

Assessing Midseason Nitrogen Status of Rice Using Spectrophotometry

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Introduction

- Nitrogen is the most limiting factor associated with rice production and its increasing cost has made it one of the major expenses (Norman et al., 2003).
 - ✓ 150-200 kg N ha⁻¹
 - ✓ \$0.59 kg⁻¹ N
- Research has shown that greater than 70% of total N is accumulated by panicle differentiation (Norman et al., 2003).
- Knowledge of the N nutritional status near panicle differentiation (PD) would allow for an informed decision to be made with regards to top-dress N applications.



Introduction

- o Other nondestructive N tools include:
 - v Chlorophyll meter (Turner and Jund, 1991)
 - v Rice gauge (Ntamatungiro et al., 1999)
 - v Aerial imagery (Jayroe et al., 2005)
 - v Yardstick method (Stevens et al., 2008)

Introduction

- Varying N application rates are manifested in crop canopy spectral reflectance
 - ✓ Tarpley et al., 2000
 - ✓ Xue et al., 2004
 - ✓ Sripada et al., 2005





Goals

- ⊖ Promote higher N use efficiency
- ⊖ Greater return on N investment
- ⊖ Positive environmental message



Objective

- The objective of this study was to evaluate the potential for using spectrophotometry as a nondestructive measurement to assess the N nutrition status for rice at midseason.



Materials & Methods

- Randomized complete block design with four replications
- Cultivars
 - ▼ Cocodrie, Wells, XL723
- Six preflood N rates
 - ▼ 0, 67, 101, 134, 168, and 202 kg ha⁻¹
- Reflectance was measured at panicle differentiation in 1.5 nm increments from 350 to 1050 nm using a GER 1500
- Reflectance readings were collected from approximately 0.75 m above the canopy between the hours of 1100 and 1400



Materials & Methods

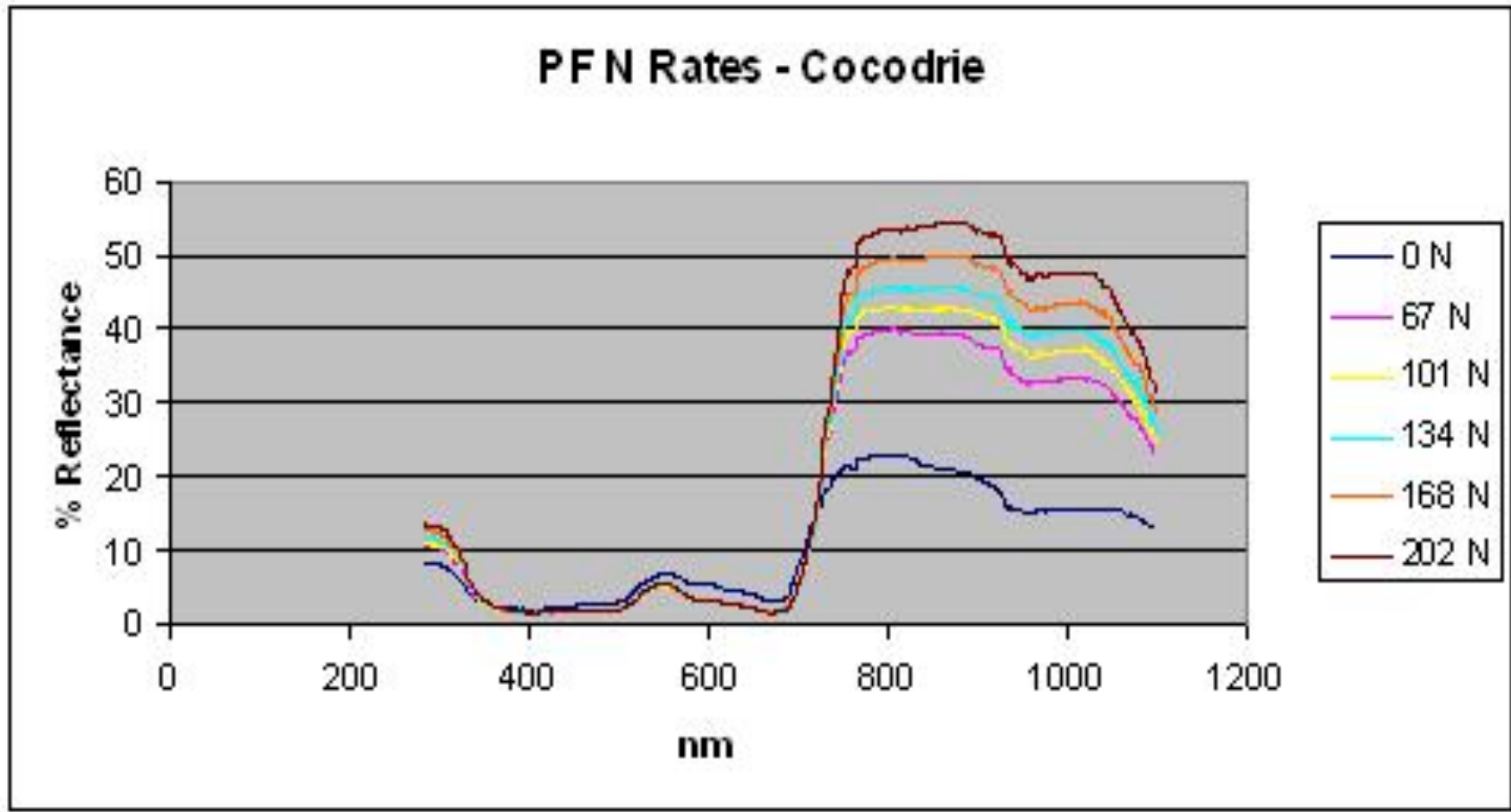
- Biomass harvested at panicle differentiation from 0.9 m of row and analyzed for total dry matter (TDM) and N concentration (%N).
- These variables were used to calculate total N uptake (TNU).
- Yield collected when grain moisture was between 170 and 200 g kg⁻¹.



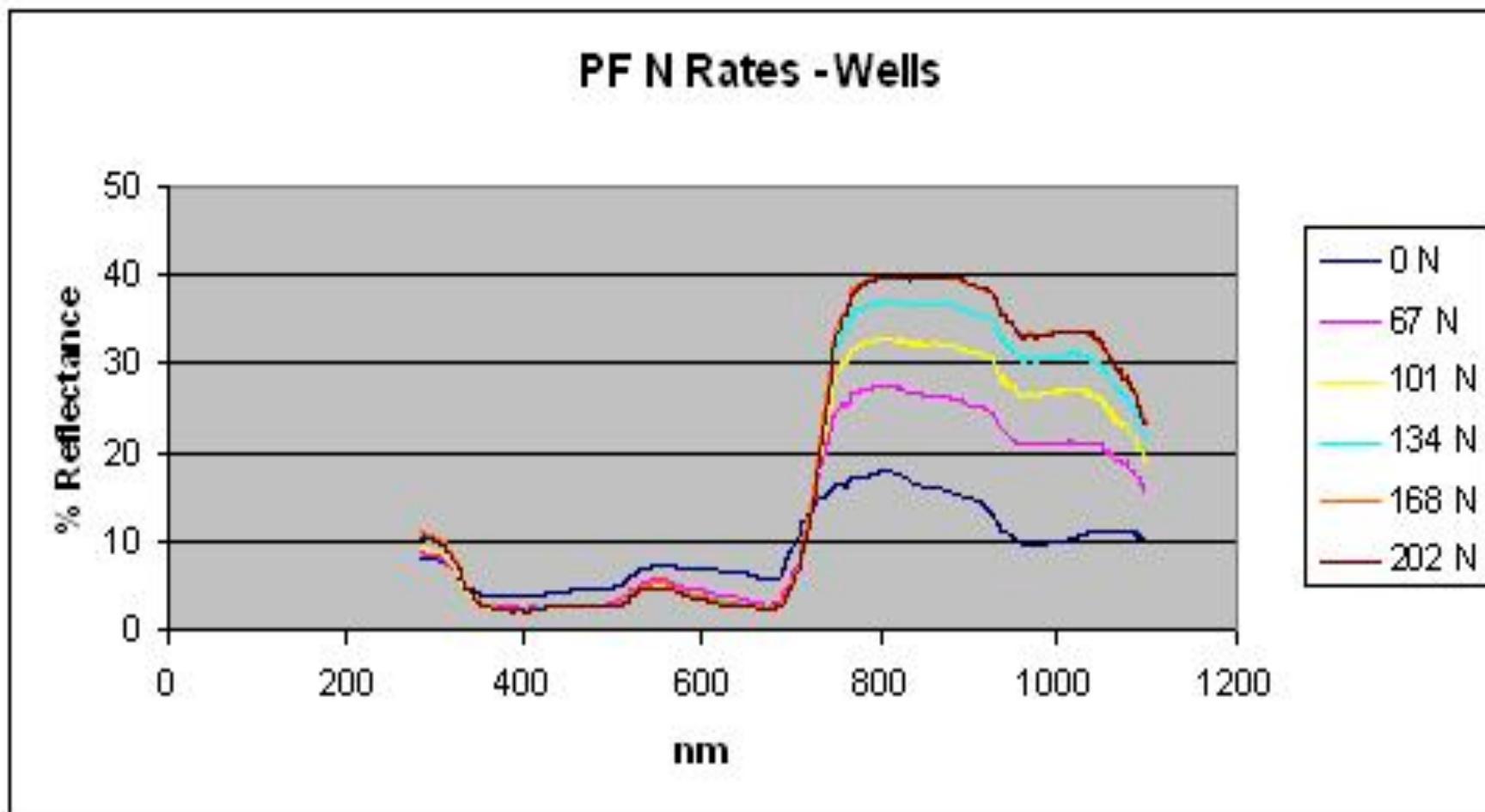
Materials & Methods

- Pearson's Correlation Coefficients generated for TDM, TNU, %N, yield, and %Ref_{850nm}
- Regression analysis conducted using PROC GLM using linear and quadratic terms

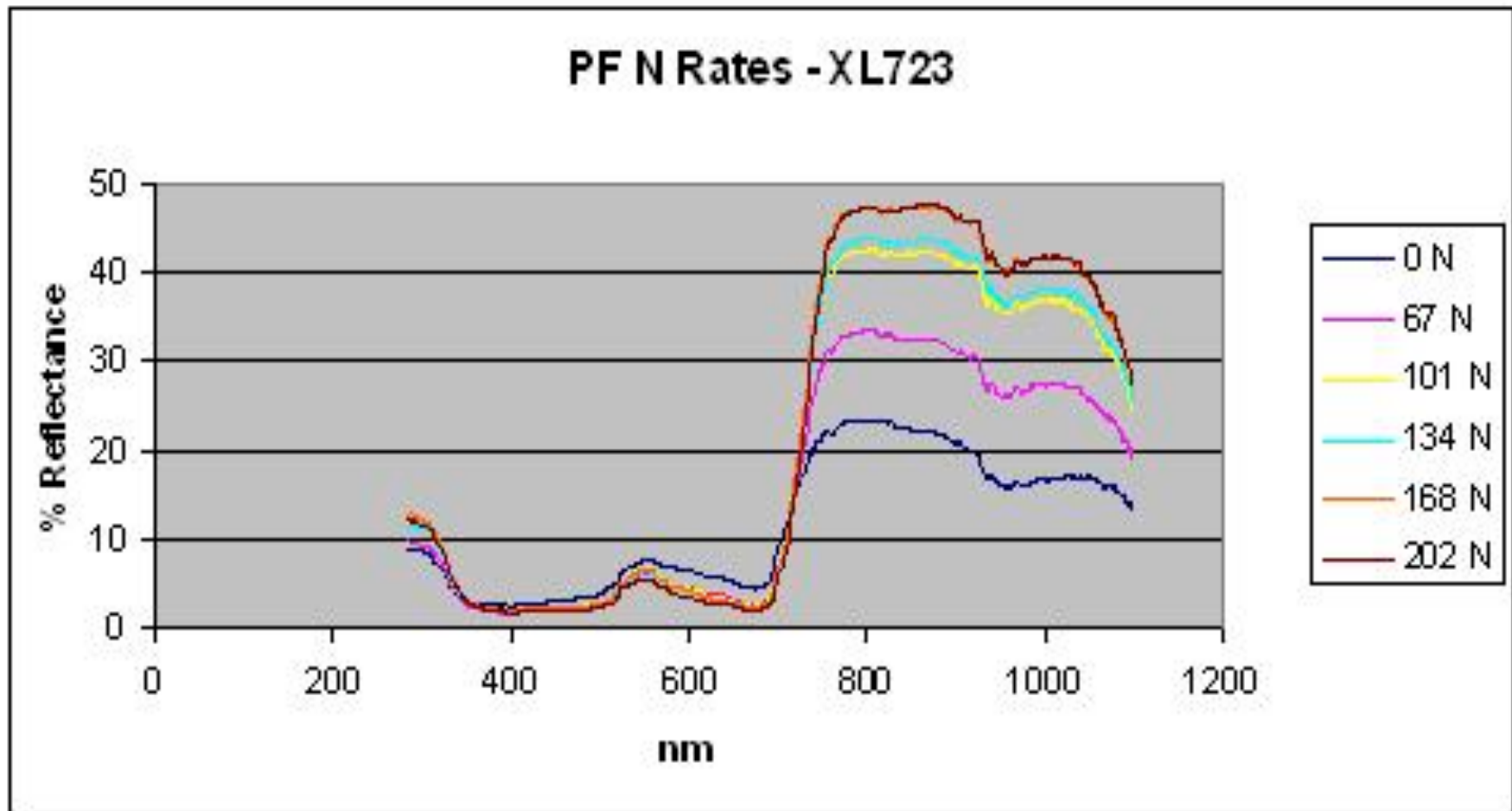
Results



Results



Results



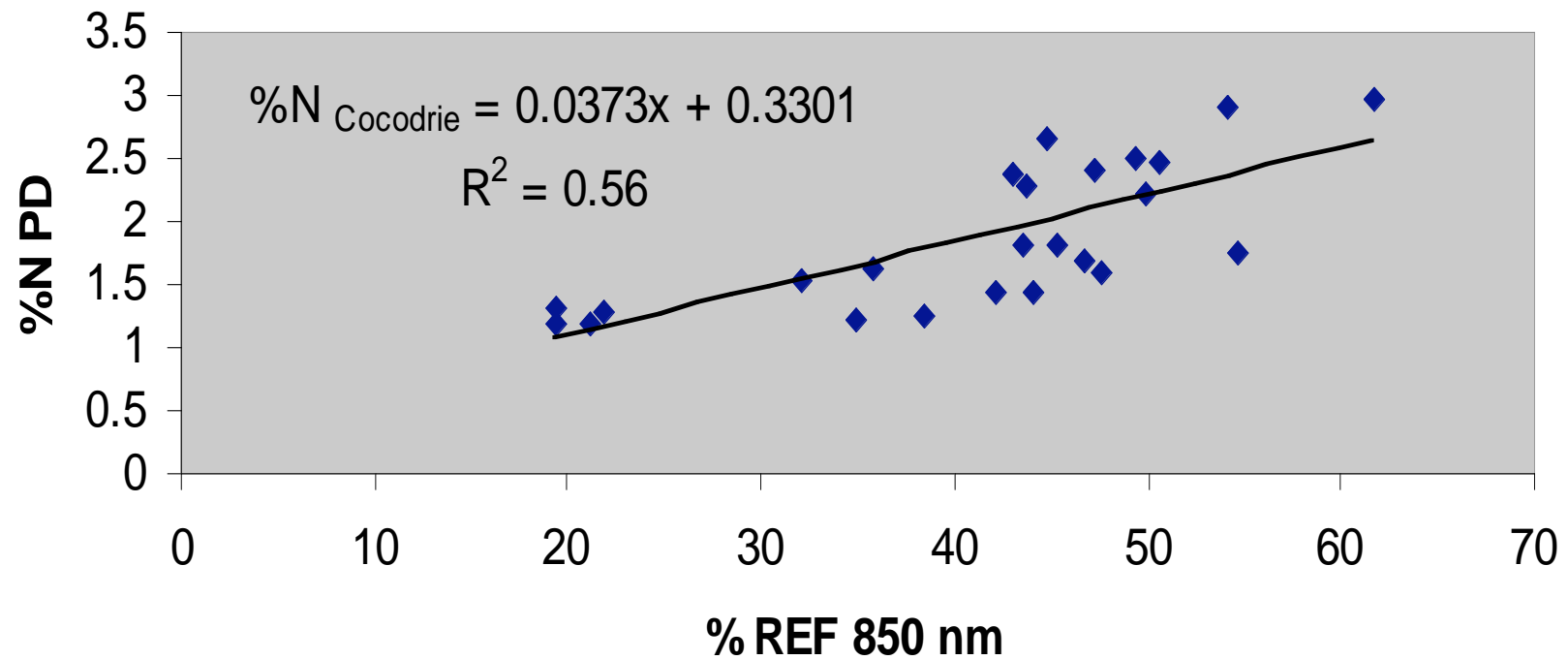
Results

Response Variable	% Reflectance at 850 nm		
	Cocodrie	Wells	XL723
	Pearson's r		
%N	0.75***	0.82***	0.68***
TDM	0.92***	0.88***	0.83***
TNU	0.86***	0.87***	0.82***
Yield	0.92***	0.90***	0.90***

*** = Significant at the 0.0001 level of probability

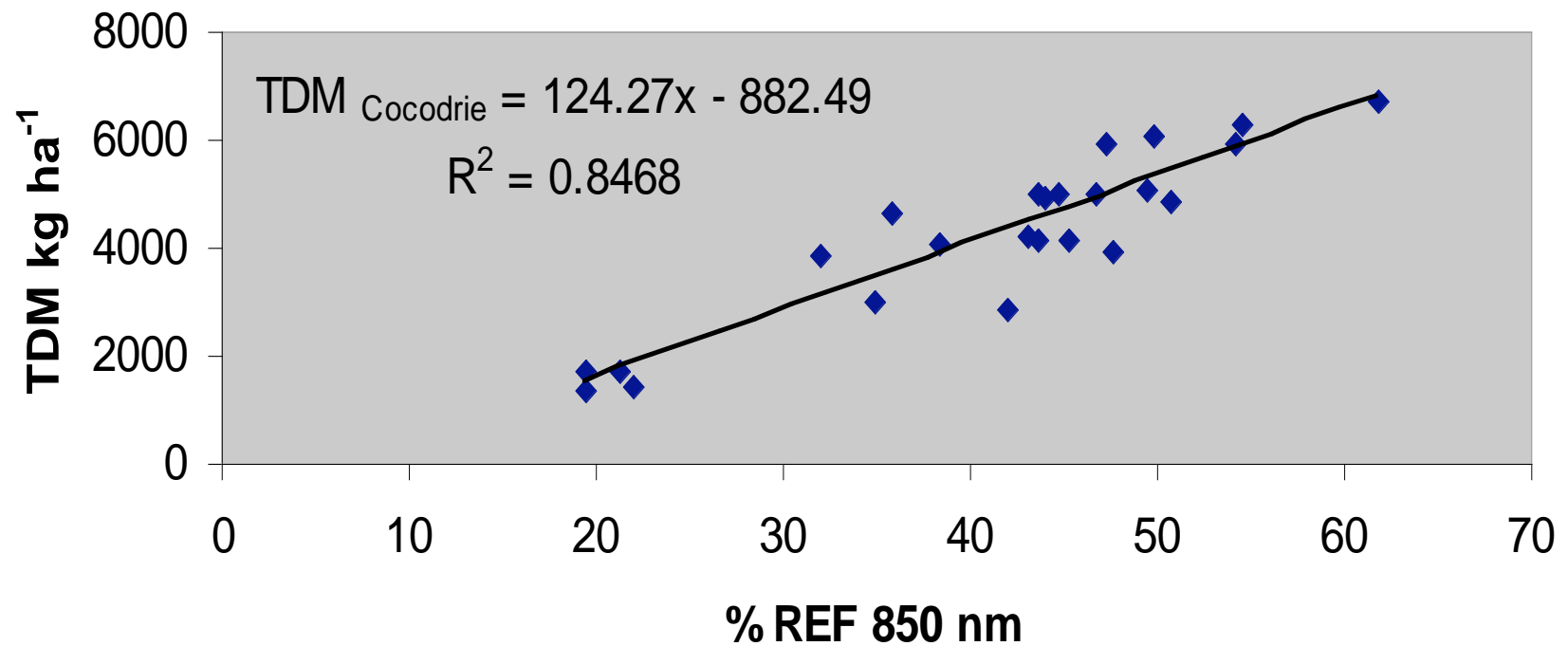
Results

Cocodrie %N as a function of Reflectance



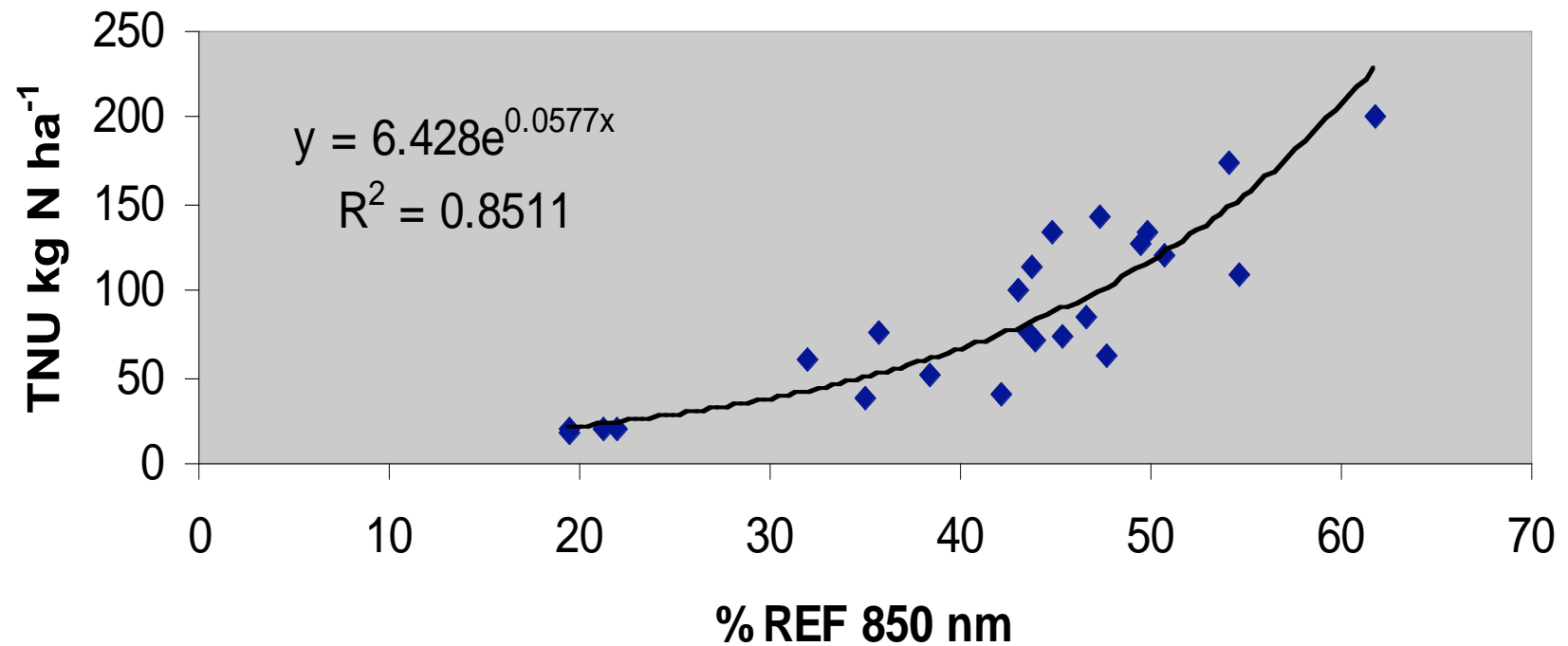
Results

Cocodrie TDM as a function of Reflectance



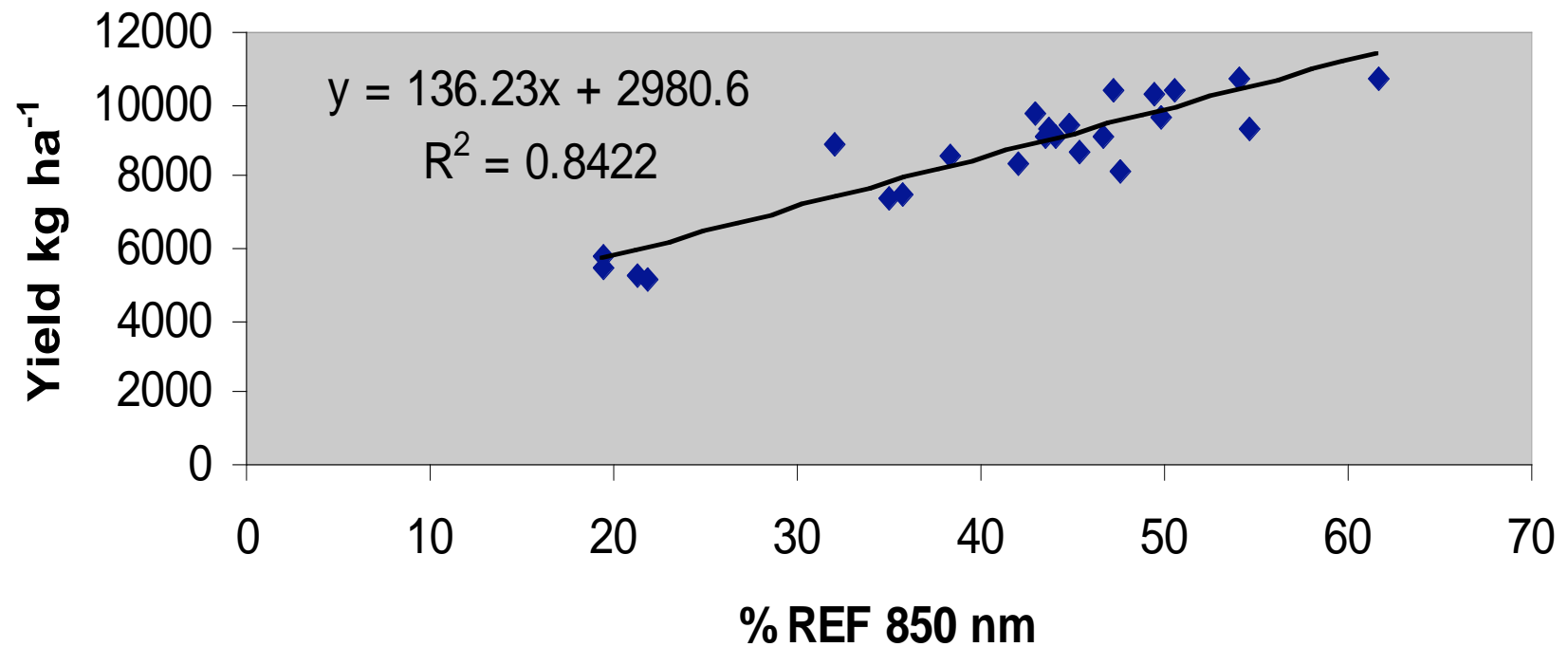
Results

Cocodrie TNU as a function of Reflectance



Results

Cocodrie Yield as a function of Reflectance





Summary

- %N, TDM, TNU, and grain yield were positively correlated (≥ 0.68) with %REF_{850 nm} for all three cultivars
- Regression analysis resulted in significant models with relatively high Coefficients of Determination (>0.56) for %N, TDM, TNU, and grain yield for Cocodrie
- Other sites and vegetative indices will be analyzed
- Studies will be repeated in multiple states in 2008 and 2009

Acknowledgments/Questions?

