REPEATABILITY AND GENOTYPIC STABILITY IN ALFALFA CULTIVAR EVALUATION

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Results from agronomic evaluation based on successive cuts are widely used in alfalfa to identify cultivar phenotypic superiority. In this context, defining the number of evaluations needed to determine perdurable differences among cultivars is probably the most important challenge. To solve the problem, the estimation of the repeatability coefficient (R) of a trait, which is a function of trait measurements repeated over time, has been proposed. Based on this value, the number of necessary evaluations to predict the real value of a genotype or a cultivar can be calculated (Cruz et al. 2004). Since repeatability expresses how much of the phenotypic variation is due to genetic differences, it can be assimilated to heritability, thus providing an interesting tool for assisting selection and breeding.
The objectives of this paper were: 1) to estimate the repeatability coefficient for relevant agronomic traits using different statistical procedures; and 2) to estimate the number of evaluations necessary to obtain a coefficient of determination compatible to genotypic stability. A field experiment evaluating 92 alfalfa cultivars was conducted at Embrapa Pecuária Sudeste, Sao Carlos (SP, Brazil), using a complete randomized block design with two replicates. The evaluated traits were: DM production (PMS); plant height at cutting (APC); disease tolerance (TD); and phenotypic appearance (AF). A total of 11 cuts were made: five in the rainy season (November-March) and six in the dry season (April-October). For each trait, R was calculated according to four distinct methods: a) analysis of variance (ANOVA), removing temporary environmental effect from the error term; b) principal components (PC) calculated from the correlation matrix; c) PC calculated from the covariance matrix; and d) structural analysis (AE) based on theoretical eigenvalues from the correlation matrix or average correlation.
All methods gave similar R values. The six cuts during the dry season were enough to obtain $R^2 \geq 90\%$ for PMS, APC and AF, but < 90 % for TD. On the contrary, the five cuts in the rainy season provided R^2 close to 90% only for APC. However, when cultivar genotypic stability (based on PC from the correlation matrix as a function of cultivars) was taken into account, all variables were estimated with high precision using only three and two cuts for the dry and rainy seasons, respectively. It was concluded that the incorporation of genotypic stability in trial data analyses made feasible to attain adequate experimental precision (> 90% on PMS and APC; and 70-80% on TD and AF) using only half of the cuts in each growing season (dry and rainy).

REFERENCE

CRUZ, C. D.; REGAZZI, A. J.; e P. C. S. CARNEIRO. 2004. Modelos biométricos aplicados ao melhoramento genético. 3. ed., v. 1. Viçosa: Universidade Federal de Viçosa. 480 pp.