GENOTYPE SPECIFIC MANAGEMENT FOR NITROGEN USE EFFICIENCY IN KENTUCKY SOFT RED WINTER WHEAT

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INTRODUCTION

The complex interaction of genotype x environment x management (GxExM) that defines crop yield is often only explored with research on a single genotype or a select few genotypes. Improvements in crop management and understanding local adaptation to climate variability will require a broader understanding of specific genotype interactions with management systems across multiple environments. A multi-year study investigating the potential for variety specific management systems based on phenotypic characters in Kentucky soft red winter wheat (*Triticum aestivum*) was initiated in the 2012-2013 growing season.

METHODS

A randomized split plot design was replicated 3 times at the University of Kentucky Spindletop Research Farm in Lexington, KY. The field study evaluated 10 genotypes under 3 management systems across 4 nitrogen rates. (Tables 1, 2) Field sampling included: kernel growth rate, soil nitrate analysis, vegetative tissue and grain nitrogen analysis, relative water content, developmental staging, lodging and disease observations. Data collection was determined as input for DSSAT crop model for use with implementing climate scenarios on specific wheat genotypes. Data was analyzed using SAS Proc GLM (p=0.05).

TREATMENTS

Table 1. Genotypes

1	**Truman**	**6**	**25R32**
2	**Pembroke**	**7**	**Dinah**
3	**1237-32**	**8**	**SS8700**
4	**Shirley**	**9**	**SSMPV57**
5	**1238-17-1**	**10**	**Branson**

Table 2. Management Systems

	High	Recommended	Low
Seeding Rate	45 seeds / ft^2	35 seeds / ft^2	35 seeds / ft^2
Seed Treatment	Cruiser	Cruiser	Cruiser
Fungicides	Headline @ Feekes 6.0, Prosaro @ Feekes 10.5	Prosaro @ Feekes 10.5	No
Growth Regulator	Palisade	No	No
Insecticide	Warrior	Warrior	Warrior
Nitrogen	0 lb/A	0 lb/A	0 lb/A
	60 lb/A	60 lb/A	60 lb/A
	100 lb/A	100 lb/A	100 lb/A
	150 lb/A	150 lb/A	150 lb/A

*Recommended Management= University of Kentucky Recommendations

RESULTS

Figure 1. Grain Yield (bu/A) by Genotype and Nitrogen Rate (lb/A), (2012-2013)

(Nitrogen rates analyzed separately)

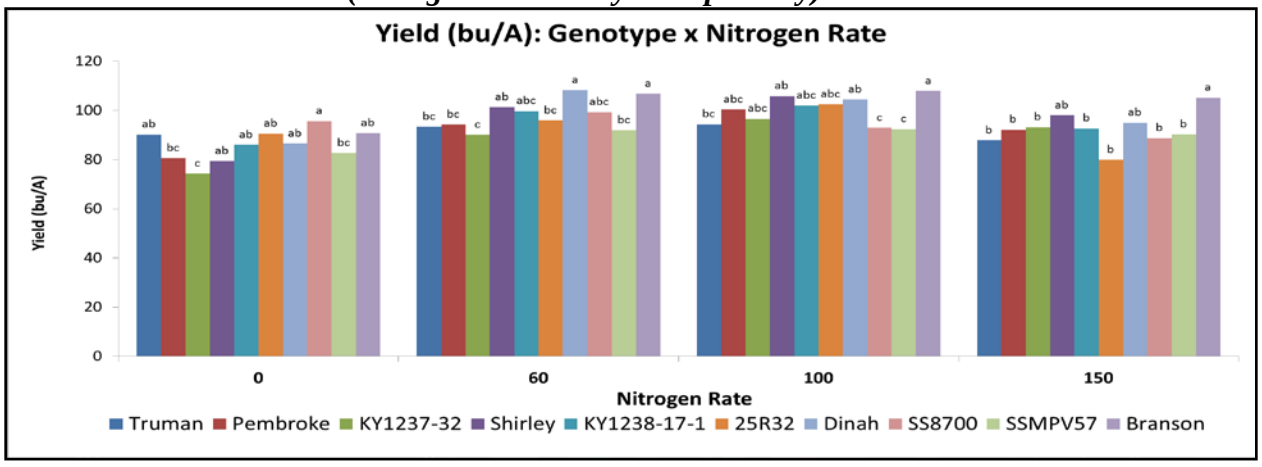


Figure 2. Grain Yield (bu/A) by Genotype and Management System, (2012-2013).

(Management systems analyzed separately)

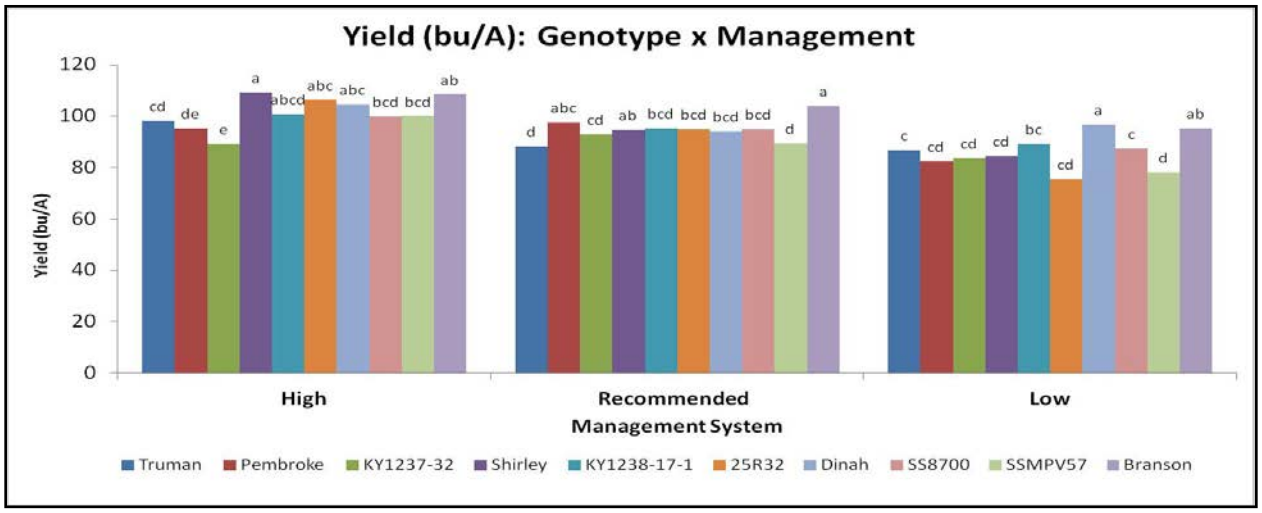


Figure 3. Grain Protein (%N) by Genotype and Nitrogen Rate (lb/A), (2012-2013).

(Nitrogen rates analyzed separately)

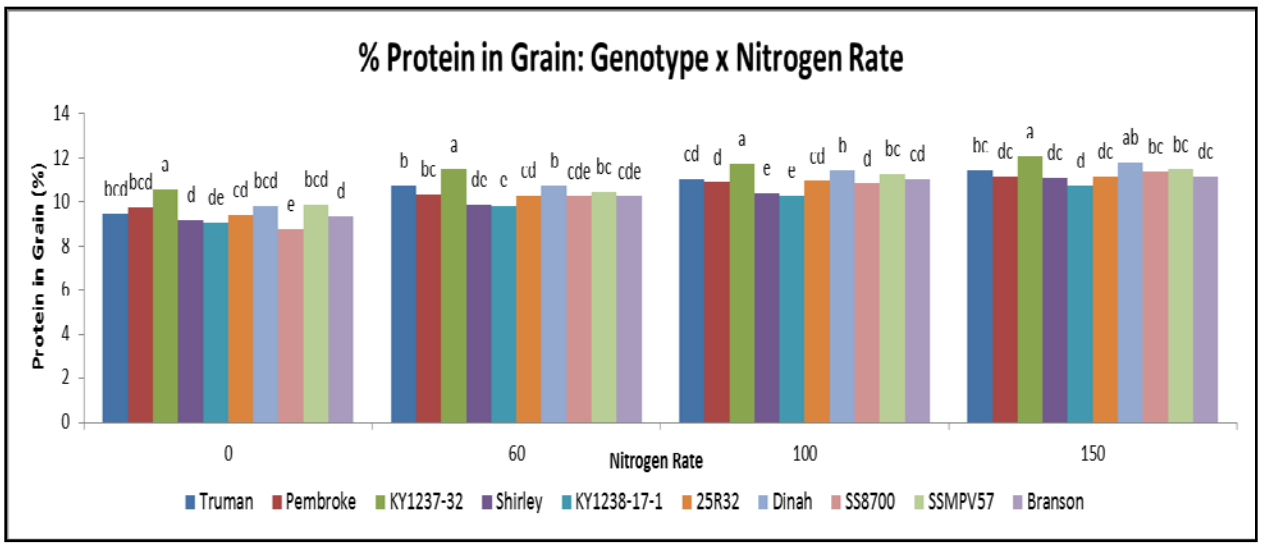
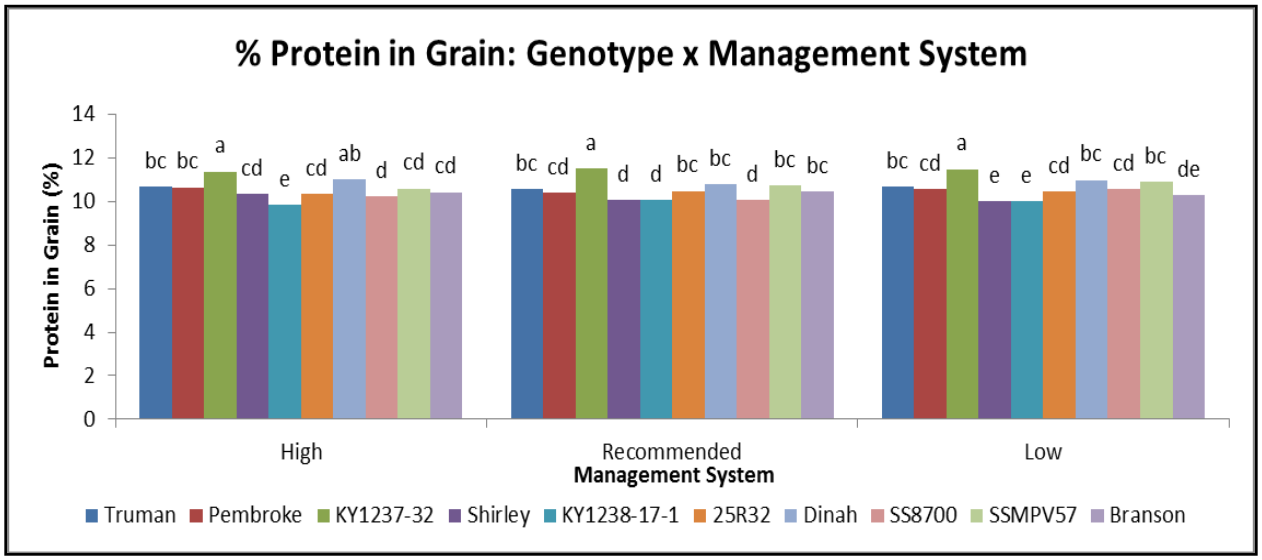


Figure 4. Grain Protein (%N) by Genotype and Management System, (2012-2013).

(Management systems analyzed separately)



The 2012-2013 wheat crop experienced abnormally high levels of nitrogen carryover from the previous corn crop due to the severe drought in 2012 and lack of uptake into the grain. This caused the 0 lb/A nitrogen rate to display high yields and high protein levels in the grain despite the lack of nitrogen fertilizer to those plots (Figures 1, 3). The nitrogen carryover also caused little variability among genotypes for yield across the management systems and nitrogen rates (Figures 1-4).Variability of yield among genotypes was greater in the high and low management systems compared to the control management indicating some genotype specific response to management inputs (Figure 2). High management resulted in greater yields than control and low management, most likely due to additional fungicide applications decreasing disease pressure (Figure 2). Nitrogen carryover is not expected in 2013-2014 growing season and we expect to see a more distinct genotypic response to decreased nitrogen levels and management intensity.

PROJECT CONTINUATION

The primary goal of this research is to gain a better understanding of genotype response to management intensity and nitrogen application rates. Understanding genotype specific management has many potential benefits including lowering the cost and quantity of inputs into production systems and the environment surrounding production; thereby creating more sustainable wheat production practices for Kentucky while decreasing emissions and adverse environmental effects. Additionally, we aim to develop a multi-environment database for use in DSSAT crop modeling software. This database can be utilized to simulate climate variability at a regional level on locally adapted soft red winter wheat genotypes and help researchers and producers make sound management decisions. Additional research on these specific genotypes includes a multiple planting date study to simulate in field temperature variability and a preliminary warming study to understand the effects of decreased diurnal temperature on regionally adapted wheat genotypes. Our preliminary data based on planting date suggests certain genotypes are better adapted to late planting and a potentially warmer temperature range due to grain and biomass yields.