SELECTION INDEX IN THE STUDY OF ADAPTABILITY AND STABILITY IN BRAZILIAN TROPICAL MAIZE

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INTRODUCTION

• It is difficult to find studies in the literature that have analyzed these selection indices at plot level and have analyzed the use of these indices for adaptability and stability analyses by multivariate methods such as the GGE biplot so that the applicability of a non-parametric selection index may be better evaluated and utilized.

OBJECTIVE

• The aim of this study was to evaluate the adaptability and stability of the genotype-ideotype distance index and selection of the best hybrids by means of this alternative.

MATERIAL AND METHODS

• Assessment data were used of seven traits from 25 maize hybrids subjected to performance evaluation trials in six locations of the south of Brazil (Vacaria, RS; Abelardo Luz, SC; Candoi, PR; Canoinhas, SC; Castro, PR; and Ponta Grossa, PR) during the 2010/2011 crop year. The trials were prepared in a completely randomized block design with two replications.

• The traits assessed were: grain yield – kg ha^{-1}, percent of damaged grains, percent of lodging, percent of breakage and percent of fallen plants, Common Rust (*Puccinia sorghi*) score and Gray Leaf Spot (*Cercospora zeae-maydis*) score.

• The ideotype for yield (kg ha^{-1}) was determined seeking the value of the highest yielding plot of all the trails and using the next thousand value above that. As the highest yielding plot was 16959 kg ha^{-1}, the ideotype was 17000 kg ha^{-1}. For the traits of percent of damaged grains, percent of lodging, percent of fallen plants and percent of breakage, the ideotype was 0%. For Common Rust and Grey Leaf Spot, the ideotype was score 1.

• To obtain the matrix of variances and covariances among the traits assessed, multivariate analysis of variance (MANOVA) was performed using the data from all the hybrids, traits and locations, For that purpose, the model was used expressed in the vectorial form in the following expression:

$$Y_{ijk} = \mu + \alpha_i + \beta_i + \delta_{ij} + \varepsilon_{ijk}$$

• The genotype-ideotype distance index (GIDI) for selection was obtained using the data at the plot level of the seven traits assessed in the 25 hybrids, based on the Generalized Mahalanobis Distance, using the matrix model according to the following expression:

$$D_{Gl}^2 = diag(IS^{-1}I')$$

• Analysis by means of the GGE biplot method was performed as presented by Oliveira et al. (2010), considering the simplified model for two principal components:

$$\overline{Y}_{ij} - \mu_j = \lambda_1 \gamma_{i1}\alpha_{j1} + \lambda_2 \gamma_{i2}\alpha_{j2} + \rho_{ij} + \bar{\varepsilon}_{ij},$$

• The graph accuracy of the identification methods of mega-environments and winning genotypes was tested by the cross validation procedure proposed by Gabriel (2002). For that purpose, the PRESSm and PRESScorr statistics were used to measure the discrepancy between the observed and predicted values and the predictive correlation.

RESULTS

Table 1. Estimates obtained for PRESS$_m$ (sum of squared prediction error) and PRECORR$_{(m)}$ (predictive accuracy) in cross validation of the GGE1 and GGE2 models (Biplot with 1 and 2 principal components respectively) for the GIDI and for yield (ton ha^{-1}).

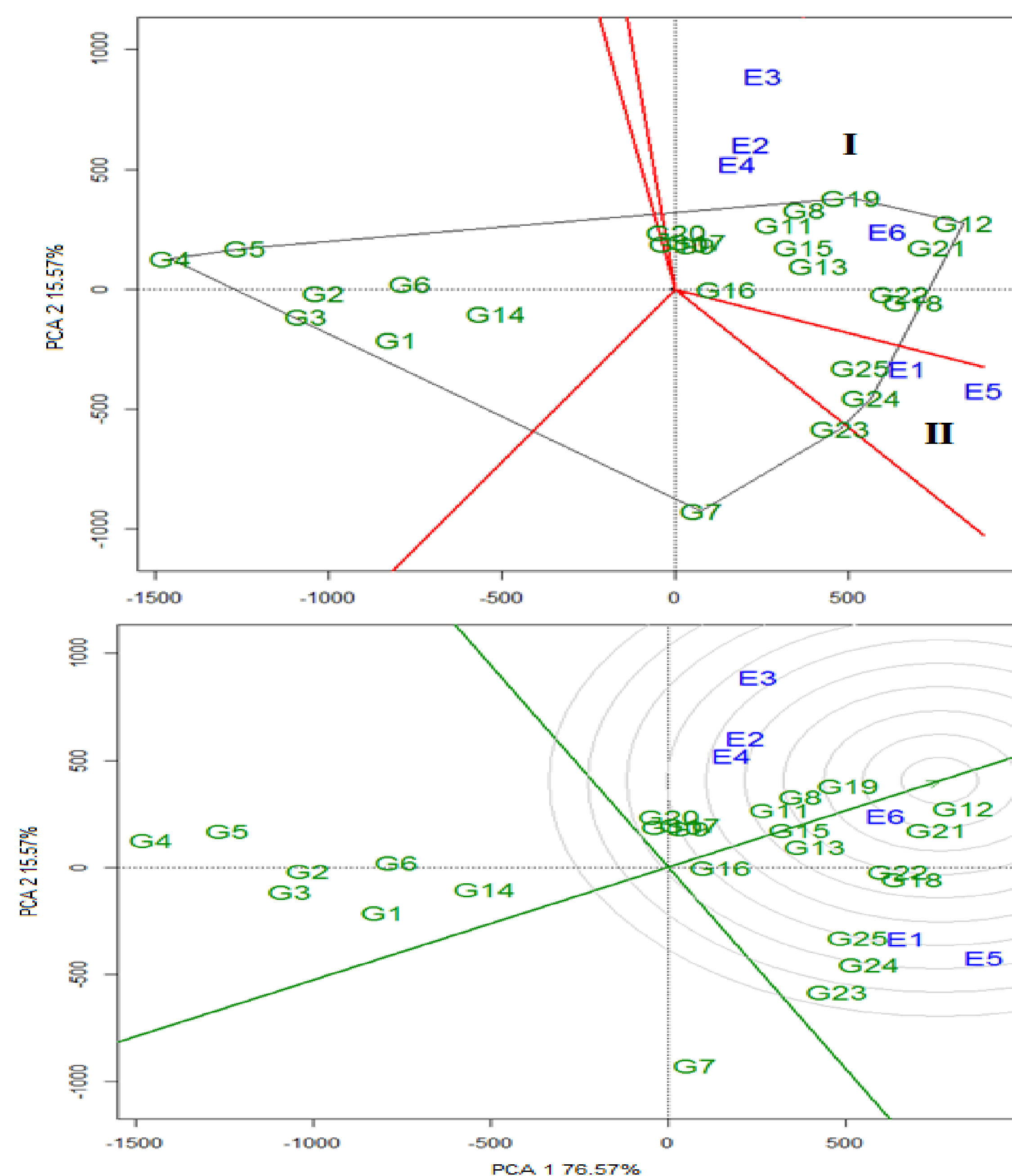| Model	GIDI		Yield	
	PRESS$_m$	PRECORR$_{(m)}$	PRESS$_m$	PRECORR$_{(m)}$
GGE1	36324.678	0.8086993	1.0547498	0.8656868
GGE2	21597.326	0.8913184	1.0179156	0.8708956

Fig 1. GGE biplot graph, evaluating the GIDI, with the grouping of the six locations (Vacaria, RS; Abelardo Luz, SC; Candoi, PR; Canoinhas, SC; Castro, PR; and Ponta Grossa, PR) identified from E1 to E6, respectively, with the groups of environments being identified by the Roman numerals I and II, and GGE biplot graph, with the distance of the 25 hybrids (identified from G1 to G25) from the "ideal genotype" in regard to the GIDI.
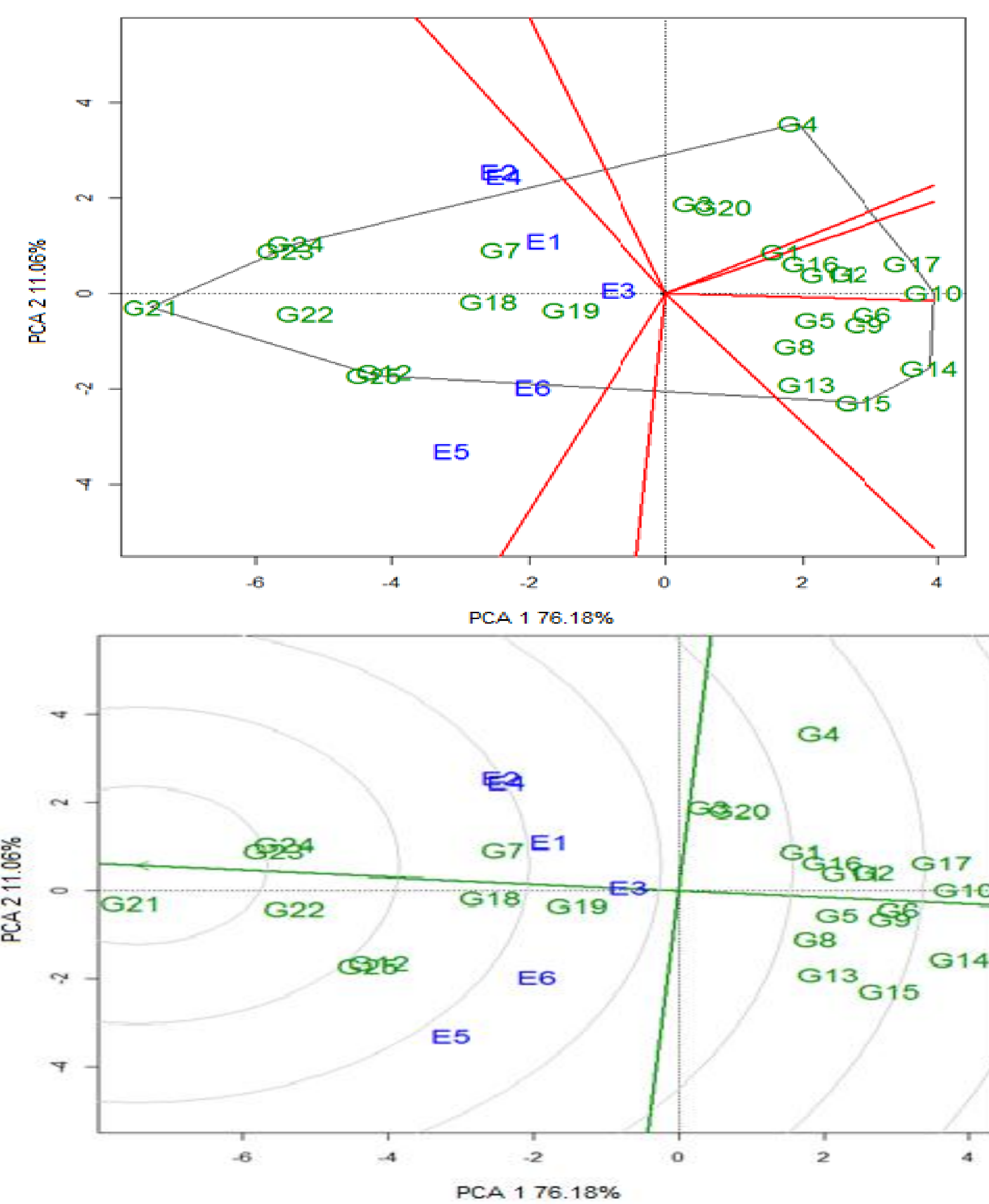

Fig 2. GGE biplot graph, evaluating grain yield (t ha^{-1}), with the grouping of the six locations (Vacaria, RS; Abelardo Luz, SC; Candoi, PR; Canoinhas, SC; Castro, PR; and Ponta Grossa, PR), identified from E1 to E6, respectively, and GGE biplot graph, with the distance of the 25 hybrids (numbered from G1 to G25) from the "ideal genotype", in regard to grain yield (t ha^{-1}).

CONCLUSIONS

• The evaluation of adaptability and stability of the GIDI led to the selection of hybrids that combine adaptability and stability for most of the traits assessed. Use of it is more practical than analyzing each trait separately.

REFERENCES

Gabriel, K. R. (2002) Le biplot–outil d'exploration de données multidimensionnelles. **Journal de la Société Française de Statistique**, Paris, 143: 5-55.
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