

STABILITY MEASURES IN COTTON: WHERE DO WE STAND?

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Abstract

Cotton breeders conduct multi-environment trials to determine the performance of a genotype in relation to environmental changes, producing a genotype x environment interaction (GE), and to determine a genotype's area of adaptation. In order to fully characterize yield, which is a function of the effect of the genotype (G), the environment (E), and GE, the magnitude and nature of GE must be considered. GGE Biplot is a Windows application that performs biplot analysis of two-way data that assumes an entry x tester structure and creates a graphical, interactive presentation of the data thereby aiding in multi-environment data exploration. GGE Biplot generates a numeric instability figure while creating a visual biplot of the data. These are affected by choice of analytical model and scaling combinations of the data, options within the program. Using data from the 2000, 2001, and 2002 Louisiana Variety Trials (medium maturity), balanced for varieties (7) and locations (18), comparisons were made between GGE Biplot instability figures and figures generated by other GE analytical methods. Generally speaking, GGE Biplot correlated well with all other stability measures dependent upon the model and scaling used. Correlation coefficients between GGE Biplot and the Cultivar Superiority Measure, Ecovalence, Stability Variance with and without location as a covariate, and the Eberhart-Russel regression model were 0.75, 0.92, 0.92, 0.86, and 0.86, respectively. There was some redundancy between the traditional stability measures, as evidenced by the identical correlation coefficients with GGE Biplot. Some of the traditional methods focus heavily on yield, while others were heavily focused on GE; GGE Biplot allows for a more versatile presentation of the data and variety selection based on both yield and stability. Correlation coefficients for GGE Biplot between the various model combinations were variable depending on whether mean data or replicated data was input. GGE Biplot scaling combinations, within model, were highly correlated, indicating that scaling of the biplot does not affect the instability figure associated with that genotype. Based on the results of this study and our experience using GGE Biplot, Model 3 with an entry-focused scaling is the most valuable analysis for breeders engaged in cultivar development.