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CORRELATION BETWEEN GENOTYPE DIFFERENCES IN YIELD AND CANOPY TEMPERATURES IN WYOMING DRY BEAN

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INTRODUCTION

Breeders and physiologists continue to seek phenotypic and genetic markers that are easy to measure and help predict yield.

METHODS

In 2015, 49 dry bean genotypes from varying market classes were sown on 19 June 2015 on a Haverson and McCook loam at Lingle (WY). Experimental design was a split-plot with irrigation level the main plot and genotypes (one row only, 6 m, 76-cm spacing) assigned to subplots. Irrigation levels were “unstressed” (for the season) vs. “partial drought.” Partial drought consisted of full irrigation pre-bloom but was followed by approximately irrigation at 50% potential evapotranspiration post-bloom. There were two replicates per genotype per water regime. The fully irrigated plot received 6.09 inches of supplemental water while the limited plot received 2.38 inches of supplemental water (irrigation was performed weekly). Other details of the methods are provided in Heitholt and Baumgartner (2016). Canopy temperatures were recorded on 9 August with a Spectrum Technologies IR Temp Meter.

A second and similar study was sown on 27 May 2016 at Lingle (WY) with 23 genotypes on a Haverson, McCook loam and a Heldt silty clay. Plots (four rows) were 5 m long with 76-cm rows. Differential watering (0.75 inches vs. 0.50 inches) was employed at each irrigation post-bloom with a split-plot arrangement (three replicates per genotype per irrigation regime). Canopy temperature was recorded mid-morning and mid-afternoon on 23 July with an Apogee MI-2H0 infrared thermometer several days after a differential watering. Other methodological details for this second study are provided in Heitholt et al. (2017). A hail storm on 27 July terminated the crop and no yield data was collected.

A third study was conducted at Powell, WY. The study was sown on 25 May 2016 at PREC using a split-plot arrangement with two irrigation rates and 36 genotypes replicated three times per irrigation regime. Plots were three rows (56-cm spacing) wide and 4.6 m long. Irrigation rate (full vs. less-than-full) was the main plot and genotype the subplot. Canopy temperature was recorded on 23 July (mid-morning and mid-afternoon) with an Apogee MI-2H0. Other methods information for this third study are provided in Heitholt et al. (2017).

RESULTS AND DISCUSSION

At Lingle during 2015, yield was negatively correlated with canopy temperature across both watering regimes (Fig. 1). At Lingle in 2016, canopy temperatures were significantly different among the 23 genotypes (data not shown) and there was the expected trend for the canopies in the drought treatment to be warmer than the well-watered treatment (32.6 vs. 29.5°C in the am and 33.8 vs. 31.4°C in the pm). At Powell 2016, yields were unaffected by drought treatment but yields (averaged across irrigations) were again negatively related to canopy temperatures (Fig. 2). These results showed that canopy temperature may provide some indication of relative yield potential and this trait may be an important screening option for breeders.

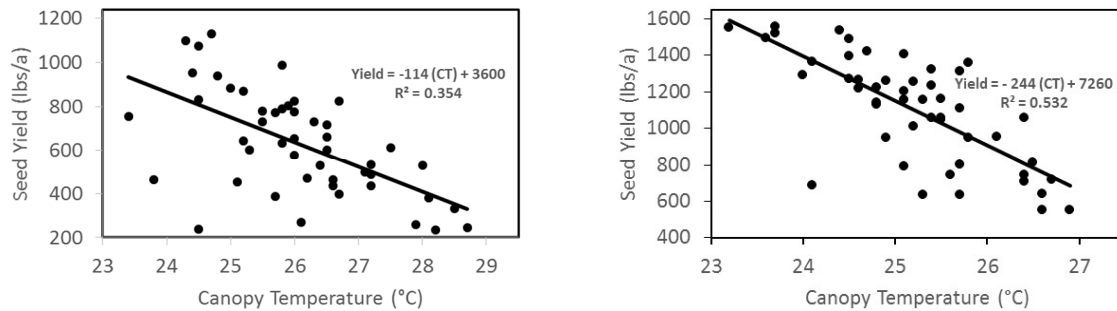


Figure 1. Relationship between grain yield among 49 genotypes and canopy temperature at Lingle (WY) on 9 August 2015. Drought treatment (left) and well-watered (right).

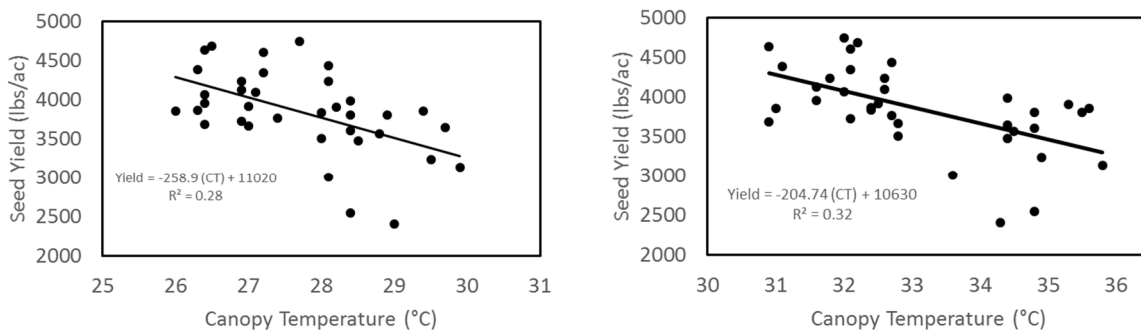


Figure 2. Relationship between grain yield among 36 genotypes and canopy temperatures on 18 July at Powell in 2016. Morning measurements can be found on the left and afternoon measurements can be found on the right.

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