

# Oklahoma State University

## Optical Sensor Cotton Experiences

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# Current Studies

- Delayed Fertilization Study
- Regional Yield Prediction ( $Y_p$ ) Equations
- PGR's and Harvest Aids (boll openers and defoliants)
- New Equipment



# Delayed Fertilization

- Delayed Fertilization Study:
  - Causes a deficiency in the plant for a more visible recovery. Pre-plant rates of 0, 30, 60, and 90 lbs./ac were used. All treatments were brought to a total of 120 lbs./ac.
  - N was applied at Pin Head Square, White Flower and 30 days after White Flower stages.
  - The best correlations have been found up to the first White Flower stage but not beyond it.



# Delayed Fertilization (North Central OK)

Trt	Prep-pLant kg N ha <sup>-1</sup>	Sidedress kg N ha <sup>-1</sup>	Growth stage of Sidedress N Application	Lint Yield kg ha <sup>-1</sup>	t Grouping Alpha 0.05
1	0	0		1060.68	A
2	60	0		975.40	A
3	120	0		828.96	A
4	0	120	Early pinhead square	1049.47	A
5	0	120	White flower	1052.41	A
6	0	120	30 days after white flower	1137.86	A
7	30	90	Early pinhead square	973.78	A
8	30	90	White flower	966.93	A
9	30	90	30 days after white flower	1002.11	A
10	60	60	Early pinhead square	1146.48	A
11	60	60	White flower	925.11	A
12	60	60	30 days after white flower	1109.17	A
13	90	30	Early pinhead square	982.56	A
14	90	30	White flower	1089.08	A
15	90	30	30 days after white flower	1182.15	A

# Delayed Fertilization (SW OK)

Trt	Prep-pLant kg N ha <sup>-1</sup>	Sidedress kg N ha <sup>-1</sup>	Growth stage of Sidedress N Application	Lint Yield kg ha <sup>-1</sup>	t Grouping Alpha 0.05
1	0	0		759.53	F
2	60	0		1276.39	D, E
3	120	0		1517.11	A, B, C
4	0	120	Early pinhead square	1652.61	A
5	0	120	White flower	1449.78	B, C
6	0	120	30 days after white flower	823.44	F
7	30	90	Early pinhead square	1568.30	A, B, C
8	30	90	White flower	1604.84	A, B
9	30	90	30 days after white flower	1124.63	E
10	60	60	Early pinhead square	1460.16	B, C
11	60	60	White flower	1529.57	A, B, C
12	60	60	30 days after white flower	1276.88	D, E
13	90	30	Early pinhead square	1496.70	A, B, C
14	90	30	White flower	1538.86	A, B, C
15	90	30	30 days after white flower	1421.31	C, D

# Delayed Fertilization

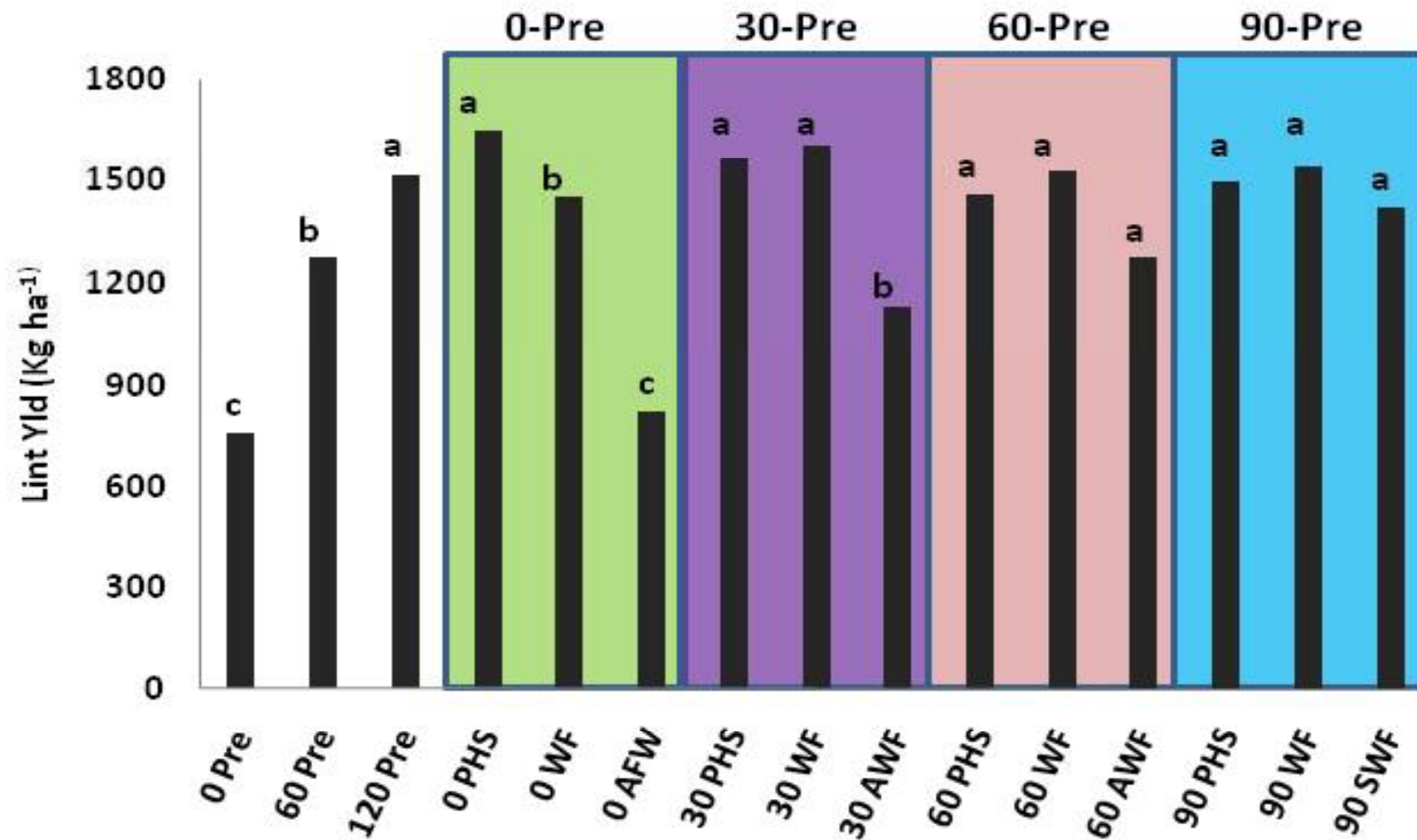


Figure 1. Nitrogen applied Kg ha<sup>-1</sup> and timing of application. Pre-plant (Pre), Early pinhead square (PHS), White Flower (WF), and 30 days after white flower (AWF).

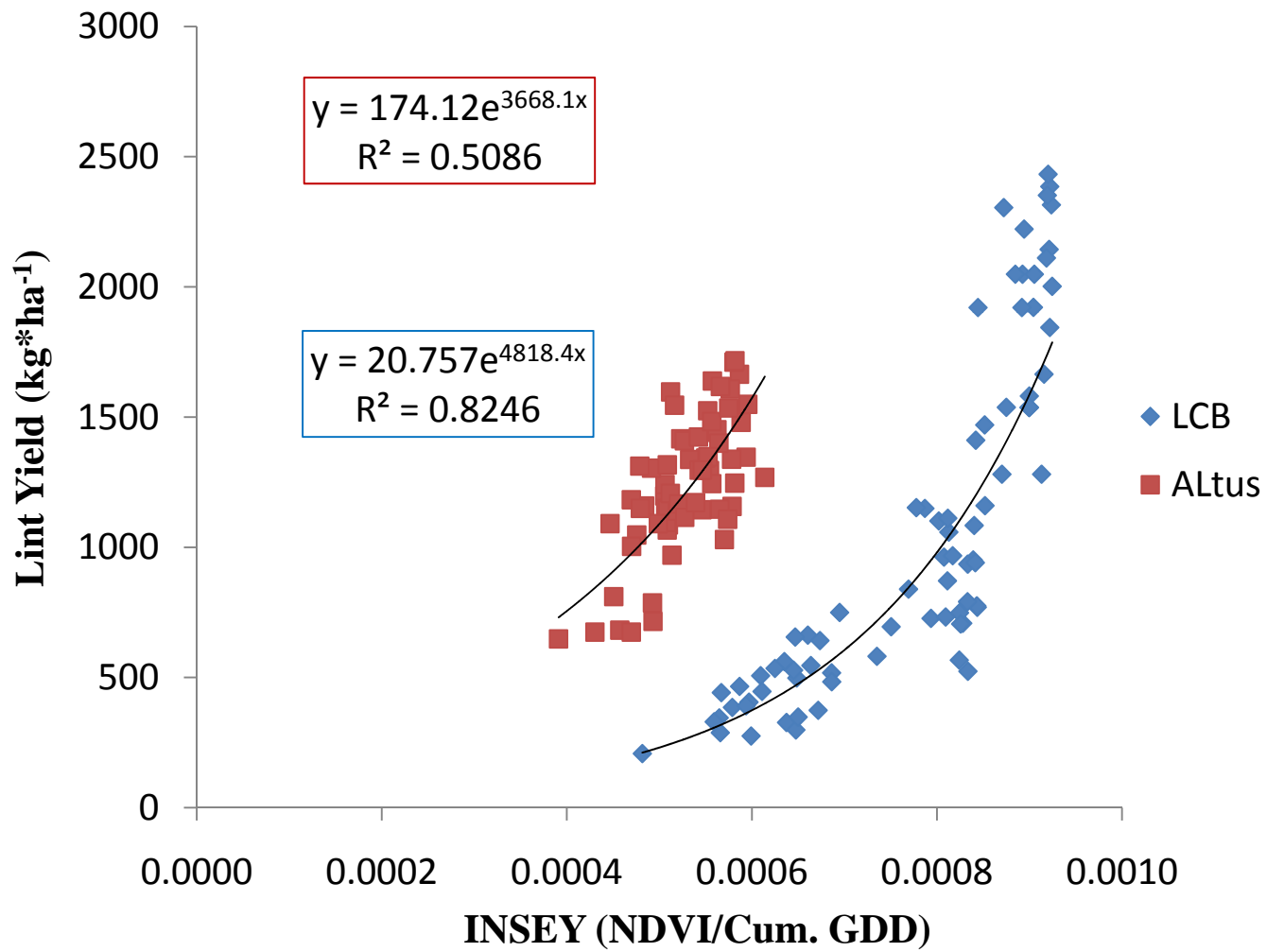
\* Significance measured for each group of three treatments, not all 15 together. Treatments with no significant difference at an alpha of 0.05 reported with same letter.

# Regional $Y_p$ Equation Differences

- Two locations were used in OK, Altus and a site near Lake Carl Blackwell.

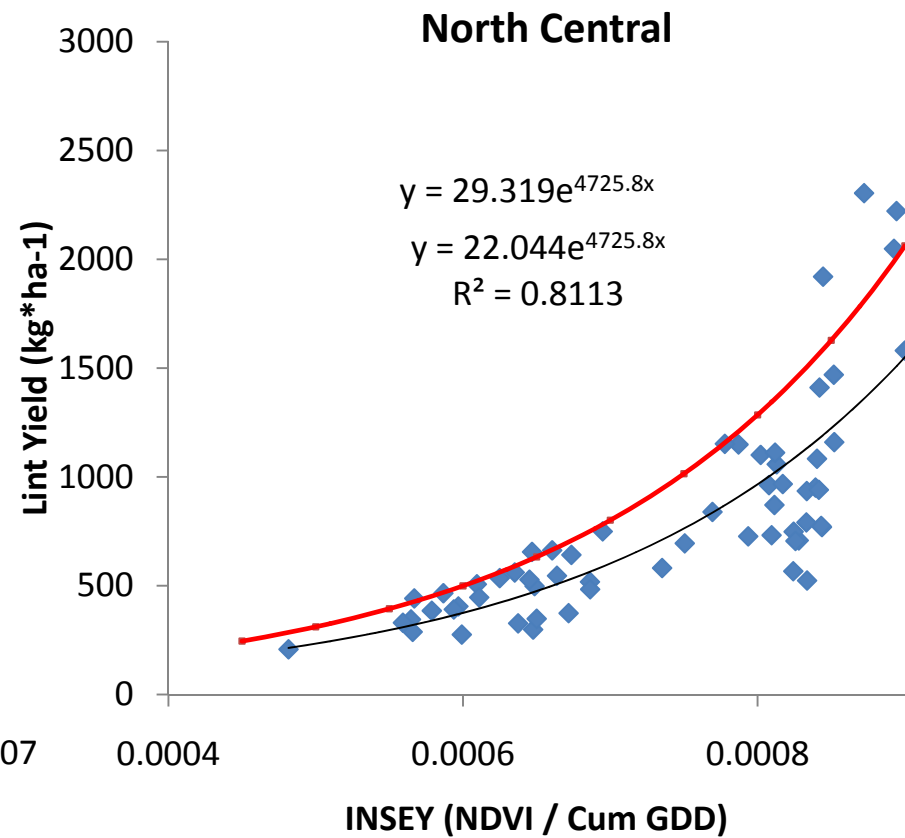
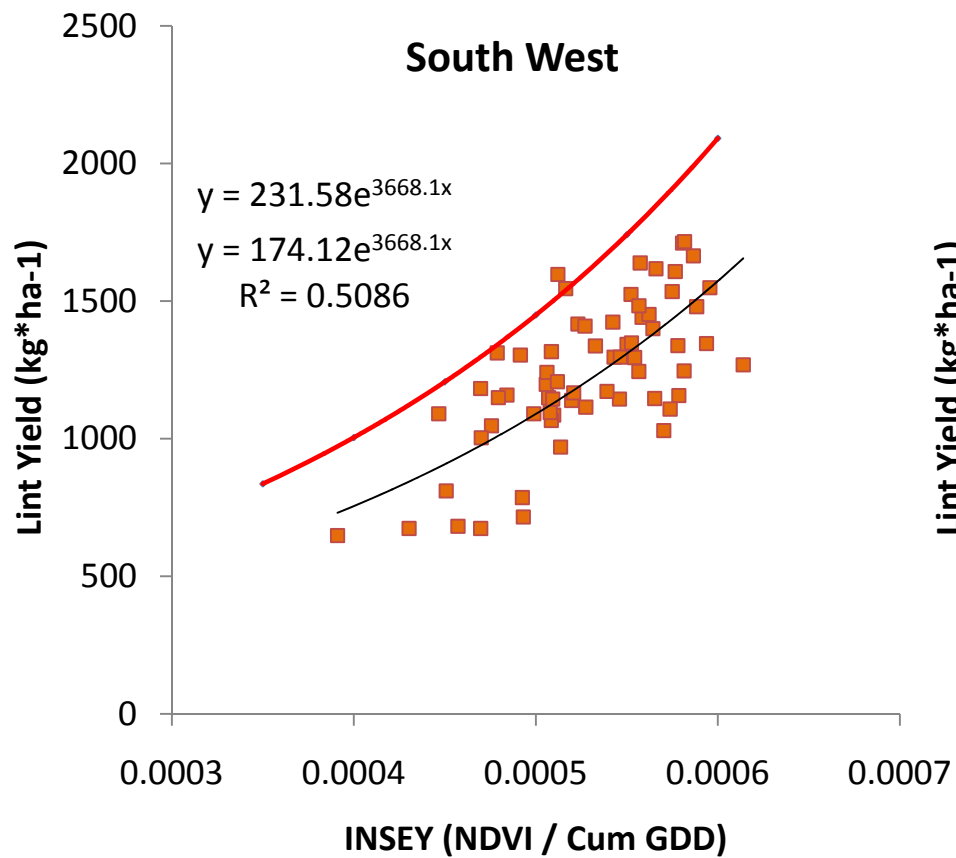


# Yield Prediction

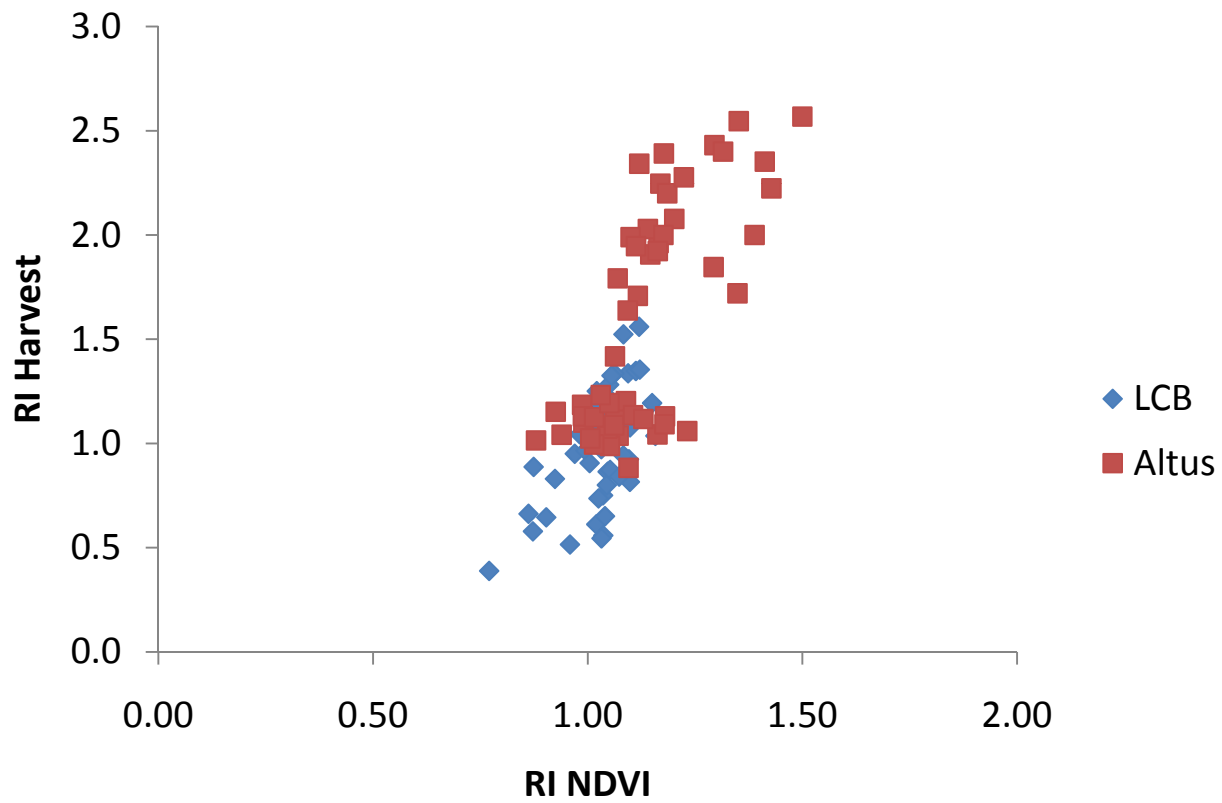




# Yield Prediction Models



# Response Index



# Regional $Y_p$ Equations Differences

The two areas of OK being used are different in many ways, thus causing a difference in the yield prediction equations:

- Climate
- Irrigation
- Soil



# Using NDVI as a Predictor of Cotton Plant Height for Real-Time Sensor-Based Variable Rate Application of Growth Regulators

A special thanks to the cooperators from University of Tennessee: Chris Main and Owen Gwathmey



# Data Collection

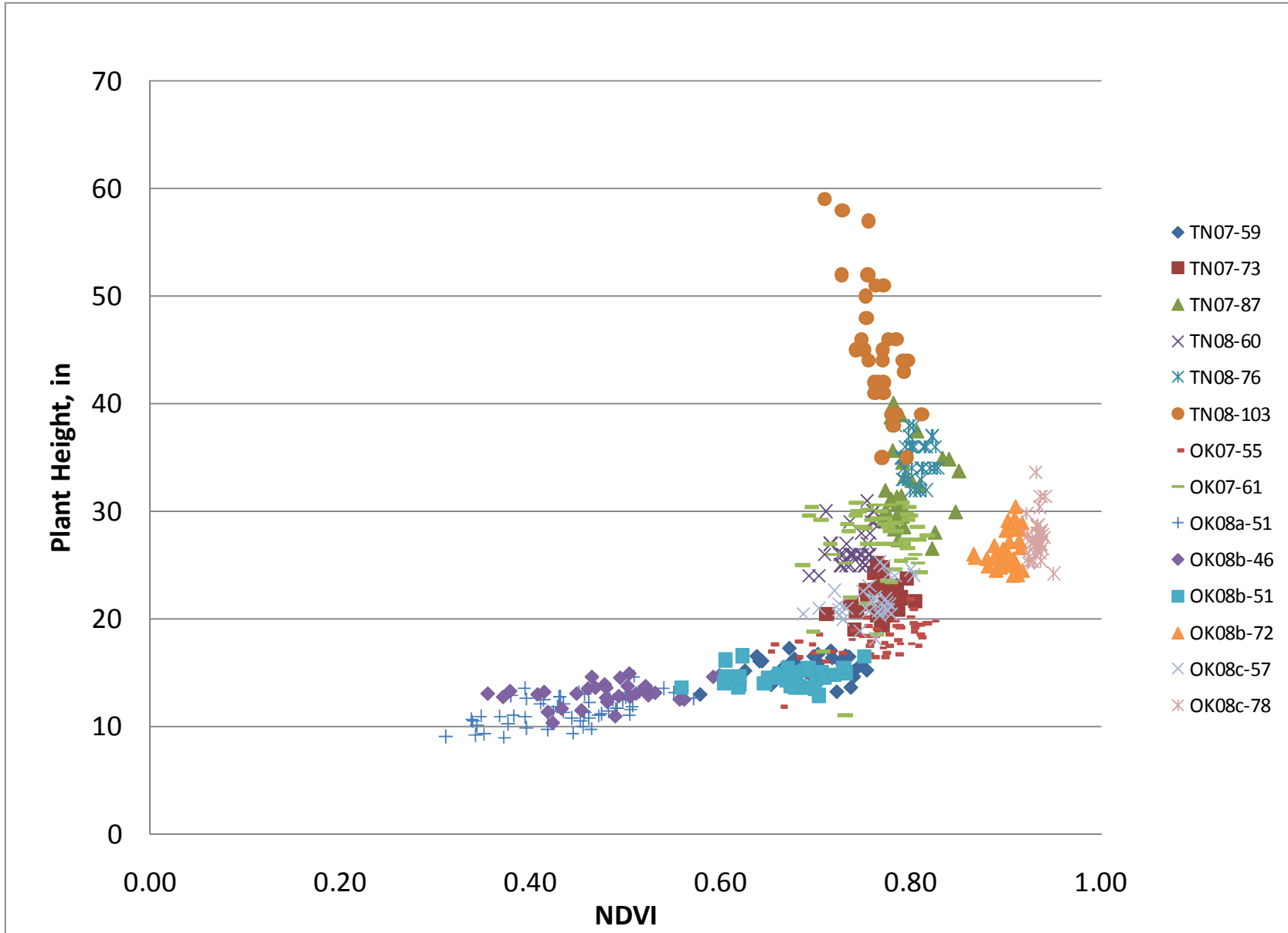
- NDVI recorded with a hand held GreenSeeker sensor
- Height measured at the same time
- Measurements taken over the growing season



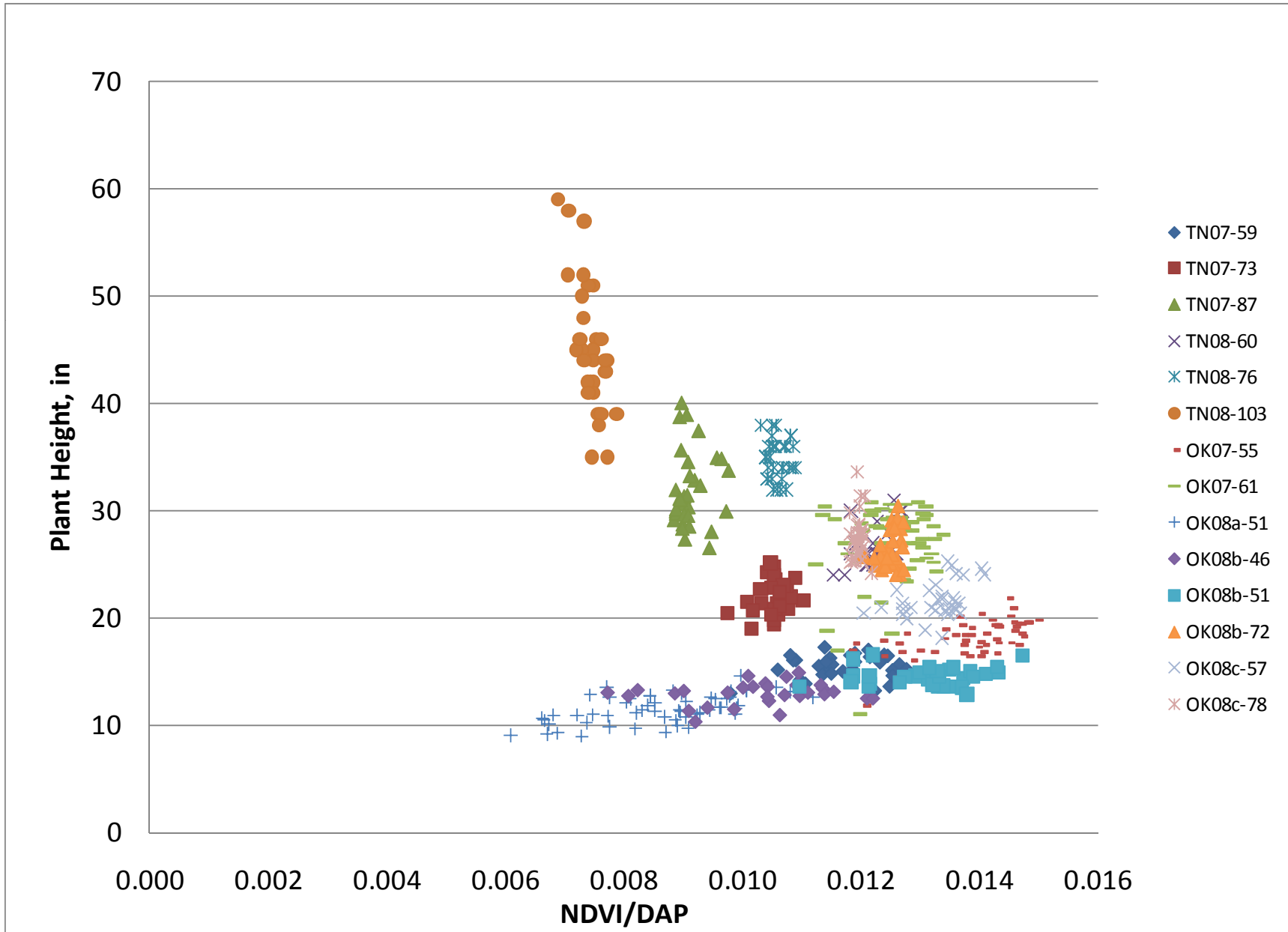
# Normalizing Data

- Since data were collected from two diverse geographic regions and across multiple years (growing conditions), we looked for a means to normalize the data.
- The expectation from normalizing data was that we would have a more robust prescription.
- Days after planting and cumulative heat units were used to normalize NDVI data.

# Plant Height vs NDVI

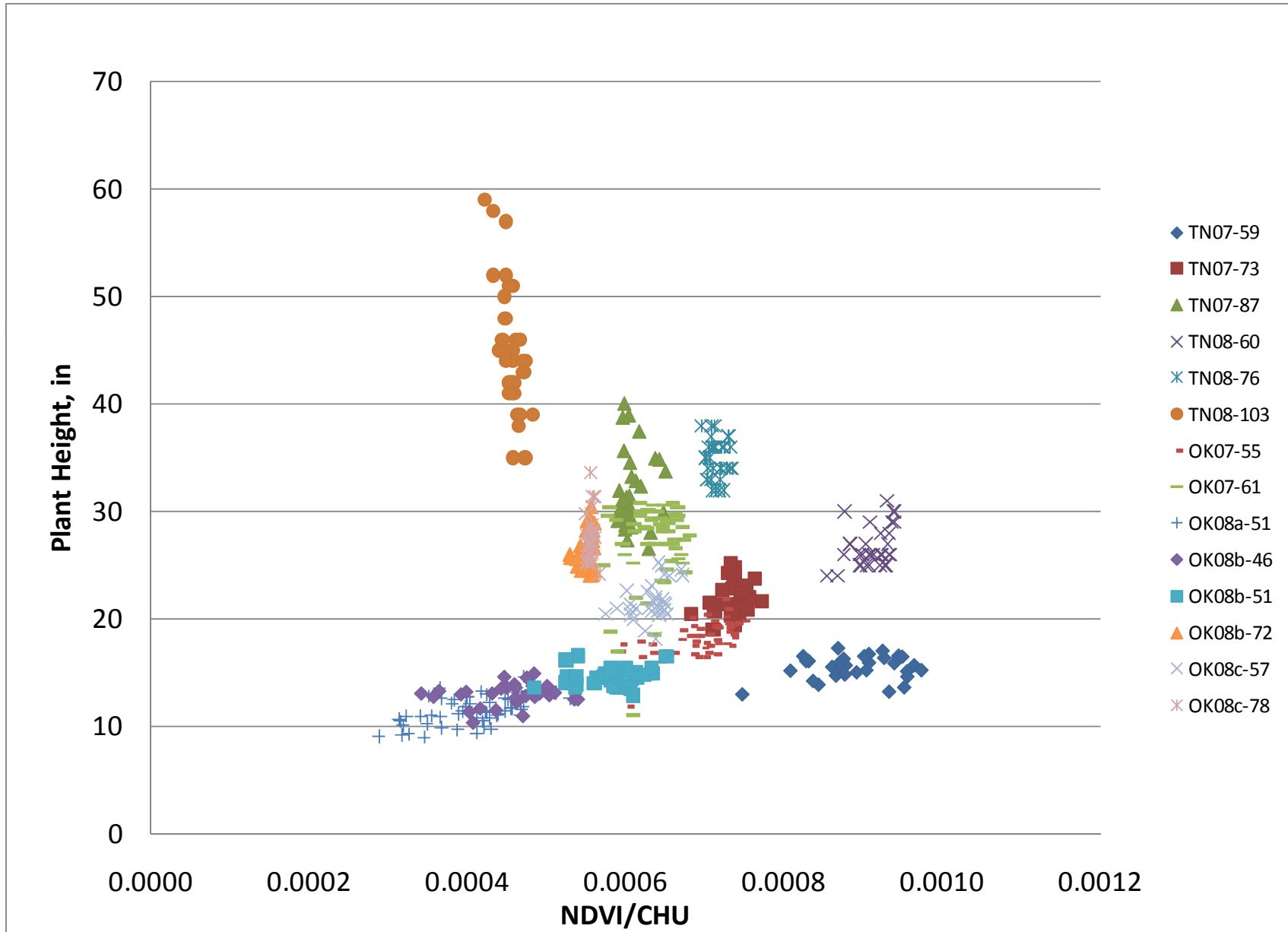


# Plant Height vs NDVI/DAP

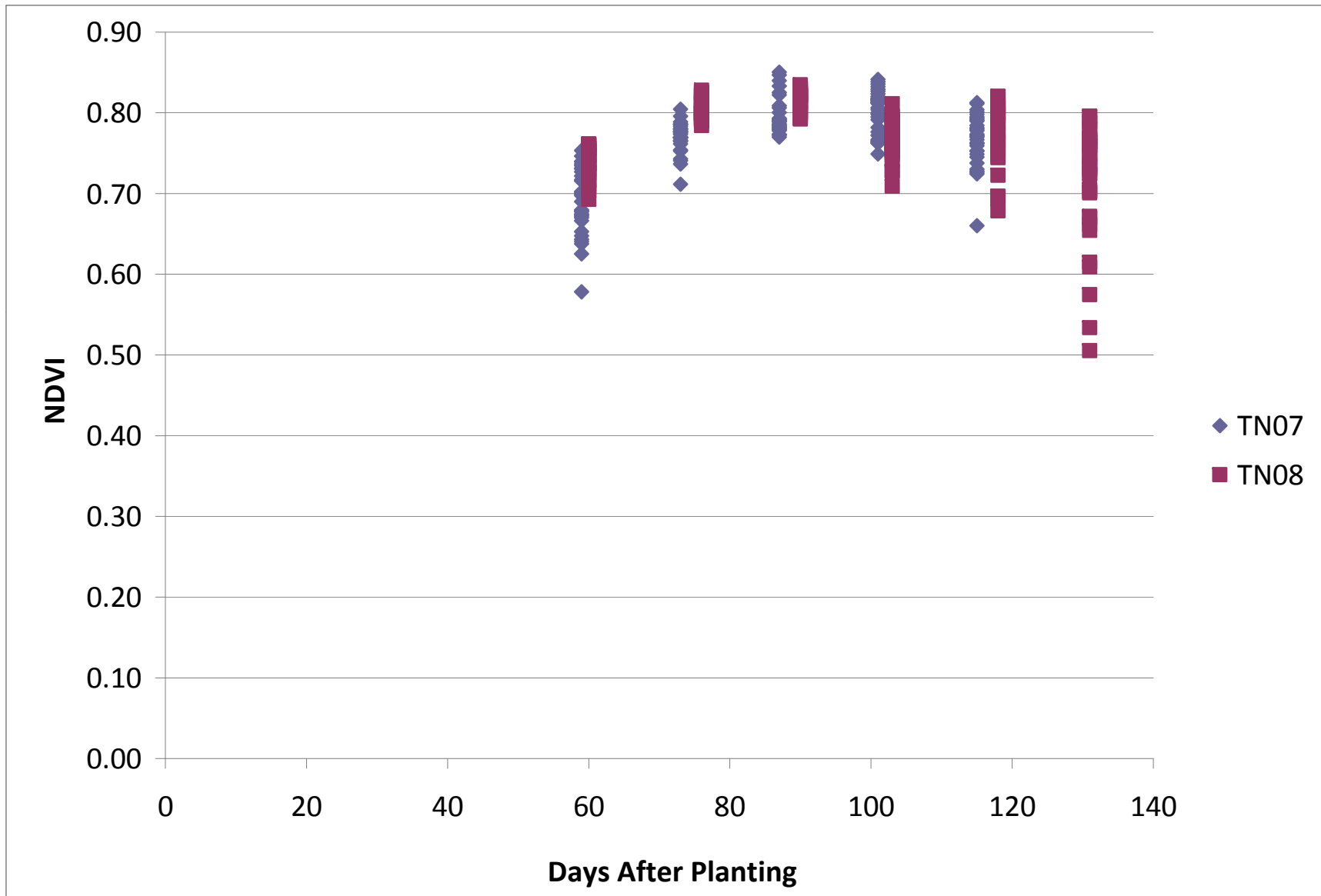




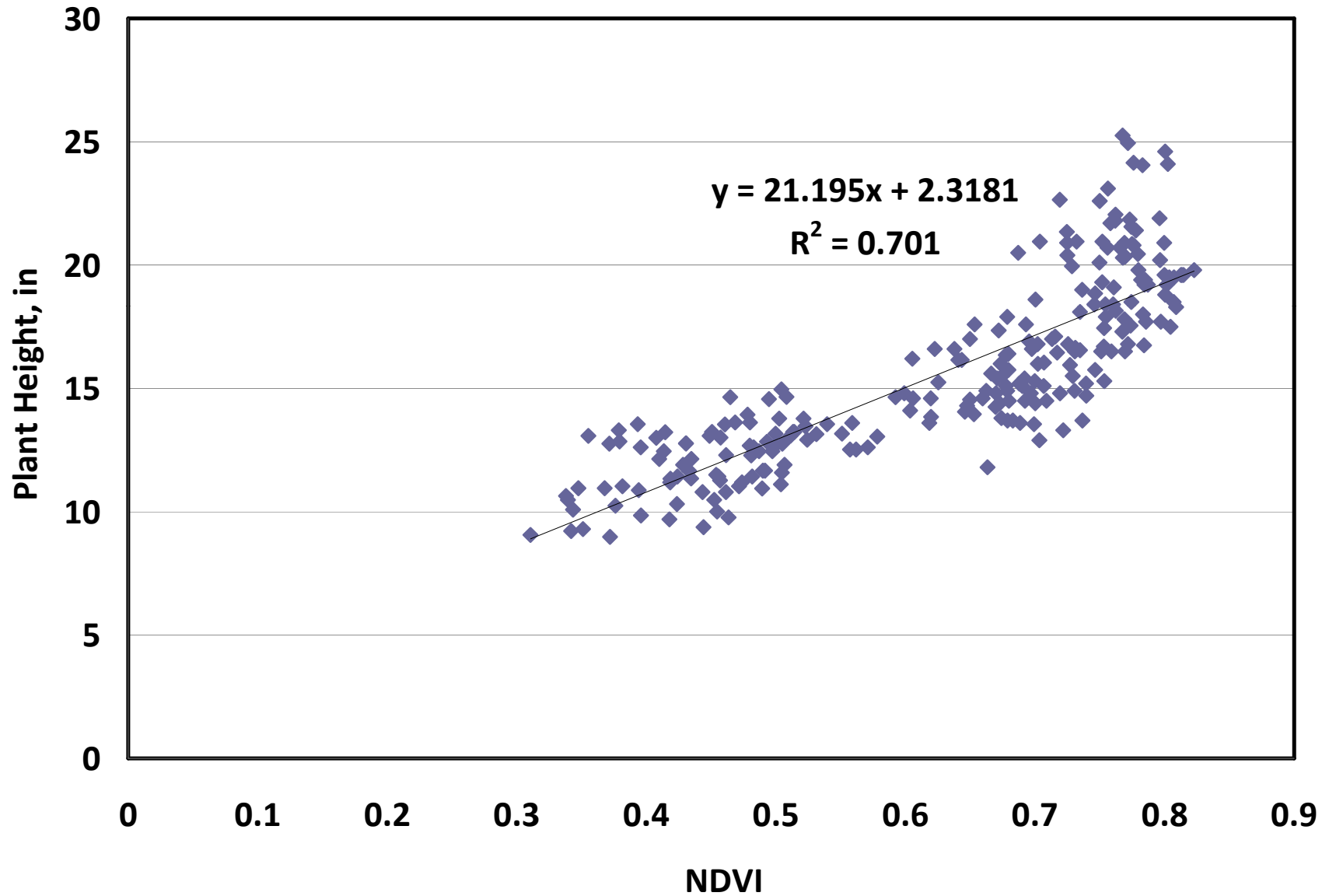
# Plant Height vs NDVI/CHU



# NDVI vs Time



# Height vs NDVI (DAP<60)



# Summary

- NDVI was a good indicator of cotton plant height until plants reached 24 inches (about 60 DAP)
- After height exceeded 24 inches the sensor field of view is all plant.
- Normalization techniques showed no improvement.

# Using NDVI as a Predictor of Cotton Plant Parameters such as Node Above Cracked Boll (NACB) and % Open Boll for Real-Time Sensor- Based Variable Rate Application of Harvest Aids



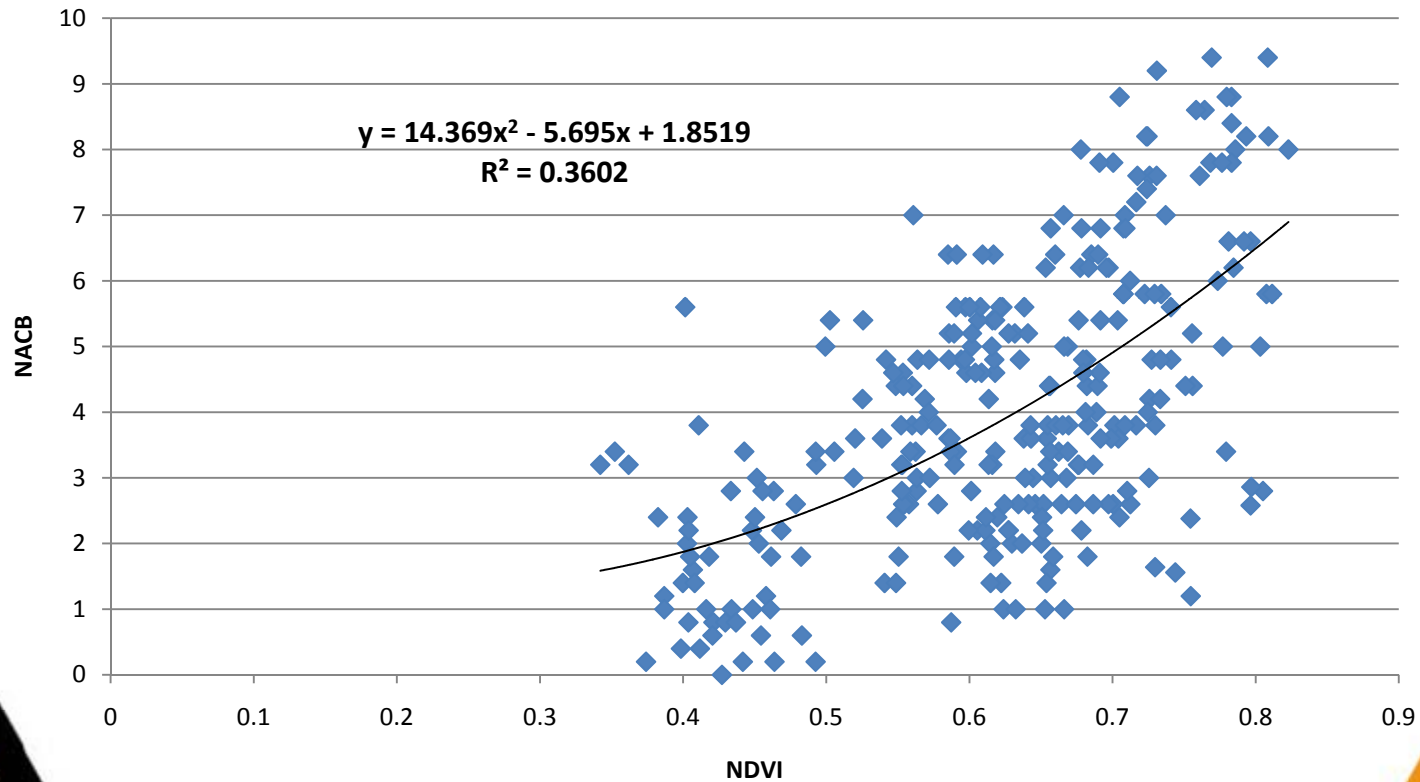
# Data Collection

- NDVI was recorded at various plant stages along within multiple studies.
- NACB and %Open Boll data were collected at various locations throughout the plots during growing years of 2007-2010



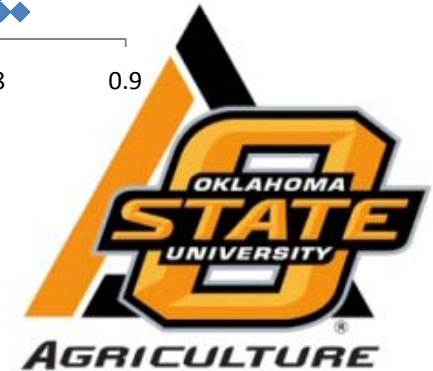
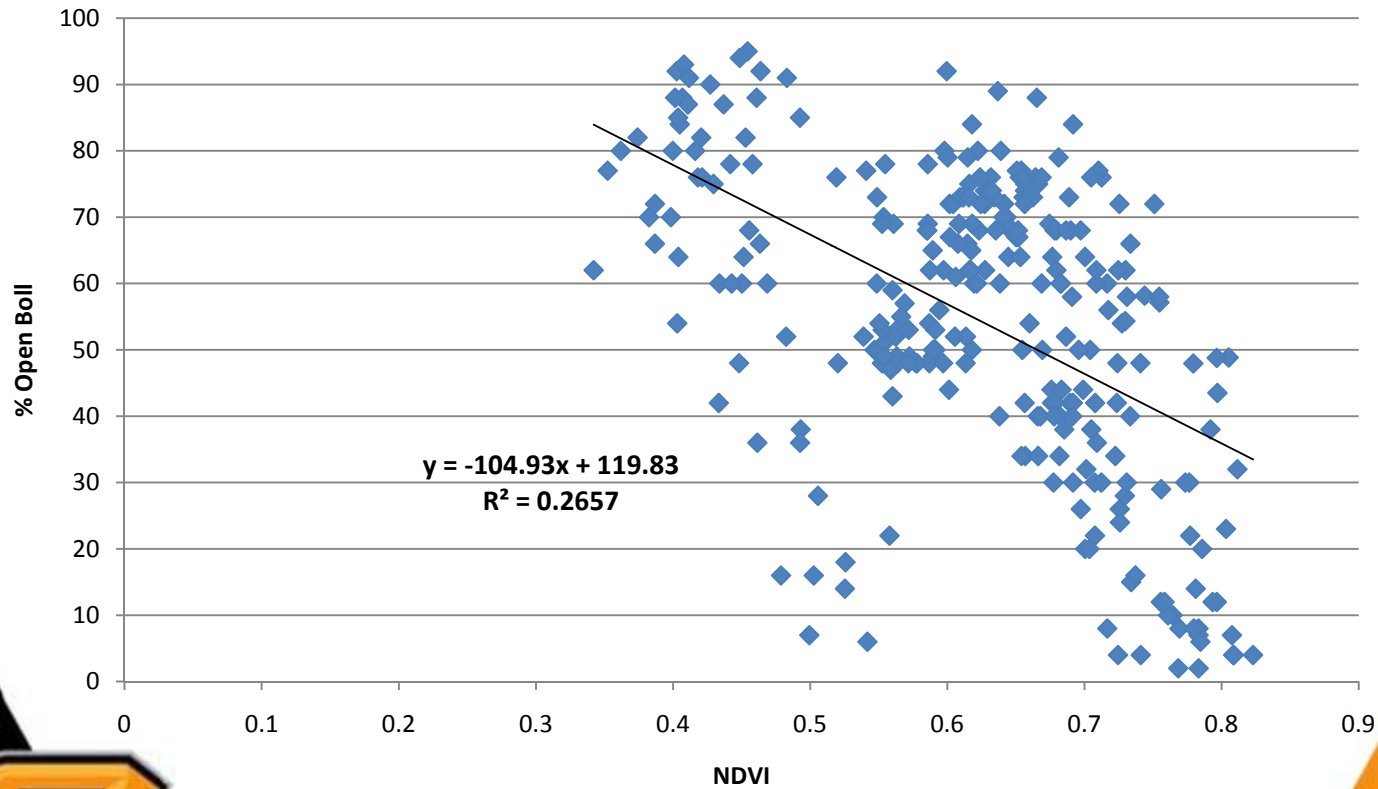
# NACB

NACB 2007-2010



# % Open Boll

% Open 2007-2010





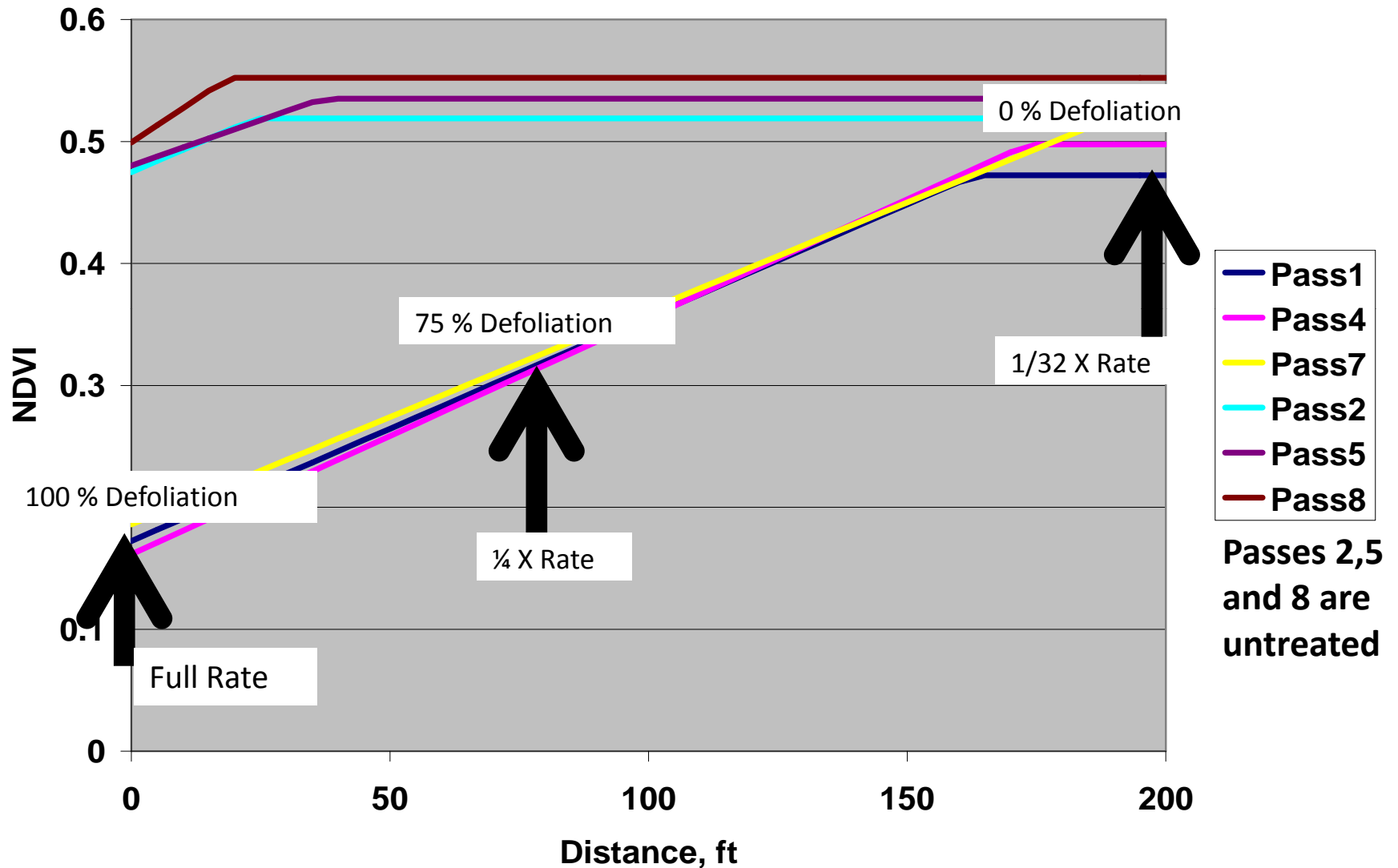
# Treatments

- Specific Plots were dedicated to developing an initial prescription equation for harvest aid applications.

Trt No.	Product	Initial Log Rate	Timing (Maturity)
1	Finish 6 Pro Def 6	96 oz/A 64 oz/A	40% Open Bolls
2	Finish 6 Pro Def 6	96 oz/A 64 oz/A	70% Open Bolls
3	Finish 6 Pro Def 6	96 oz/A 64 oz/A	100% Open Bolls



# NDVI vs. Logarithmic Defoliation



# Initial Results

- A relationship between NDVI and NACB and an inverse relationship between NDVI and % Open Boll.
- An initial prescription equation can be formed from the data collected



# New Equipment



# Questions/Comments?

