

## Rationale

The algorithm presently used at Oklahoma State University for nitrogen (N) fertilizer recommendation utilizes the normalized difference vegetation index (NDVI) to predict yield potential, and the response index using N Rich Strips. Besides NDVI, other parameters such as plant height and stalk diameter can be utilized to predict yield. Combining these factors could aid in refining current mid-season N fertilizer recommendations in Maize (*Zea Mays* L.).

## Objective

Evaluate the relationships between stalk diameter, plant height, NDVI, and final maize grain yield.



Figure 1. Reflectance measurement using the bike sensor

## Materials and Methods

- Site-years:
  - Efaw Research Station, Stillwater, OK., 2009-2011
  - Lake Carl Blackwell, Stillwater, OK., 2009-2012
  - Eastern Research Station, (Haskell, OK.), 2009-2010
  - Ciudad Obregon, Mexico, 2010
- NDVI measurements using bike sensor (shaft encoder) (GreenSeeker™) (Fig. 1).
- NDVI, individual plant height and stalk diameter at V6-VT growth stages in selected corn rows (Fig 2).
- Pre-plant N rates 0, 45, 90, and 180 kg N ha<sup>-1</sup>, Oklahoma, and 35, 70, and 245 kg N ha<sup>-1</sup>, Mexico.
- Linear and non-linear regression analysis using SAS.



Figure 2. Measuring stalk diameter and plant height

## Results

**Table 1. Linear relationship between by-plant grain yield and measured plant height, stalk diameter, and NDVI, at V6, V8, V10, V12, and VT corn growth stages, averaged across locations and years in Oklahoma and linear relationship between by plant and stalk diameter in Mexico, V15 in 2010.**

Growth stage	Independent	Dependent	r <sup>2</sup> ‡
V6	Height, cm	Grain yield, kg ha <sup>-1</sup>	0.39**
	Stalk diameter		0.09*
	Stalk diameter*height		0.02¶
	NDVI		0.05¶
	NDVI*height		0.02¶
V8	Height	Grain yield, kg ha <sup>-1</sup>	0.25**
	Stalk diameter		0.03*
	Stalk diameter*height		0.17**
	NDVI		0.06**
	NDVI*height		0.23**
V10	Height	Grain yield, kg ha <sup>-1</sup>	0.04**
	Stalk diameter		0.06**
	Stalk diameter*height		0.08**
	NDVI		0.04**
	NDVI*height		0.06**
V12	Height	Grain yield, kg ha <sup>-1</sup>	0.04**
	Stalk diameter		0.13**
	Stalk diameter*height		0.11**
	NDVI		0.01*
	NDVI*height		0.04**
VT	Height	Grain yield, kg ha <sup>-1</sup>	0.11**
	Stalk diameter		0.08**
	Stalk diameter*height		0.14**
	NDVI		0.05**
V15	Stalk diameter	Biomass, kg plant <sup>-1</sup>	0.68**^

\*, \*\* Model significant at 0.05 and 0.01 probability levels, respectively.

‡ r<sup>2</sup>, proportion of variability in the dependent variable explained by the independent variable by the selected model.

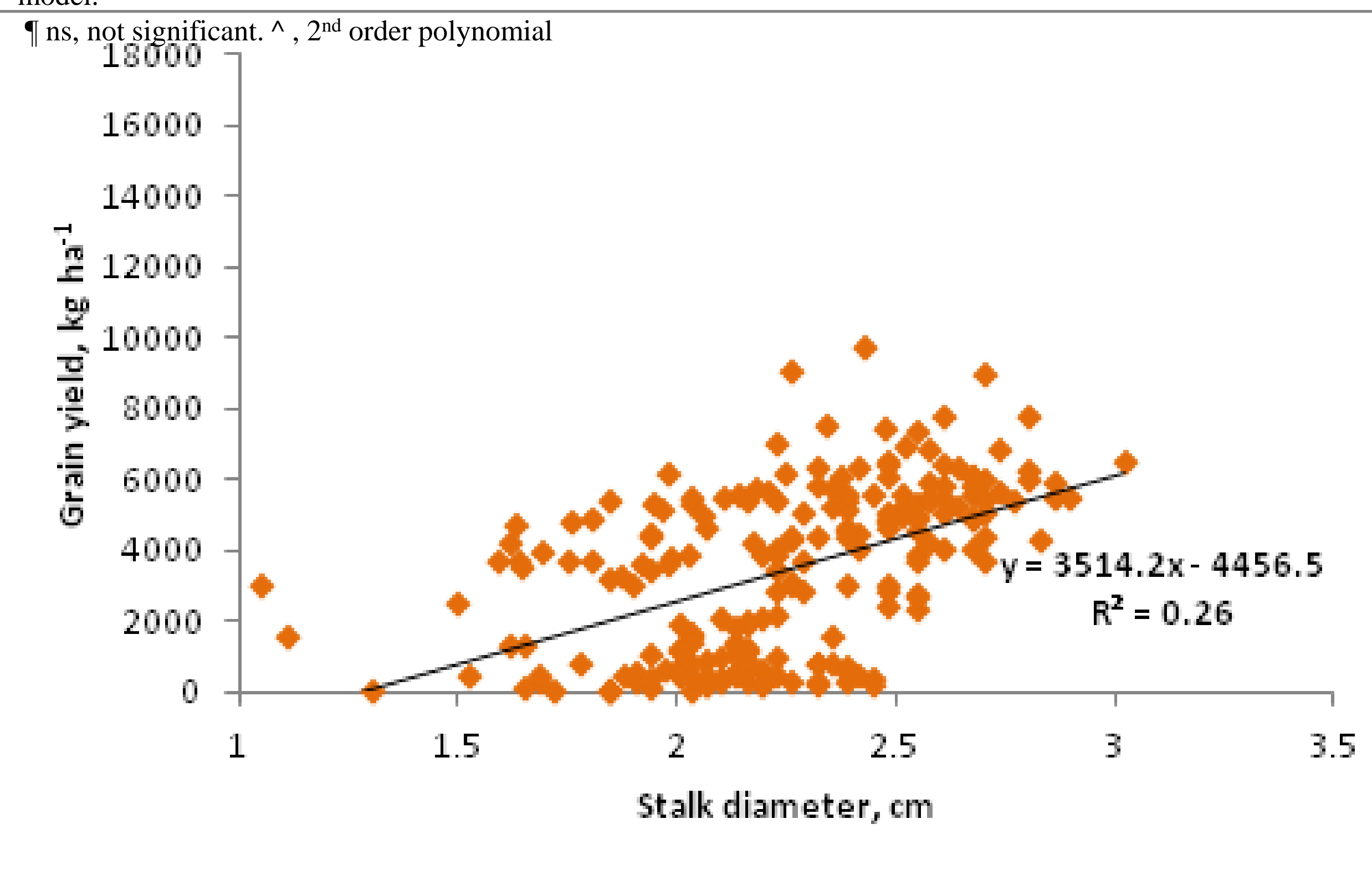


Figure 3. Grain yield versus stalk diameter at growth stage V8, Efaw, OK. 2010-2011.

- ¶ ns, not significant. ^, 2<sup>nd</sup> order polynomial
- In 2009 and 2010, plant height at V10 and V12 explained 52 and 53% of the yield variability, respectively.
- Across all sites and years, plant height at V6 and V8 positively correlated with grain yield, with r<sup>2</sup> of 0.39 and 0.25, respectively (Table 1).
- Across all years stalk diameter at V8 at Efaw, r<sup>2</sup> of 0.26 (Fig. 3).
- Stalk diameter X plant height at V12, was highly correlated with grain yield, r<sup>2</sup> of 0.67 at Lake Carl Blackwell (Fig. 4).
- From 2009-2012, positive correlation between grain yield and stalk diameter X plant height at V8 with r<sup>2</sup> of 0.17 averaged over Efaw, Haskell, and Lake Carl Blackwell, respectively (Fig. 5).
- By-plant biomass highly correlated with stalk diameter (r<sup>2</sup>=0.68), Ciudad Obregon, Mexico.

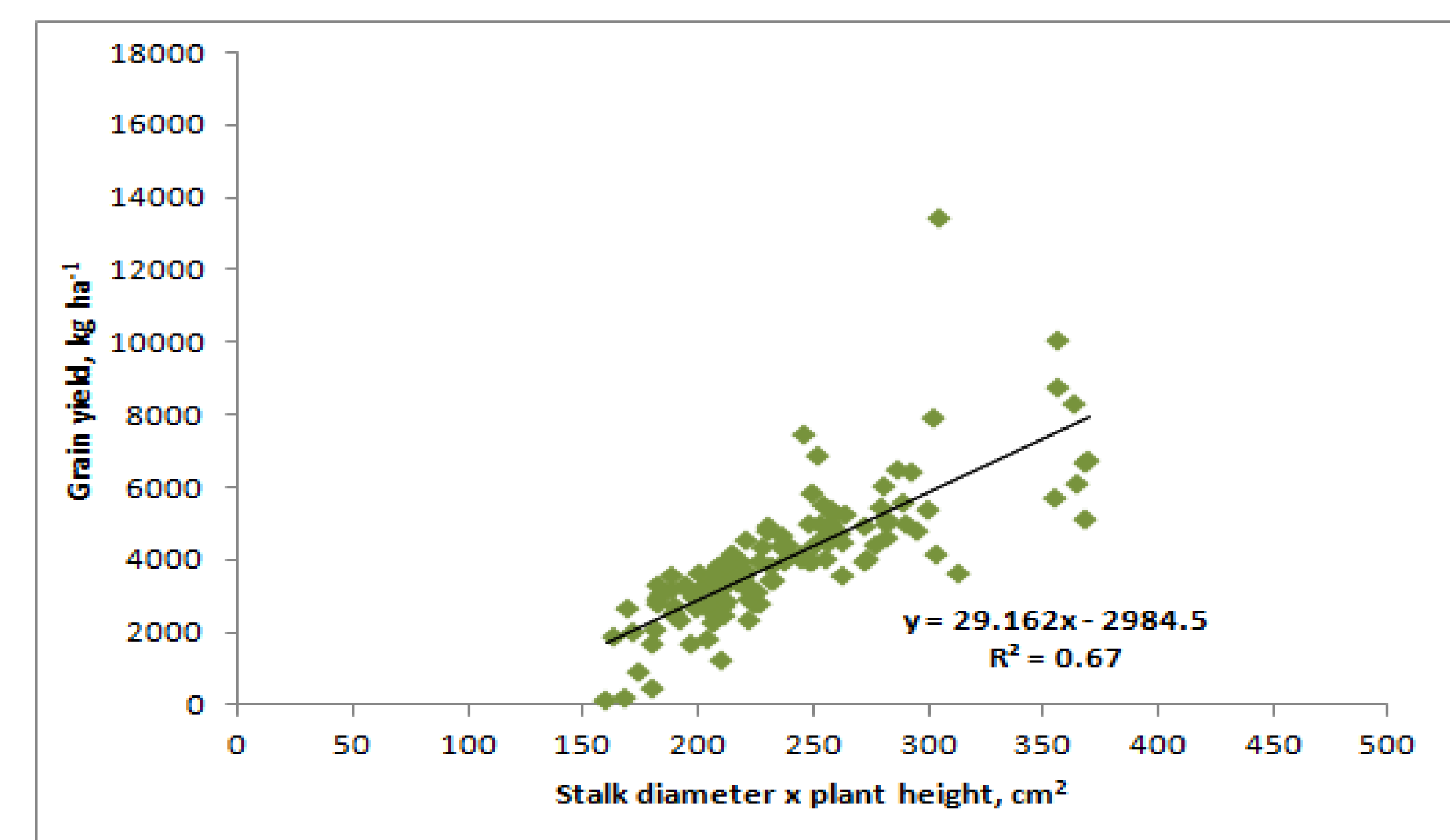


Figure 4. Grain yield versus stalk diameter x plant height at growth stage V12, Lake Carl Blackwell, OK. 2010.

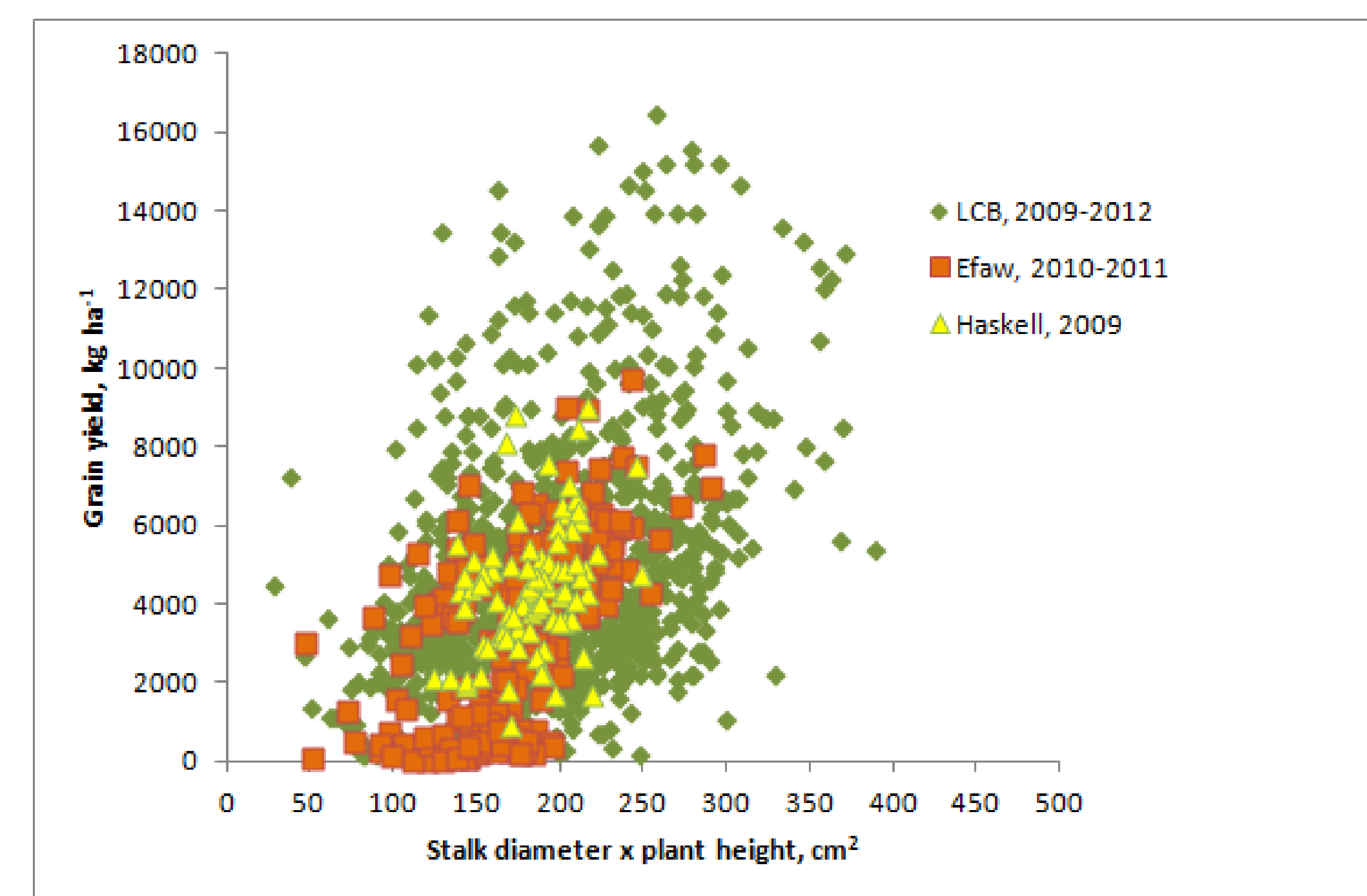


Figure 5. Grain yield versus stalk diameter at growth stage V8, Efaw, Haskell, and Lake Carl Blackwell, OK. 2009-2012.

## Conclusions

- Excessive heat and raccoon damage lowered yields in 2011 and 2012.
- Correlation between stalk diameter and grain yield highly variable across sites and years.
- Stalk diameter X height was better correlated with by plant grain yield than NDVI.
- Stalk diameter X plant height had improved correlation with yield compared to plant height alone in 2009 and 2010.
- Overall, plant height at V6 and V8 was positively correlated with by-plant grain yield.
- Stalk diameter X plant height was a good predictor of grain yield from V8-V12 in 2009 and 2010.
- Stalk diameter and plant height are physiological traits that could be used to refine current mid-season fertilizer N recommendations.

## Acknowledgments

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