TEST WEIGHT STABILITY AND THE IMPACT OF GRAIN CHARACTERISTICS ON TEST WEIGHT IN SPRING WHEAT.

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INTRODUCTION

- Test weight (TW) refers to the bulk density of a specific wheat (*Triticum aestivum*, L) consignment. Test weight is determined by measuring the weight of a wheat grain sample in a standard-sized container (US bushel or 35.2 L). This grain attribute is important to wheat producers and millers as it represents the overall grain quality; therefore it is one single most important determinant of commodity price.
- However, TW is often affected by differential response of genotypes to varying environments.
- Breeding efforts for wheat grain quality seek not only high TW, but also genotypes with TW stability across varying environments.

OBJECTIVES

To:

- Determine TW stability in different spring wheat genotypes adapted to SD;
- Simultaneously identify genotypes with stable, high TW;
- Determine the most influential grain characteristic(s) that influences TW in spring wheat.

MATERIALS AND METHODS

- **Genotypes:** Thirty-two hard red spring wheat (HRSW) cultivars that are adapted to the US Northern Plains region.
- **Design:** Each cultivar was planted to a 6m² plot. Plots were planted in a randomized complete block arrangement with four blocks per location. The experiment was maintained at ten environments in the 2011 and 2012 growing seasons.
- **Data collected:** Part from TW itself, grain characteristics such length (GL), width (GW), size and shape. Other grain attributes such as protein content, thousand grain weight (TGW), single grain weight and single grain density (SGD) were included in the model. **Data analyzed:** Analyses were performed using SAS 9.3.1 and R 2.15.1. Components of the analyses included; additive main effects and multiplicative interactions (AMMI), genotype effects, GEI, Shukla and Kang's index, Finlay and Wilkinson regression and linear mixed model.

Fig. 1. Pieces of equipment used to measure grain attributes.

RESULTS

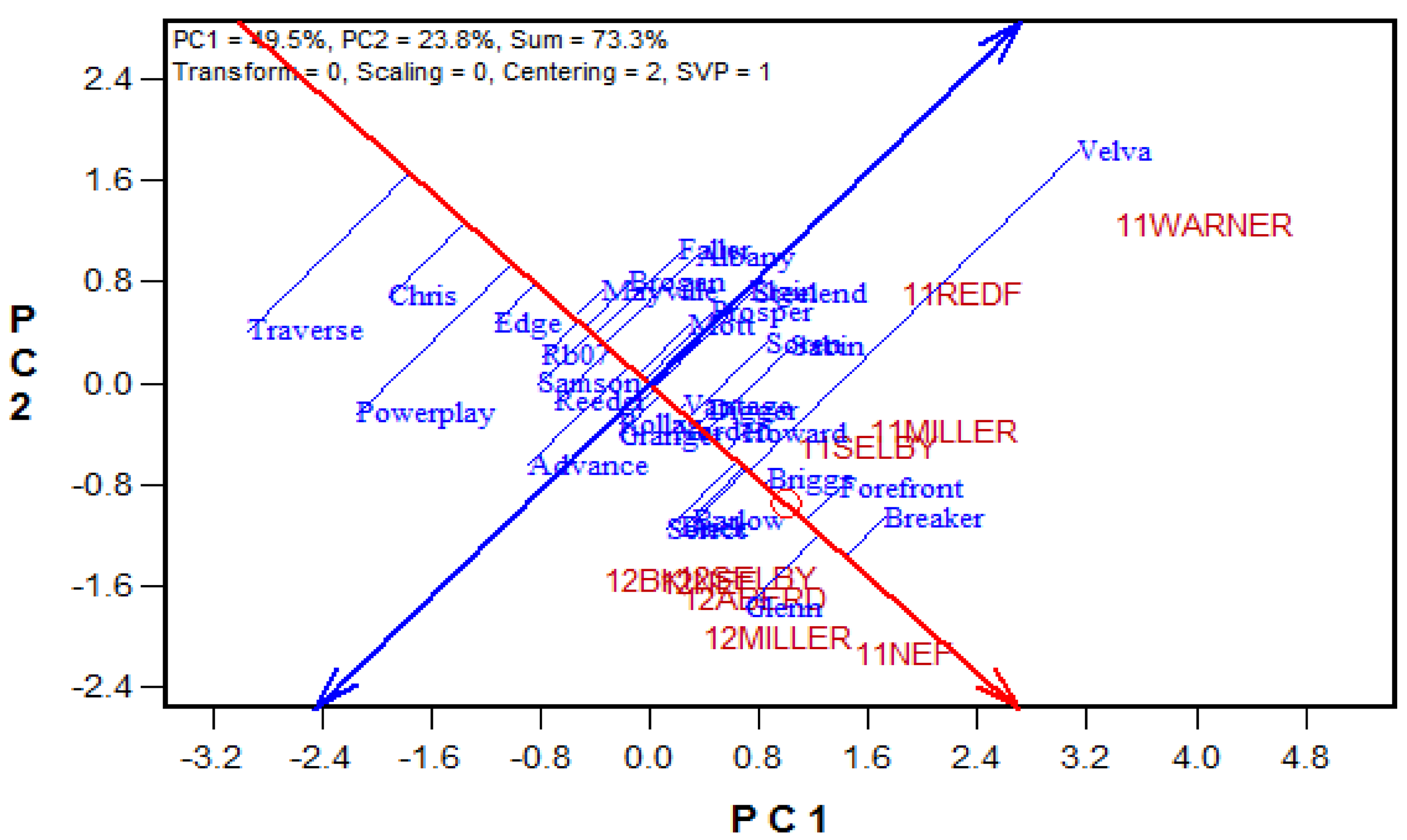

Fig. 2. Test weight stability analysis of 32 genotypes in 10 environments in 2011 and 2012.

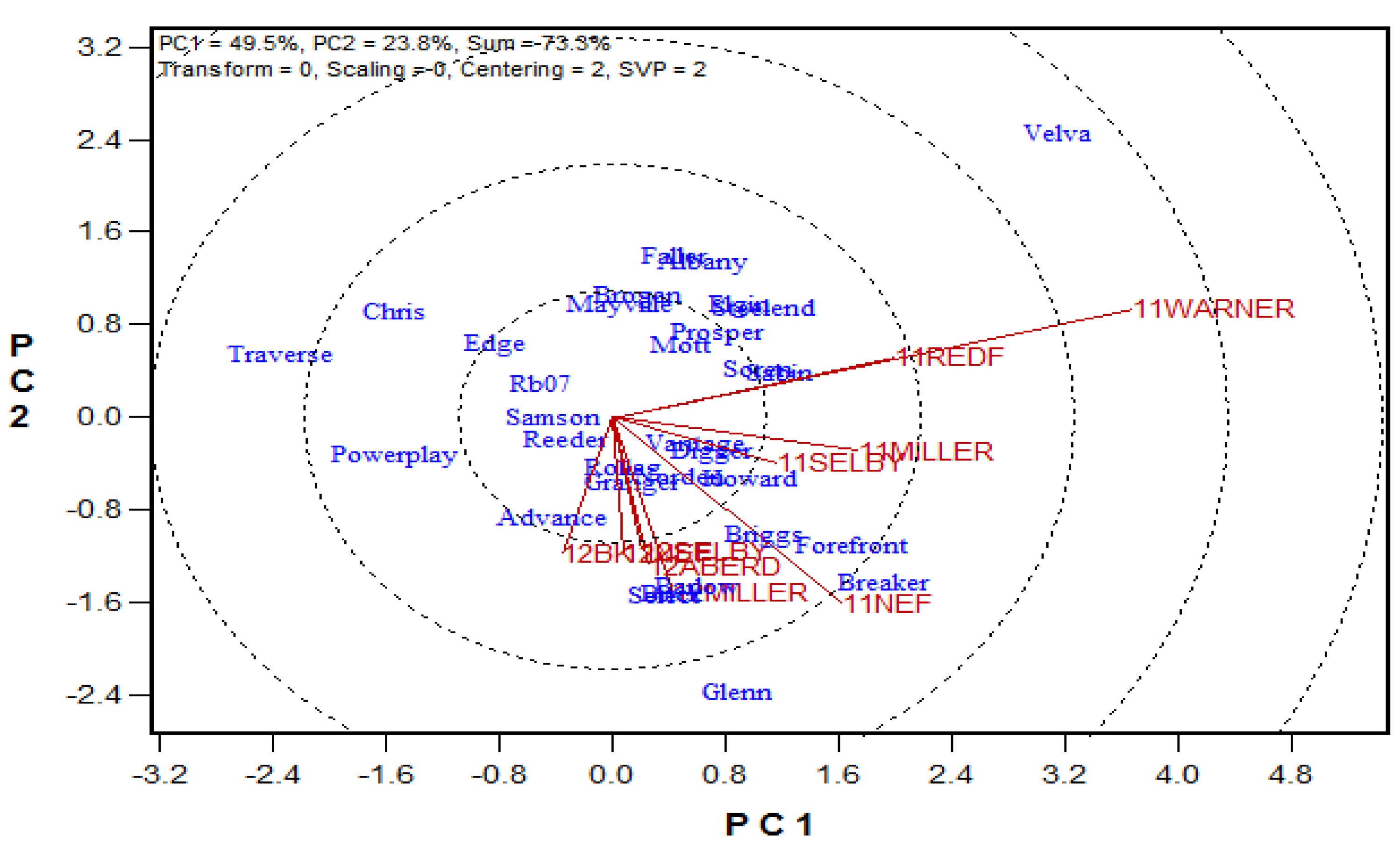

Fig. 3. Test environment relationships in 2011 and 2012.

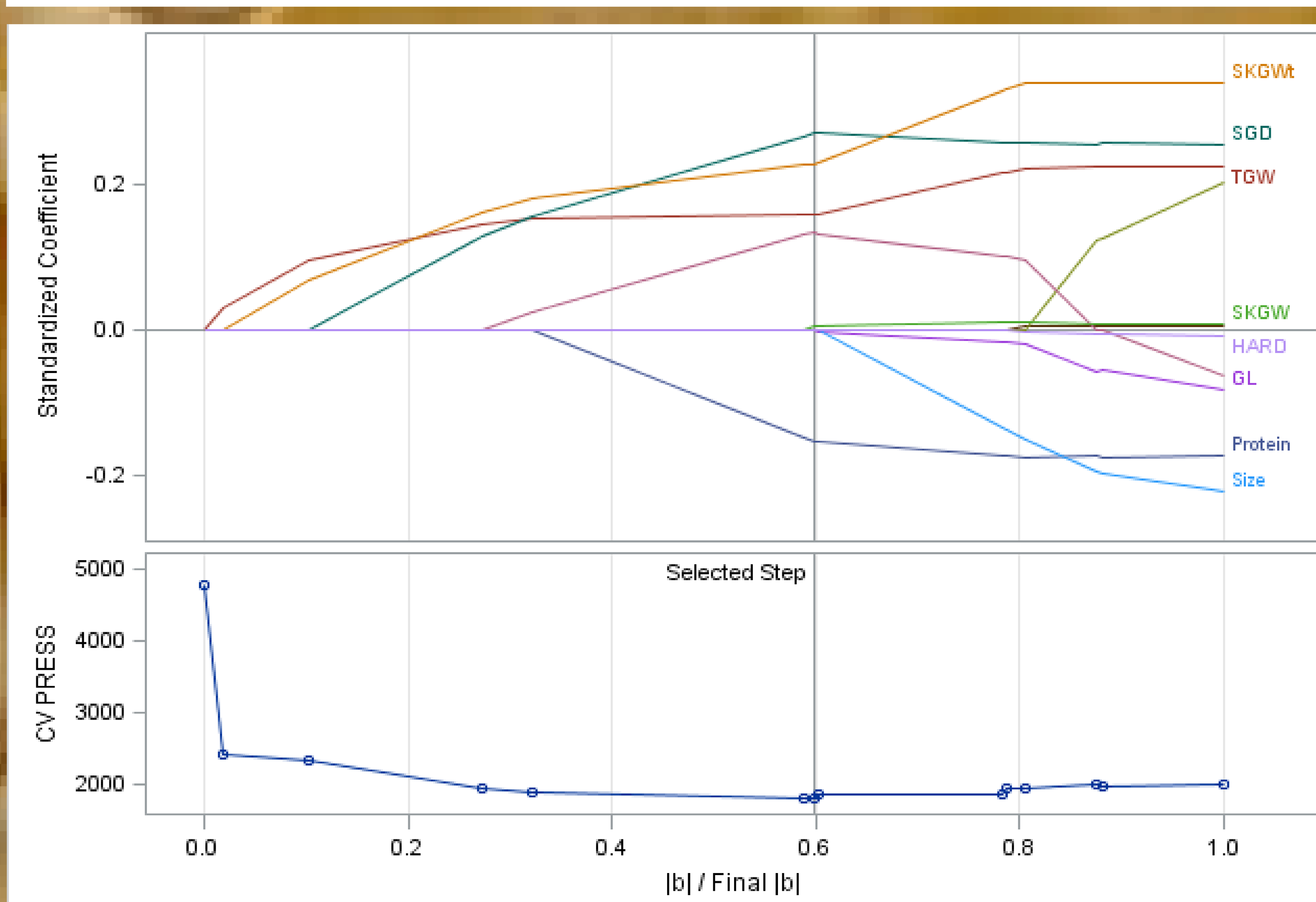

Fig. 4. Most influential grain characteristic affecting test weight using the least absolute shrinkage & selection operator (LASSO).

Table 1. LASSO and LARS regression parameter estimates [β*j*]

Trait	β_j		
	df	LASSO	LARS
Intercept	1	-15.581	-8.159
Protein	1	-0.180	-0.187
SGD	1	**27.696**	**27.927**
PE	1	0.091	0.085
GL	1	0.084	0.030
GW	1	**0.416**	**0.251**
Size	1	-0.001	____
Shape	1	____	0.033

SUMMARY

- Some genotypes that displayed TW stability across environments (e.g. Edge and Breaker) while other genotypes were not stable (e.g. Velva and Powerplay) across environments (**Fig**. 2).
- Some genotypes demonstrated not only high but also TW stability across environments. For example; Breaker, Forefront and Briggs (**Fig**. 2).
- Therefore, although TW is largely influenced by environmental factors and the interaction between the genotype and the environment, it is possible to develop cultivars with both high and stable TW.
- The test environments were diverse with varying discriminating capacities. 11Warner was most discriminating while 11Selby and 11NEF were most representative of the test environment (**Fig**. 3).
- Single grain density had the most impact on TW followed by single grain weight using the single kernel characterization system (SKCS 4100) (**Fig**. 4). Both regularized regression algorithms produced identical results (Table 1).

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