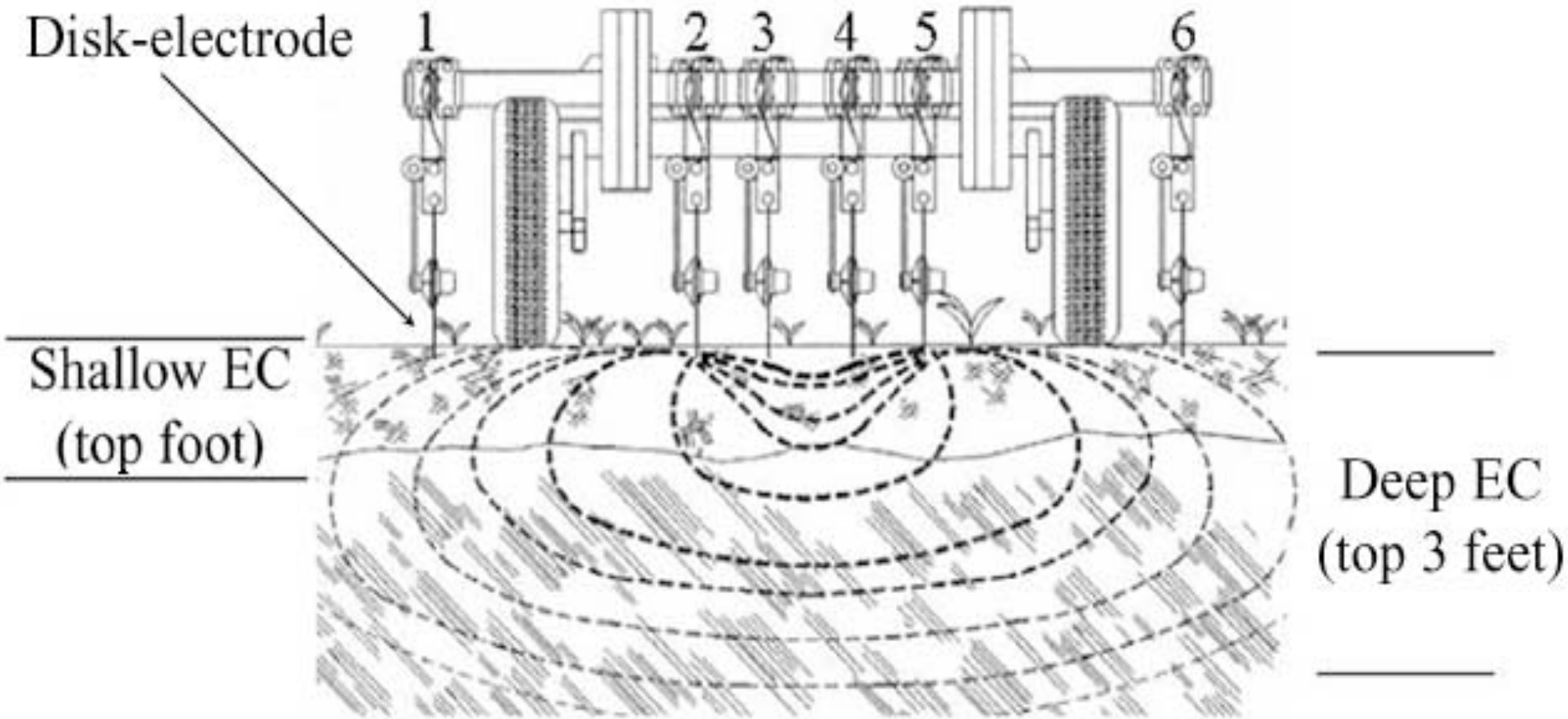
Useful to crop scouts as a preview of where to sample


On Farm Research
4 quadrants
Center Pivot
15 12:21

# Soil Electrical Conductivity (EC)

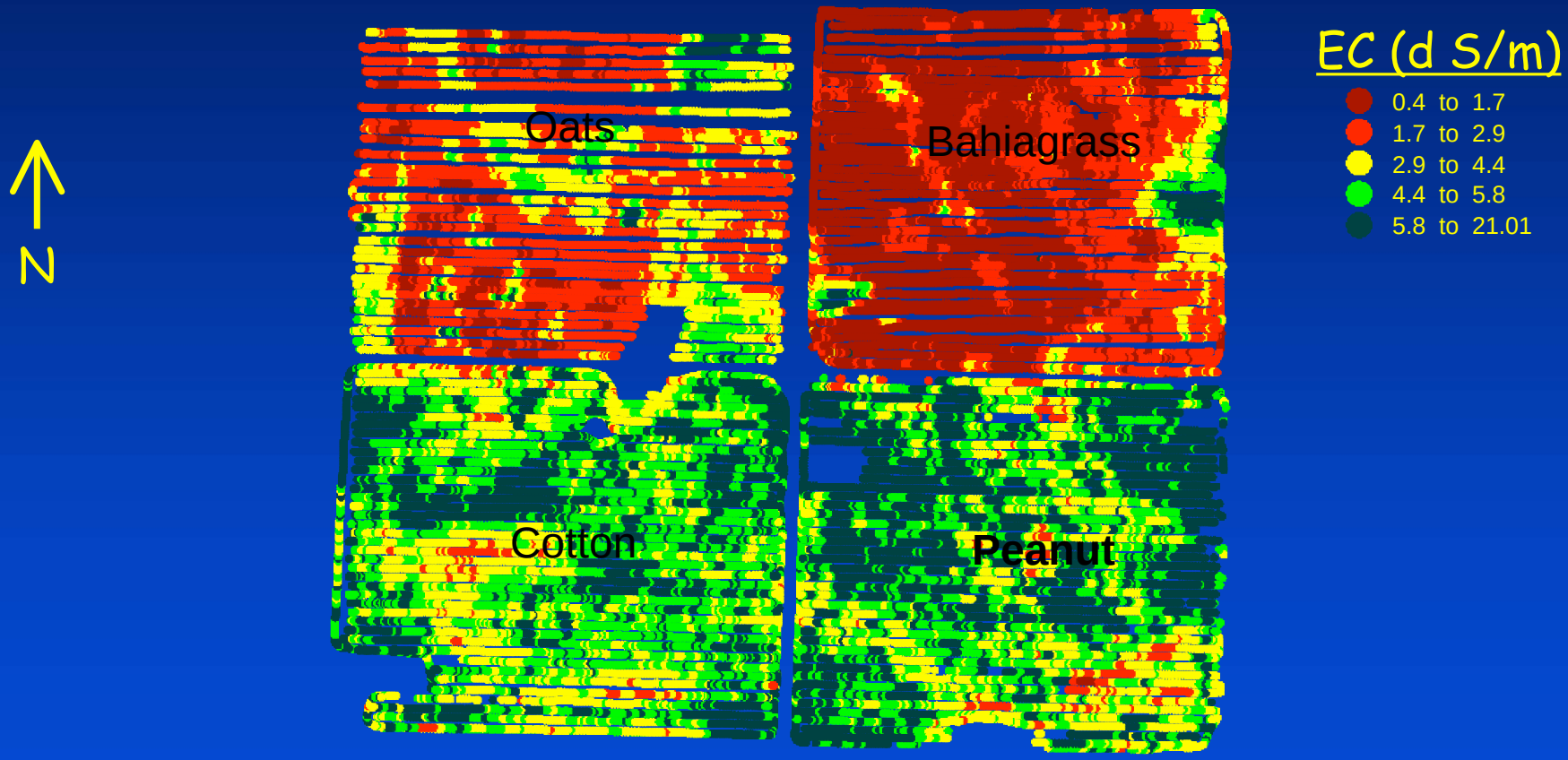
- measures the amount of salts (like sodium and calcium) in the soil and other soil properties
- soil EC relate to amount of sand, clay, and organic matter.
- Soil texture relates water holding capacity of soil. Therefore, soil EC maps often relate well with crop yield maps.

# EC Using Veris 3100



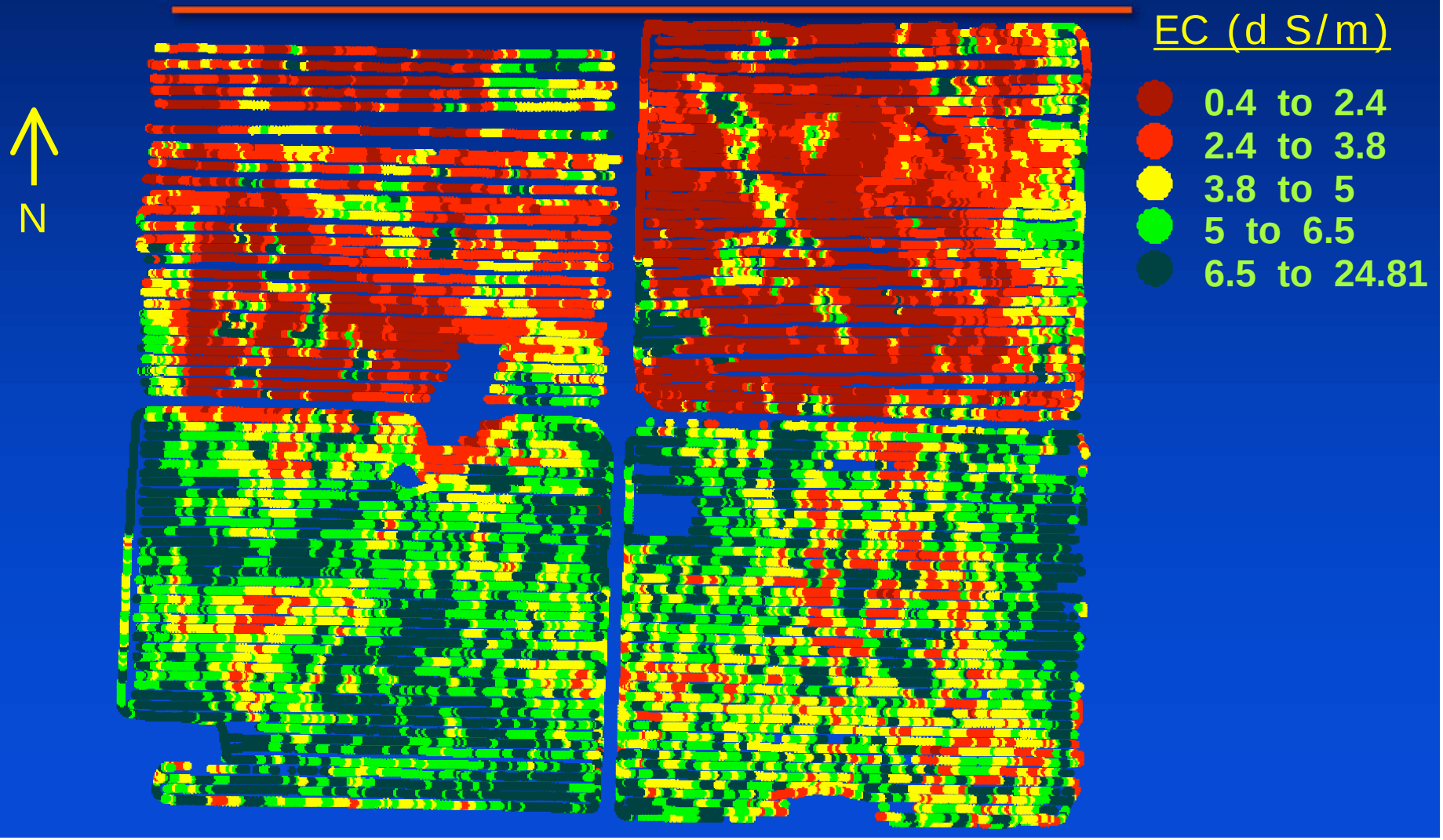
**Soil Electrical Conductivity**
**In May, 2006**

# (0-1 foot)

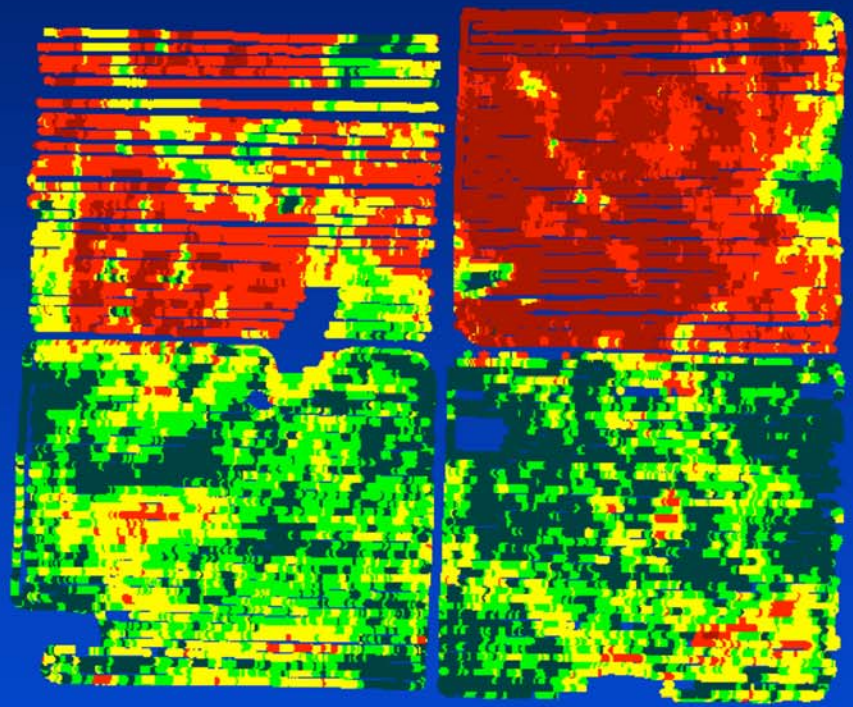


# EC values from a Sod/Livestock Integrated Peanut/Cotton Rotation (0-3 foot)

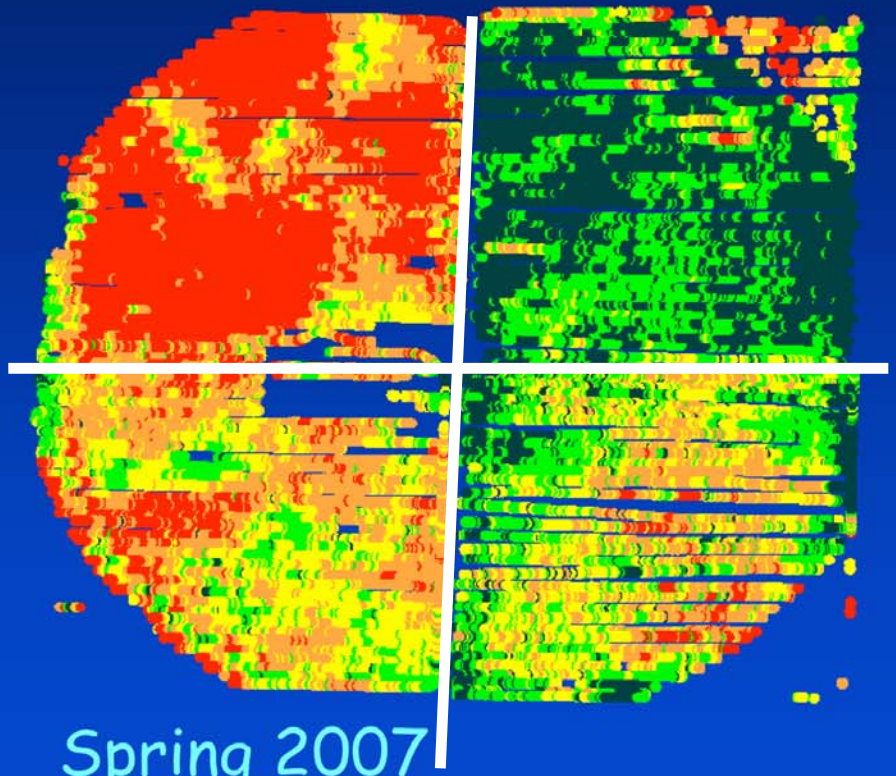
May 2006



# Electrical Conductivity (dS/m)



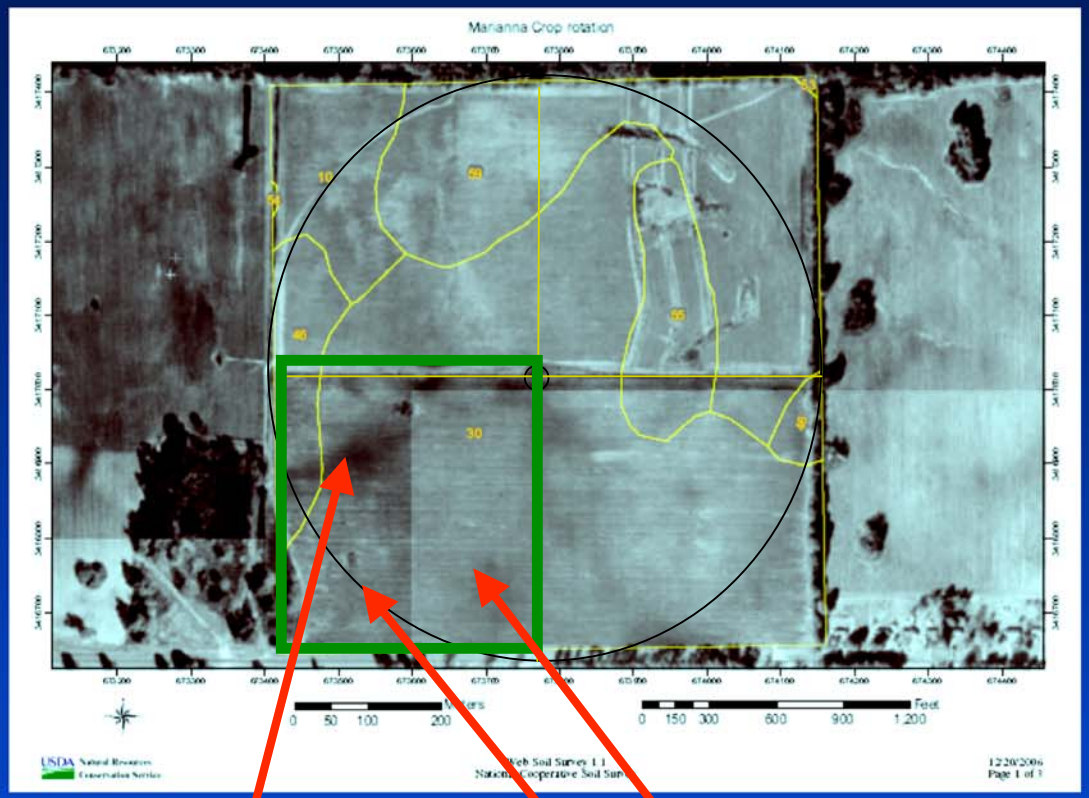
Spring 2006

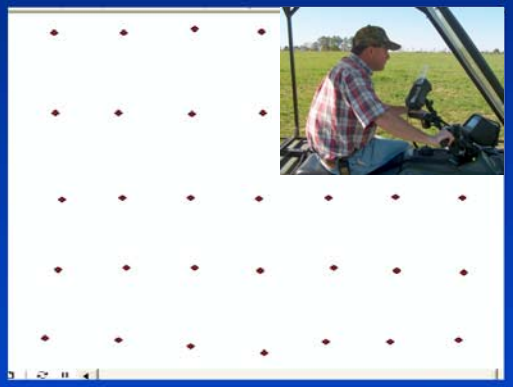


Spring 2007

**Evidence of soil moisture recharge**

# Sod-based Rotation in Florida



Wet sections

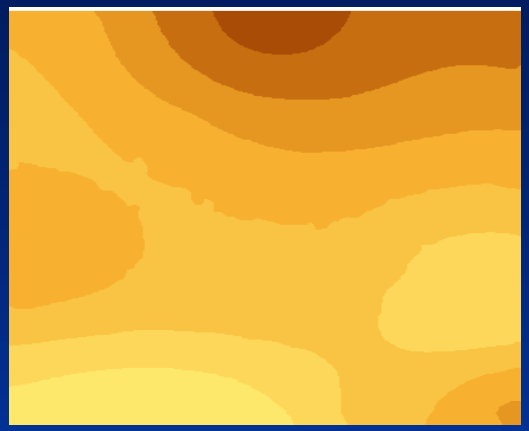
Cotton in 2006

Irrigation Circumference

Enough variation to suggest potential for VR Mgt

Fuqany coarse sand, slope 0-5 (56.8%)
Orangeburg loamy sand, slope 2-5 (5.8%)

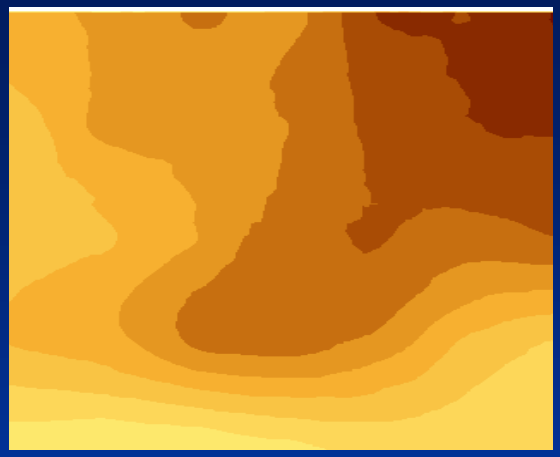
## Plant height (early season)



cm

6 – 8
8 – 9
9 – 10
10 -11
11 – 12
12 – 13
13 – 15
15 – 18
18 -22

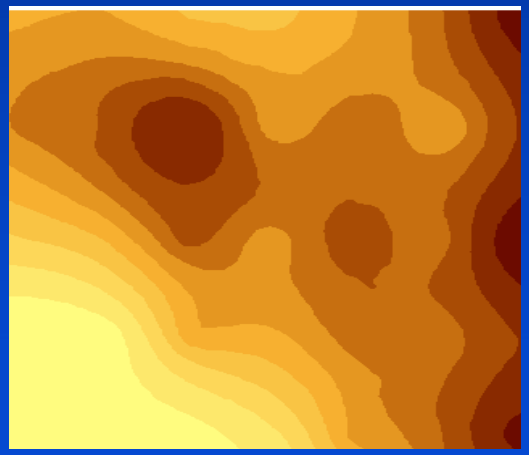
## Plant height (mid-season)



cm

33 – 35
35 – 38
38 – 40
40 – 42
42 – 45
45 – 47
47 – 49
49 – 51
51 – 54
54 - 56

## Plant height (late season)

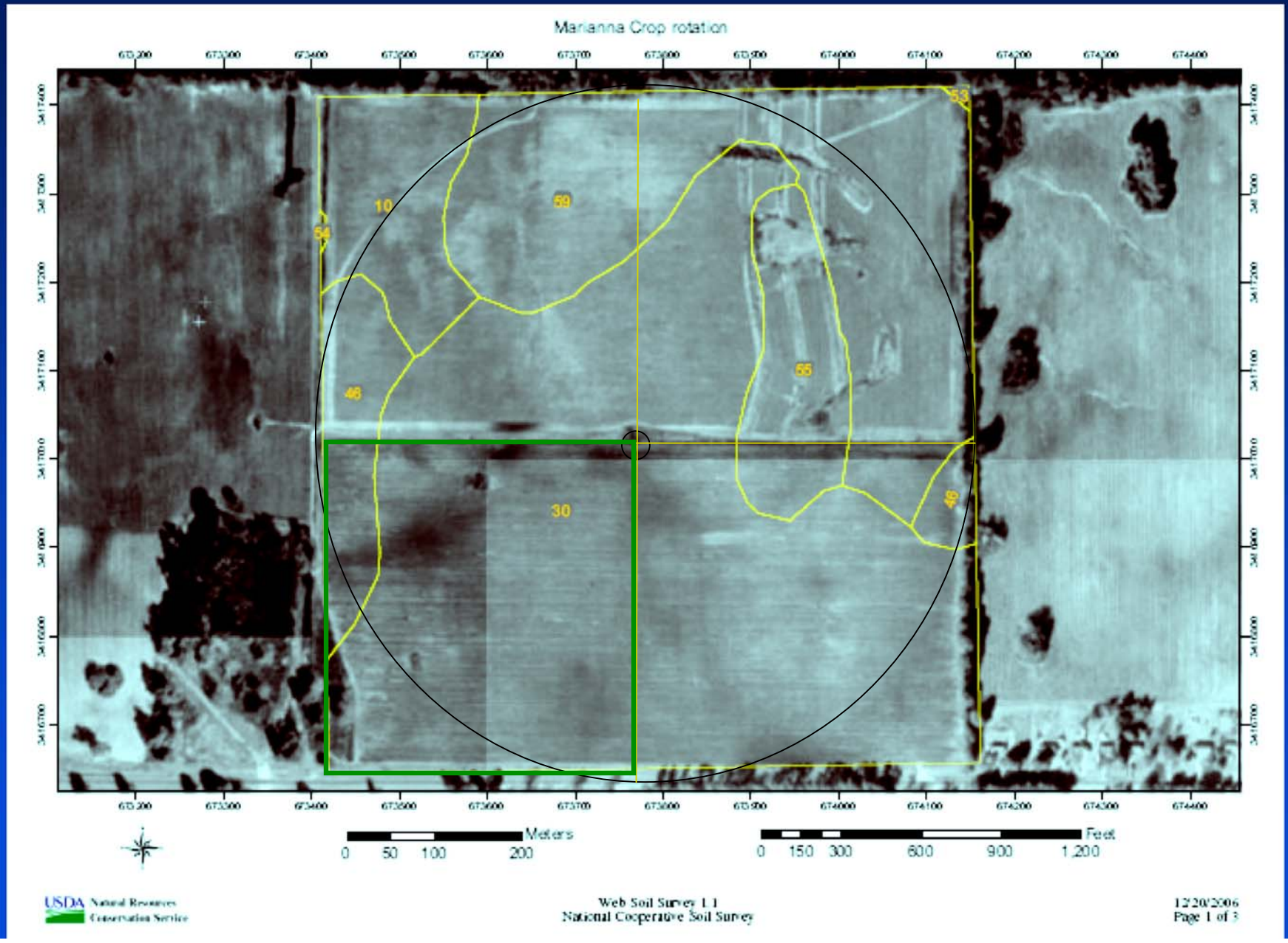


cm

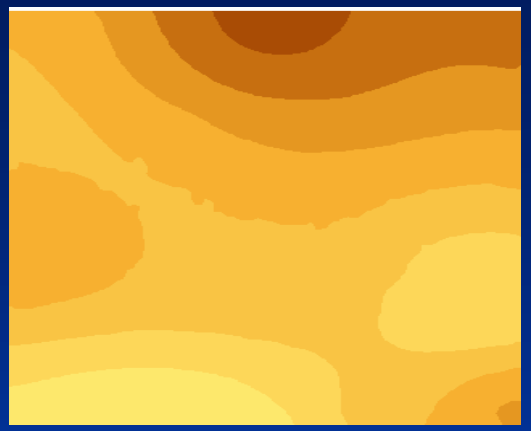
71 – 82
82 – 91
91 – 98
98 – 105
105 – 110
110 – 115
115 – 119
119 – 123
123 – 129
129 - 135

**Krigged interpolations using ArcGIS of plant height at three stages of growth and yield in cotton in a bahiagrass rotation in Florida in 2006.**

# Sod-based Rotation in Marianna



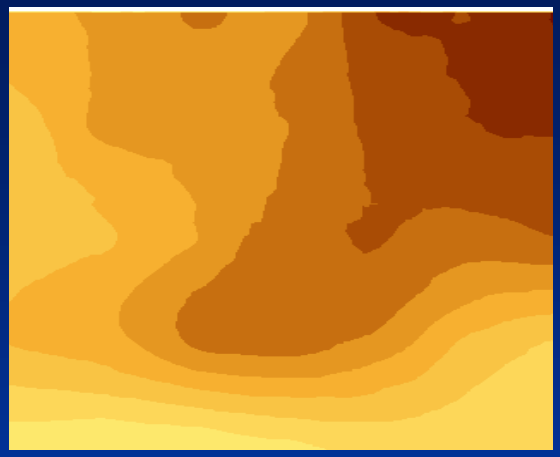
## Plant height (early season)



cm

6 – 8
8 – 9
9 – 10
10 -11
11 – 12
12 – 13
13 – 15
15 – 18
18 -22

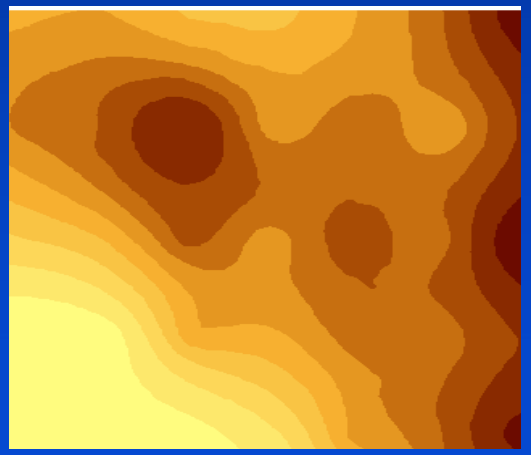
## Plant height (mid-season)



cm

33 – 35
35 – 38
38 – 40
40 – 42
42 – 45
45 – 47
47 – 49
49 – 51
51 – 54
54 - 56

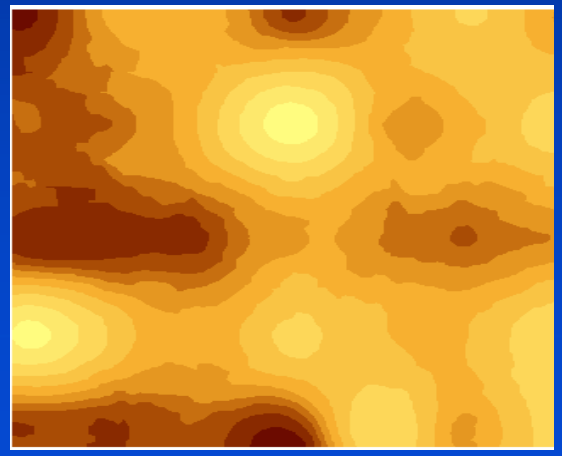
## Plant height (late season)



cm

71 – 82
82 – 91
91 – 98
98 – 105
105 – 110
110 – 115
115 – 119
119 – 123
123 – 129
129 - 135

## Cotton yield

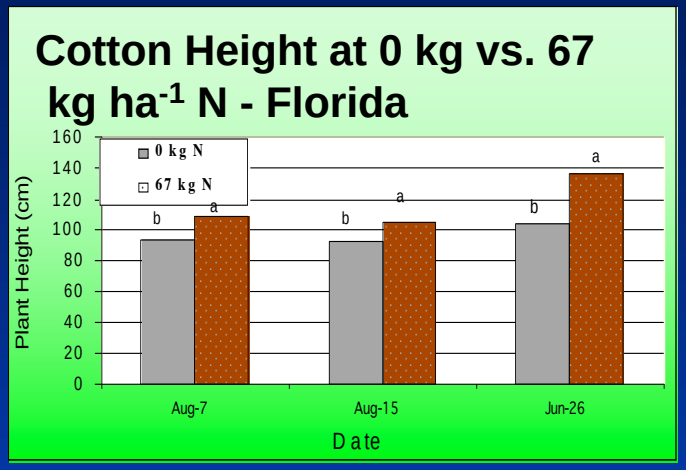


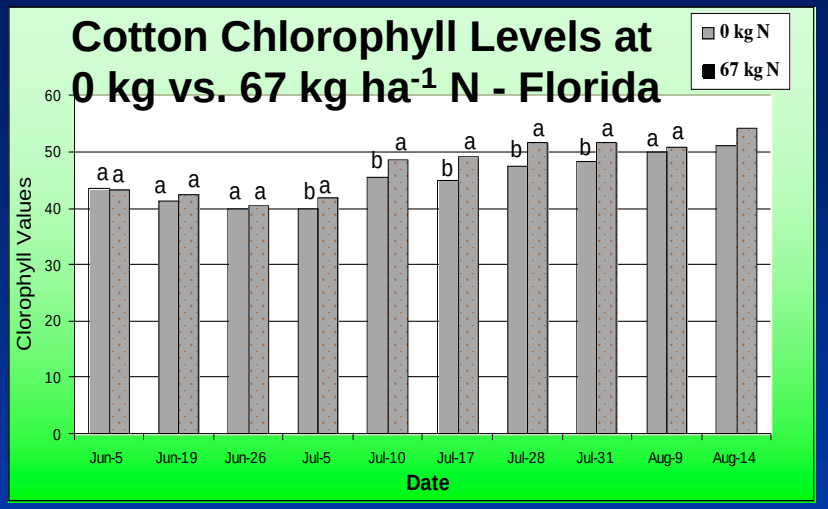
Kg $ha^{-1}$

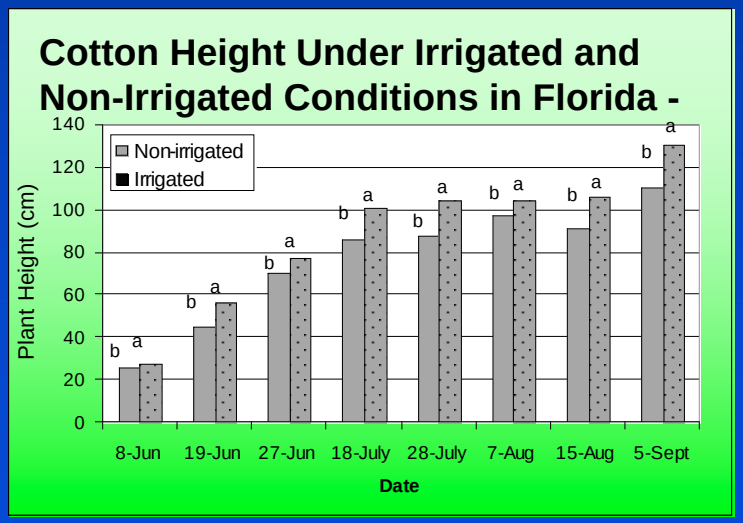
1000 – 1360
1360 – 1645
1645 – 1869
1869 – 2046
2046 – 2185
2185 – 2295
2295 – 2381
2381 – 2491
2491 – 2631
2631 - 2808

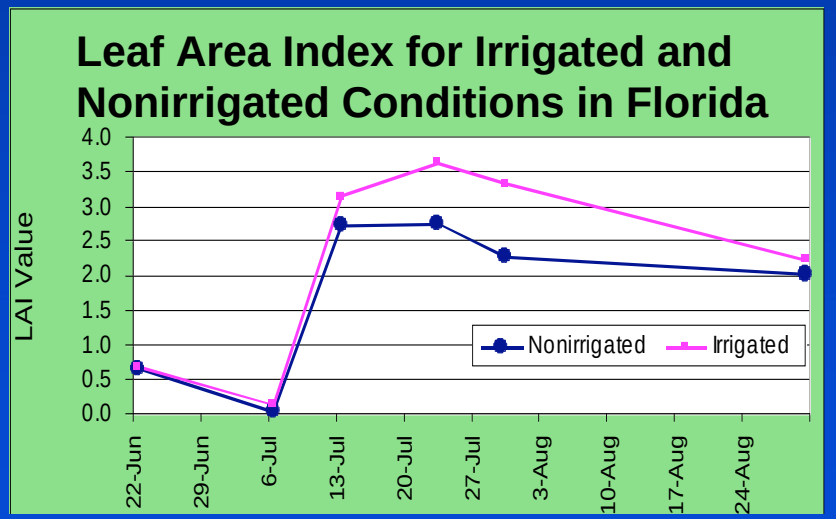
**Krigged interpolations of plant height at three stages of growth and yield in cotton in a bahiagrass rotation in Florida in 2006.**

# Not always translated to yield

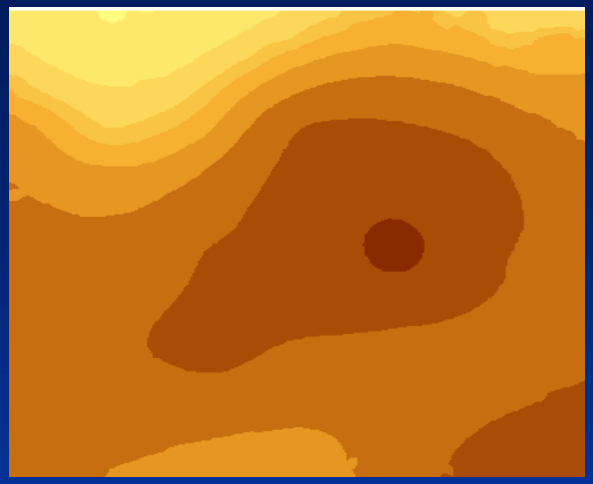


## N



Kg ha$^{-1}$

- 9 -12
- 12 – 14
- 14 -15
- 15 – 16
- 16 – 17
- 17 – 18
- 18 – 21
- 21 – 26
- 26 – 33
- 33 - 44

## P

Kg ha$^{-1}$

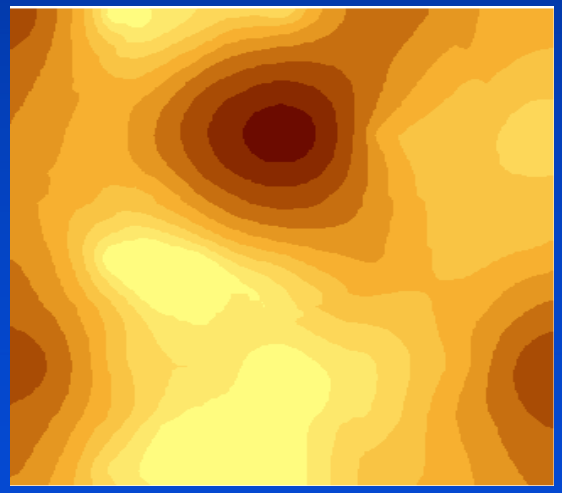
- 12 – 58
- 58 – 86
- 86 – 104
- 104 – 115
- 115 – 122
- 122 - 133
- 133 – 151
- 151 - 180
- 180 – 226
- 226 - 300

## K

Kg ha$^{-1}$

- 145 – 169
- 169 – 186
- 186 – 199
- 199 – 208
- 208 – 220
- 220 – 238
- 238 – 262
- 262 – 296
- 296 – 342
- 342 - 407

## Soil organic matter

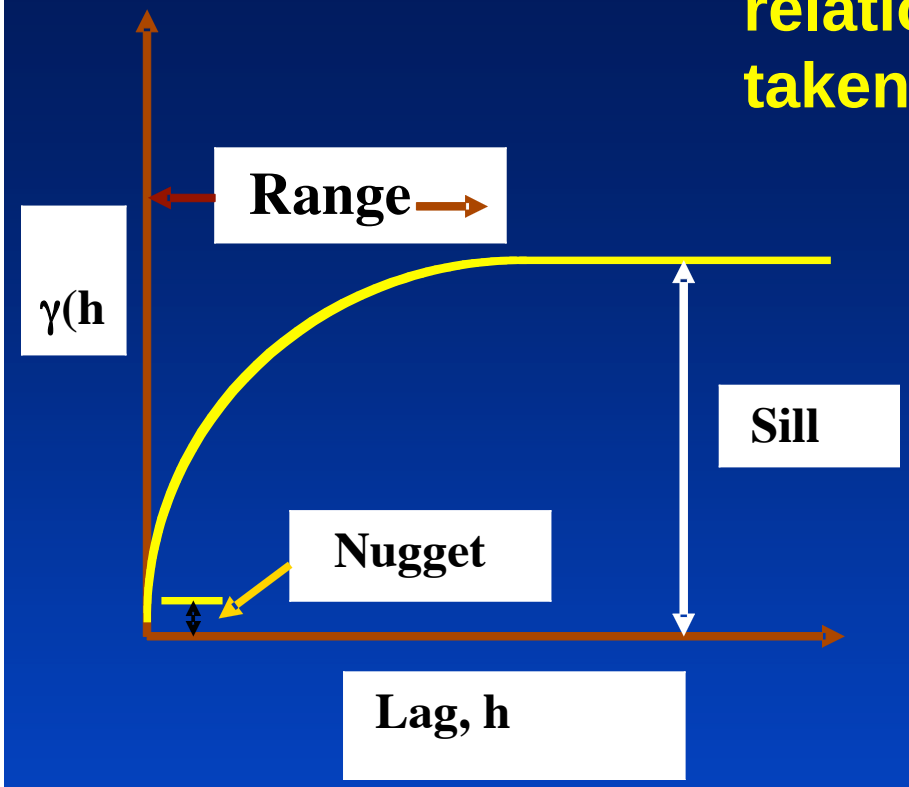


Percentage

- 0.70 – 0.74
- 0.74 – 0.79
- 0.79 – 0.86
- 0.86 – 0.95
- 0.95 – 1.07
- 1.07 – 1.23
- 1.23 – 1.43
- 1.43 – 1.69
- 1.69 – 2.04
- 2.04 – 2.50

**Krigged interpolations of N, P,K and soil organic matter cotton at the end of the growing season in Florida in 2006.** Different management zones

**A semivariogram describes the relationship between measurements taken some distance apart.**




- The nugget measure small scale intrinsic variability- noise
- The sill is the value at which the semivariogram levels off (difference between maximum variability of the samples and the nugget)

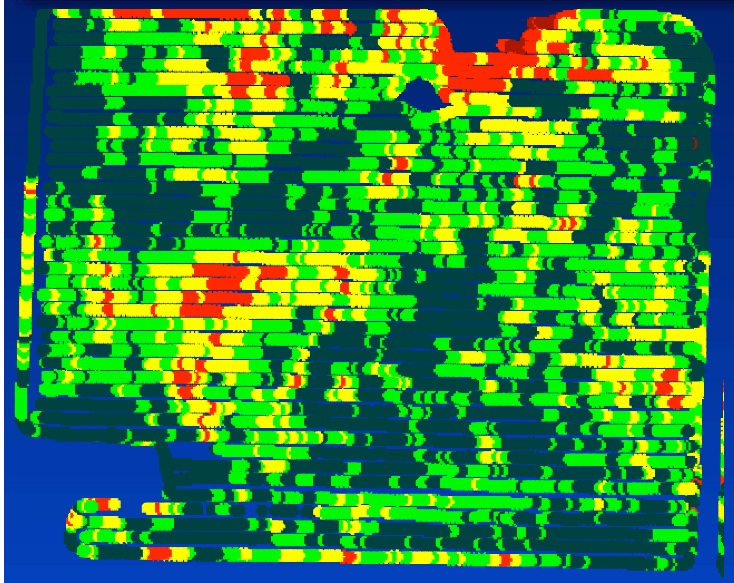
The range is the distance over which spatial dependence exists. (represent maximum distance at which sample pairs have a relationship to their separation distance. Beyond the range, there is no relationship)

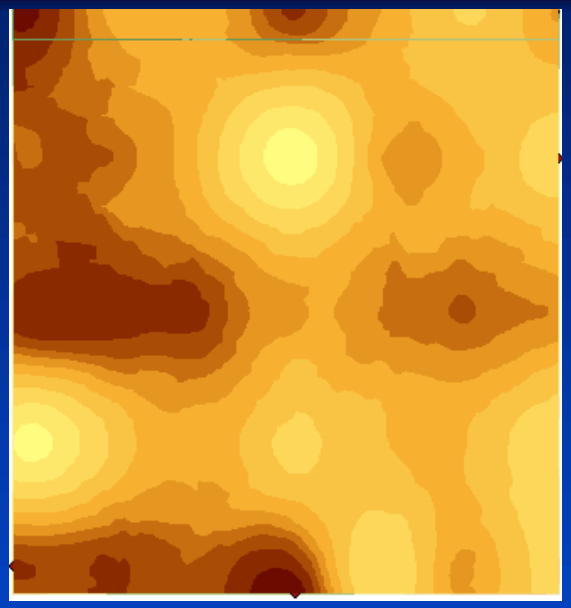
## Nugget value ($c_0$), Nugget/Sill Fraction ($c_0/c_0+c$)

| Variable | Nugget | sill | $(c_0/c_0+c)$ | range |
|---|---|---|---|---|
| SOM | 0.00 | 0.17 | 0.00 | 115 |
| Hgt. Early | 0.54 | 0.76 | 0.41 | 330 |
| Hgt. Mid | 1.80 | 6.04 | 0.23 | 330 |
| Hgt. Late | 0.00 | 61.06 | 0.00 | 330 |
| Yield | 0.00 | 179610 | 0.00 | 75 |
| N | 31.73 | 24.48 | 0.56 | 184 |
| P | 1177 | 1110 | 0.51 | 330 |
| K | 3008 | 448 | 0.87 | 330 |

<0.25 means variable is strongly spatially dependent.
0.25 to 0.75 indicates moderate spatial dependence
>0.75 indicates weak spatial dependence.

# EC and Yield Maps





EC (d S/m)

- 0.4 to 1.7
- 1.7 to 2.9
- 2.9 to 4.4
- 4.4 to 5.8
- 5.8 to 21.01

- 1000 – 1360
- 1360 – 1645
- 1645 – 1869
- 1869 – 2046
- 2046 – 2185
- 2185 – 2295
- 2295 – 2381
- 2381 – 2491
- 2491 – 2631
- 2631 - 2808

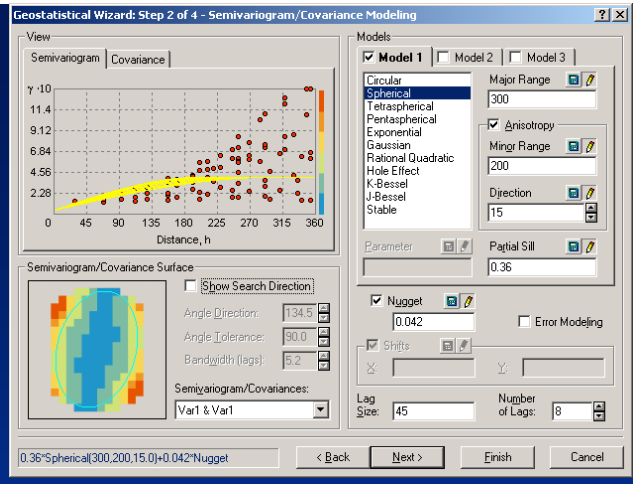
# Is Precision Agriculture Convenient?

- The technology is becoming progressively cheaper and user friendly
- Calculator
- The demand for this new technology has pushed many companies to develop new products to be used with precision agriculture systems.

# Data Mining

- Precision agriculture generates large data sets
- Data mining methods are designed to find patterns in large data sets
- MARS (Multivariate Adaptive Regression Splines) is a regression technique that allows for rapid analysis of large data sets using flexible functions

# Challenges




**Creates an immense amount of work for the farmer and the dealer to analyze**

- No F tests
- Creating maps is subjective- an art
- The results are often not as clean cut
- Require sophisticated statistical approaches. Examples may include: fuzzy clustering to identify management zones
- Peanut and cotton yield monitors not readily available

# Site Specific Farming Profitability

## One School of Thought

-Saves money!  Measuring more precise input needs, such as fertilizers eliminates waste and irrigation water

## Second School of Thought

-Does not save money but increases efficiency and conserves the environment

-Technology is still expensive

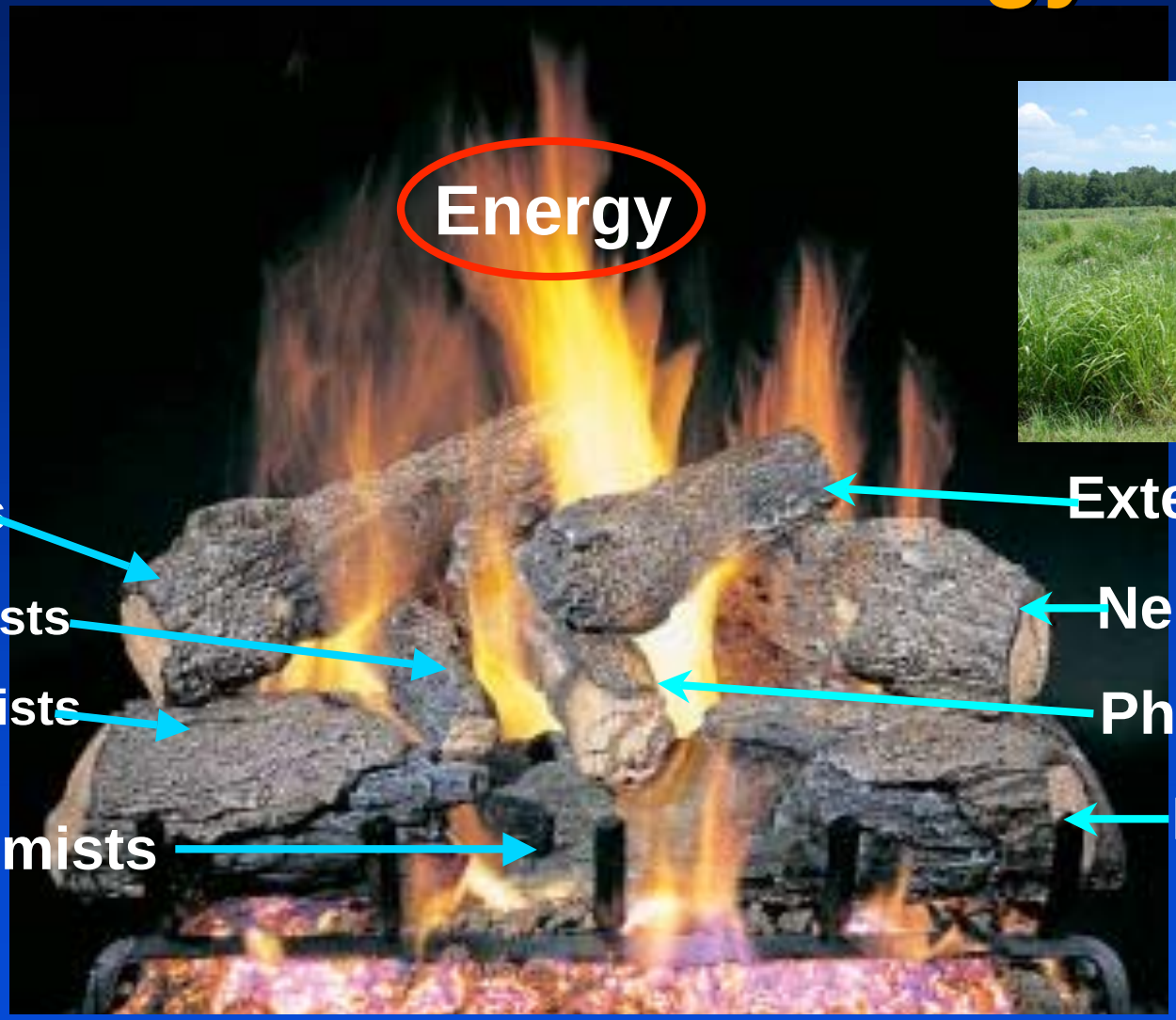
# Conclusions

- **Spatial variation observed for plant height, soil macro nutrients, soil organic matter and yield.**
- **Areas of the field with the tallest plants did not necessarily produce highest yield, and no yield**
- **No yield differences were found between irrigated and non-irrigated areas.**

# Conclusions Cont'

- There is a need to fine tune or develop new cultural practices to fully achieve benefits from the sod.
- Site-specific management has potential, however, it's necessary to create individual zone maps for some variables since variable maps did not always overlap
- There is potential to include precision agriculture with livestock/row crop systems
-

# The SE can lead the Nation in Production of Bioenergy Crops




Farmers

Economists

Pathologists

Agronomists

Extension

Nematologists

Physiologists

Breeders