IDENTIFYING and MANAGING MULTIPLE STRESSES IN COTTON

Louisiana Agricultural Technology & Management Conference

Alexandria, LA

February 8, 2008

C. Overstreet, M. Wolcott, E. Burris

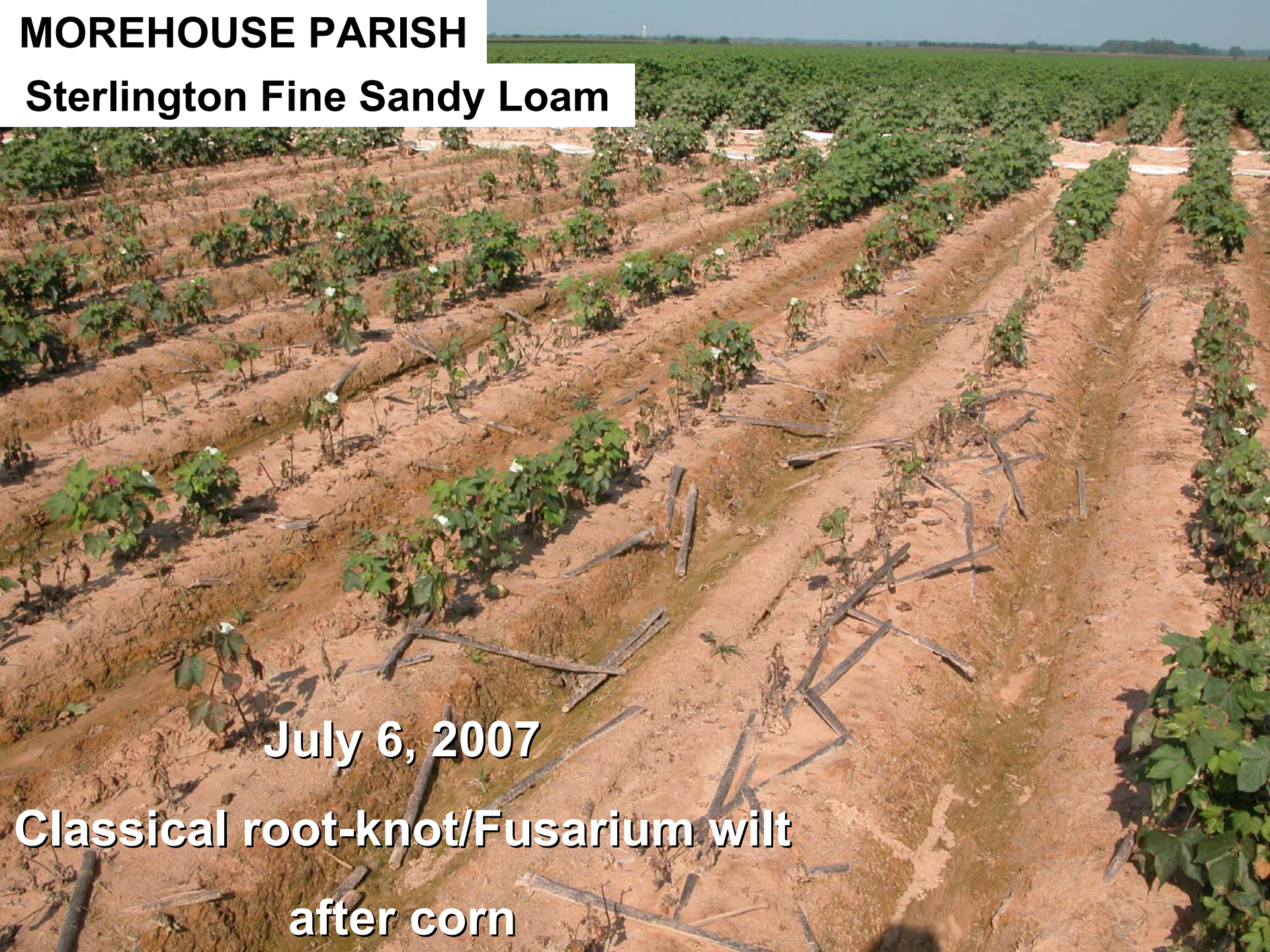
CATAHOULA PARISH

July 2, 2003

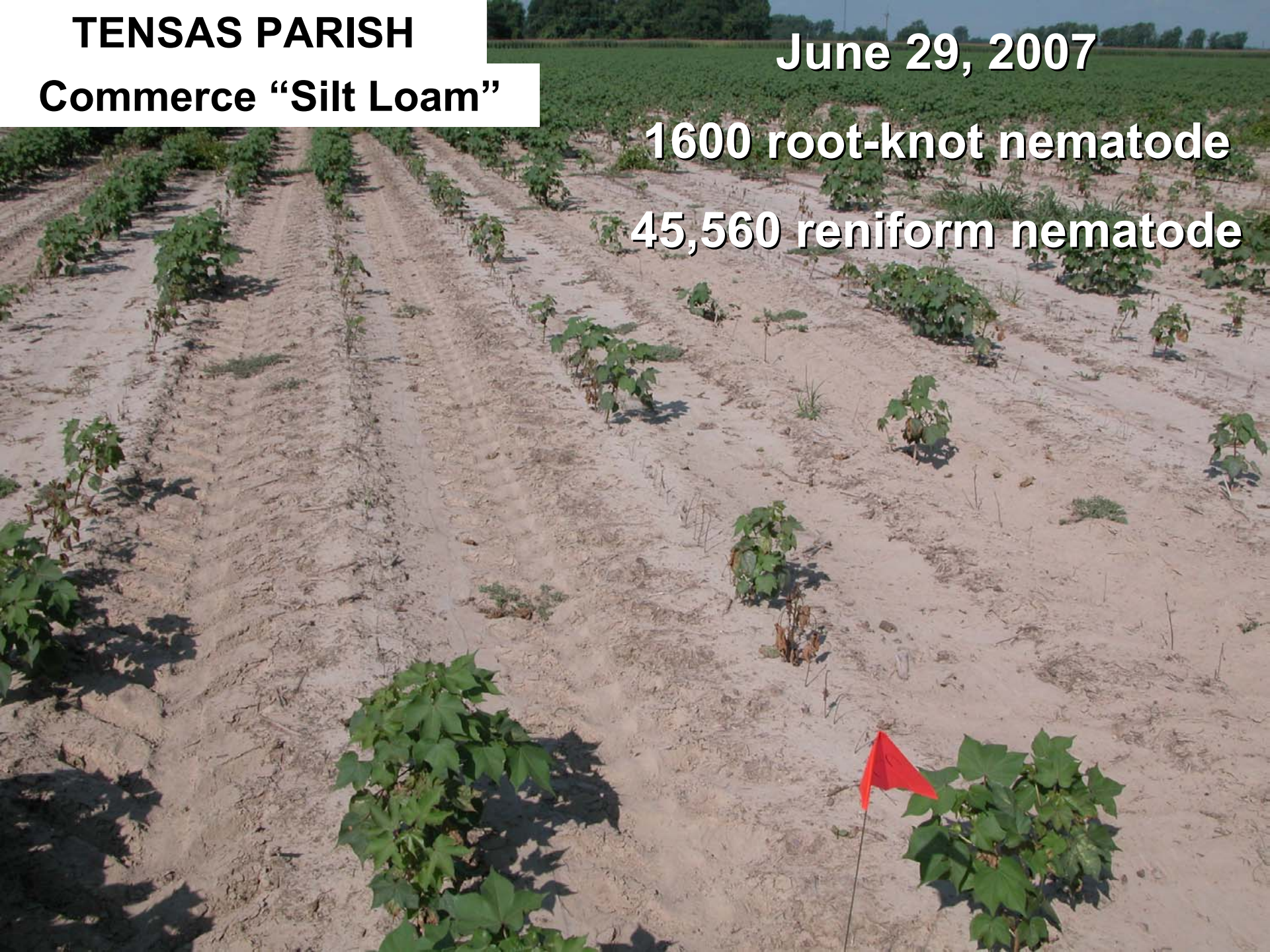
150,000 reniform

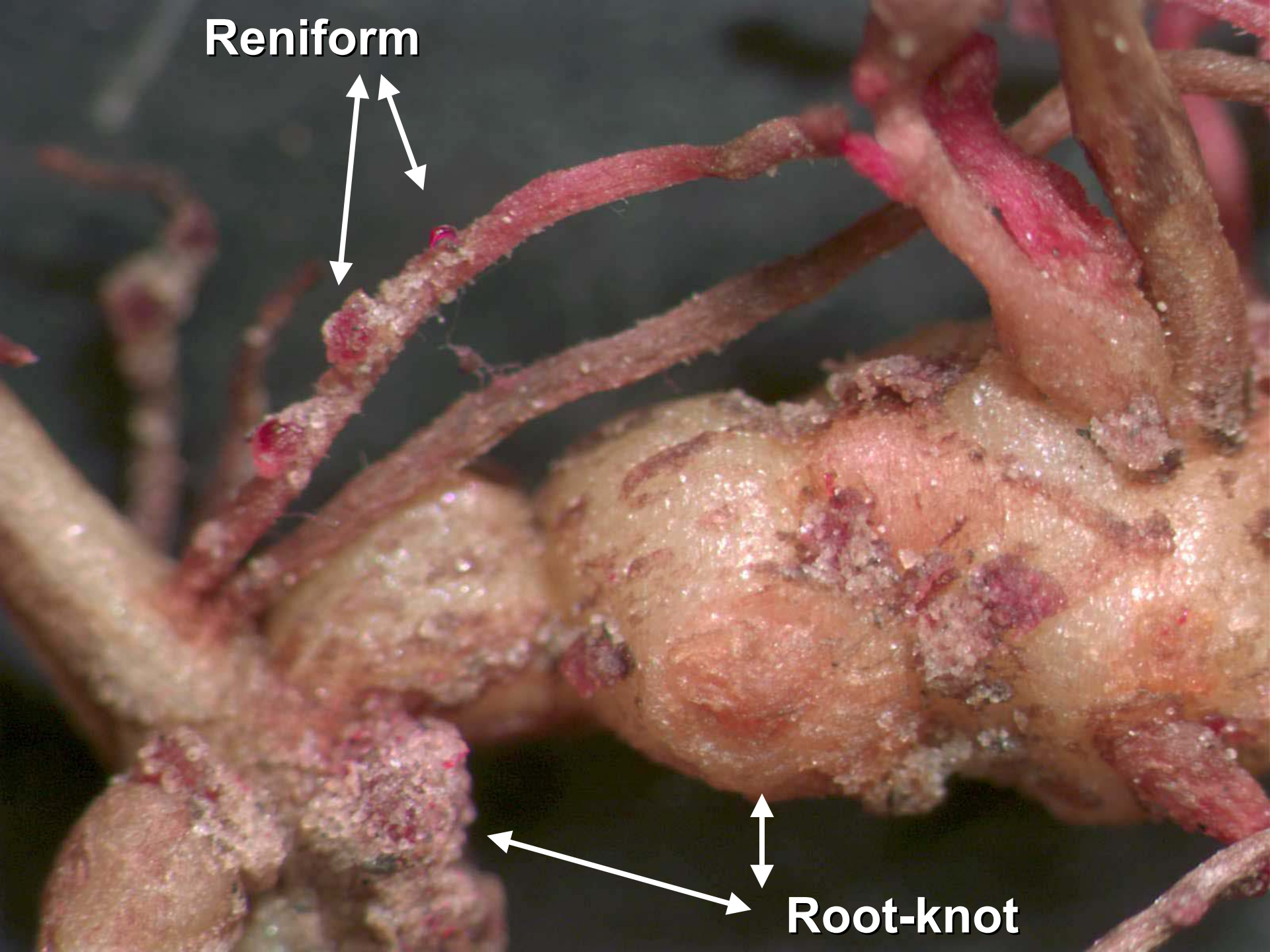
per 500 cm^3


FRANKLIN PARISH
July 16, 2007
Reniform levels in bad areas 40,000 per 500 cm3
Reniform levels in good areas 80,000 per 500 cm3


MOREHOUSE PARISH
Sterlington Fine Sandy Loam
July 6, 2007
Classical root-knot/Fusarium wilt
after corn

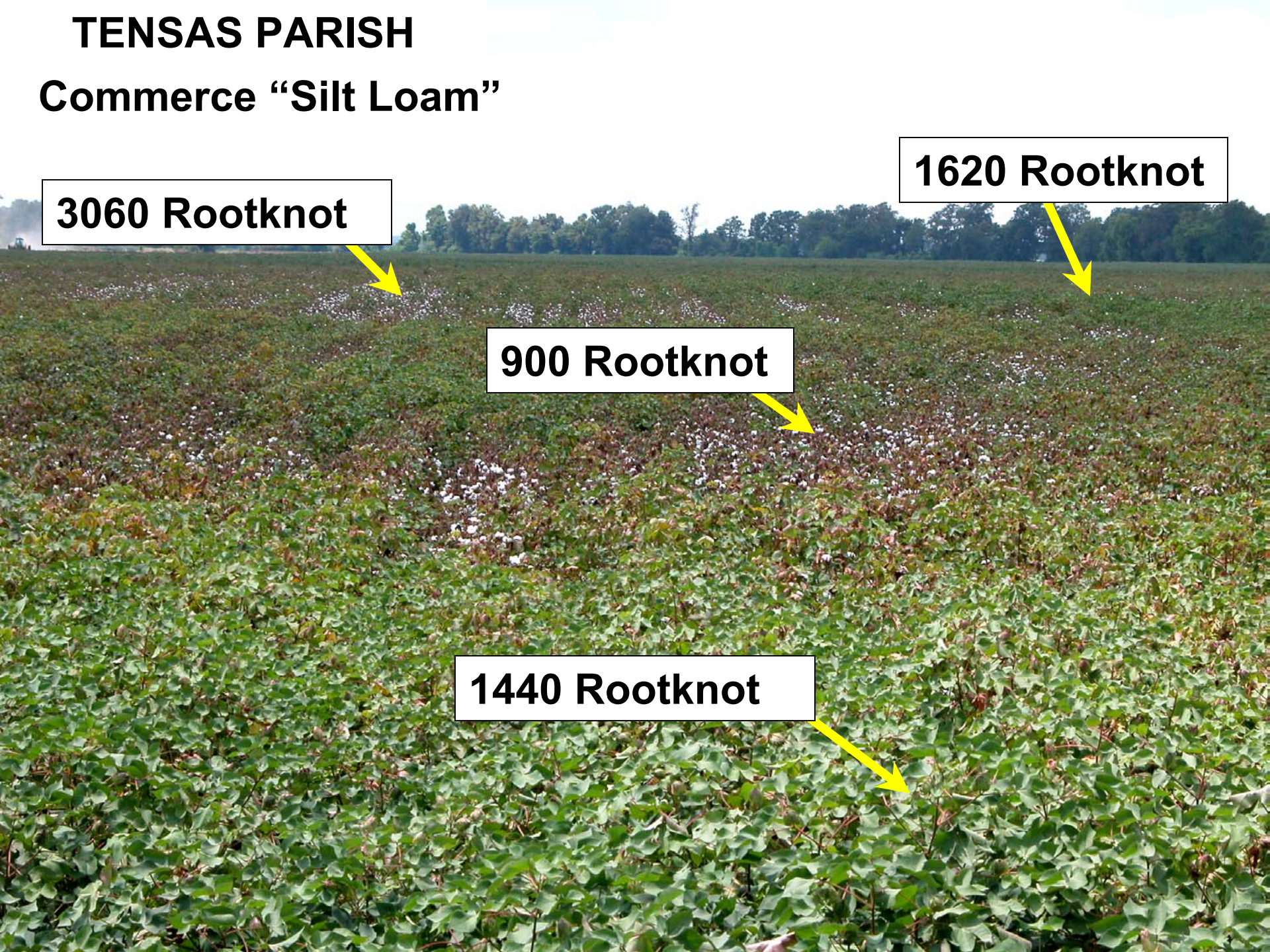

MOREHOUSE PARISH
Sterlington Fine Sandy Loam
August 1, 2006
Classical root-knot/Fusarium wilt
after cotton


TENSAS PARISH
Commerce “Silt Loam”
June 29, 2007
1600 root-knot nematode
45,560 reniform nematode


Reniform
Root-knot

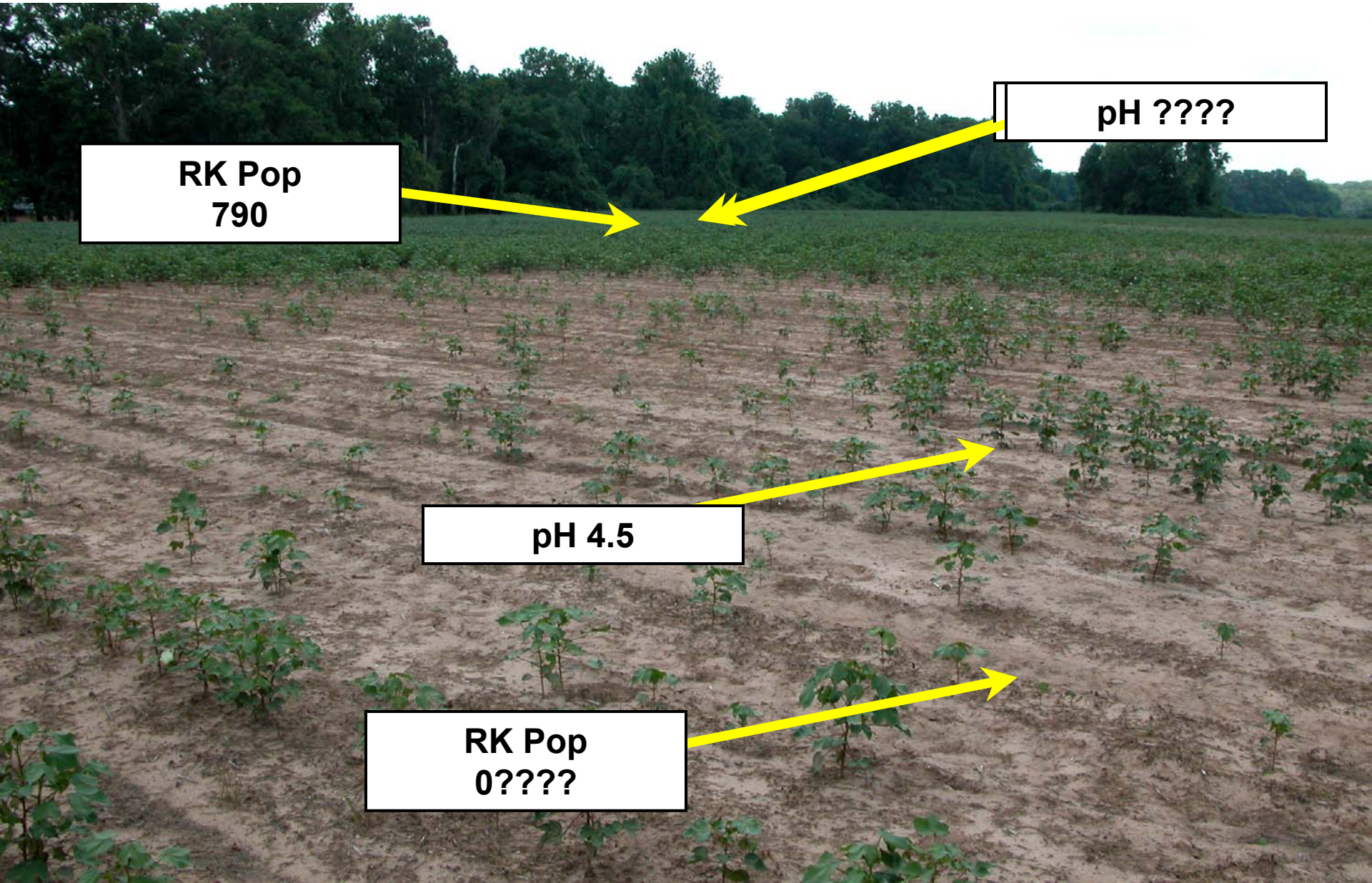

TENSAS PARISH
Commerce “Silt Loam”
Root-knot
Reniform
Fusarium wilt

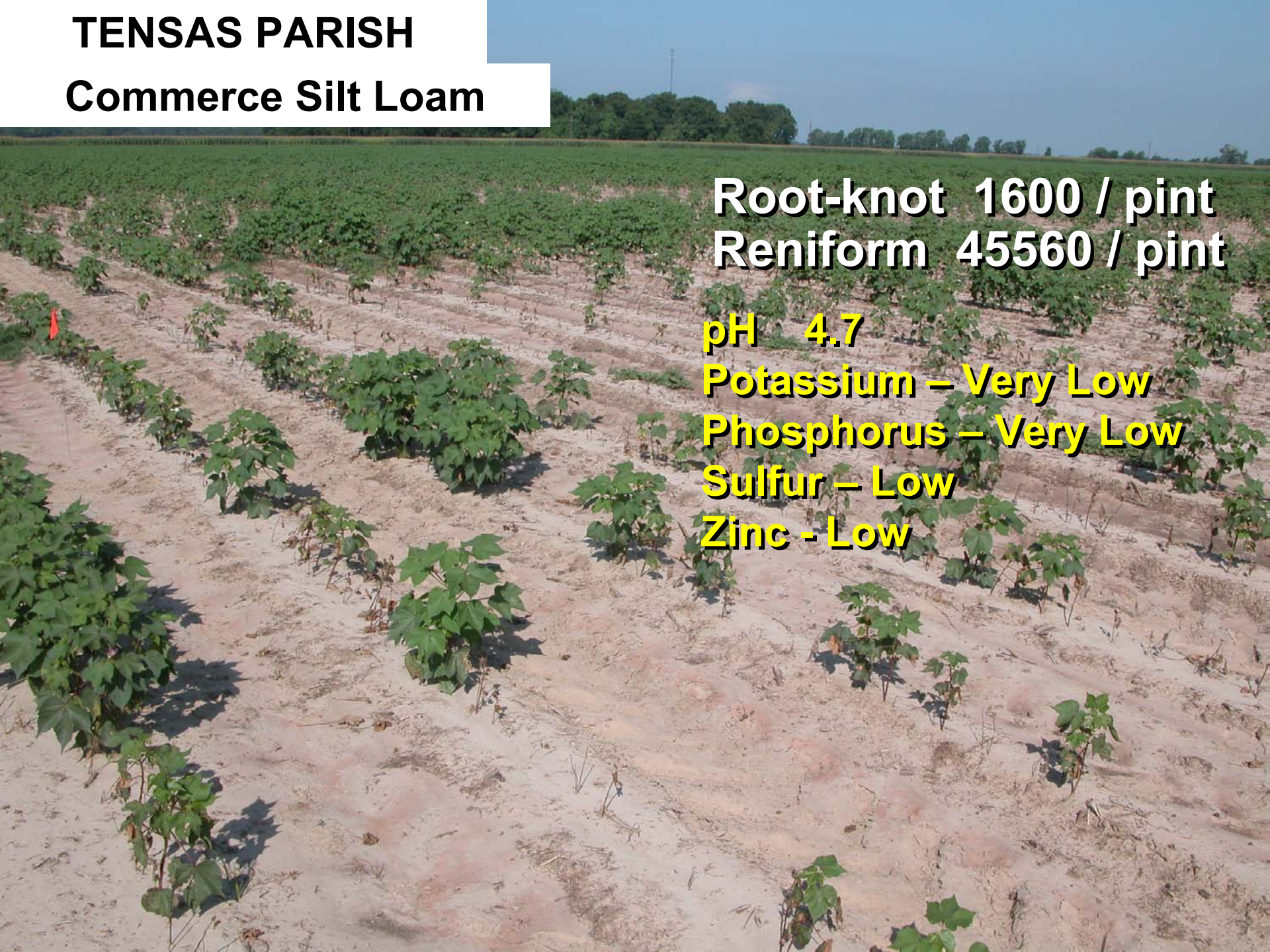

TENSAS PARISH
Commerce “Silt Loam”
Root-knot Stunting
Sulfur, Potassium, Zinc
Issues

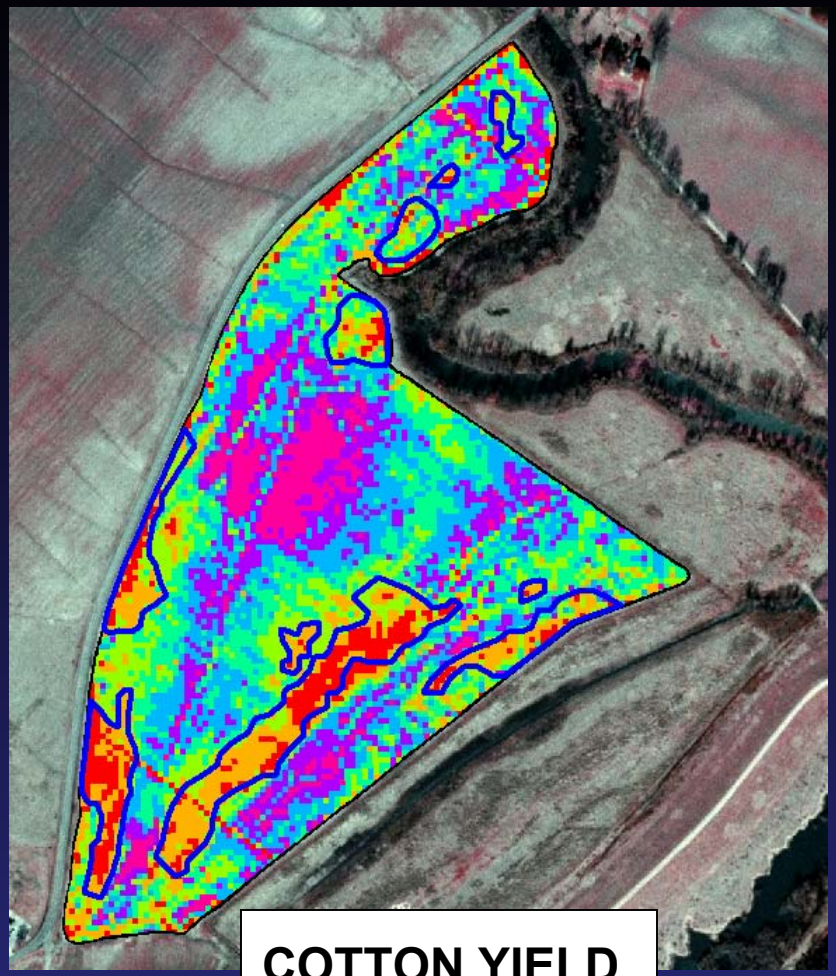

TENSAS PARISH
Commerce “Silt Loam”
3060 Rootknot
1620 Rootknot
900 Rootknot
1440 Rootknot

AVOYELLES PARISH

Roxana Fine Sandy Loam




TENSAS PARISH
Commerce Silt Loam
Root-knot 1600 / pint
Reniform 45560 / pint
pH 4.7
Potassium – Very Low
Phosphorus – Very Low
Sulfur – Low
Zinc - Low



COTTON YIELD

Low

High

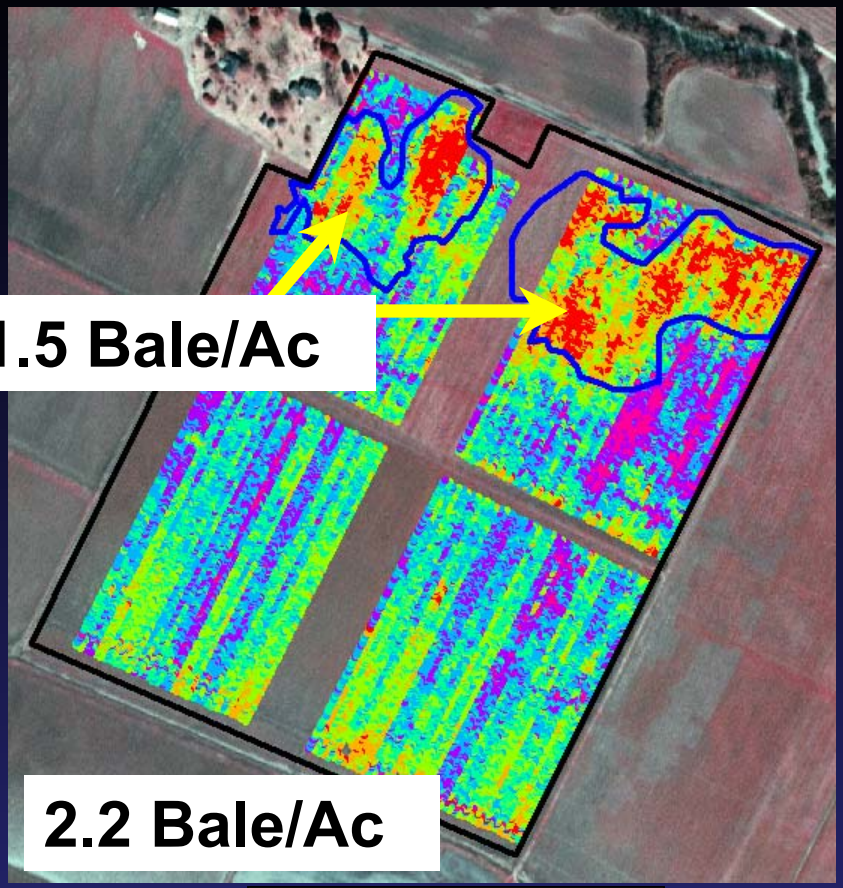
LOW YIELD

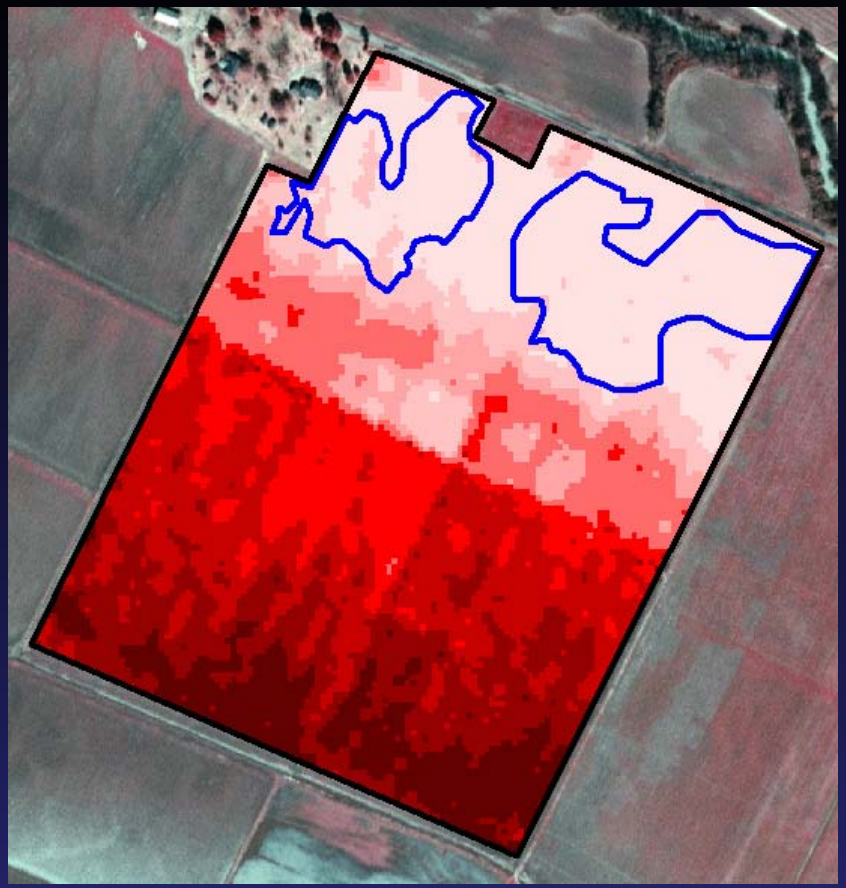
DEEP EC

Low

High

LOW YIELD





COTTON YIELD

Low

High

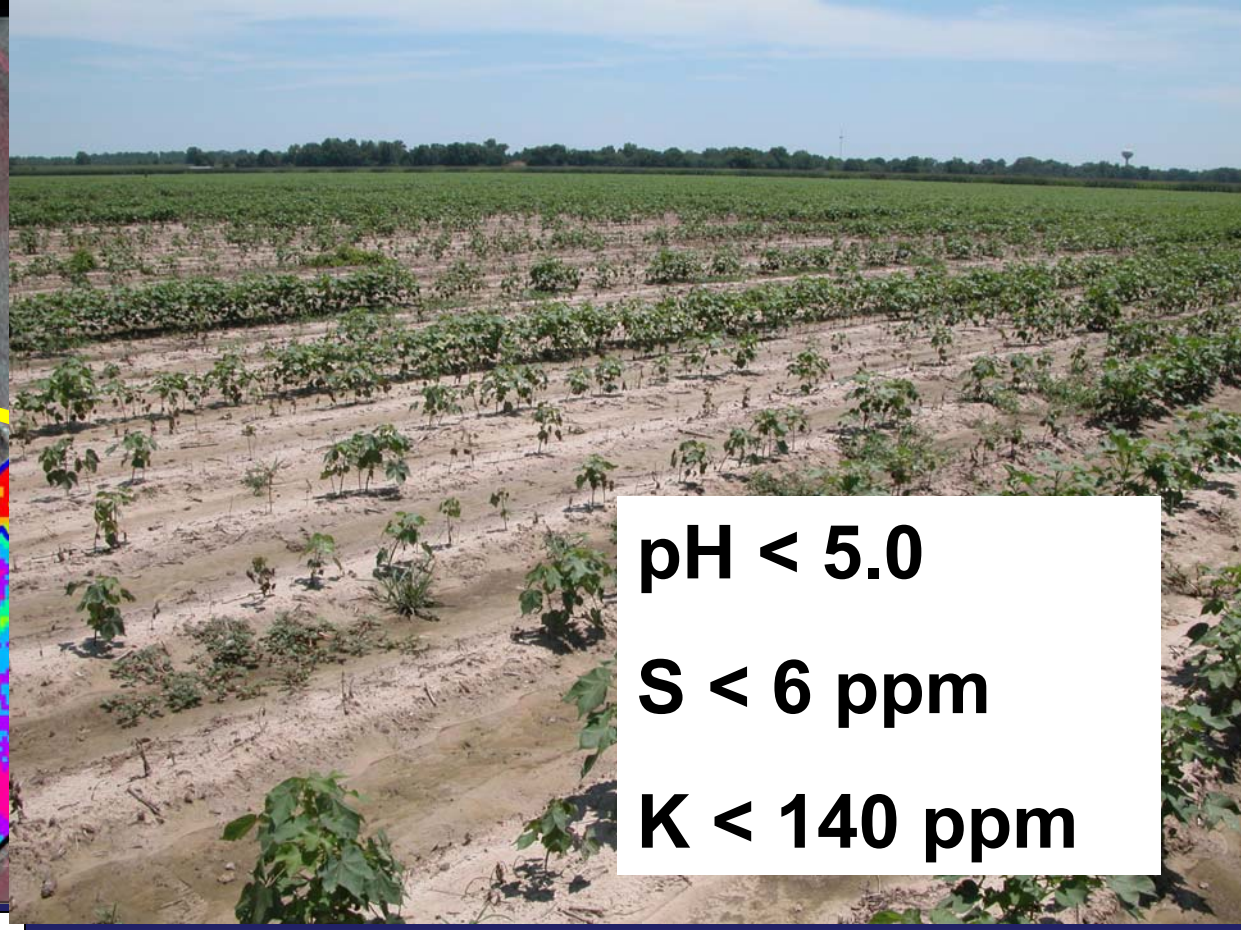
LOW YIELD

DEEP EC

Low

High

LOW YIELD



pH < 5.0

S < 6 ppm

K < 140 ppm

COTTON YIELD

Low

High

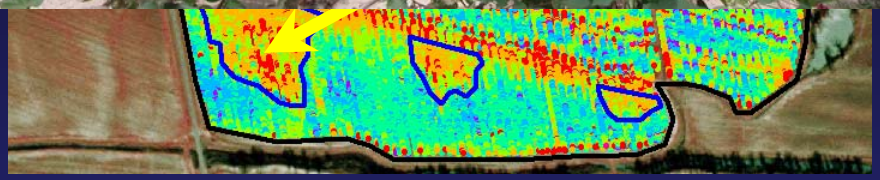
LOW YIELD

DEEP EC

Low

High

LOW YIELD

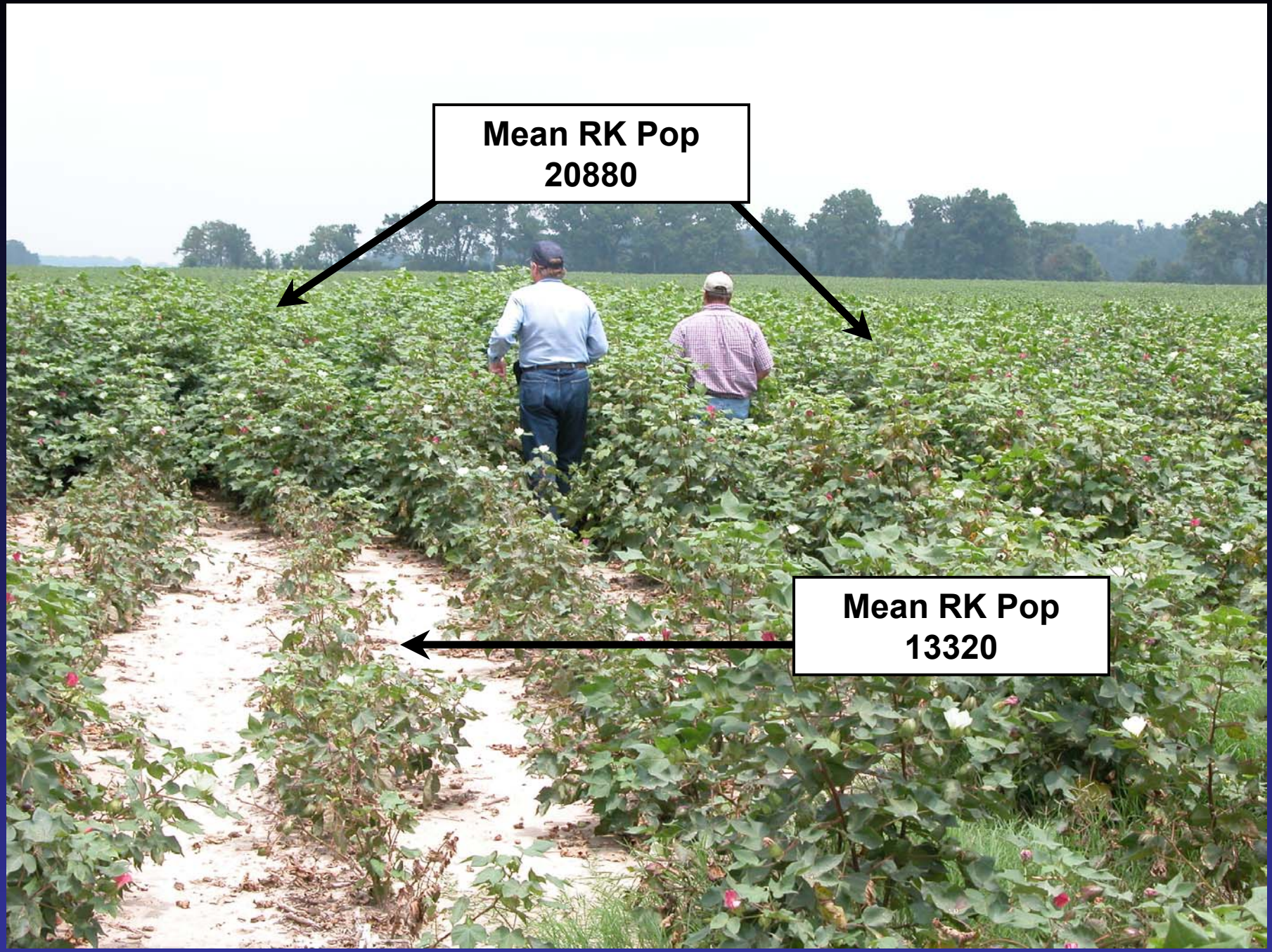


COTTON YIELD

- Low
- High
- LOW YIELD

DEEP EC

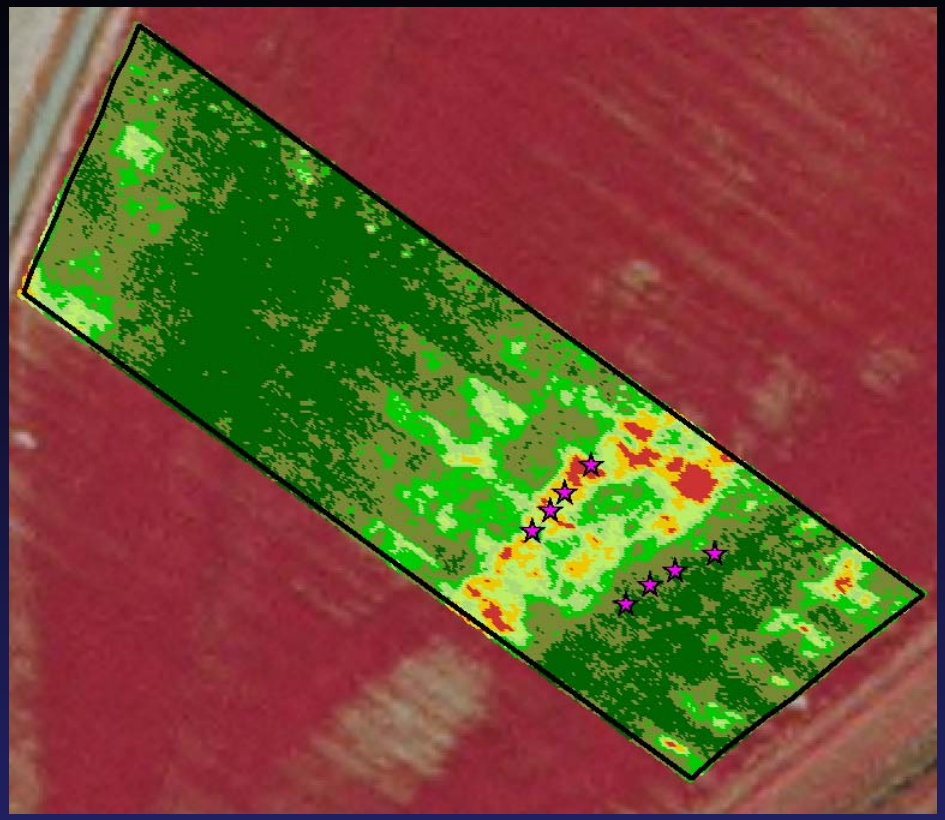
- Low
- High
- LOW YIELD

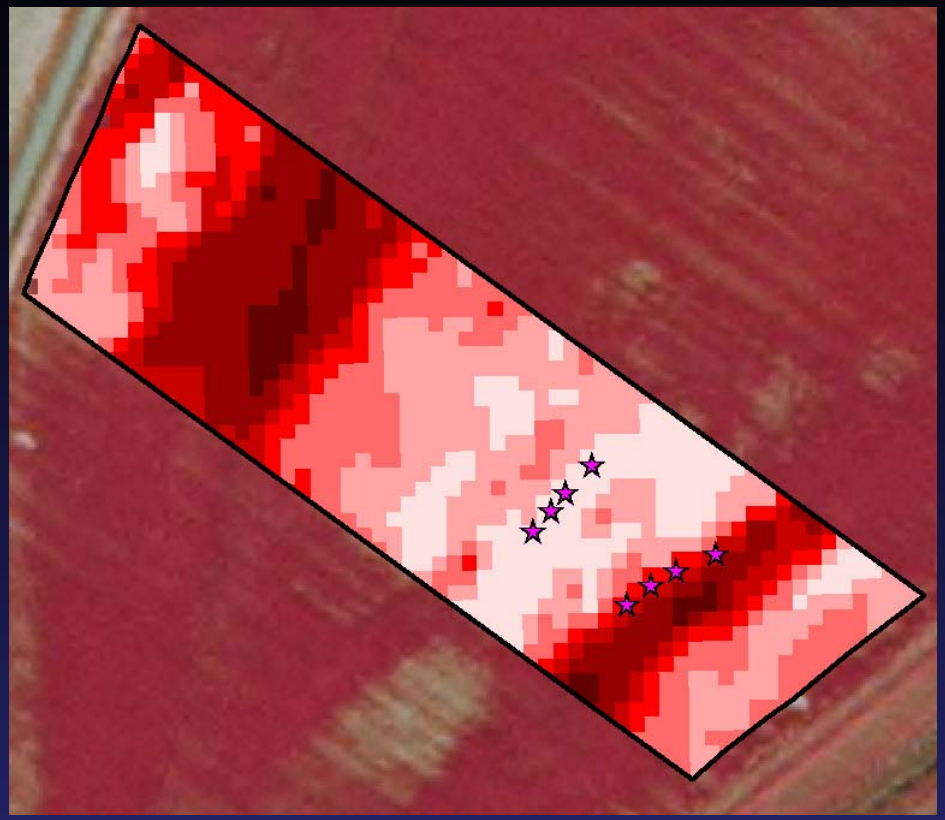

Mean RK Pop
20880
Mean RK Pop
13320

TENSAS PARISH PANOLA FIELD 2005

NEMATODE AND SOIL TEST RESULTS

STATUS	RK POP	SOIL pH	SOIL OM	SOIL K PPM	SOIL S PPM	SOIL ZN PPM
WEAK AREA	13320	5.2	0.56	90	3.71	0.44
STRONG AREA	20880	6.1	0.94	100	6.04	0.55





NDVI

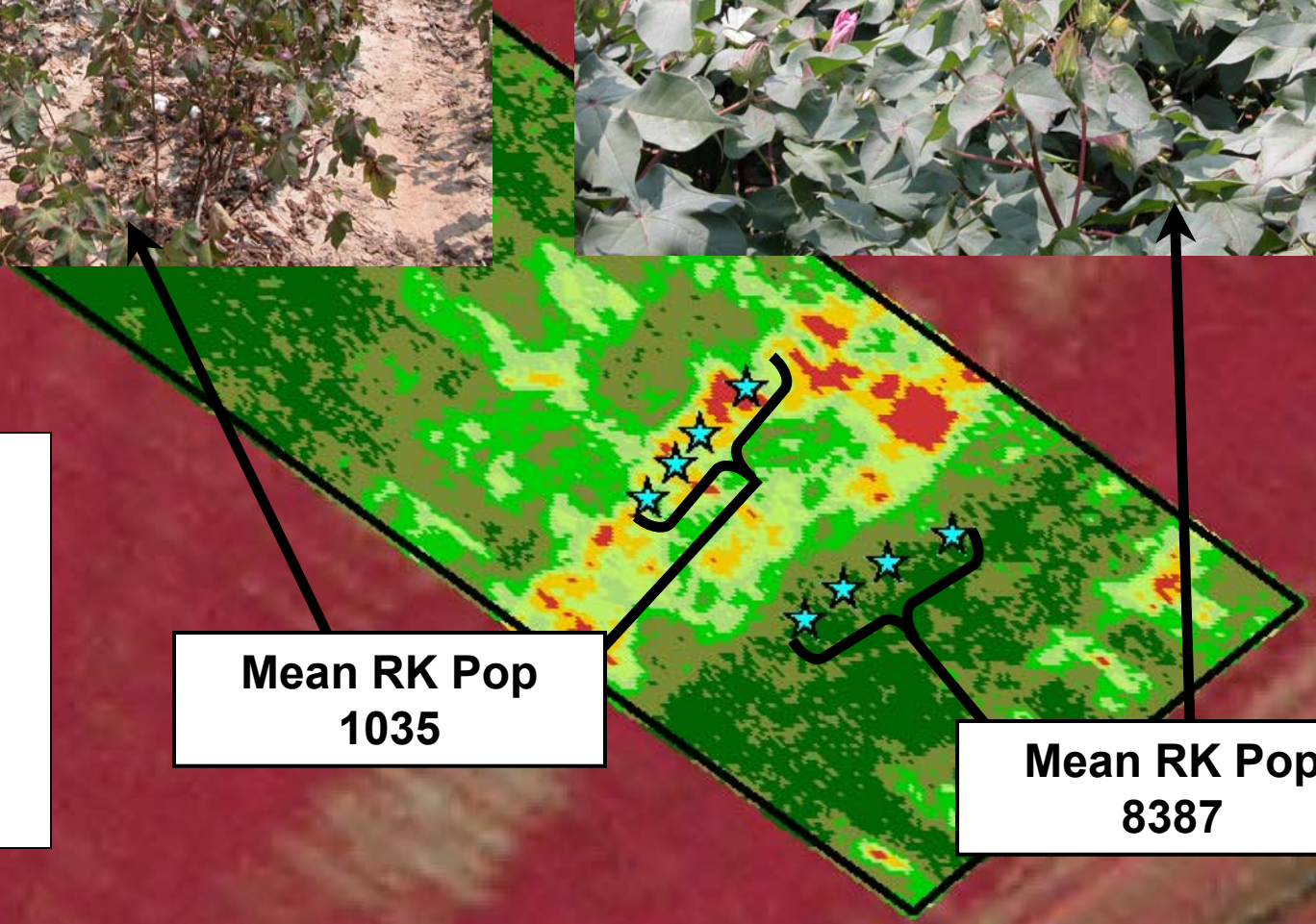
Low

High

DEEP EC

Low

High



NDVI

Low

High

Mean RK Pop 1035

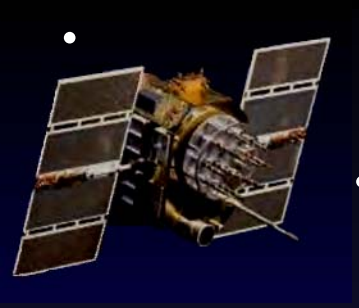
Mean RK Pop 8387

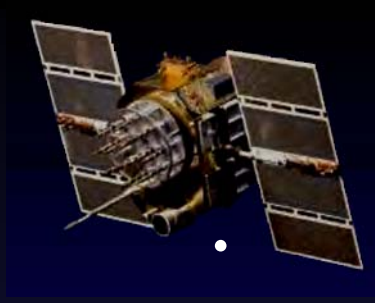
TENSAS PARISH LEVEE FIELD 2005

NEMATODE AND SOIL TEST RESULTS

STATUS	RK POP	SOIL pH	SOIL OM	SOIL K PPM	SOIL S PPM	SOIL ZN PPM
WEAK AREA	1035	4.76	0.62	119	3.53	0.45
STRONG AREA	8387	5.41**	1.20**	186**	4.47**	0.78**

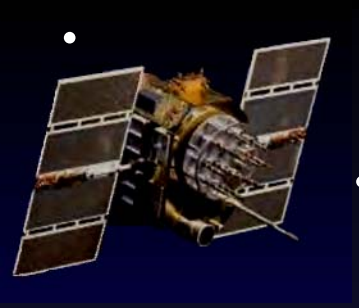
** P > .01

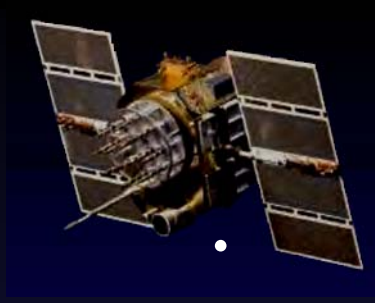




“Ice Cream Soil Syndrome”

Low-yielding areas in what should be very productive soils





“Ice Cream Soil Syndrome”

Roxana very fine sandy loam

Commerce silt loam

Bruin silt loam

Dundee silt loam

Sterlington silt loam

cotton

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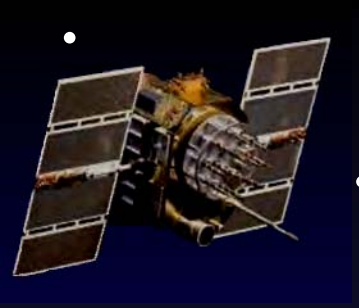
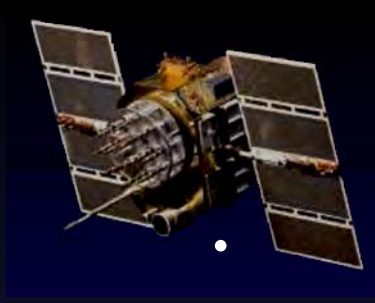
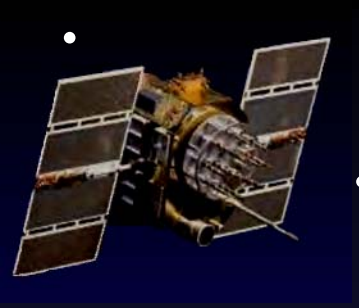
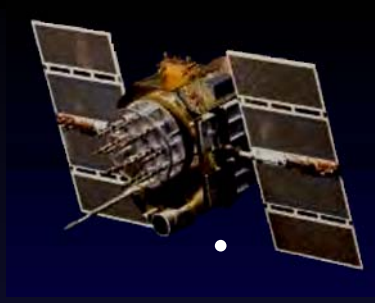




“Ice Cream Soil Syndrome”

- Damaging levels of root-knot nematode, reniform nematode, or both





“Ice Cream Soil Syndrome”

One or more soil fertility issues

Low pH

Low K

Low Sulfur

Low Zinc

IDENTIFYING and MANAGING MULTIPLE STRESSES IN COTTON

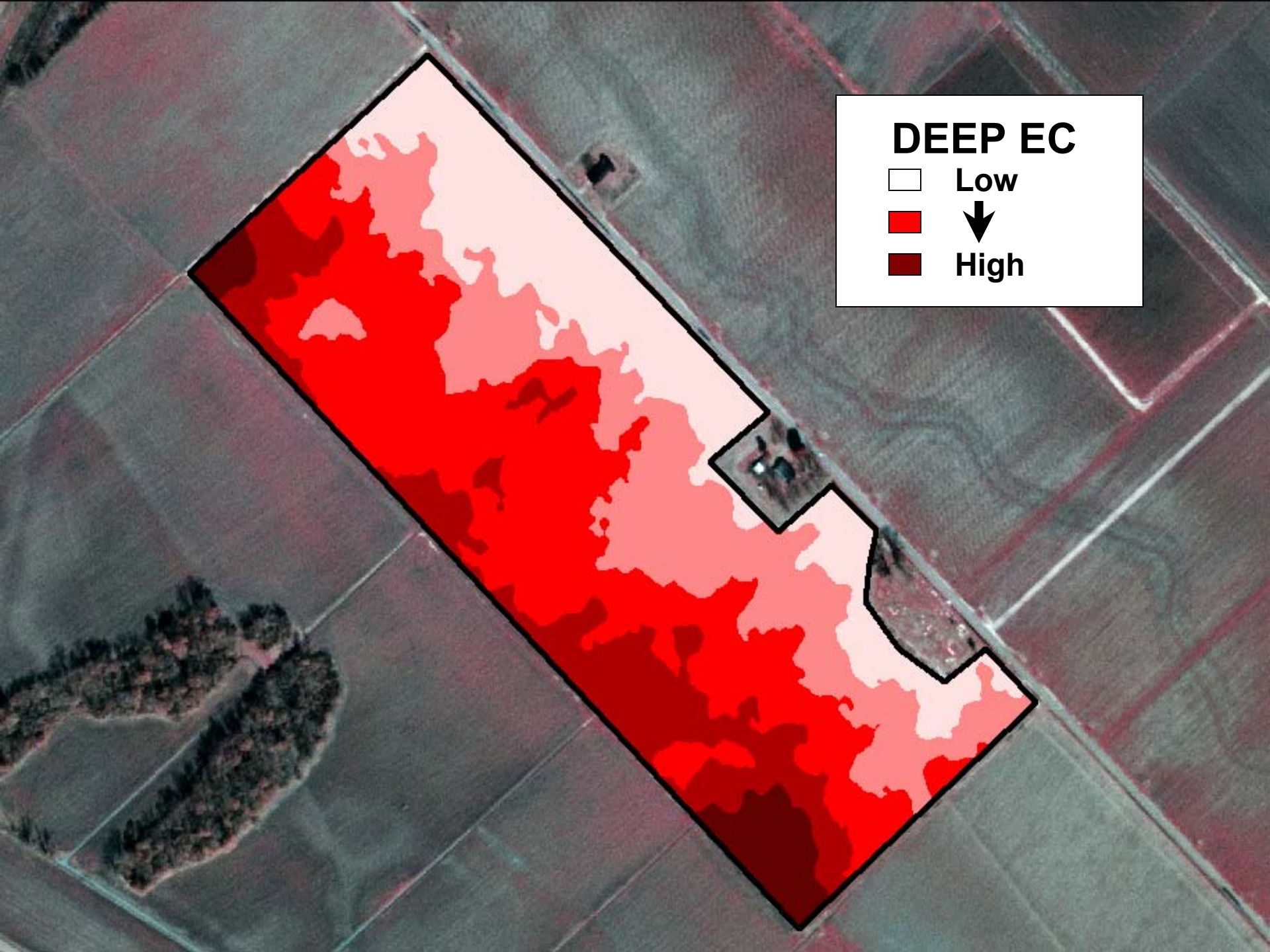
The Potential for Site-Specific Management

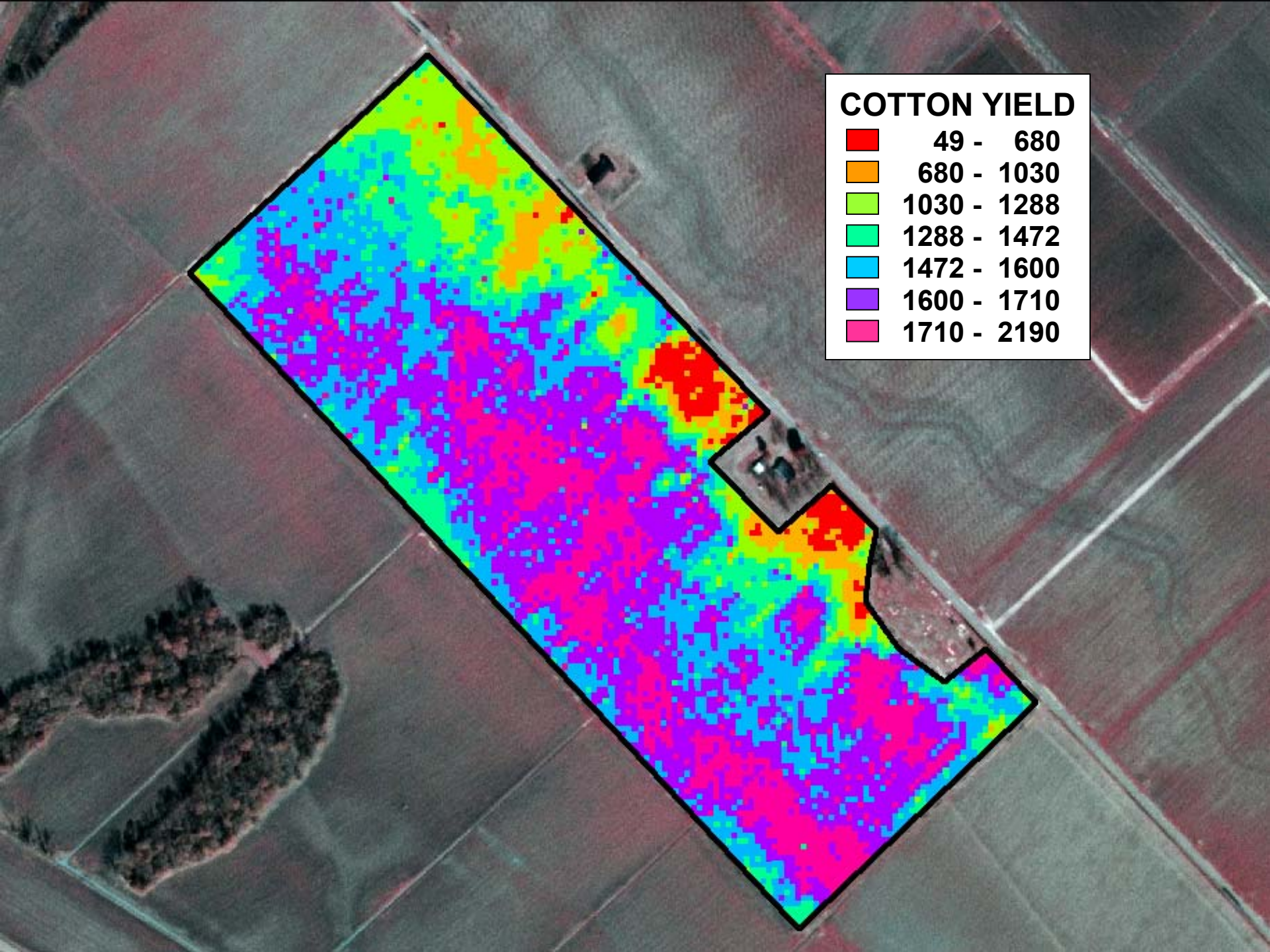
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

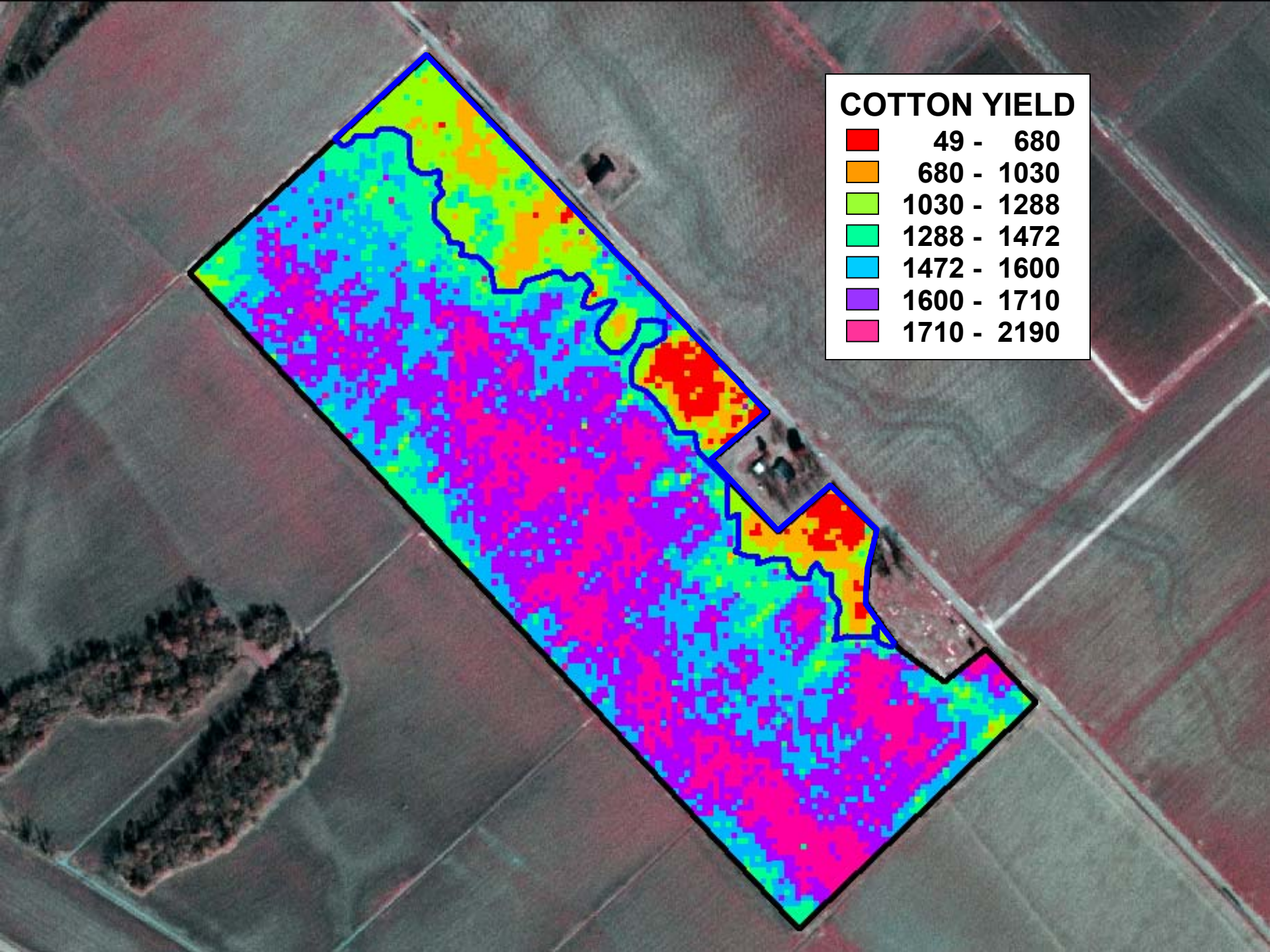
cotton

LSU AgCenter Research & Extension


78 Acres


DEEP EC
Low
High


COTTON YIELD
49 - 680
680 - 1030
1030 - 1288
1288 - 1472
1472 - 1600
1600 - 1710
1710 - 2190


COTTON YIELD
49 - 680
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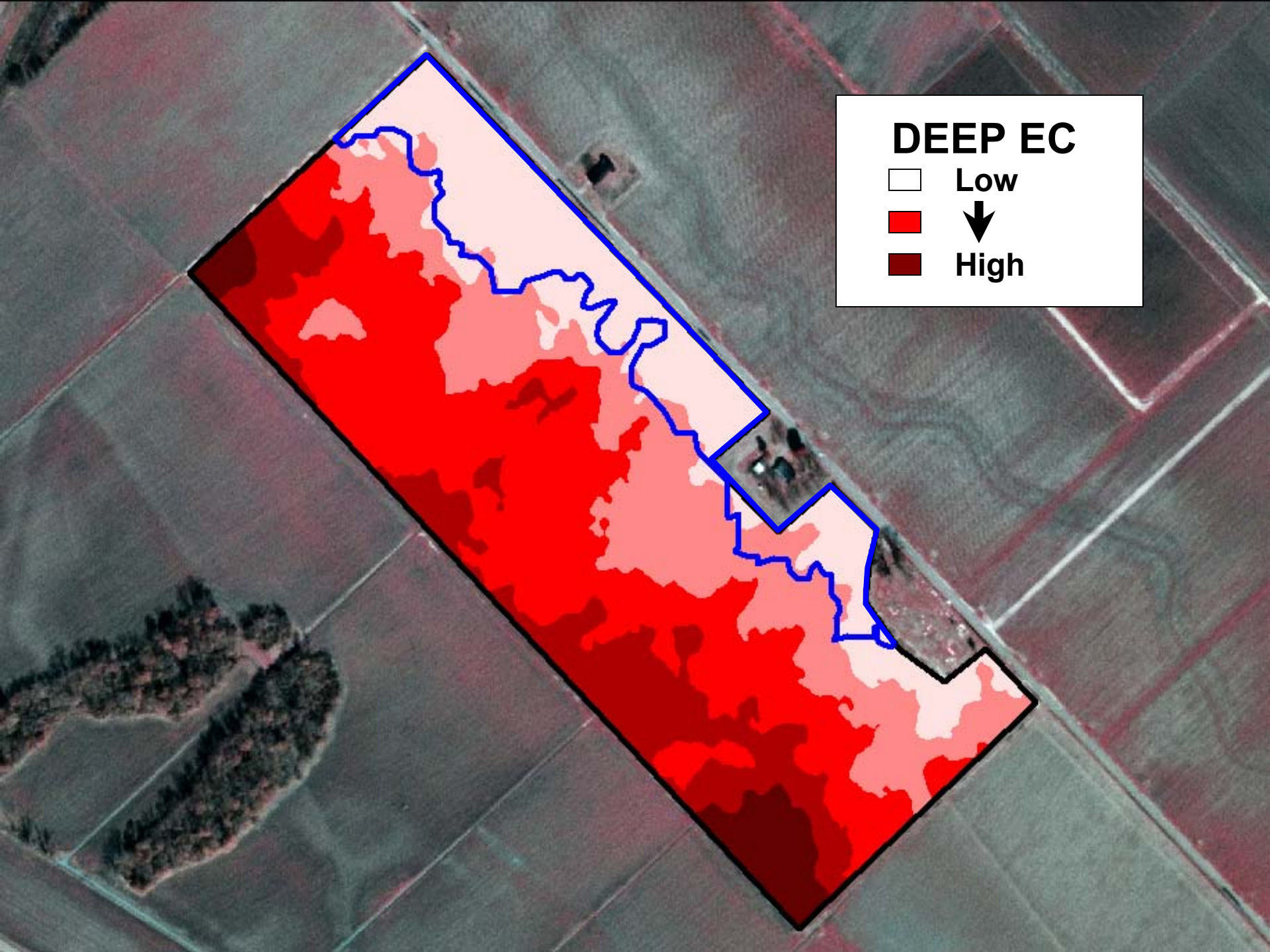
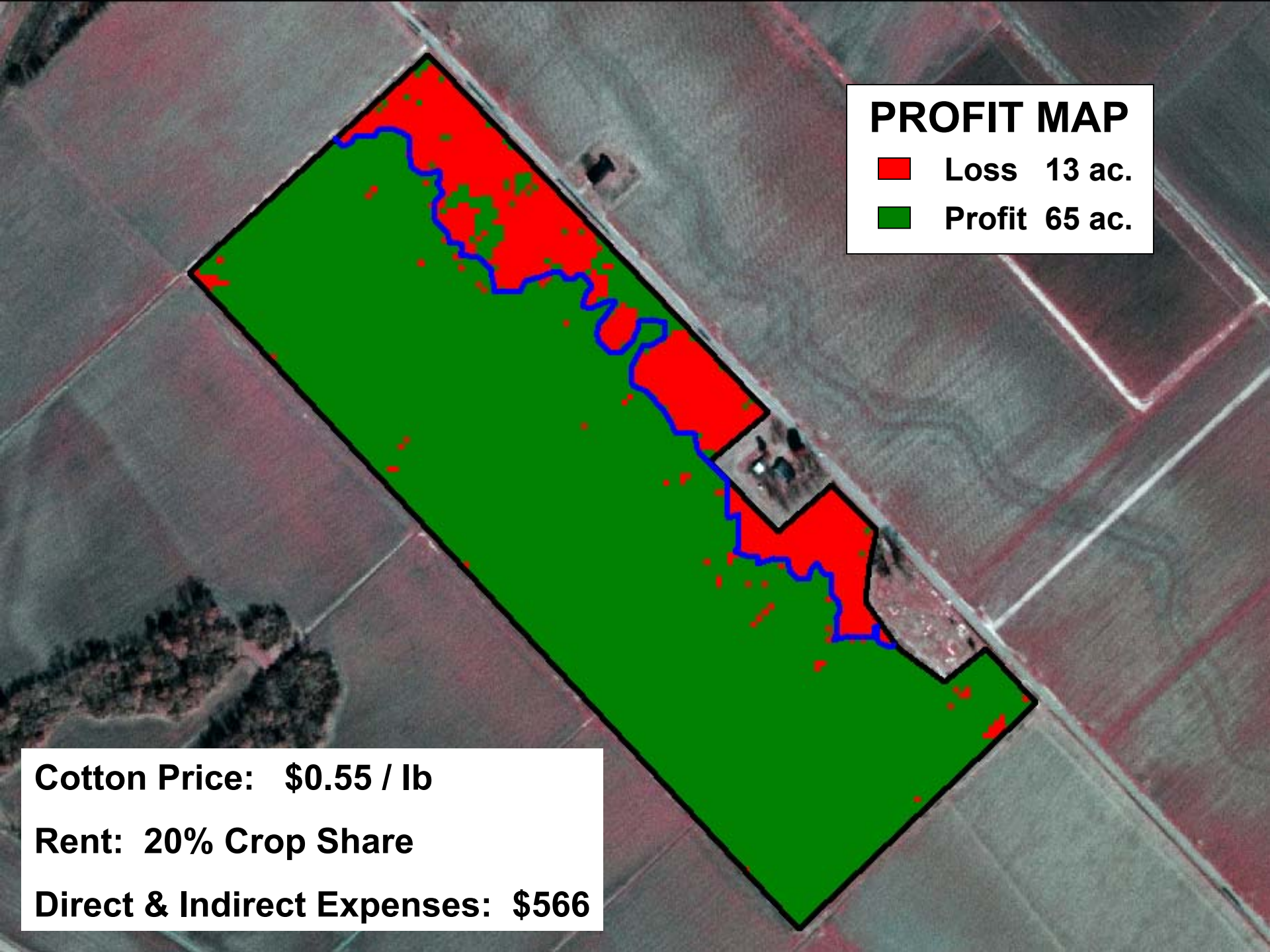
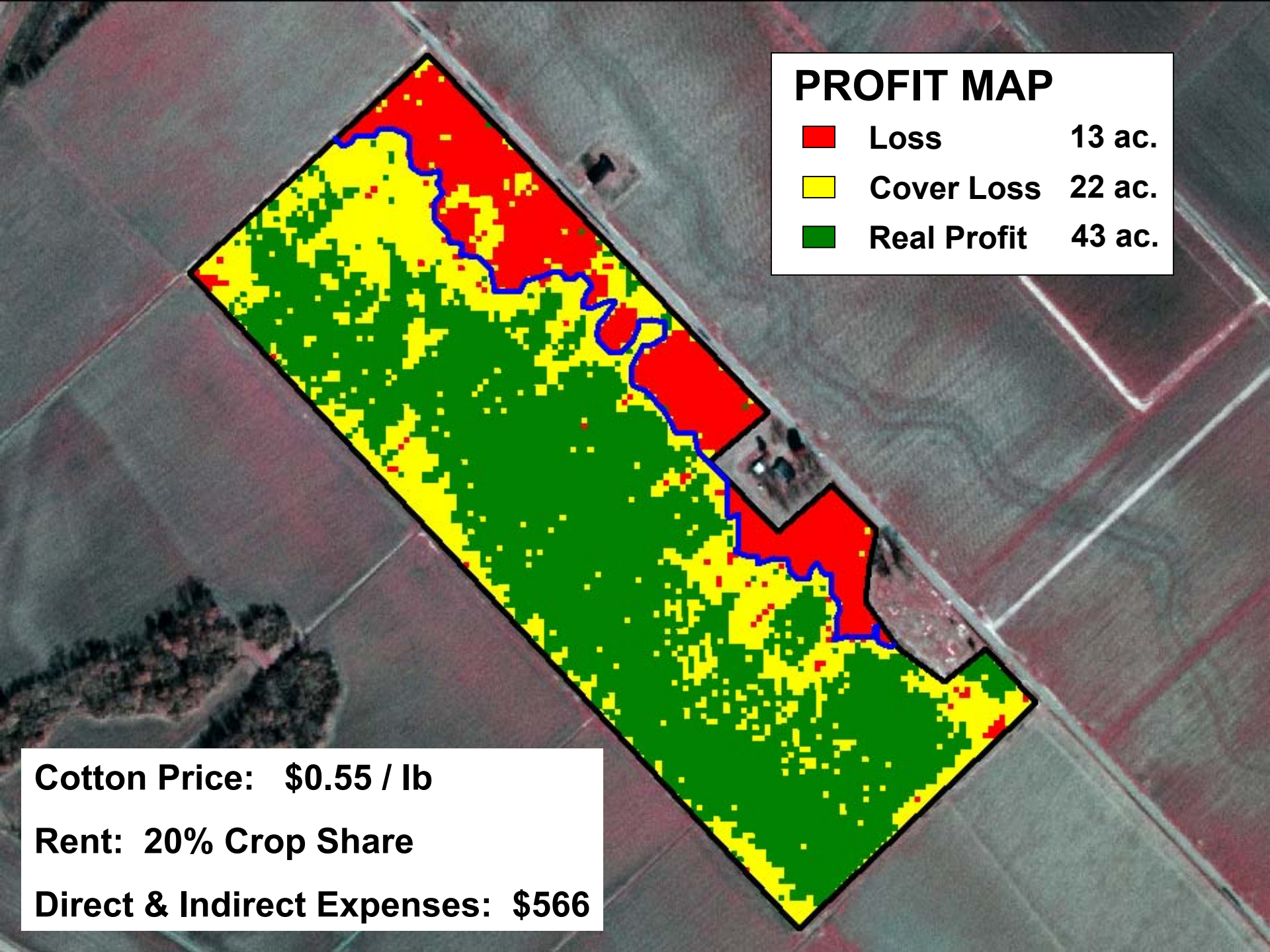
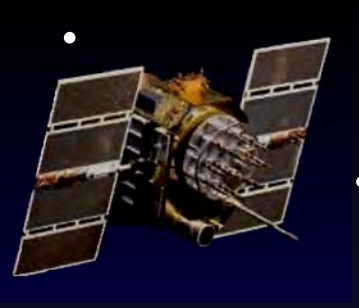
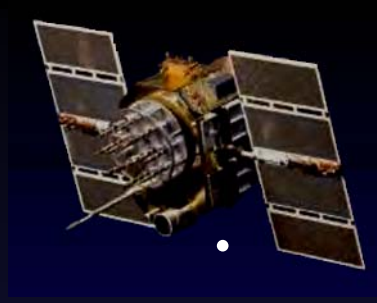

DEEP EC
Low
High


PROFIT MAP
Loss 13 ac.
Profit 65 ac.
Cotton Price: $0.55 / lb
Rent: 20% Crop Share
Direct & Indirect Expenses: $566


PROFIT MAP
Loss 13 ac.
Cover Loss 22 ac.
Real Profit 43 ac.
Cotton Price: $0.55 / lb
Rent: 20% Crop Share
Direct & Indirect Expenses: $566





Site-Specific Nematode Management Research

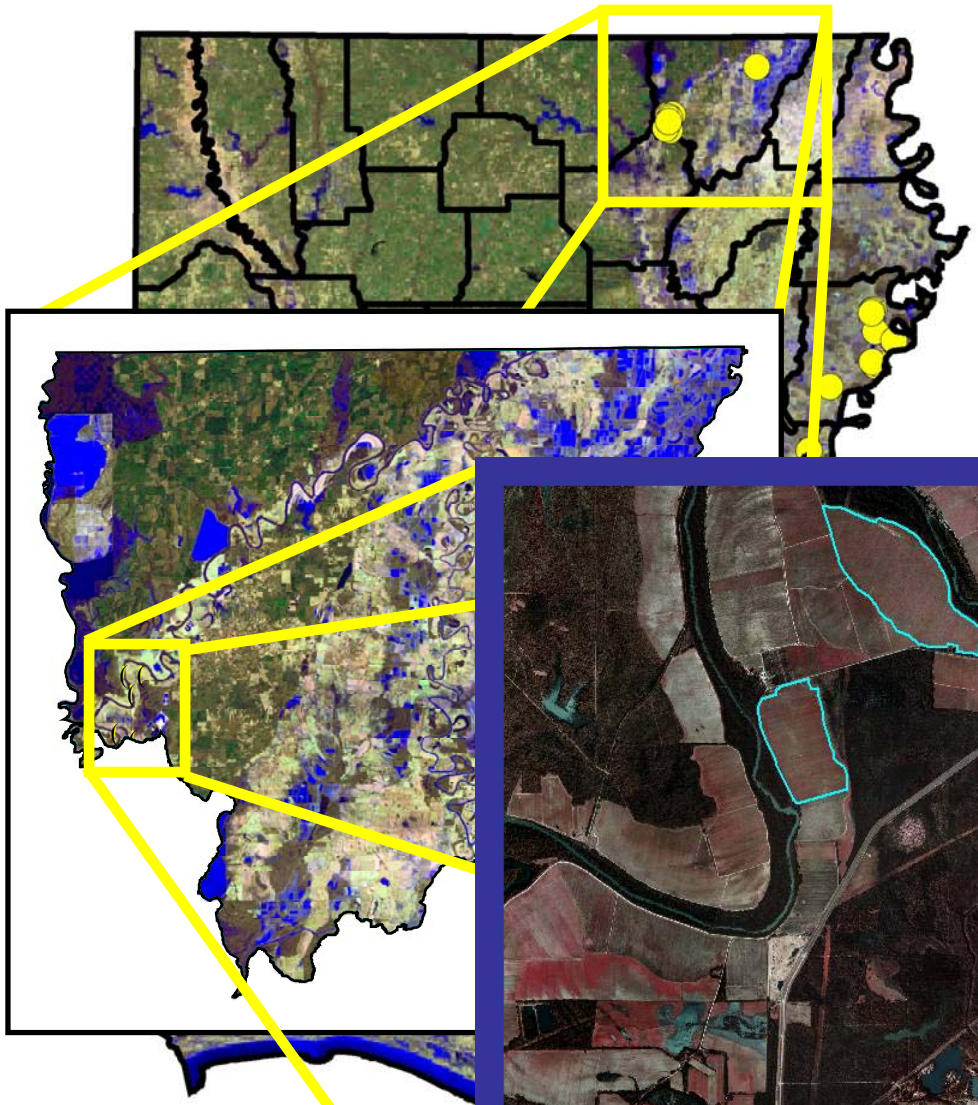
Cotton Yield Response and Nematode Population Issues

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

cotton

LSU AgCenter Research & Extension

Site-Specific Nematode Field Research Locations 2004-2007



Holley Farms

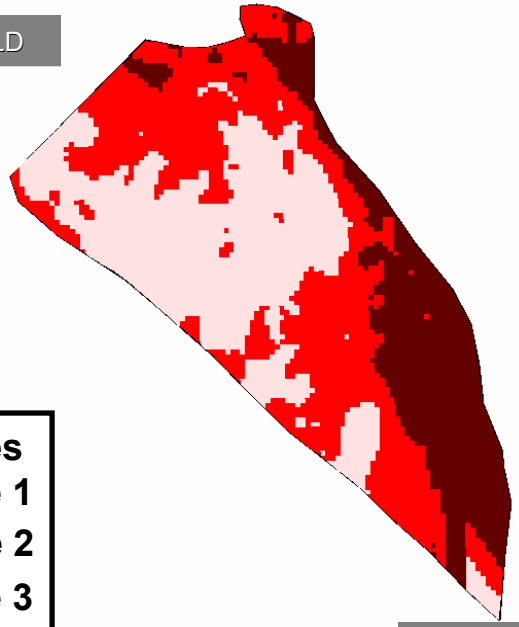
Bastrop, LA

Ouachita River Soil

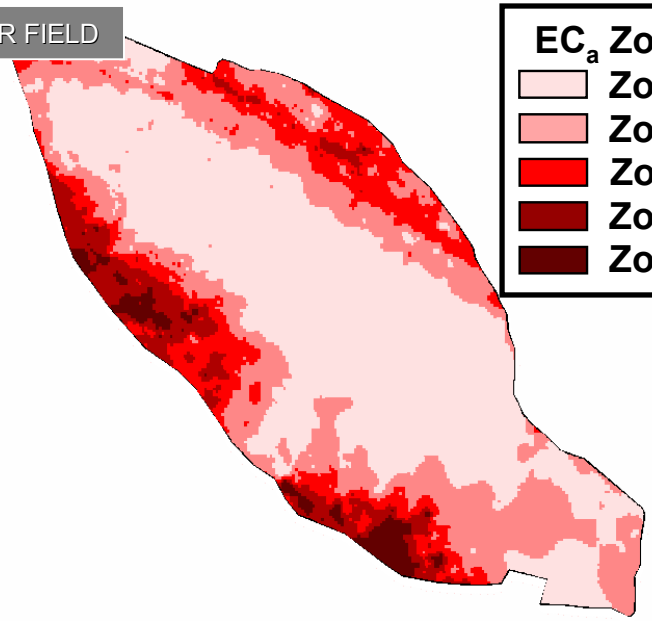
LSU AgCenter Research & Extension

Test locations in 2006

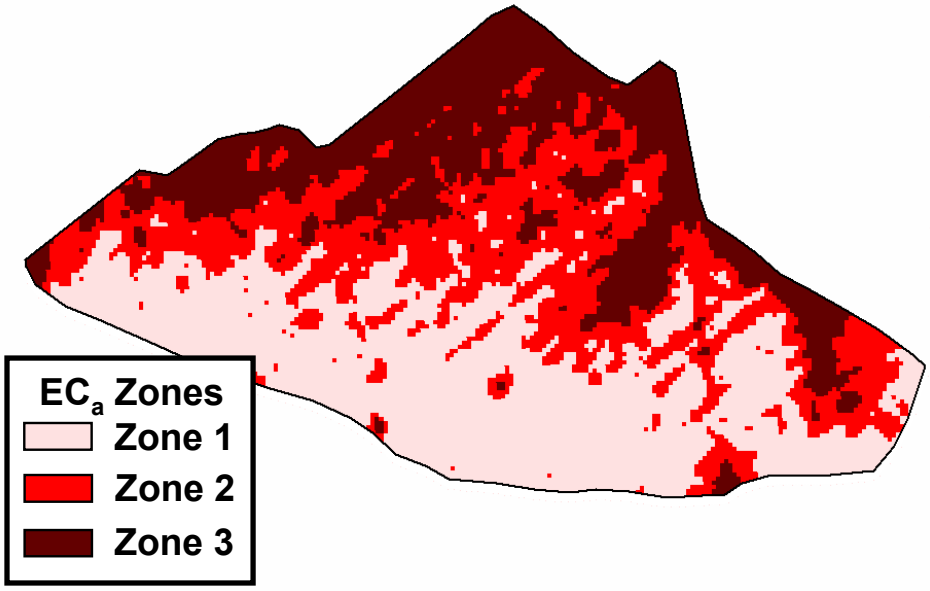
PERRY FIELD



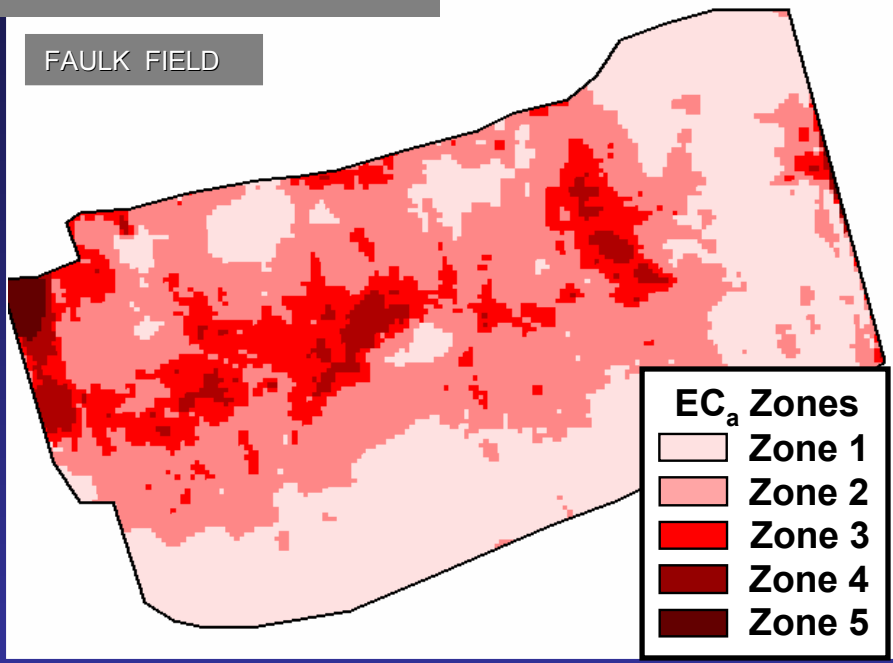
SPYKER FIELD



RAILROAD FIELD



FAULK FIELD



MOREHOUSE PARISH, LOUISIANA

Lint yield (lb/a) with and without Telone II

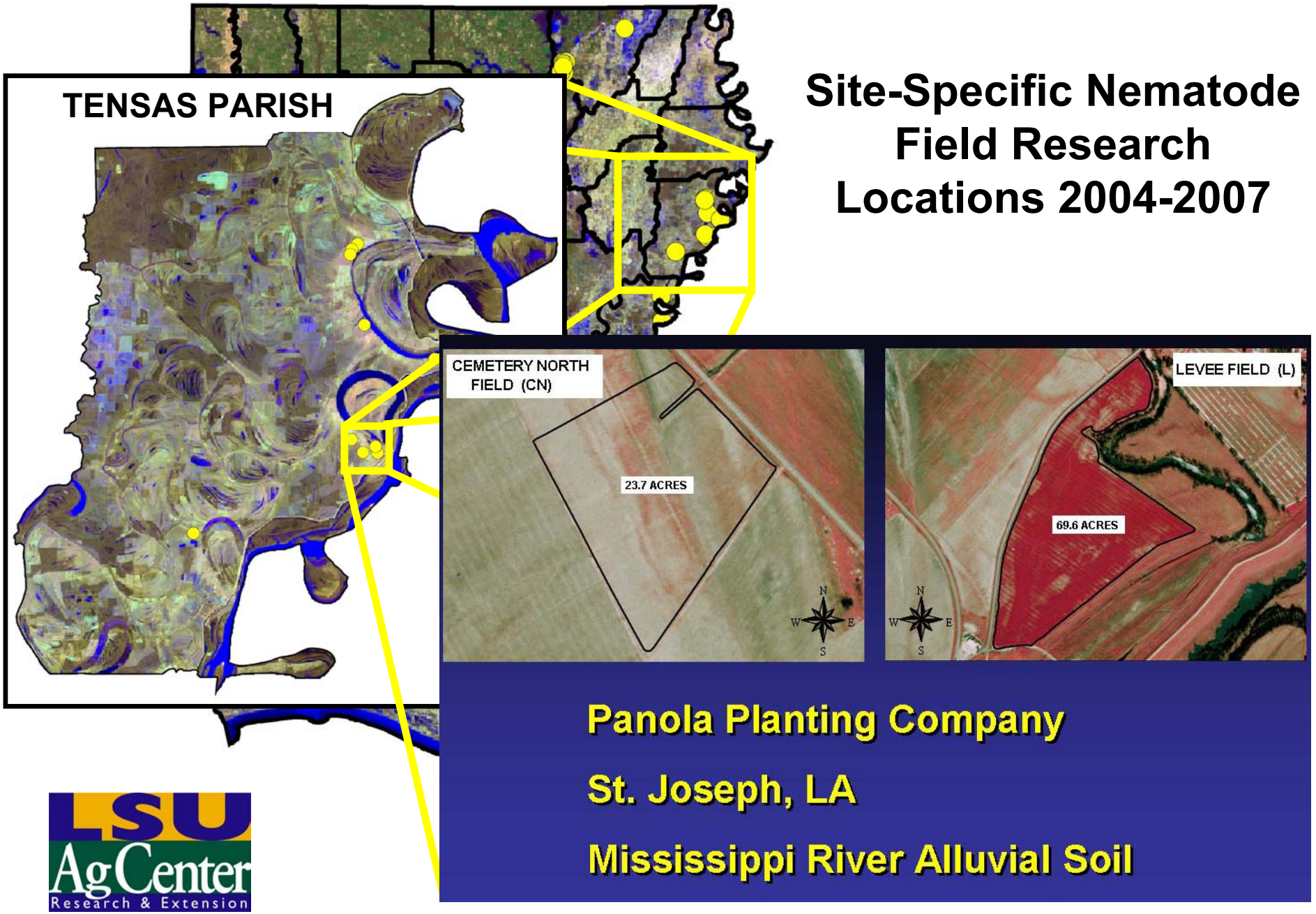
Field	Telone II	No Telone II	Diff.
RR Cut Zone 1	1093.2	783.2	310
RR Cut Zone 2	1125.3	851.5	275
RR Cut Zone 3	1137.0	939.9	197
Spyker Field Zone 1	1208.8	982.5	226
Spyker Field Zone 2	1152.8	1027.6	125
Faulk Field Zone 1	1081.8	908.0	174
Perry Cut Zone 1	1290.7	966.7	324

LSU Agricultural Center

Overstreet, Wolcott, Erwin, & Letlow

Avg. 233#/Ac

Site-Specific Nematode Field Research Locations 2004-2007



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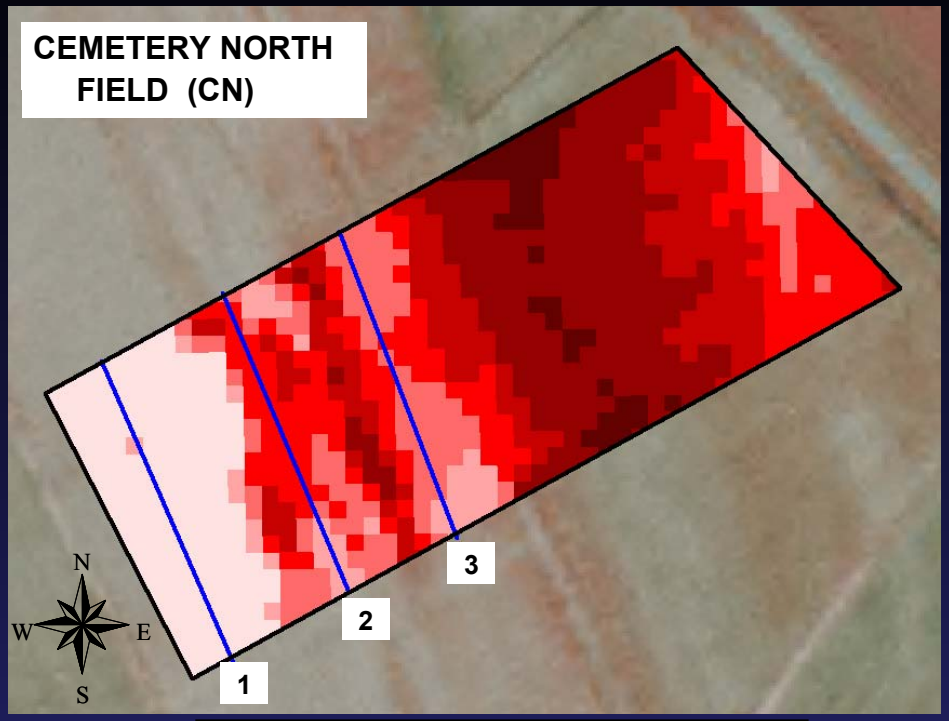
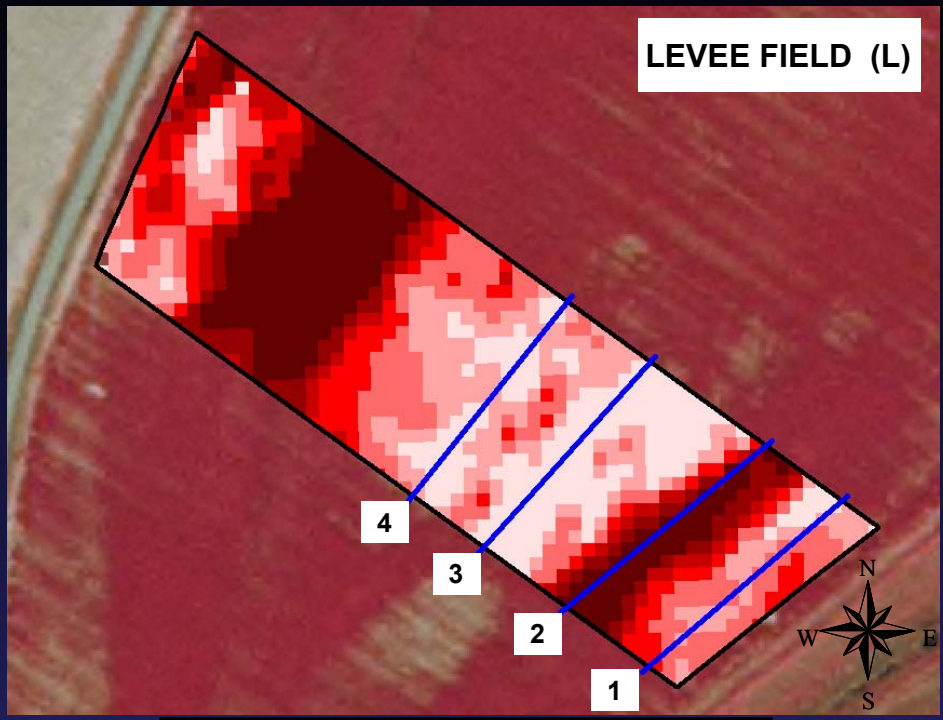




$EC_{a\text{-}dp}$ Zones

Zone 1	21.9 – 49.9 mS/m
Zone 2	49.9 – 74.1 mS/m
Zone 3	74.1 – 92.6 mS/m
Zone 4	92.6 – 110.3 mS/m
Zone 5	110.3 – 128.5 mS/m
Zone 6	128.5 – 147.9 mS/m
Zone 7	147.9 – 196.1 mS/m

SAMPLE TRANSECT

$EC_{a\text{-}dp}$ Zones

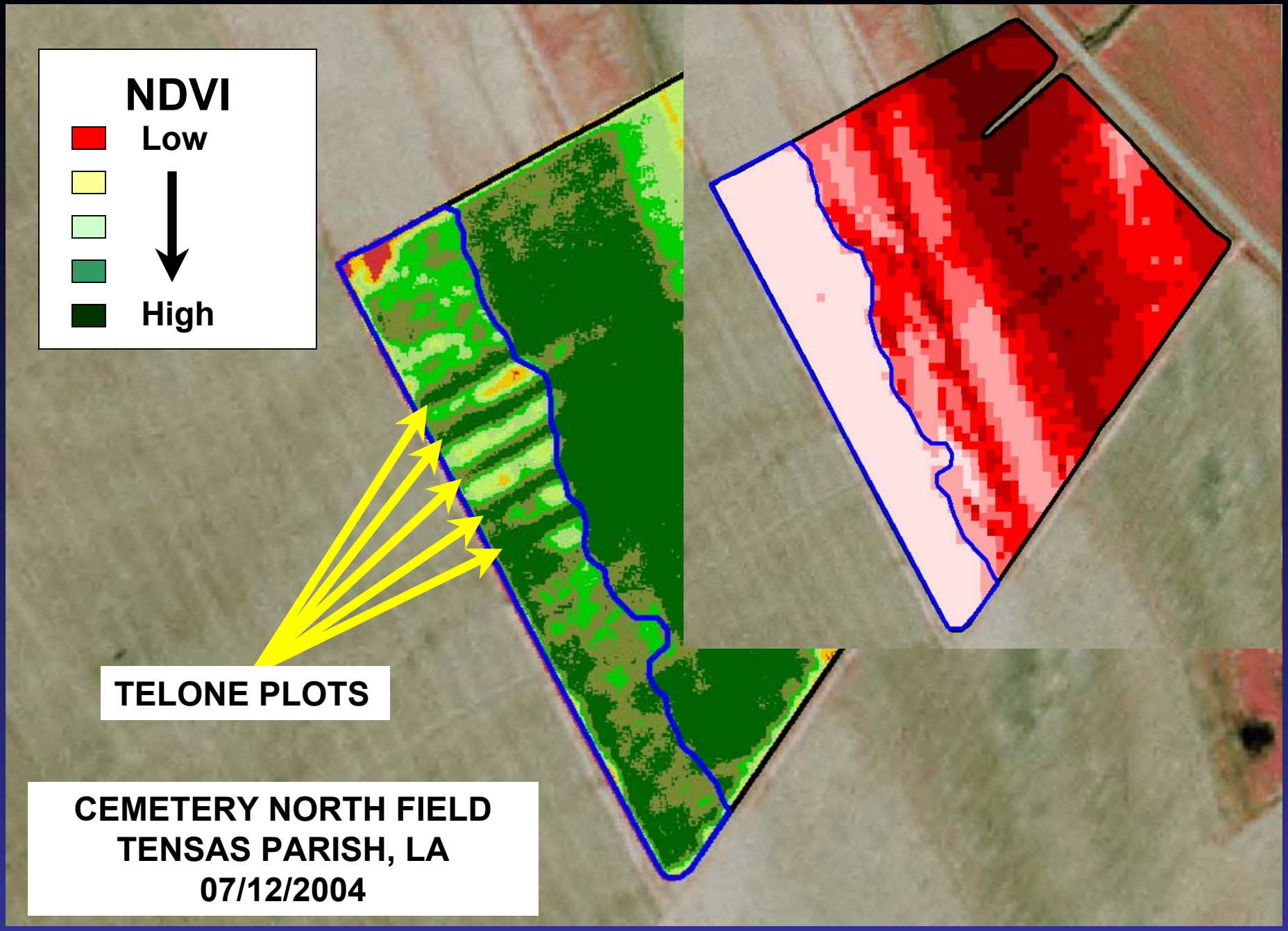
Zone 1	4.1 – 13.0 mS/m
Zone 2	13.0 – 16.6 mS/m
Zone 3	16.6 – 21.0 mS/m
Zone 4	21.0 – 25.8 mS/m
Zone 5	25.8 – 31.7 mS/m
Zone 6	31.7 – 40.0 mS/m
Zone 7	40.0 – 72.8 mS/m

SAMPLE TRANSECT

LEGEND

TELONE @ 3 gal/ac

NO TELONE


NDVI
Low
High
TELONE PLOTS
CEMETERY NORTH FIELD
TENSAS PARISH, LA
07/12/2004

- John Deere 6 row
- Microwave Sensors
- Greenstar II System
- USDA – ARS Yield Editor
- SSToolbox

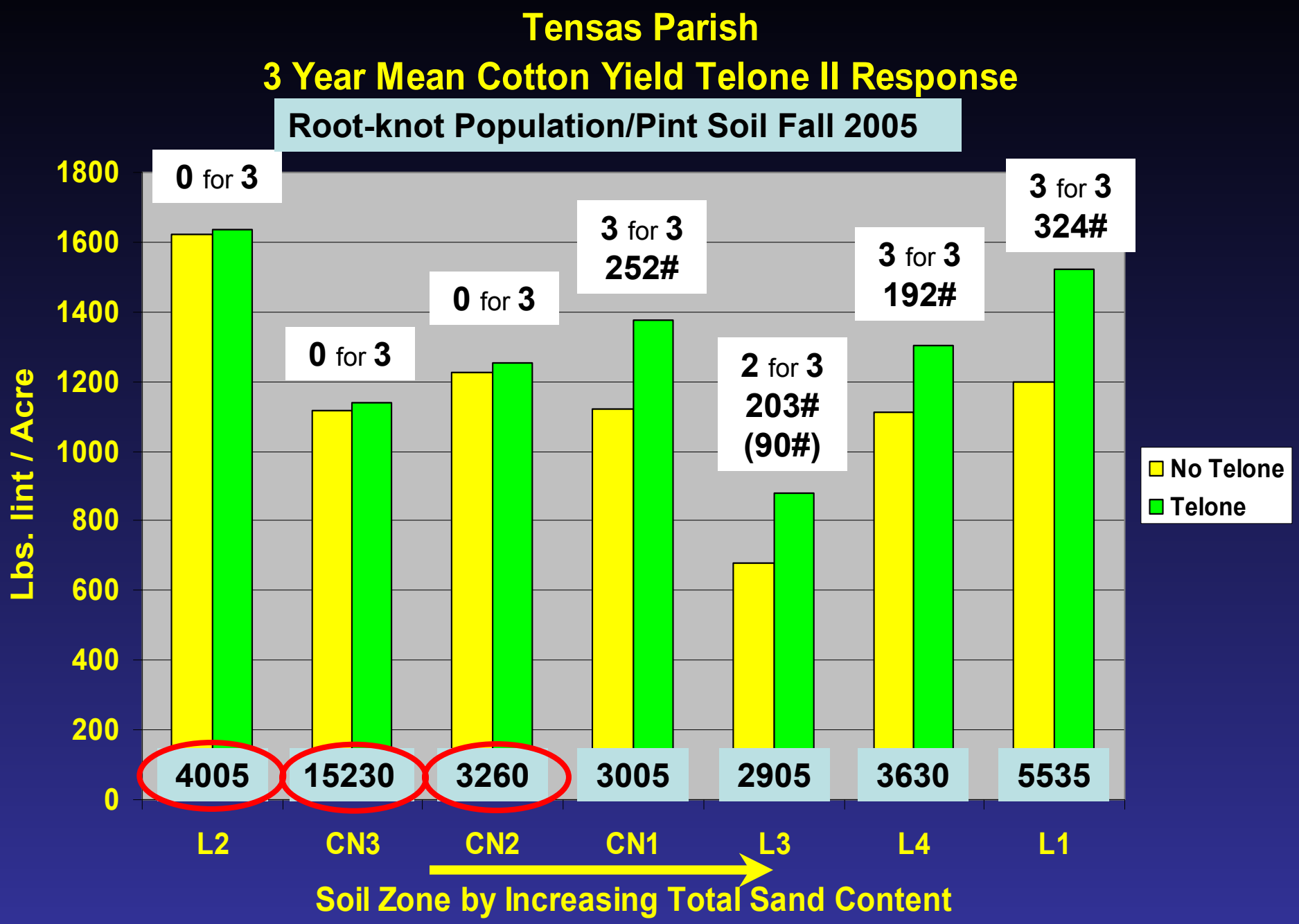
Results

- Cotton yield response to nematicides such as Telone was not the same across EC (soil texture) zones

- Yield responses were observed in only the lower EC (lighter textured, less clay) zones

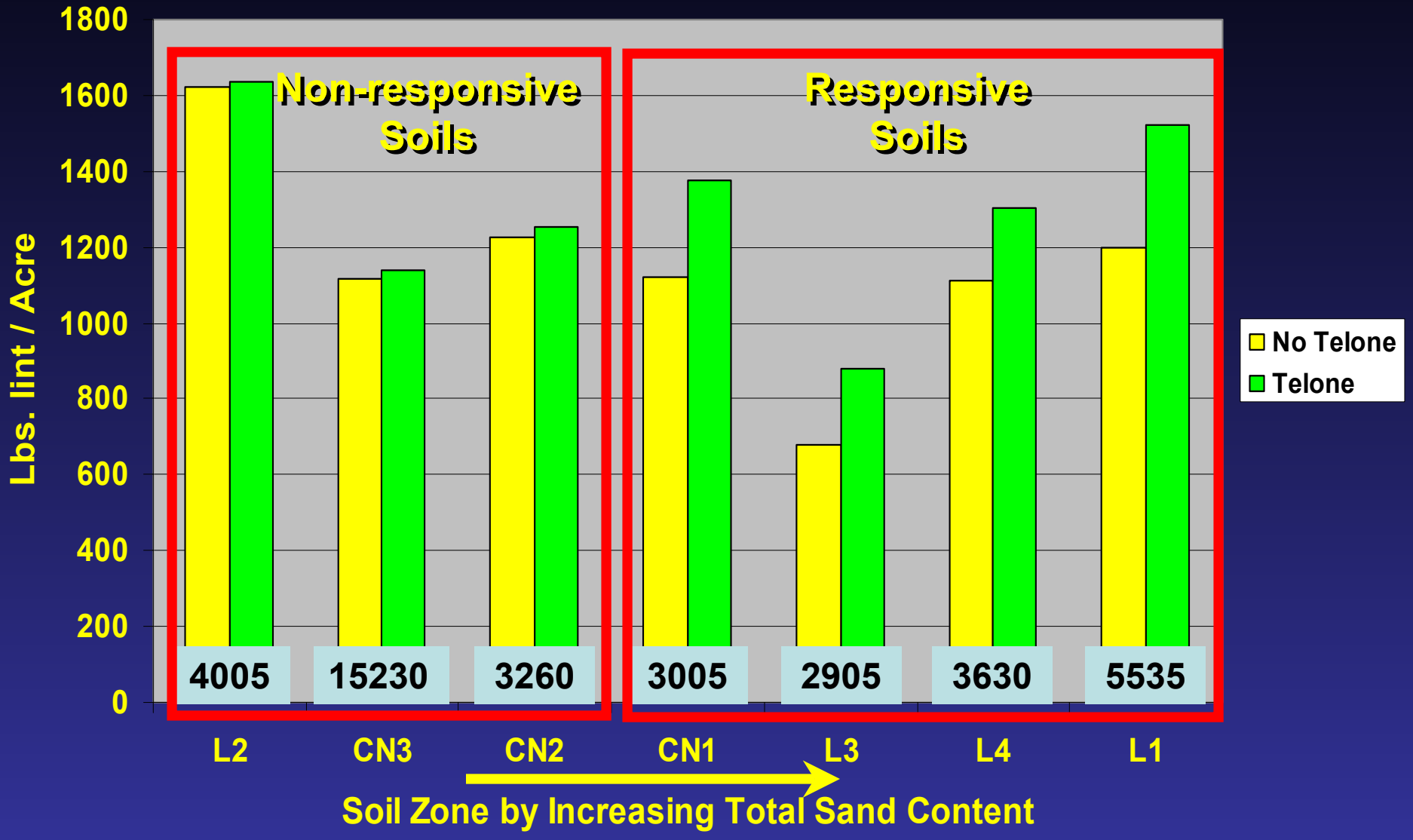
Results

- Optimum yields were obtained on some soils in spite of the presence of nematode populations previously considered to be potentially “extremely” damaging


Tensas Parish
3 Year Mean Cotton Yield Telone II Response
Root-knot Population/Pint Soil Fall 2005
Lbs. lint / Acre
1800
1600
1400
1200
1000
800
600
400
200
0
0 for 3
0 for 3
0 for 3
3 for 3
252#
2 for 3
203#
(90#)
3 for 3
192#
3 for 3
324#
4005
15230
3260
3005
2905
3630
5535
L2
CN3
CN2
CN1
L3
L4
L1
No Telone
Telone
Soil Zone by Increasing Total Sand Content

Tensas Parish
3 Year Mean Cotton Yield Telone II Response

Root-knot Population/Pint Soil Fall 2005

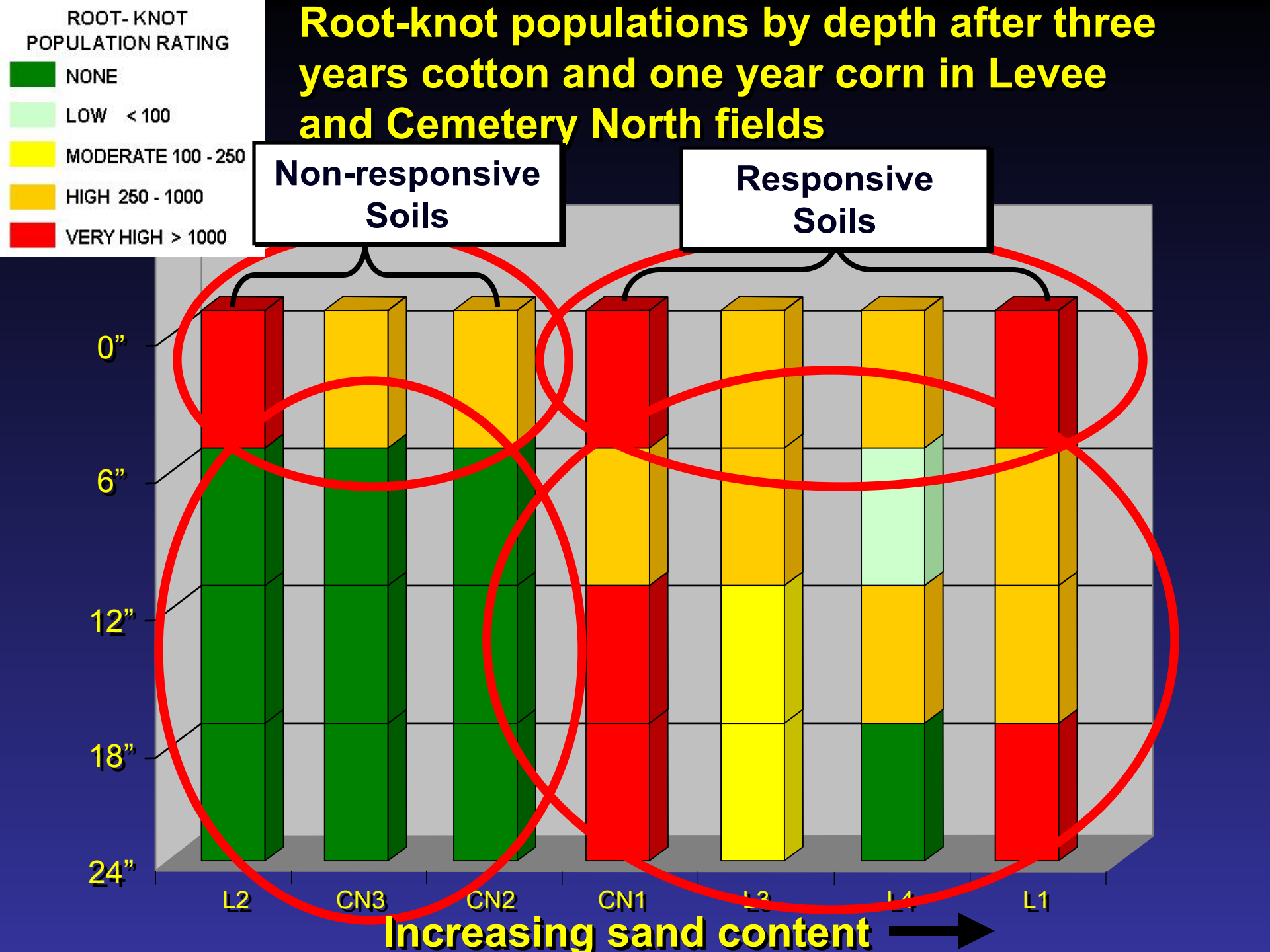


WHY???

METHODS

- In Aug. 2007, sampled soil zones to depth of 24 inches in 6 inch increments
- Samples replicated 4x per soil zone
- GPS sample locations – check plots
- Nematode population analysis
- Particle size analysis
- Soil nutrient analysis

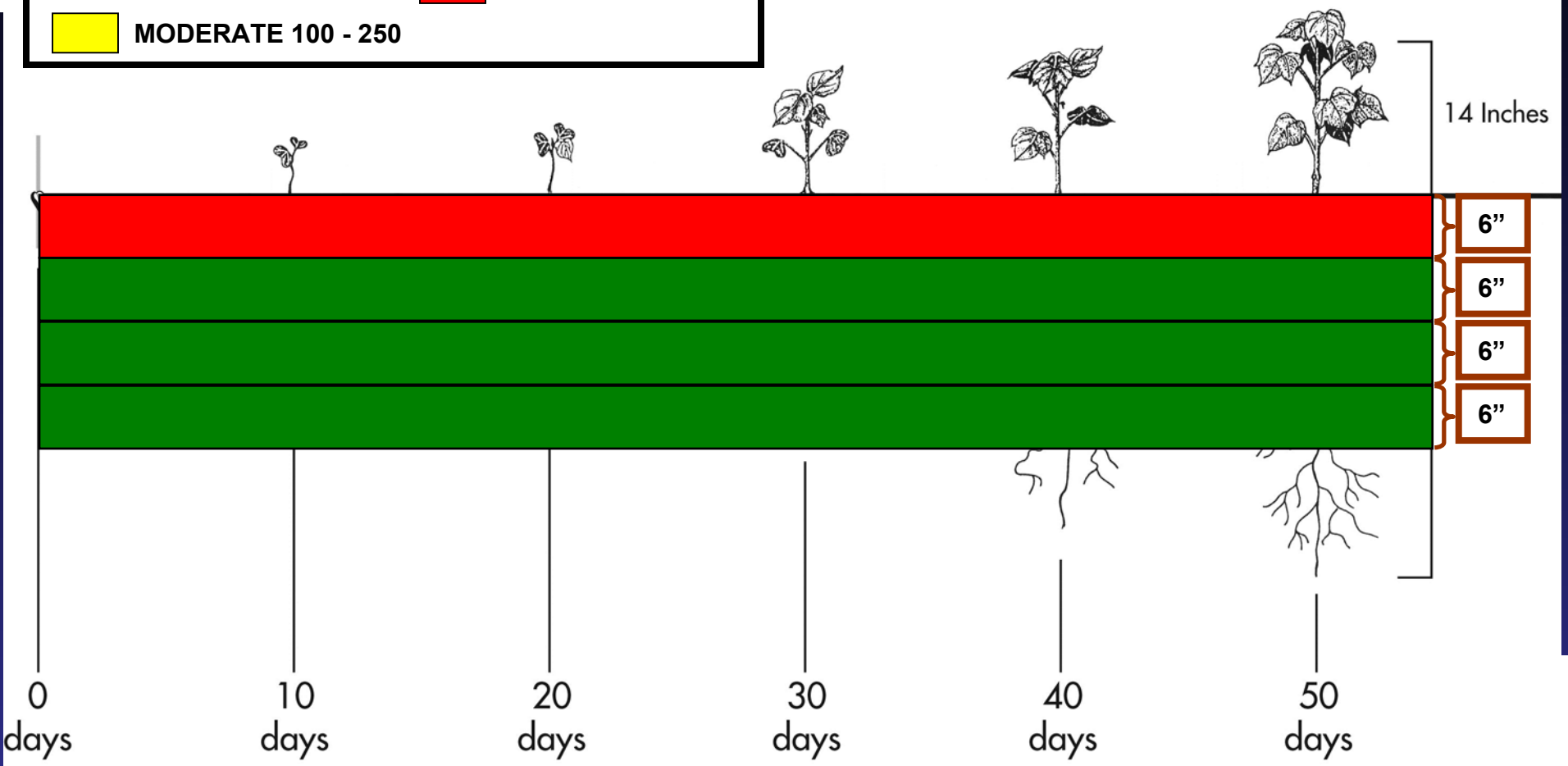
Root-knot populations by depth after three years cotton and one year corn in Levee and Cemetery North fields



EARLY SEASON COTTON DEVELOPMENT

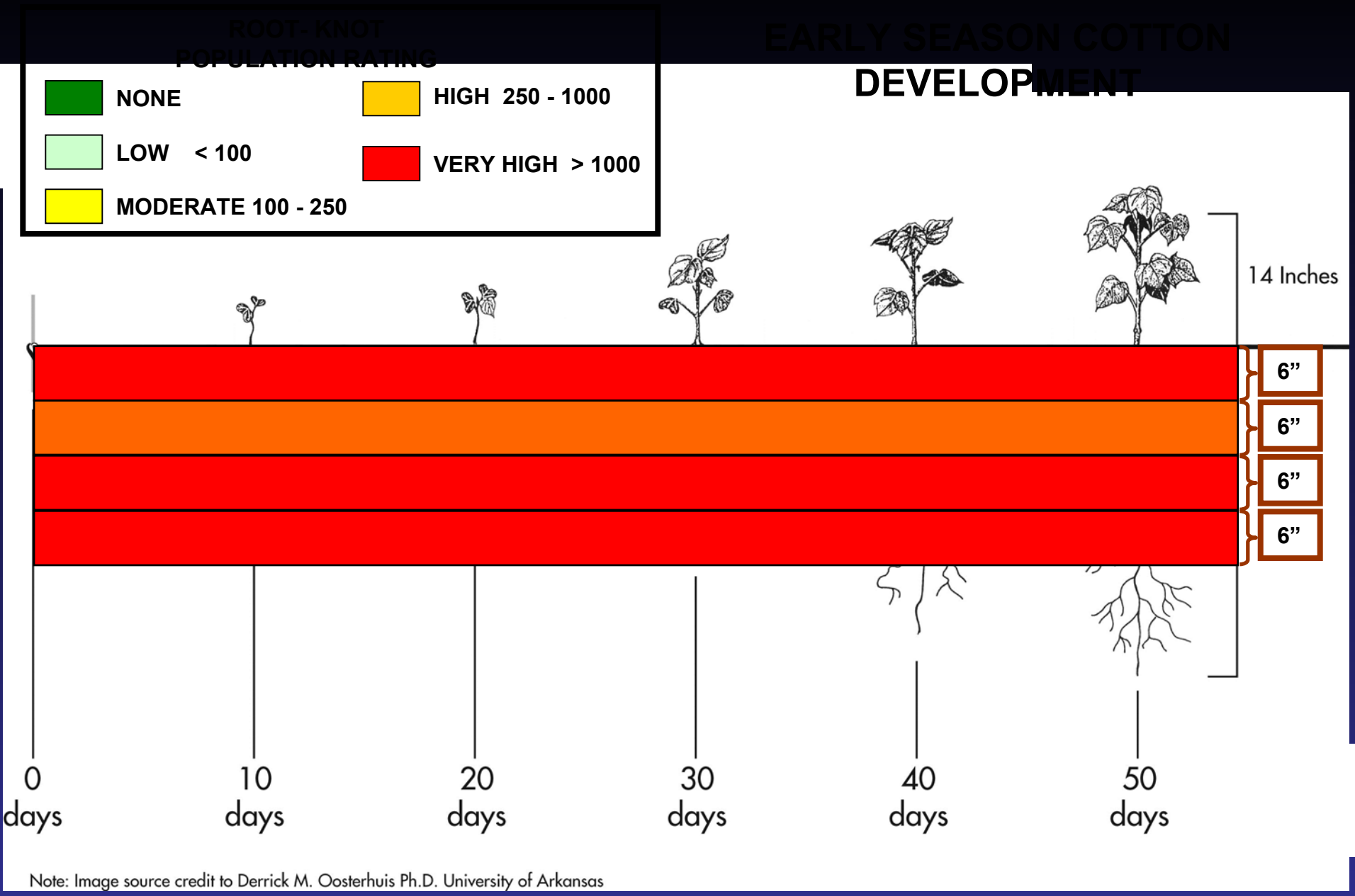
ROOT- KNOT POPULATION RATING

- NONE
- LOW < 100
- MODERATE 100 - 250
- HIGH 250 - 1000
- VERY HIGH > 1000



Note: Image source credit to Derrick M. Oosterhuis Ph.D. University of Arkansas

EARLY SEASON COTTON DEVELOPMENT



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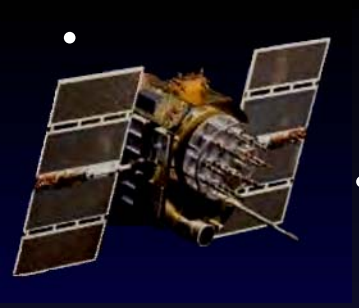
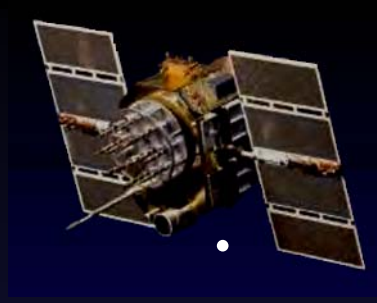




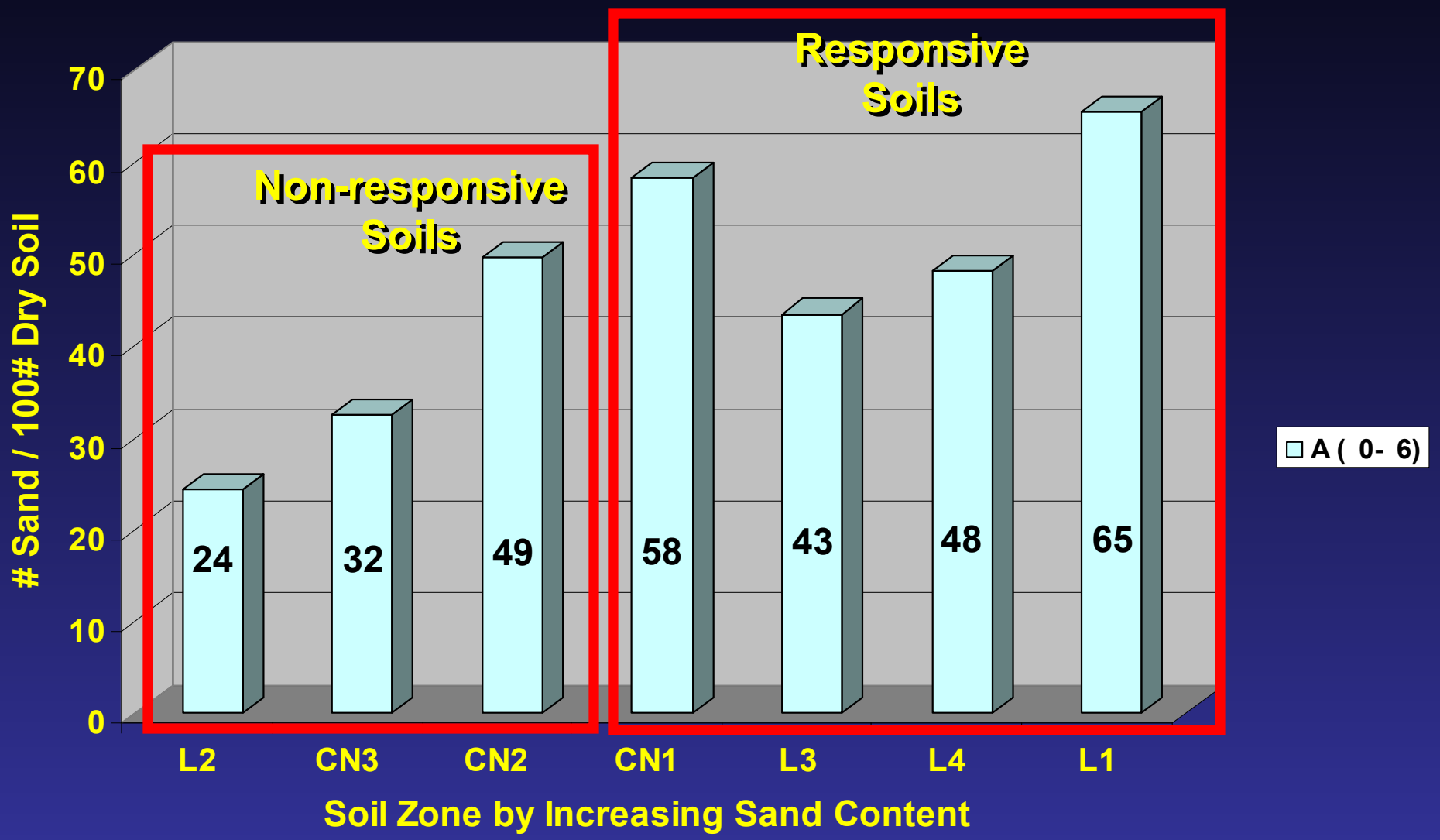
Site-Specific Nematode Management Research

Soil Texture and Soil Fertility Issues

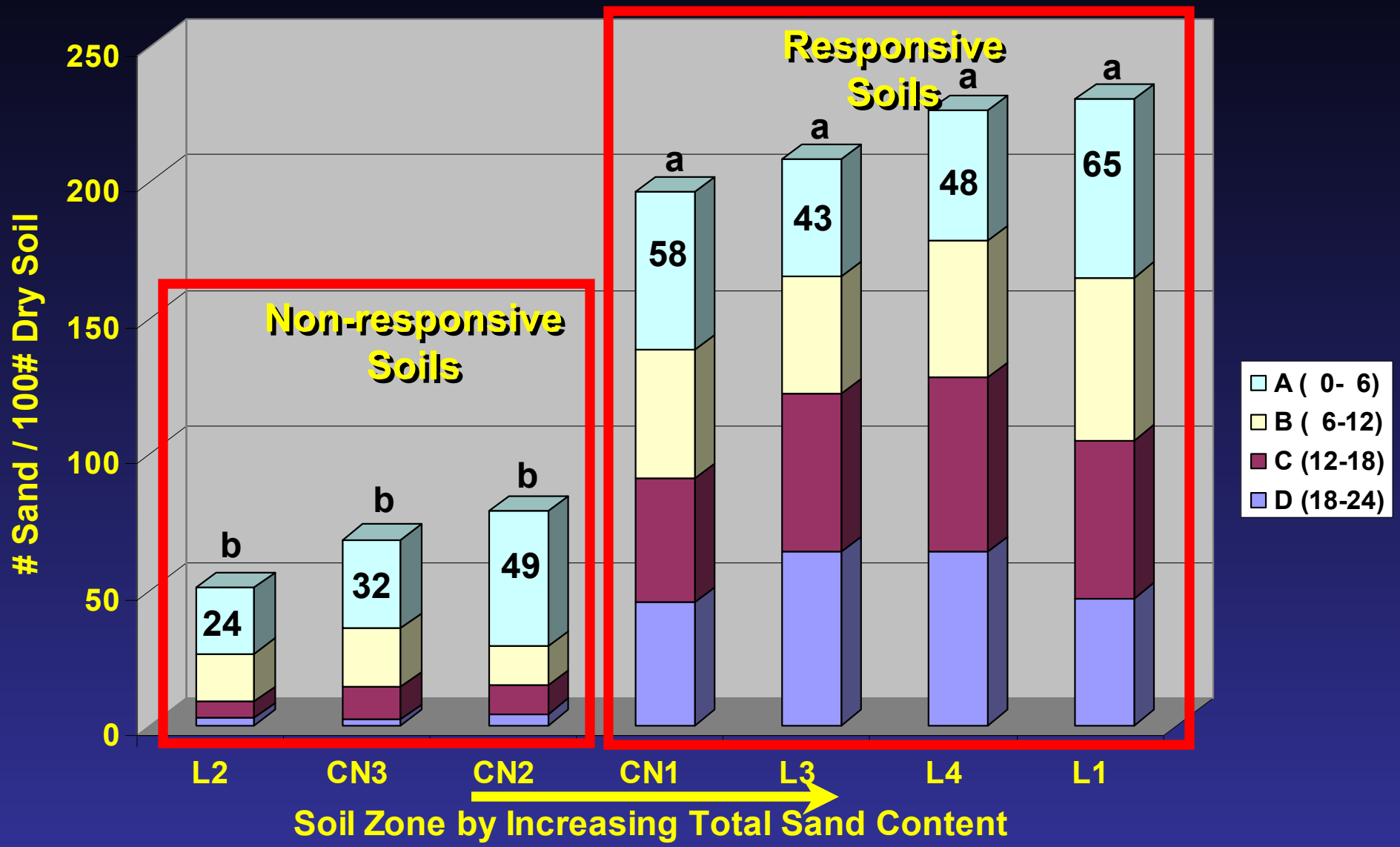
LSU AgCenter Research & Extension

LSU AgCenter Research & Extension

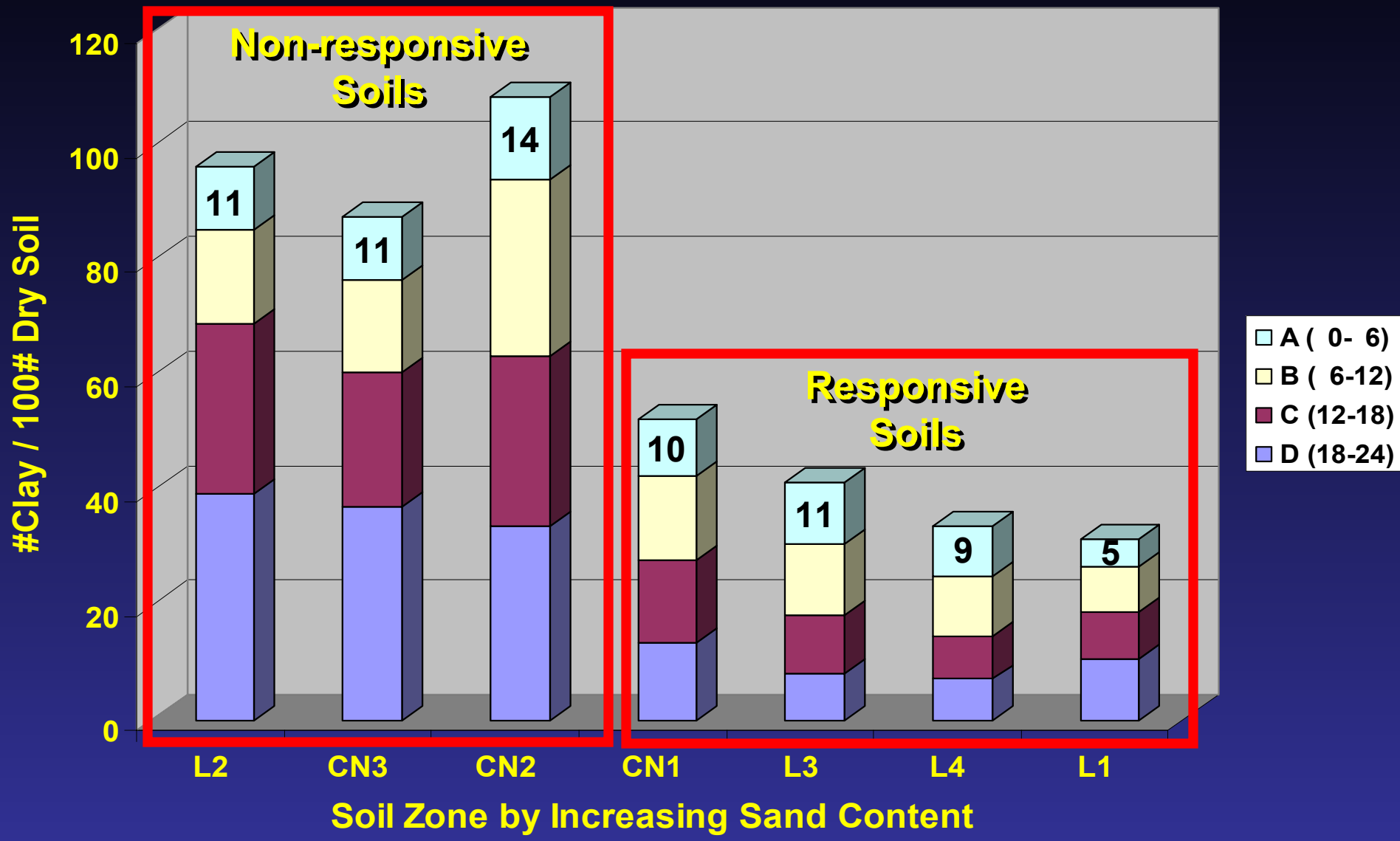
Sand Content by Depth



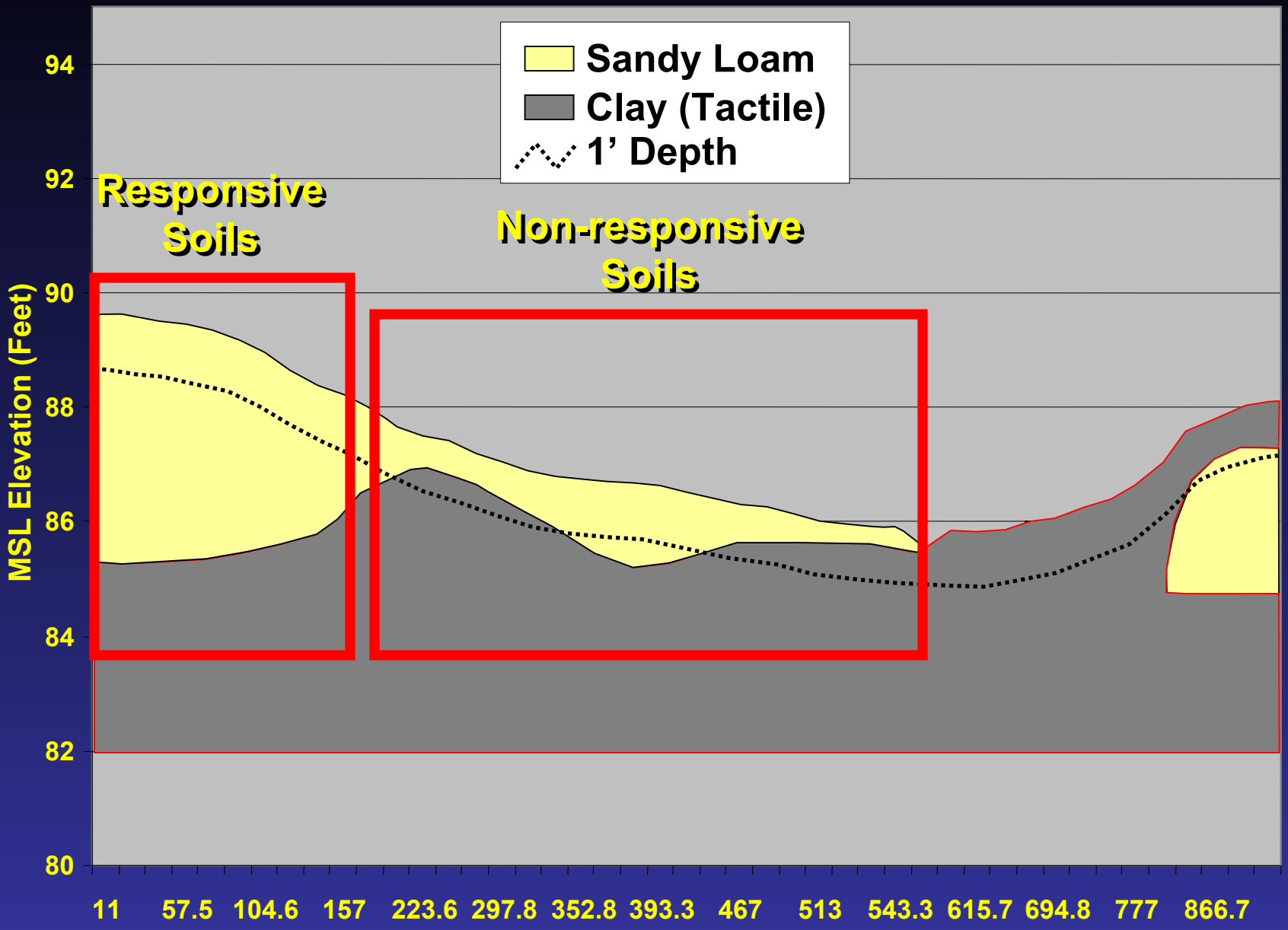
Sand Content by Depth



Clay Content by Depth



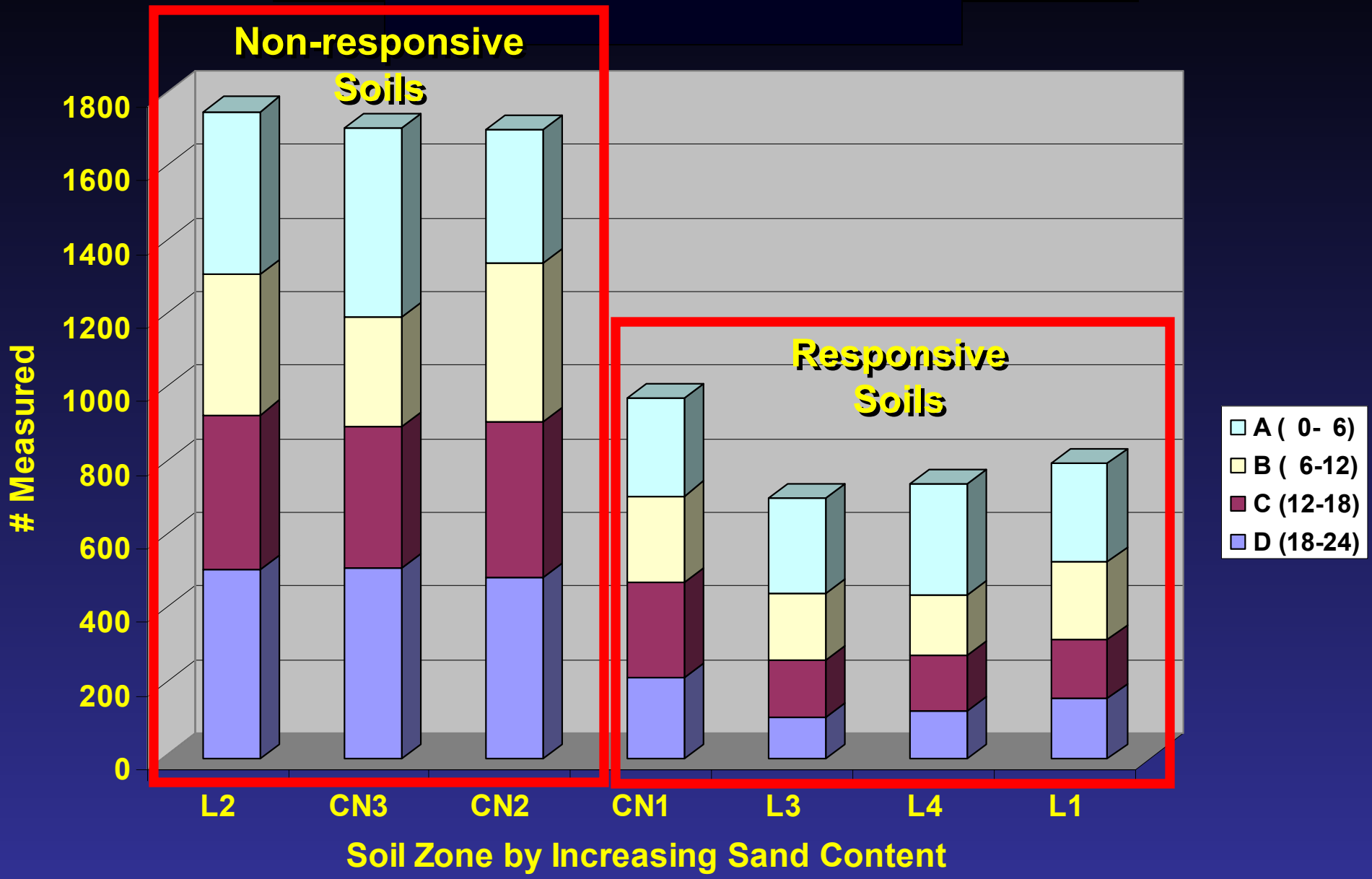
Cemetary North Field
Elevation and Depth to Clay



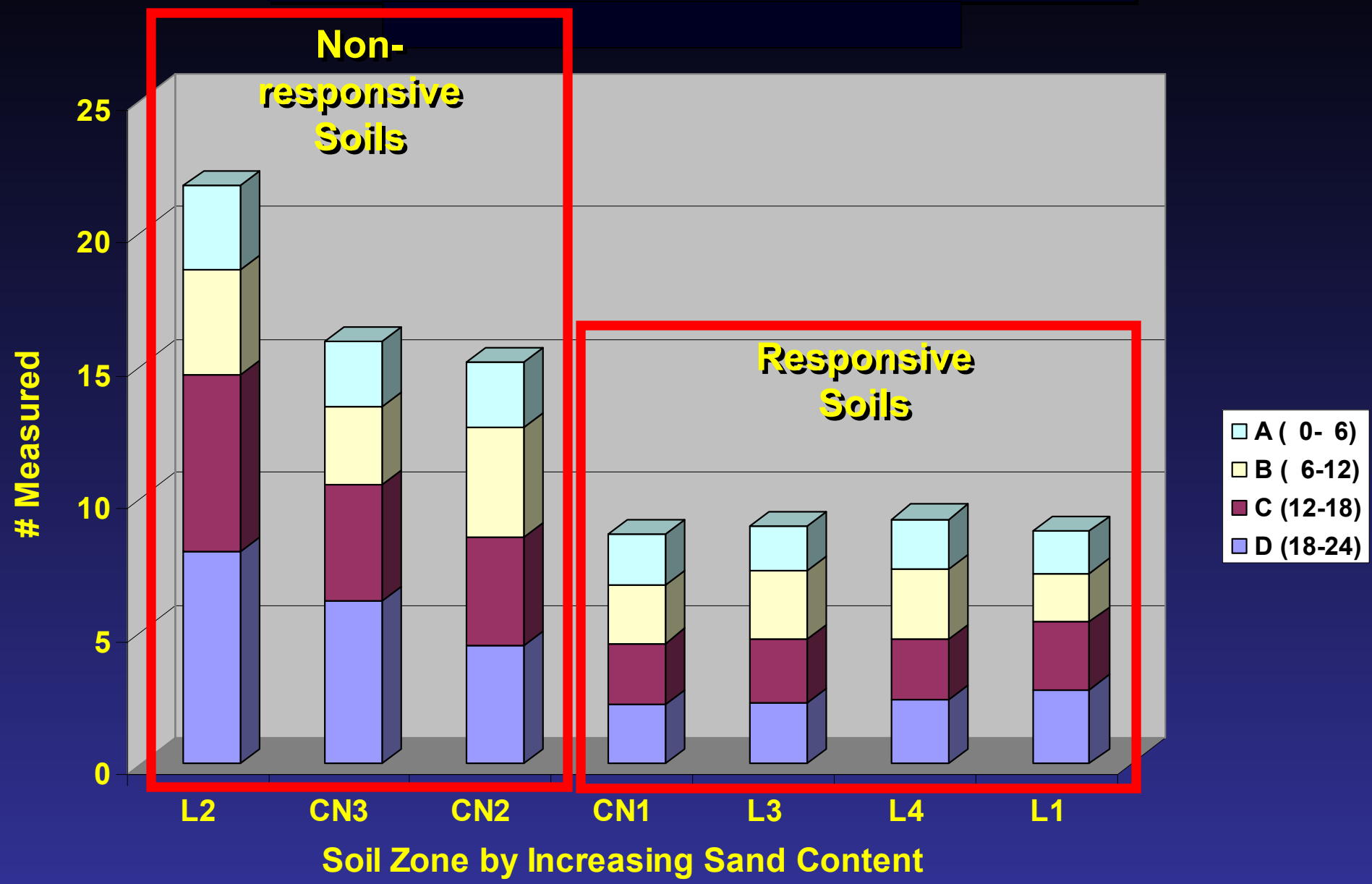
RESPONSIVE SOIL

NON-RESPONSIVE SOIL

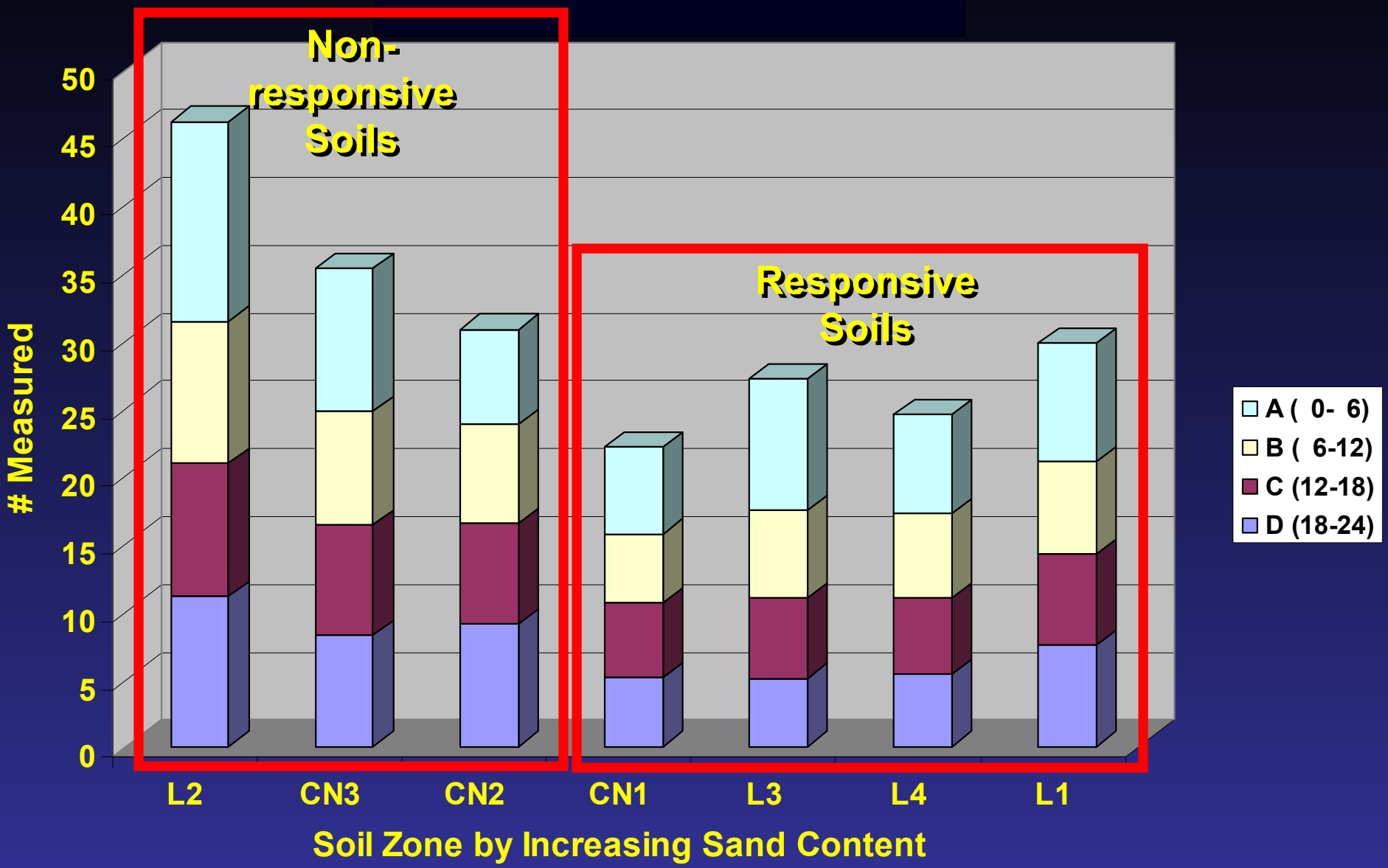
Soil Potassium by Depth



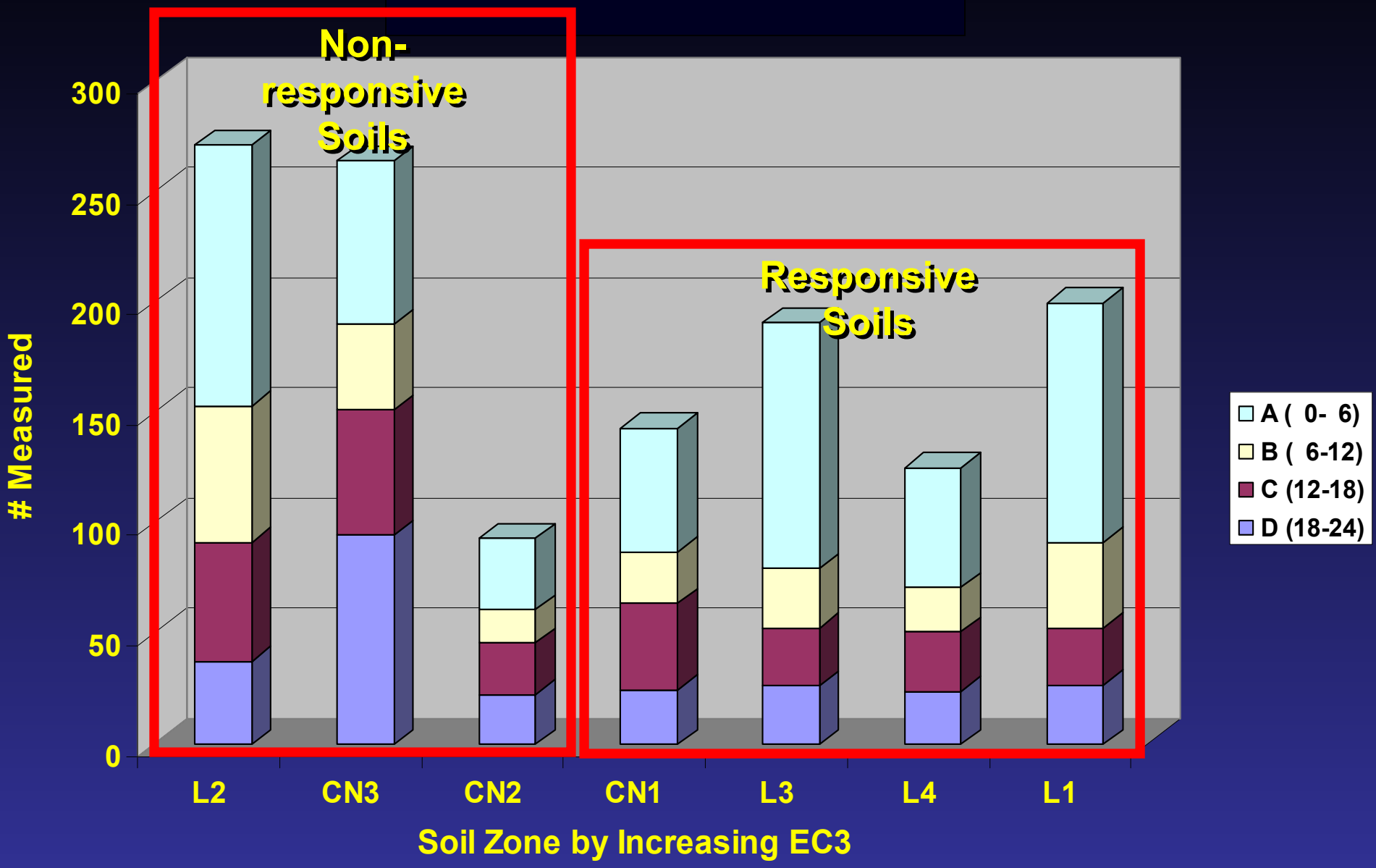
Soil Zinc by Depth



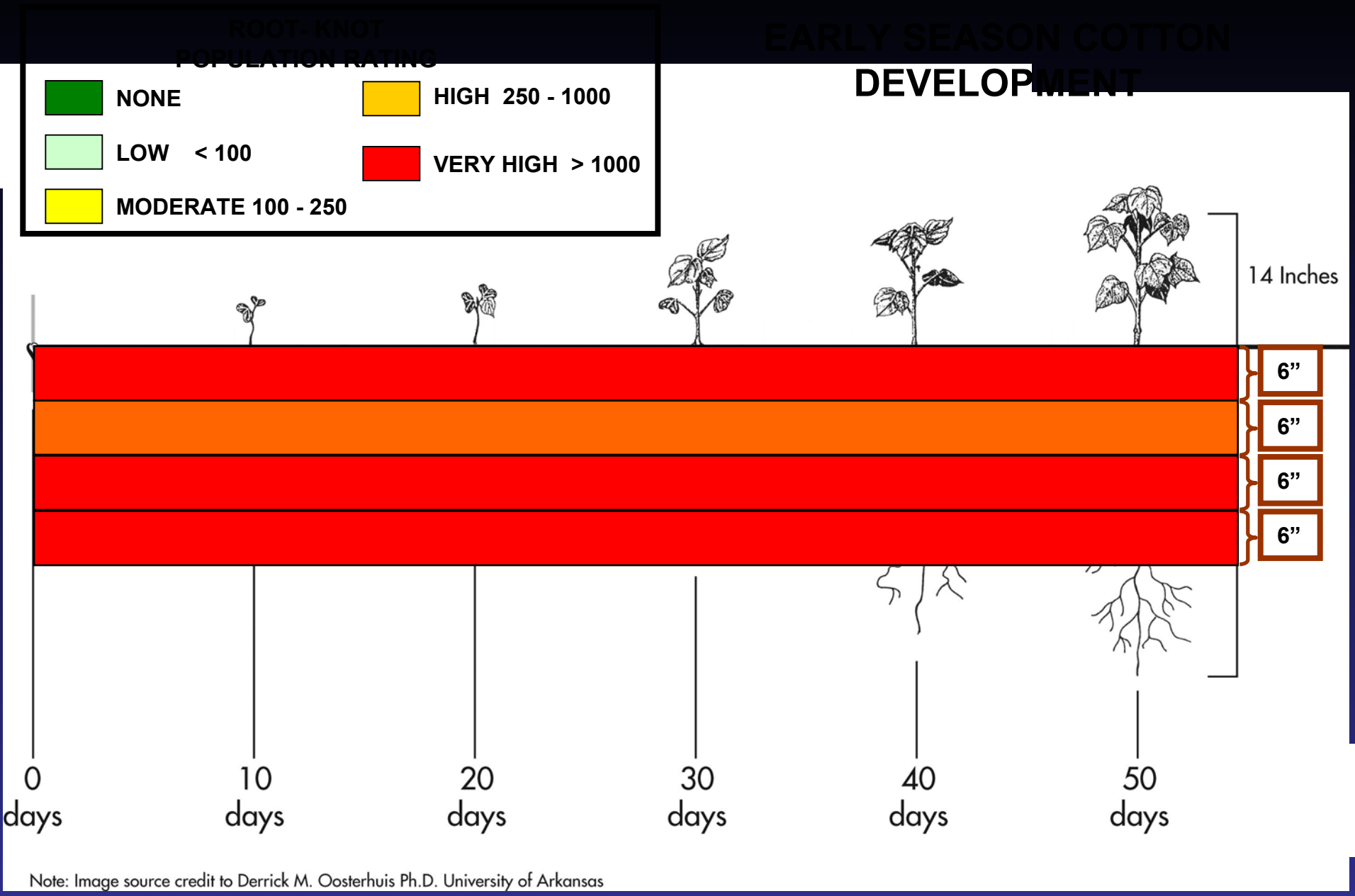
Soil Sulfur by Depth



Soil Phosphorus by Depth



EARLY SEASON COTTON DEVELOPMENT



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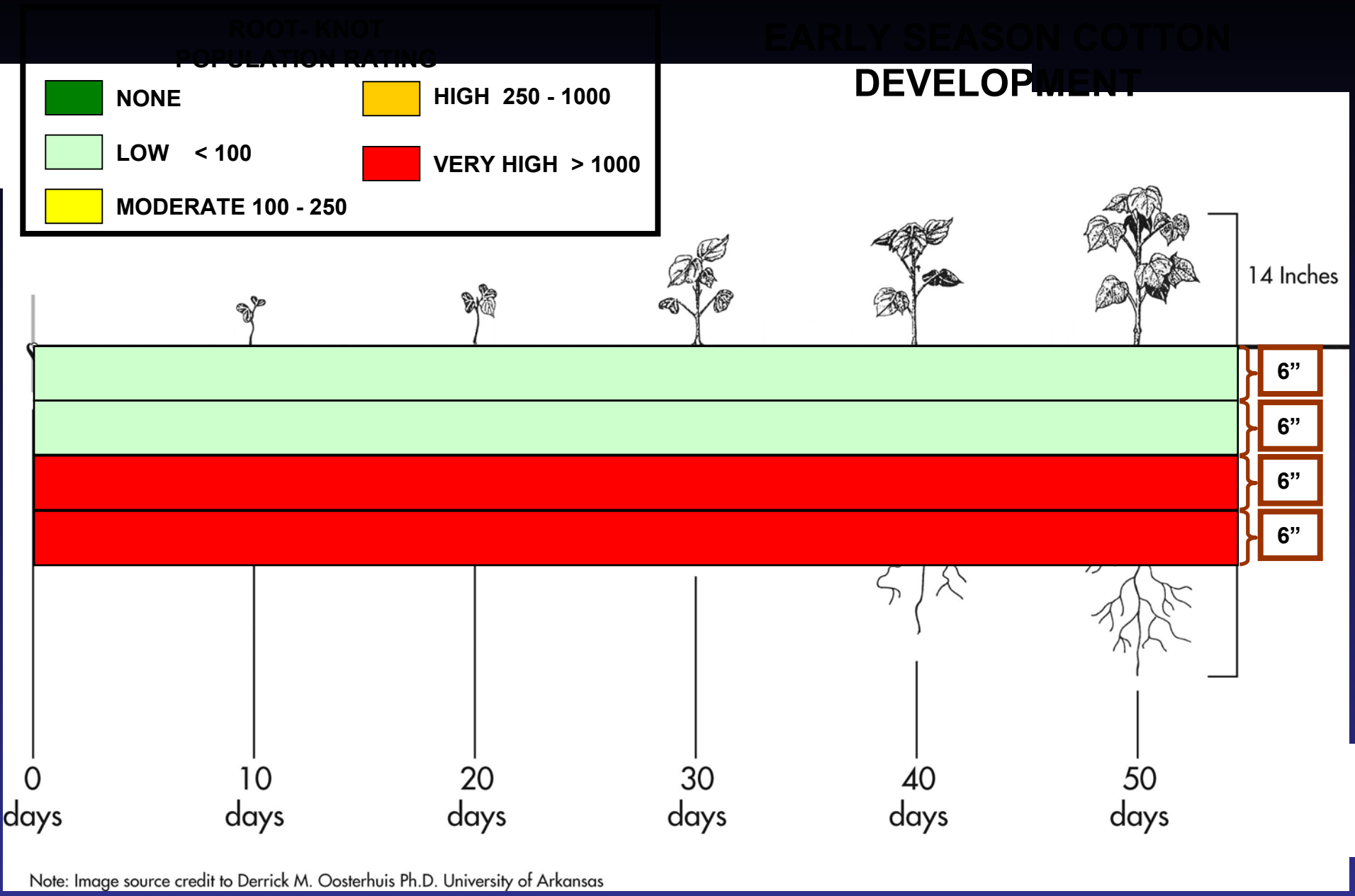
EARLY SEASON COTTON DEVELOPMENT



Note: Image source credit to Derrick M. Oosterhuis Ph.D. University of Arkansas

SUGGESTIONS FOR DEVELOPING A SITE SPECIFIC NEMATODE MANAGEMENT PLAN

- Recognize from the start that this is a multi-year process
- You will never get it right on the first try

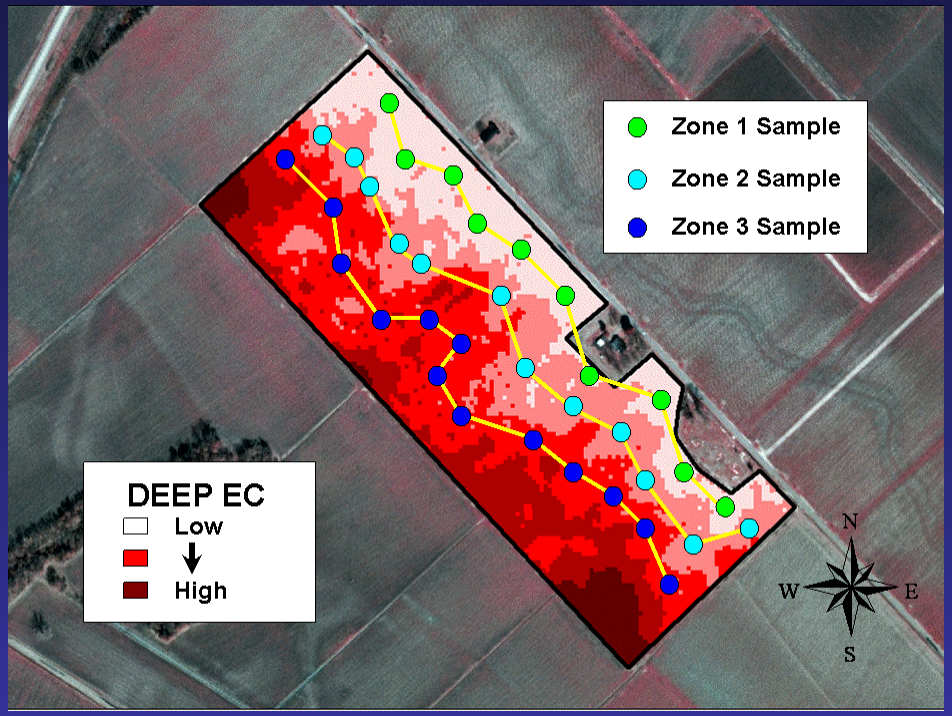
SUGGESTIONS FOR DEVELOPING A SITE SPECIFIC NEMATODE MANAGEMENT PLAN

- Divide fields into soil textural zones using best available data

1) Personal knowledge of the field
2) NRCS Soils Data (Free)
3) Non-crop imagery (DOQQ) (Free)
4) Electrical Conductivity (EC) data

SUGGESTIONS FOR DEVELOPING A SITE SPECIFIC NEMATODE MANAGEMENT PLAN

- Collect composite zone samples from the light-textured soil zones in the fields



SUGGESTIONS FOR DEVELOPING A SITE SPECIFIC NEMATODE MANAGEMENT PLAN

- Collect a sample large enough to divide and have samples for both nematode analysis and nutrient / pH analysis

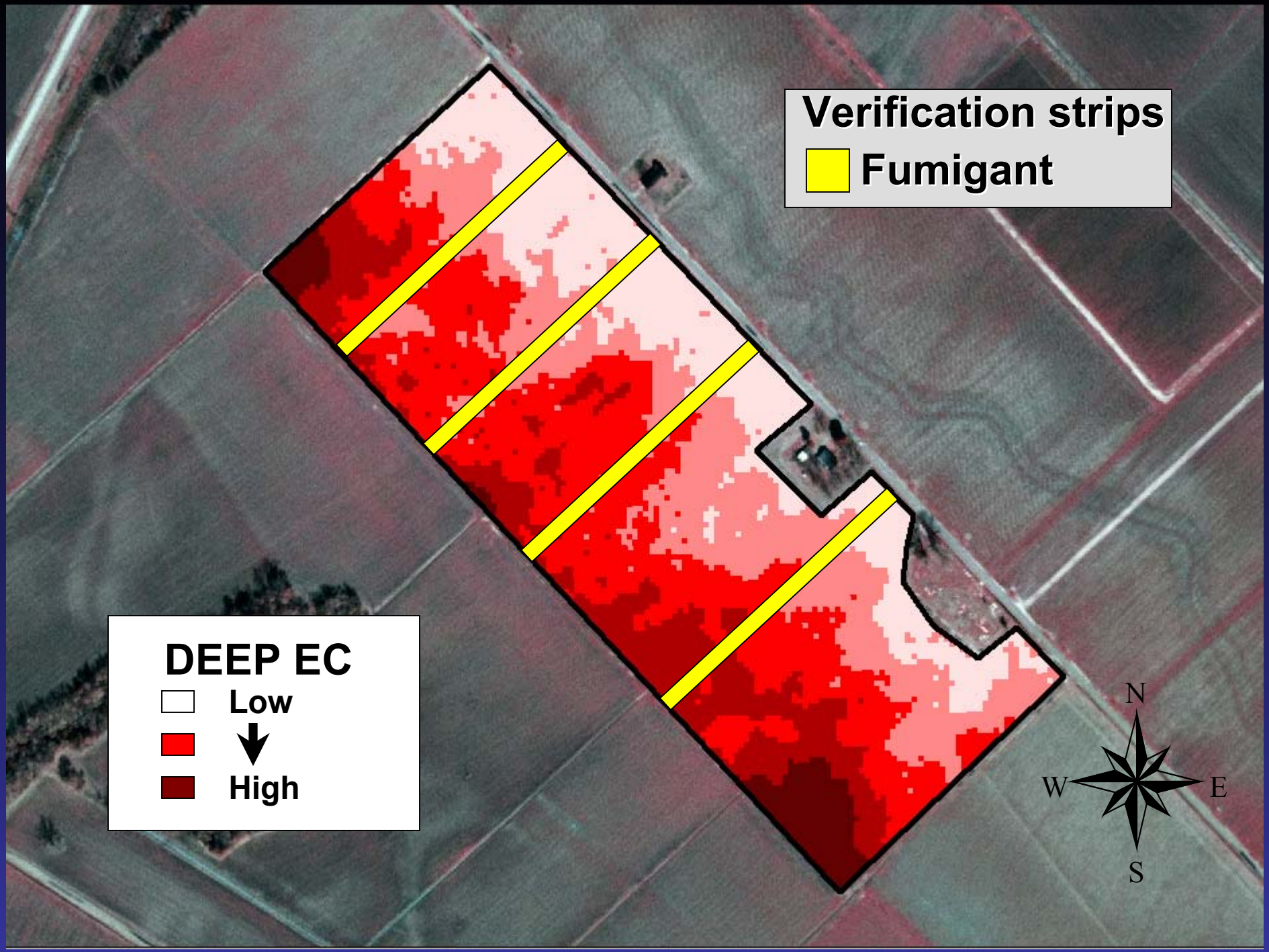
SUGGESTIONS FOR DEVELOPING A SITE SPECIFIC NEMATODE MANAGEMENT PLAN

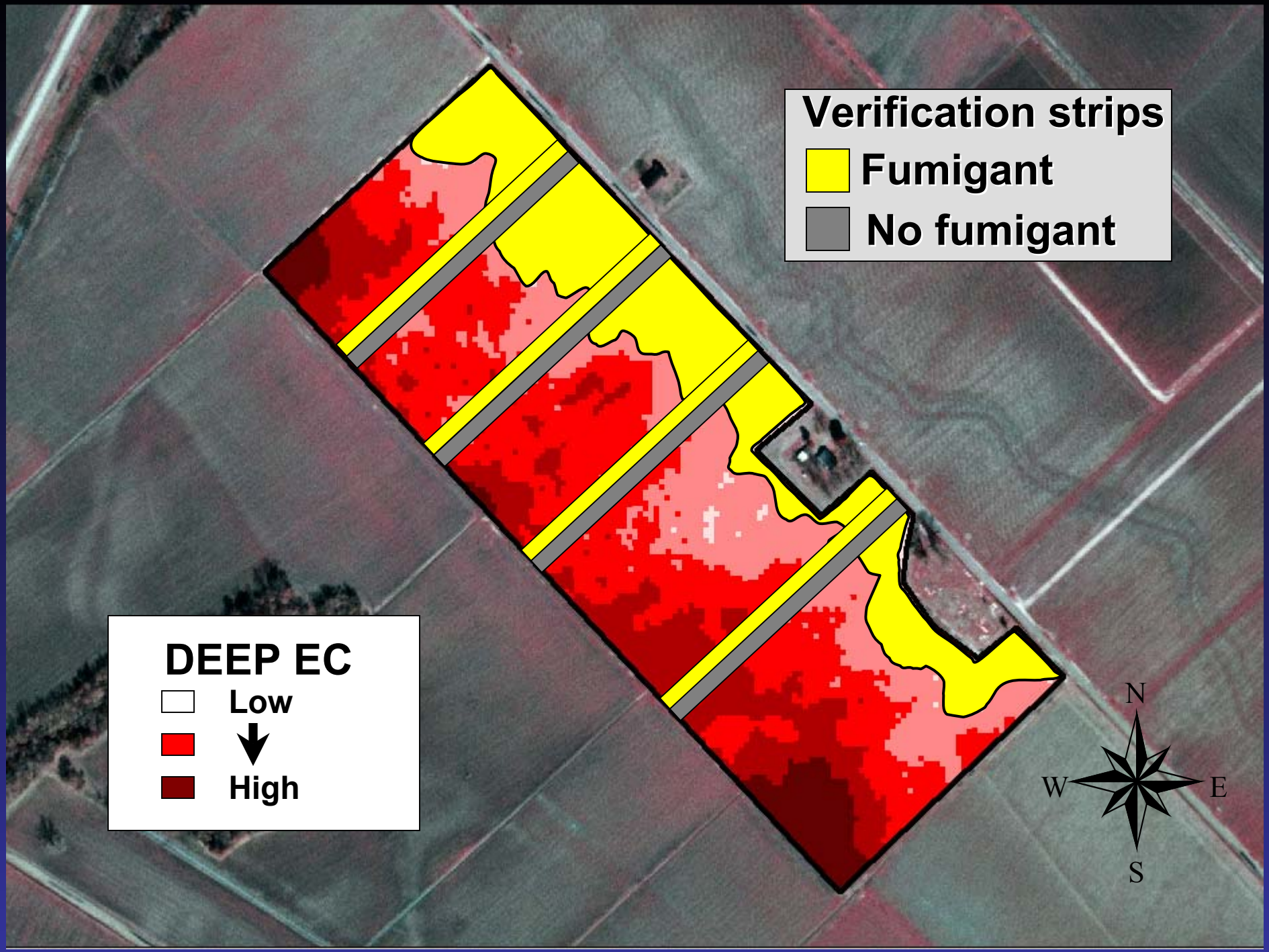
- **FERTILITY IS IMPORTANT**
  - The types of soils where the most severe injury usually occurs are also the soils that are most likely to have severe fertility issues – deep sandy soils, highly permeable, low CEC, low organic matter, low pH, low potassium, low sulfur
  - **TAKE CARE OF SEVERE NUTRIENT ISSUES FIRST**

SUGGESTIONS FOR DEVELOPING A SITE SPECIFIC NEMATODE MANAGEMENT PLAN

- Apply Telone II to “verification” strips in fields at regular intervals

- Evaluate crop response using aerial imagery or yield monitor data, or both


Verification strips
Fumigant
DEEP EC
Low
High
N
W
E
S


Verification strips
Fumigant
No fumigant
DEEP EC
Low
High
N
W
E
S

SUMMARY

- The development of site-specific nematode management plans for Mississippi River alluvial soils must consider factors other than nematode population alone.
- Yield response was more related to soil texture through the profile than nematode populations

SUMMARY

- Greatest yield responses were obtained on light-textured soils extending deep into the soil profile
- The areas of responsive soil and non-responsive soil were best represented by the deep electrical conductivity values, as obtained using the Veris 3100 EC Mapping Cart

EPIPHANY

Perhaps “soil” drives the nematode damage equation much more than simply a function of nematode population levels

Charles Overstreet

Precision Agriculture and Chemical Treatments

Hypotheses:

$Costs$ of crop production can be reduced by using site-specific chemical applications

Examples/probability for success

PGR's = low

Insecticides = low

Insecticide/Nematicide = high (-)

Limited Success for Site Specific Practices:

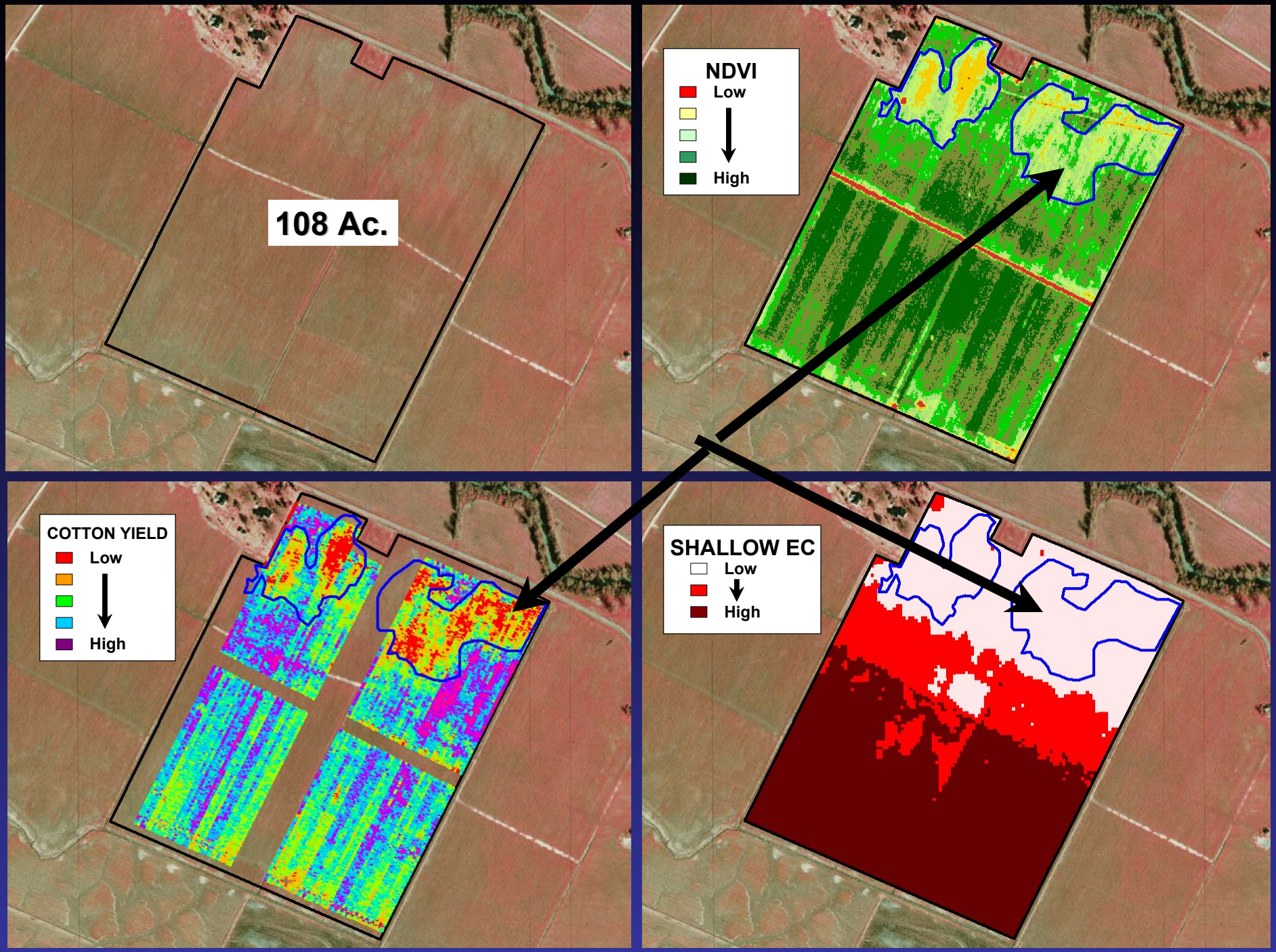
Effectiveness Questionable

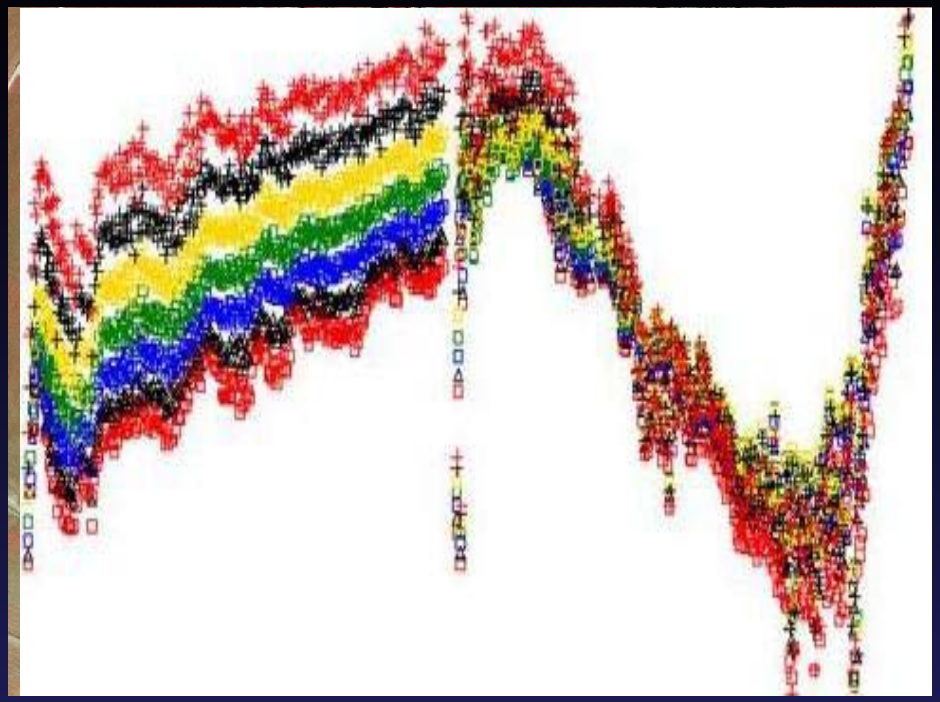
"Spatially variable applications offer the promise of significant savings in crop production costs while preserving crop yield. **However**, the effectiveness of these approaches has not been adequately quantified with **supporting data and statistical findings."**

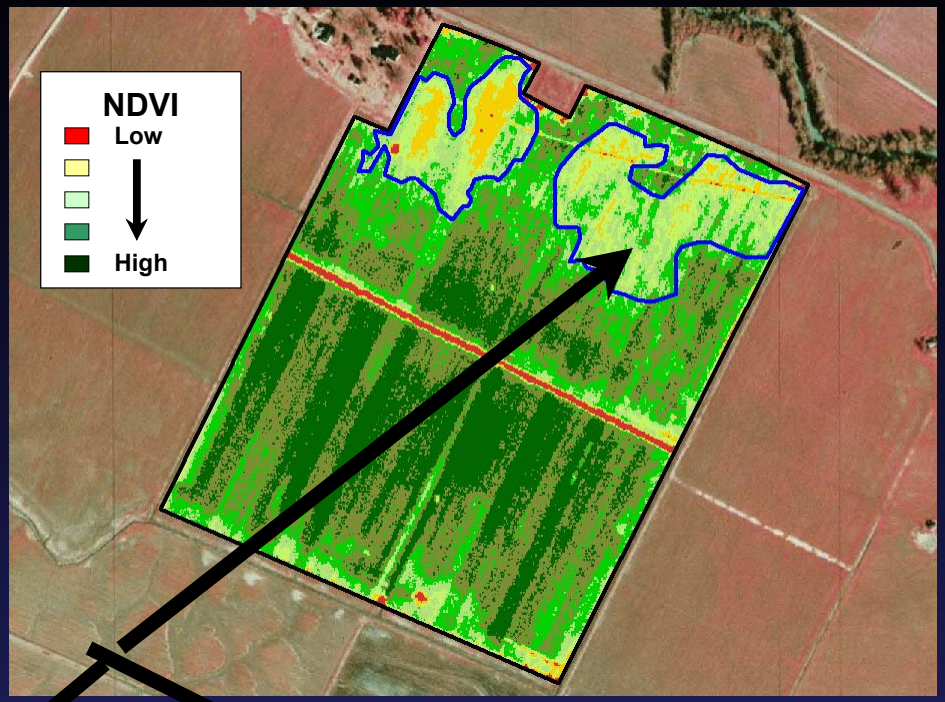
MAFAS – Starkville, MS

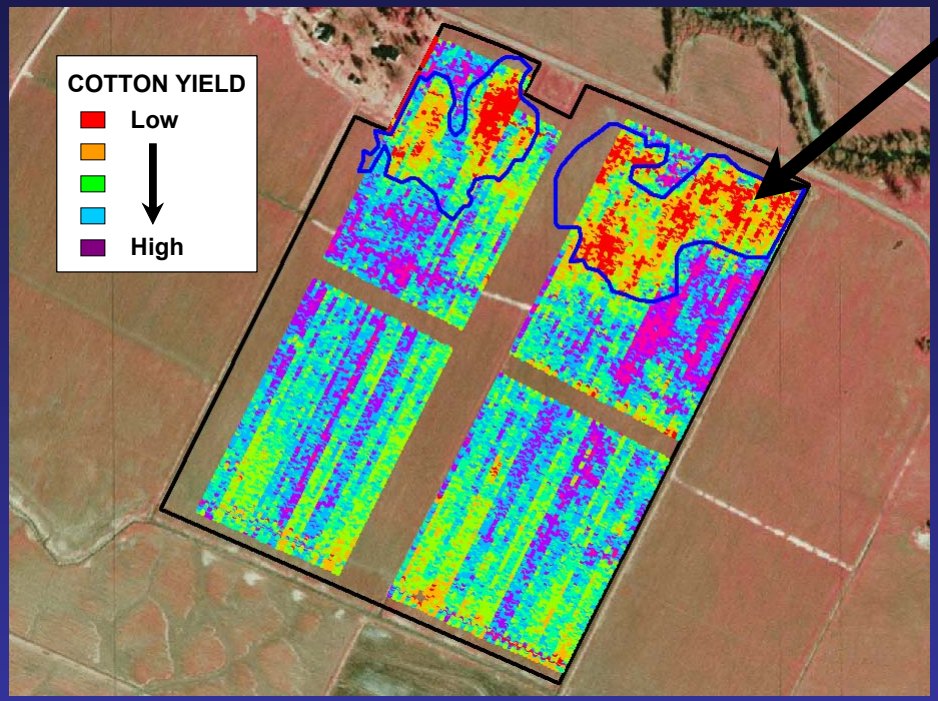
Progress is being made in determining……

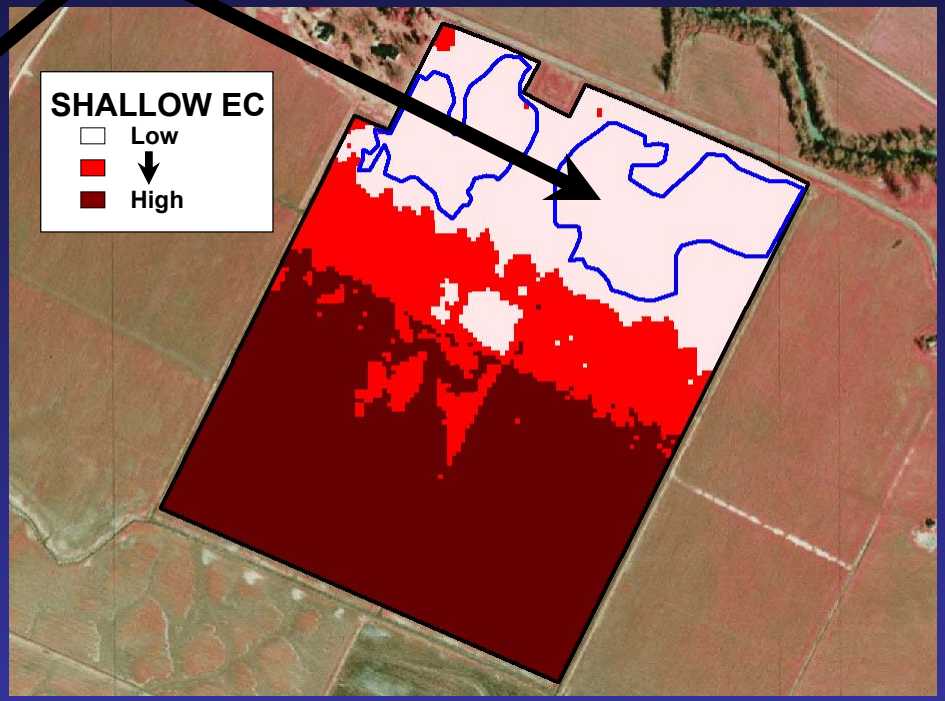
- **The Right Amount…**
- **At the Right Place…**
- **At the Right Time!!!**
- with **supporting data and statistical findings.”**

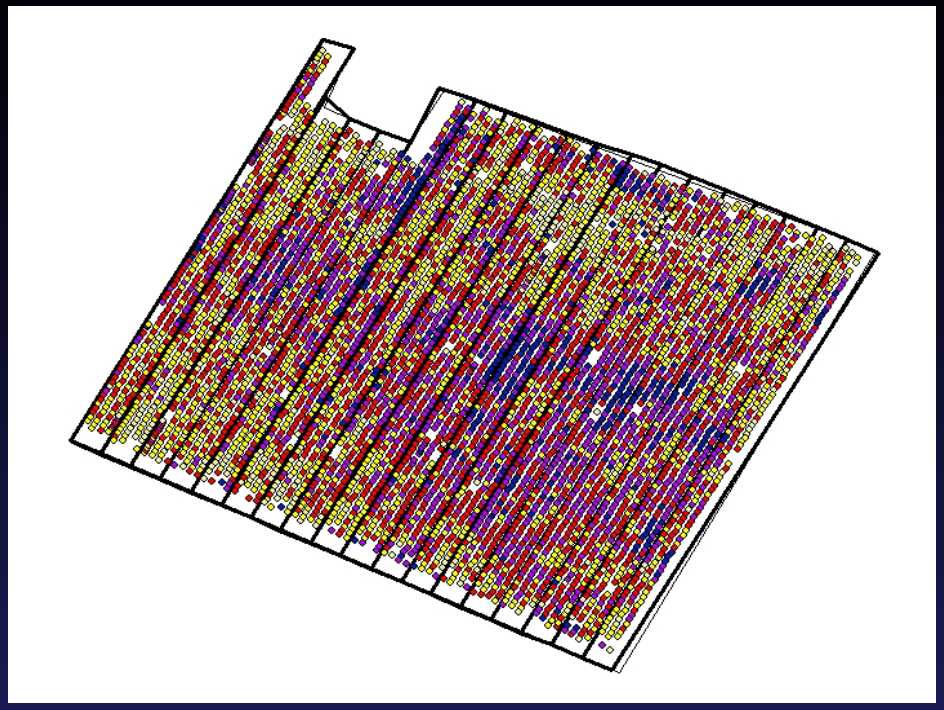

108 Ac.
NDVI
Low
High
COTTON YIELD
Low
High
SHALLOW EC
Low
High

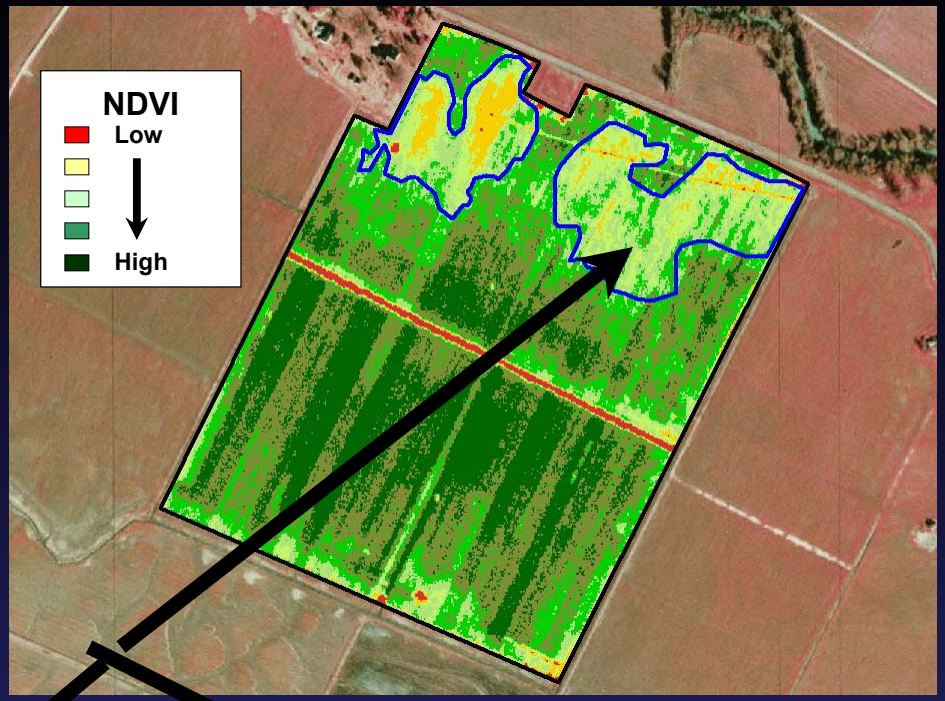


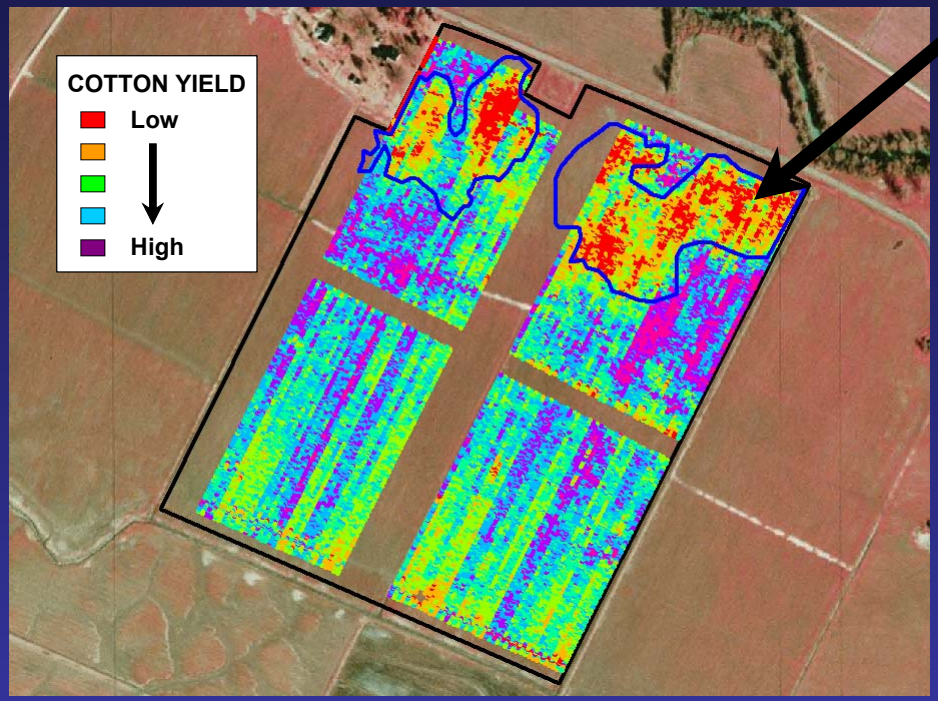

NDVI
Low
High

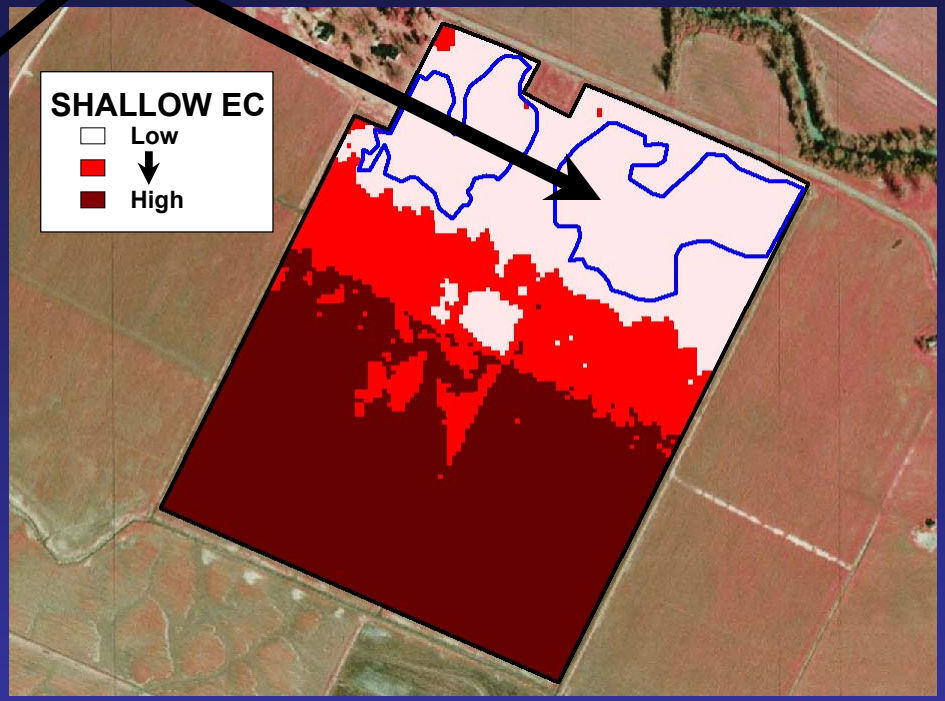

COTTON YIELD
Low
High

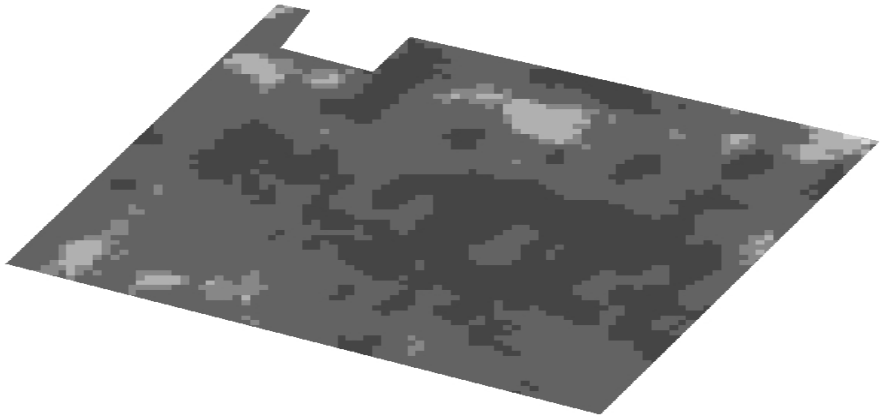

SHALLOW EC
Low
High

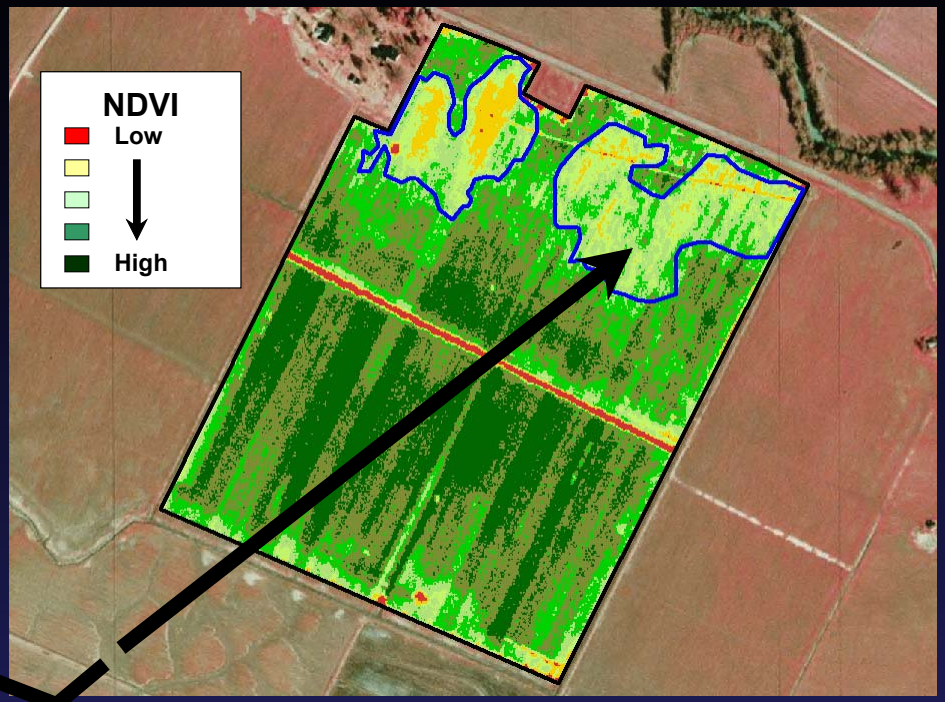


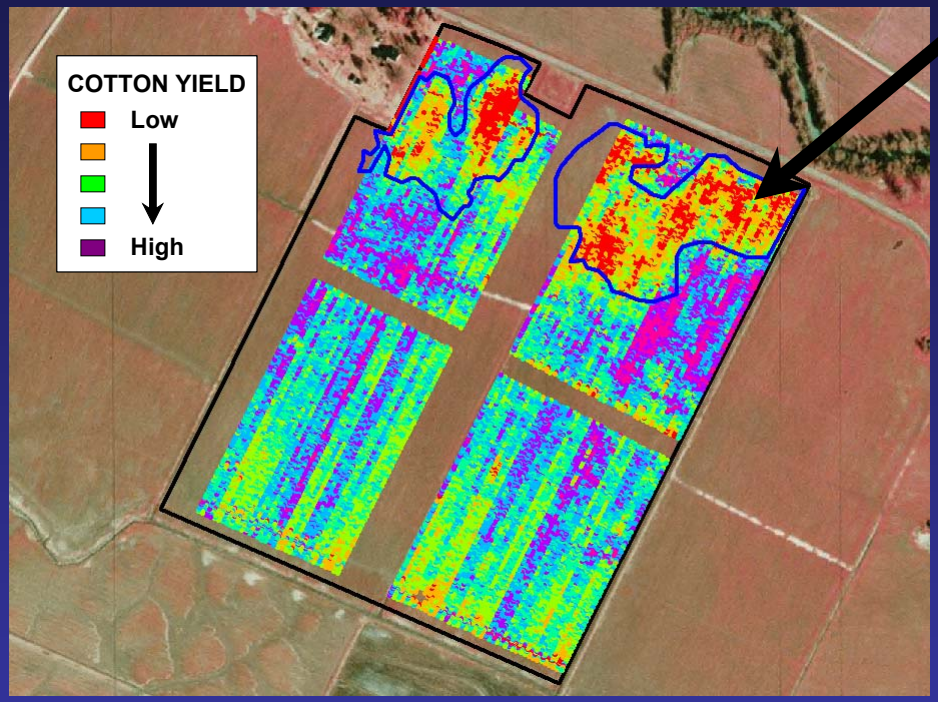

NDVI
Low
High

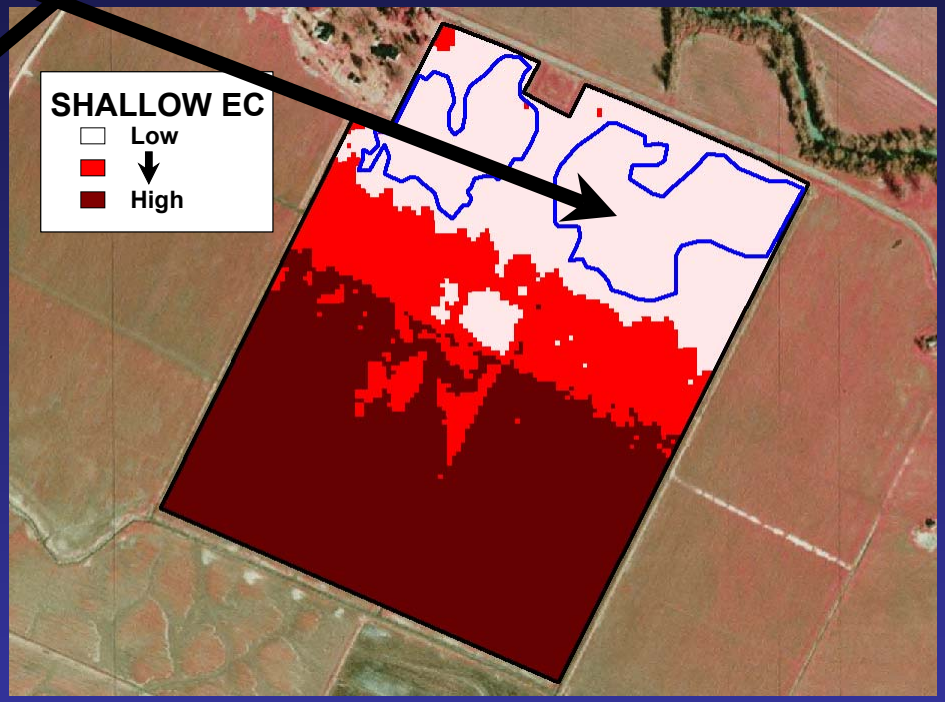

COTTON YIELD
Low
High

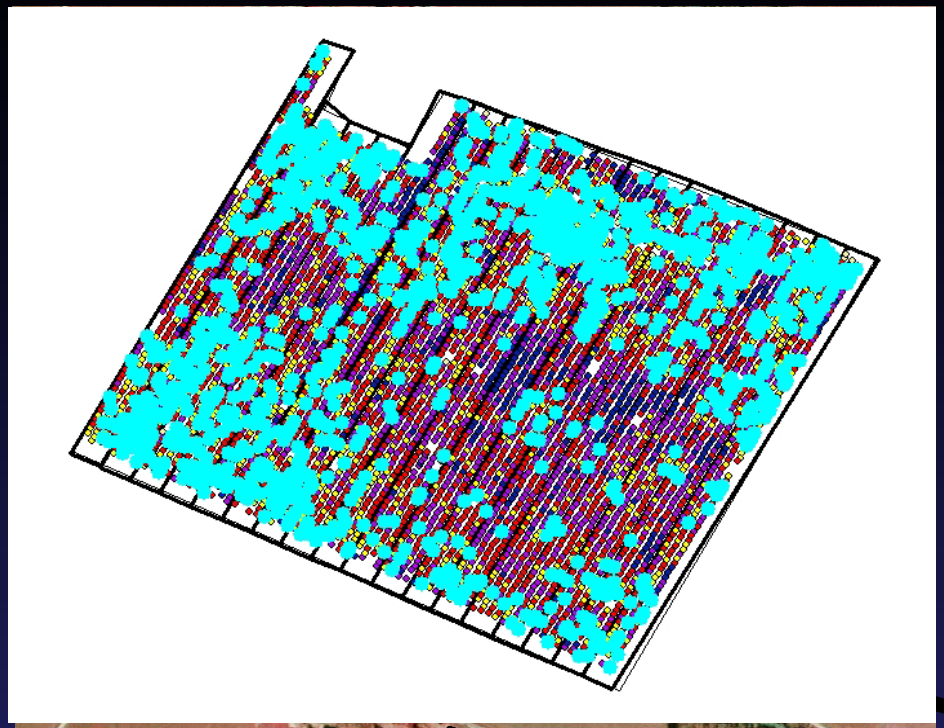

SHALLOW EC
Low
High

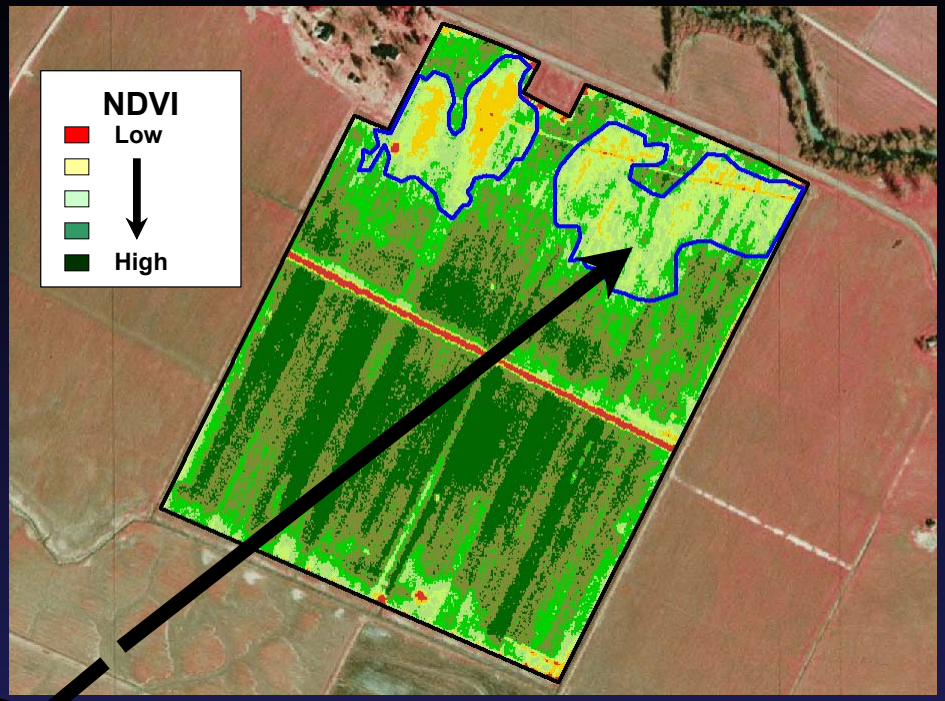



NDVI
Low
High


COTTON YIELD
Low
High


SHALLOW EC
Low
High




NDVI
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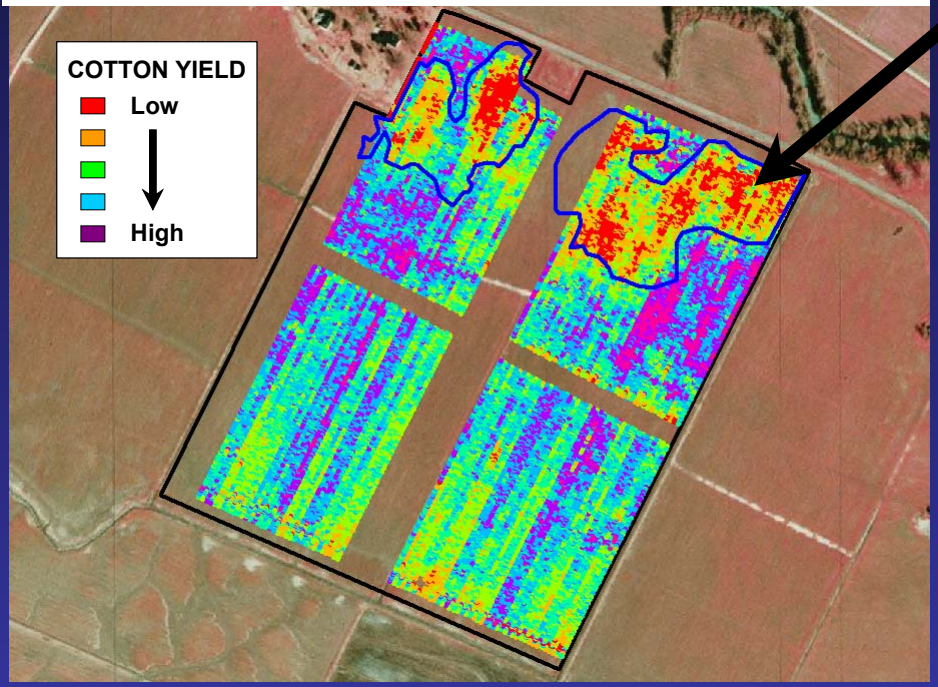
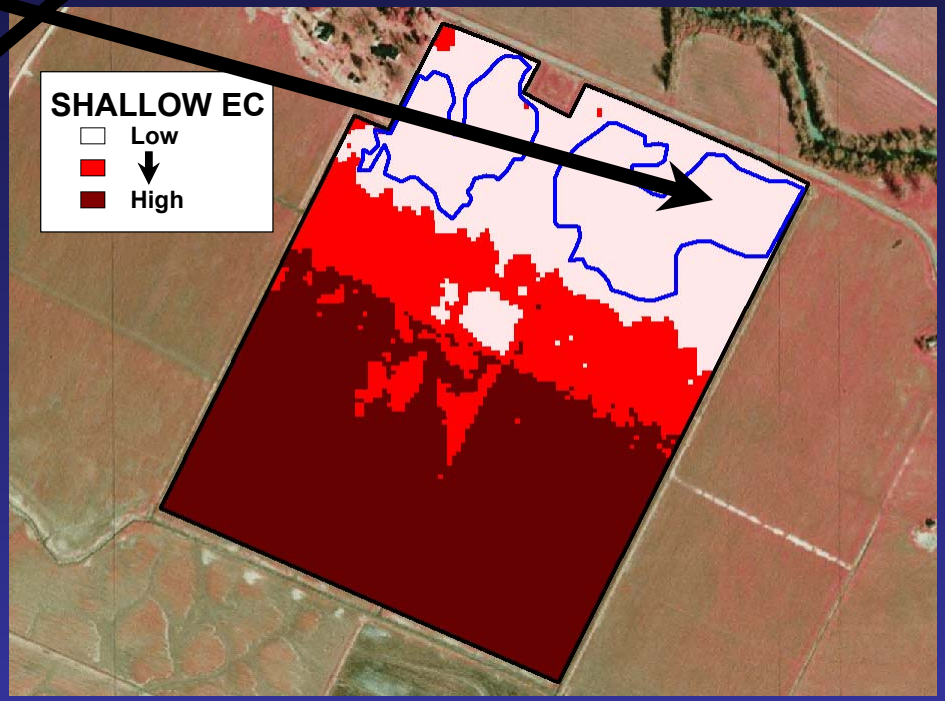
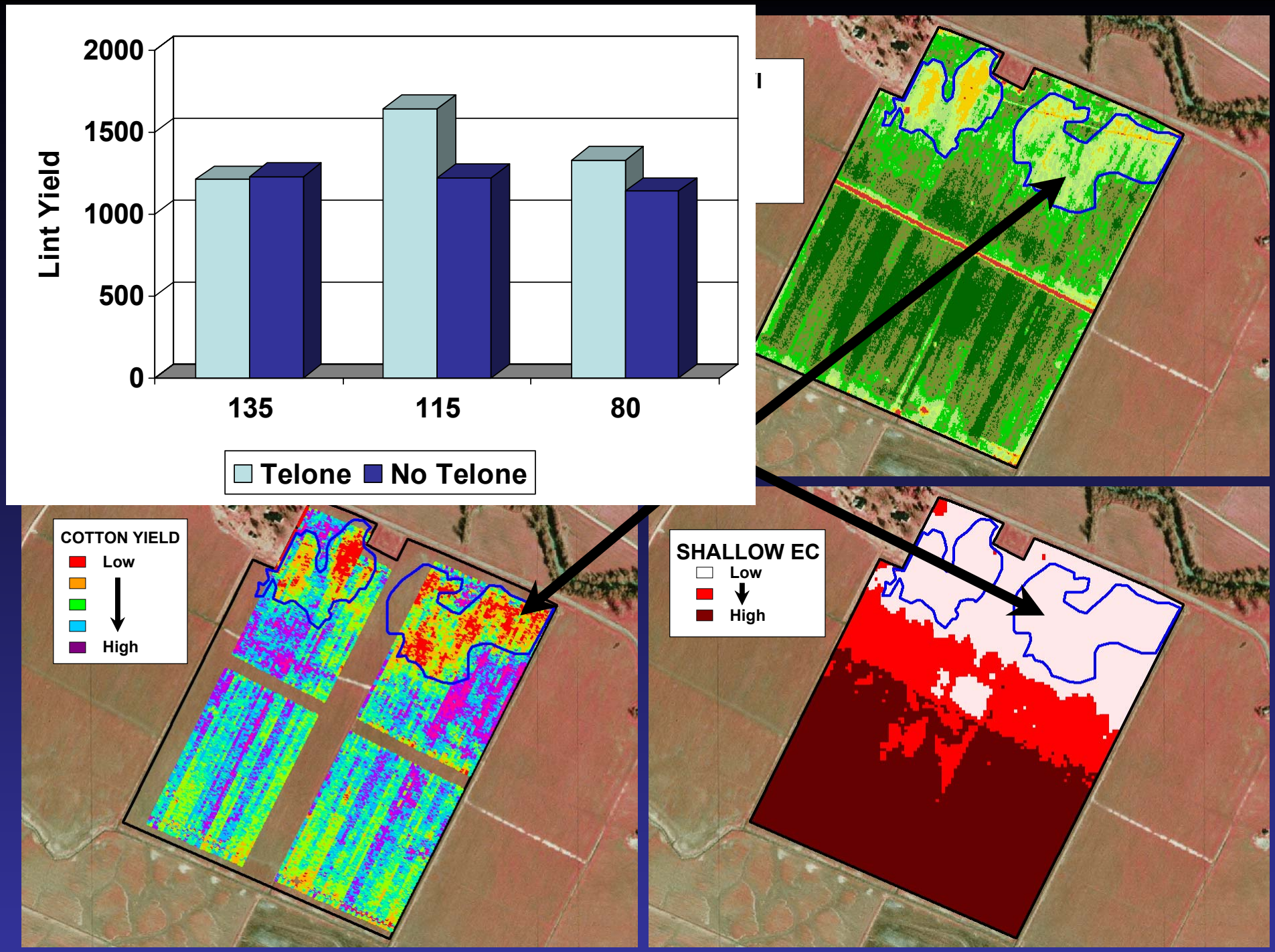

COTTON YIELD
Low
High


SHALLOW EC
Low
High


2000
1500
1000
500
0
Lint Yield
135
115
80
Telone
No Telone
COTTON YIELD
Low
High
SHALLOW EC
Low
High

Progress is being made in determining……

- **The Right Amount…**
- **At the Right Place…**
- **At the Right Time!!!**
- with **supporting data and statistical findings.”**
  - »**By**
  - »**Dr. Kevin McCarter**


THANK YOU
Precision Agriculture
LSU
AgCenter
Research & Extension
Making technology work
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
cotton

NEMATICIDES

Pre Plant Fumigants

- TELONE II
- VAPAM or K-PAM

NEMATICIDES

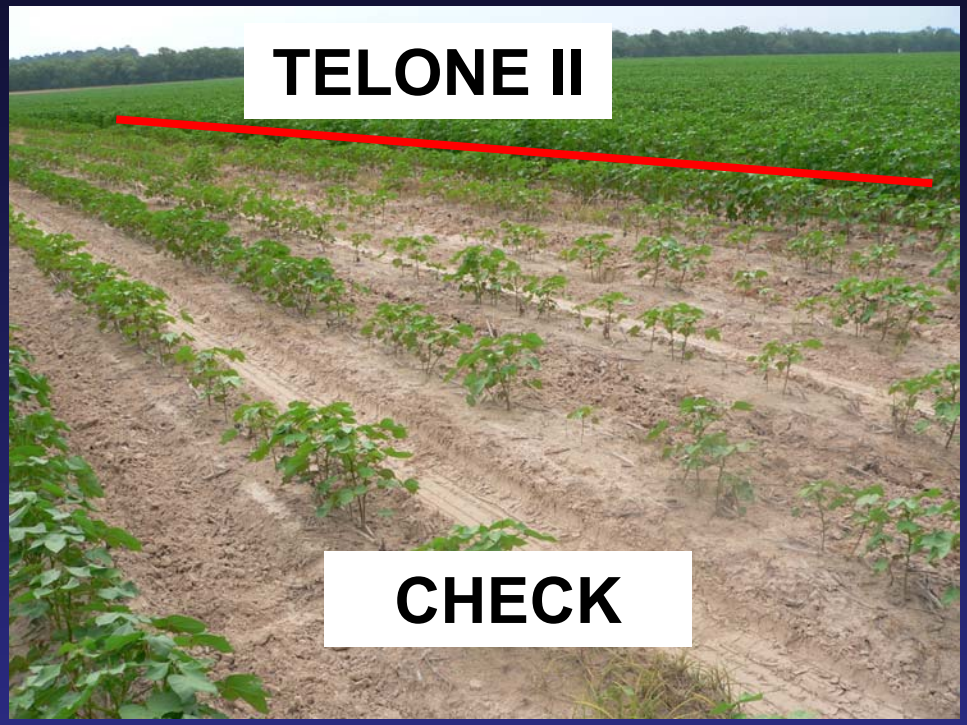
Insecticide Hopper

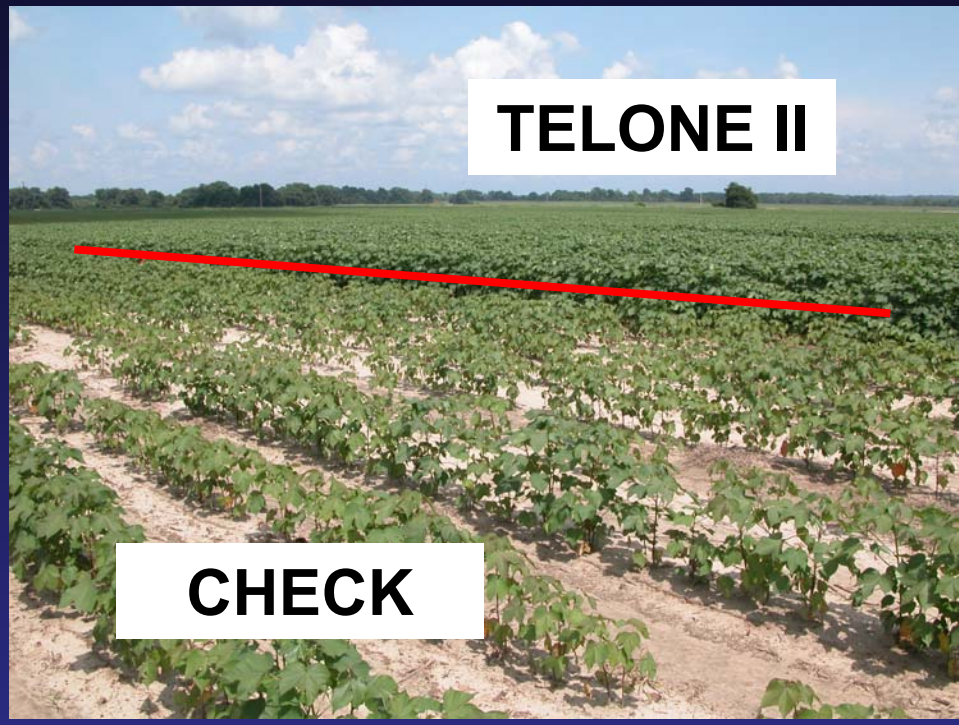
- TEMIK (Aldicarb)

Seed Treatments

- AVICTA, AERIS

HIGH–END NEMATICIDE RESPONSE





Verification strips

- Untreated or standard
- Telone

Tensas Parish
3 Year Mean Cotton Yield Telone II Response