Tropical Grasslands – Forrajes Tropicales (2013) Volume 1, 76−77

Effects of season and year of evaluation in the selection of *Brachiaria humidicola* hybrids

ULISSES J. DE FIGUEIREDO[1], JOSÉ A.R. NUNES[1], CACILDA B. DO VALLE[2], SANZIO C.L. BARRIOS[2] AND GEOVANI F. ALVES[2]

[1]*Universidade Federal de Lavras, Lavras, MG, Brazil.* www.ufla.br
[2]*Empresa Brasileira de Pesquisa Agropecuária, Embrapa Gado de Corte, Campo Grande, MS, Brazil.* www.cnpgc.embrapa.br

Keywords: Genotype by environment interaction, environmental effects, nutritive value, tropical grasses.

Introduction

Brachiaria humidicola is well adapted to infertile and acid soils with poor drainage or temporary flooding (Keller-Grein et al. 1996). It is widely used in Brazil in wetlands and areas of marginal land characterized by waterlogged soils. During the evaluation stages of the breeding program of this species, genotypes are generally tested using consecutive cuts within different seasons for at least 2 years. The 'Cerrado' region, where most animal production takes place in Brazil, has 2 well defined seasons: spring-summer with warm weather and rain; and autumn-winter with cooler, dry weather. Thus, owing to environmental variation, especially related to climate, it is important to investigate the main effects of environmental factors (years and seasons), as well as interactions between genotypes and environmental factors, in order to have greater confidence in the selection of superior hybrids of *B. humidicola* on the basis of agronomic and nutritional traits.

Methods

Fifty hybrids resulting from crossing *B. humidicola* cv. BRS Tupi with a sexual accession, both hexaploid (2n = 6x = 36), were evaluated with the 2 parents as controls. They were established by seedlings in a complete randomized block design with 8 replications, using plots of 2.0 m². Each experimental unit was subjected to 7 cuts during the rainy seasons and 2 cuts during the dry seasons in 2008 and 2009. The production of total green matter was weighed and a sample of approximately 300 g of green material was taken for separation and determination of the dry weight of leaves, stems and dead material. With this information, we calculated total dry matter (TDM), leaf dry matter (LDM), leaf percentage (%L) and leaf:stem ratio (LSR). After 7 days a visual assessment of regrowth was performed. This was a combined score ranging from 0 (poor) to 6 (excellent) of plant density (percentage of tillers shooting) and speed of regrowth. Leaf samples were analyzed for: crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF) and lignin (Lig) concentrations and in vitro organic matter digestibility (IVOMD) using near-infrared reflectance spectroscopy (NIRS) (Marten et al. 1985). The traits were analyzed statistically for the 9 cuts together using the following model: $y = Xf + Pb + Zg + Nk + Qa + Ti + Wt + Om + e$, where y is the data vector, f is the effect of combining cut-season-year (assumed fixed) added to the overall mean, b is the effect of blocks, g is the genotypic effect, k is the effect of the blocks x hybrids interaction, a is the effect of the hybrids x years interaction, i is the effect of the seasons x hybrids interaction, t is the effect of the hybrids x times x years interaction, m is the effect of the blocks x cuts interaction within season and year, and e is the error term. X is the incidence matrix of fixed effects and P, Z, N, Q, T, W and O are the incidence matrices of random effects b, g, k, a, i, t and m, respectively. The analyses were performed using the statistical package Statistical Analysis System (SAS Institute 2002).

Results and Discussion

The year effect was significant ($P<0.001$) for LDM, %L, regrowth, CP and NDF (Table 1), showing that overall mean performance of hybrids varied between the 2 years. This is due to climatic fluctuations between years causing one year to be more favorable than the other. There was a significant effect of seasons for most characters, except for NDF and ADF, since the rainy season promotes more growth than the dry season. Within agro-

Correspondence: Ulisses J. de Figueiredo, Federal University of Lavras, Lavras CEP 37200-000, MG, Brazil.
Email: ujfigueiredo@yahoo.com.br

nomic characters, the years x seasons interaction was significant only for percentage of leaf blades (%L) (P<0.001). Regarding nutritive value, NDF, IVOMD and lignin showed a significant years x seasons interaction, which is understandable since fiber deposition is highly correlated with climate and plant age and strongly affects digestibility.

Table 1. P-values of the F statistic for fixed effects and Wald Z statistic for random effects for agronomic and nutritive value traits of *Brachiaria humidicola* hybrids evaluated over 9 cuts.

Effects	LDM	TDM	%L	LSR	Regrowth	CP	NDF	ADF	IVOMD	Lig
					Fixed effects					
Year	0.001	0.103	0.001	0.055	0.001	0.001	0.004	0.091	0.422	0.098
Season	0.001	0.001	0.001	0.001	–	0.001	0.888	0.775	0.001	0.046
Y x S	0.135	0.159	0.001	0.582	–	0.140	0.016	0.205	0.001	0.001
Cut (Y – S)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002
					Random effects					
Hybrid	0.001	0.001	0.001	0.467	0.001	0.001	0.014	0.038	0.001	0.093
H x Y	(.)	.	.	.	0.154	0.001	0.370	0.115	.	.
H x S	.	.	.	0.075	.	.	0.032	.	0.075	0.372
H x Y x S	.	.	.	0.032	0.001	.	.	.	.	.
H x C (Y – S)	0.001	0.001	0.001	.	0.001	0.040	0.190	0.131	0.187	0.387

(.) Nulls value for Wald Z statistic.

There was significant variation between cuts in both years and seasons for all characters. It is important to verify the existence of genetic variability among hybrids for response to environmental factors. While significant genetic divergence was observed for most characters, no significance was observed for the effects of interactions with years and/or seasons for the characters studied (Table 1), implying that hybrids behaved consistently in the seasons and/or years of evaluation. The hybrids x cuts interaction within seasons and years, however, was significant for almost all agronomic traits (P<0.001), except for LSR (.) as opposed to that observed for the characters of nutritive value, with only CP influenced by this effect.

Conclusion

We conclude that the interactions of hybrids with years and/or seasons were not important, but there was marked variation explained by the interaction of cuts within seasons and years. This suggests that breeders should not correct for the effects of years and seasons in models used in the statistical analysis, once the use of a parsimonious model involving the general effect of the cuts can properly select hybrids for agronomic and nutritive value traits.

Acknowledgments

Authors are grateful to UNIPASTO and CNPq for financial support.

References

Keller-Grein G; Maass BL; Hanson J. 1996. Natural variation in *Brachiaria* and existing germplasm collections. In: Miles JW; Maass BL; Valle CB do, eds. *Brachiaria*: Biology, Agronomy and Improvement. CIAT publication 259, CIAT, Cali, Colombia. p. 17–42.

Marten GC; Shenk JS; Barton FE. 1985. Near infrared reflectance spectroscopy (NIRS), analysis of forage quality. USDA, Washington, DC, USA.

SAS (Statistical Analysis System) Institute. 2002. SAS/STAT user's guides. Version 9. SAS Institute, Cary, NC, USA.

Figueiredo UJ de; Nunes JAR; Valle CB do; Barrios SCL; Alves GF. 2013. Effects of season and year of evaluation in the selection of *Brachiaria humidicola* hybrids. Tropical Grasslands – Forrajes Tropicales 1:76–77.
DOI: 10.17138/TGFT(1)76-77

This paper was presented at the 22nd International Grassland Congress, Sydney, Australia, 15−19 September 2013. Its publication in *Tropical Grasslands – Forrajes Tropicales* is the result of a co-publication agreement with the IGC 2013 Organizing Committee. Except for adjustments to the journal's style and format, the text is essentially the same as that published in: **Michalk LD; Millar GD; Badgery WB; Broadfoot KM, eds. 2013. Revitalising Grasslands to Sustain our Communities. Proceedings of the 22nd International Grassland Congress, Sydney, Australia, 2013. New South Wales Department of Primary Industries, Orange, NSW, Australia. p. 238–239.**