Factor analysis using mixed models of multi-environment trials with different levels of unbalancing

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ABSTRACT. This study aimed to analyze the robustness of mixed models for the study of genotype-environment interactions (G x E). Simulated unbalancing of real data was used to determine if the method could predict missing genotypes and select stable genotypes. Data from multi-environment trials containing 55 maize hybrids, collected during the 2005-2006 harvest season, were used in this study. Analyses were performed in two steps: the variance components were estimated by restricted maximum likelihood, using the expectation-maximization (EM) algorithm, and factor analysis (FA) was used to calculate the factor scores and relative position of each genotype in the biplot. Random unbalancing of the data was performed by removing 10, 30, and 50% of the plots; the scores were then re-estimated using the FA model. It was observed that 10, 30, and 50% unbalancing exhibited mean correlation values of 0.7, 0.6, and 0.56, respectively. Overall, the genotypes classified as stable in the biplot had smaller prediction error sum of squares (PRESS) value and prediction

amplitude of ellipses. Therefore, our results revealed the applicability of the PRESS statistic to evaluate the performance of stable genotypes in the biplot. This result was confirmed by the sizes of the prediction ellipses, which were smaller for the stable genotypes. Therefore, mixed models can confidently be used to evaluate stability in plant breeding programs, even with highly unbalanced data.

Key words: G x E interaction; Unstructured variance; Adaptability; Stability; Factor analysis

