MORPHOLOGICAL STUDIES AS A TOOL FOR THE EVALUATION OF WIDE TROPICAL FORAGE GRASS GERMPLASMS

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INTRODUCTION

After many experiments of introduction and evaluation of tropical forage grasses, it is known nowadays, which genera and species produce well and show adaptation to the specific soil and climatic conditions of the different regions of Brazil. One of the widely used species especially for finishing cattle, is *P. maximum* Jacq.

The Brazilian Agricultural Research Corporation (EMBRAPA) introduced germplasm of *P. maximum* from Africa, in an attempt to bring variability into the country, aiming at selection and release of new, more productive cultivars, therefore increasing pasture diversification.

This introduced *P. maximum* germplasm was collected by Orstom (Combes and Pernès, 1970) in East Africa, centre of diversification of the species and is representative of the genetic variability of the natural populations. This variability has been clearly confirmed through the range of variation on agronomic performance (Jank *et al.*, 1989) and great polymorphism (Costa *et al.*, 1988) displayed by the accessions.

The objectives of the morphological evaluation of this germplasm were to identify and eliminate replicates that might exist in the germplasm since its collection ; furnish a detailed description of the selected accessions, which are being evaluated in national network trials and will be released to farmers ; and organize the accessions in distinct morphological groups. This organization may help interpret the agronomic performance of the accessions in their initial evaluation stage, and should assist in subsequent stages of selection and improvement of promising accessions.

MATERIAL AND METHODS

Four-hundred and seventeen introduced accessions of *P. maximum* and 31 accessions collected in various regions of Brazil were morphologically characterized in the field, in the same plots used for the agronomic evaluation (Savidan *et al.*, 1985).

The characterization included 22 morphological descriptors (Table 1), somewhat modified from the originally presented by Savidan *et al.* (1985). Most of these descriptors had been previously studied in the Ivory Coast, Africa (Chaume, 1985).

Multivariate analysis of factorial correspondence and cluster analysis (Judez *et al.*, 1984) were used. The results of the first analysis were used for the formation of groups, following Ward's method of clustering (Milligan, 1980). This method utilizes the semi-partial R-squared criterium for the formation of groups.

RESULTS AND DISCUSSION

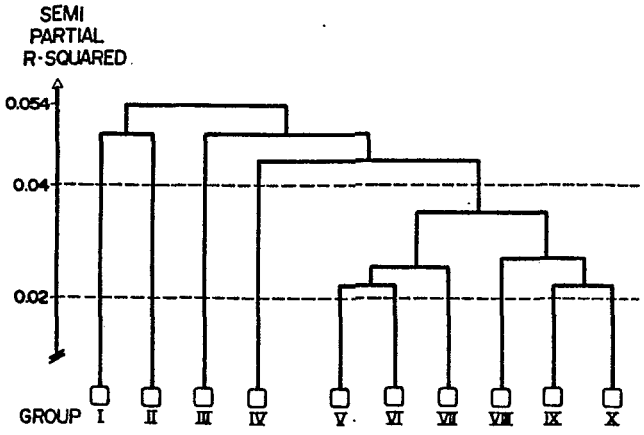
Data on 22 morphological descriptors were used in the multivariate analysis of factorial correspondence and cluster

Table 1. Plant descriptors used on *Panicum maximum* germplasm evaluation in Brazil[1].

1. Plant height	14. Verticil pubescence
2. Plant growth habit	15. Spikelet pubescence
3. Leaf growth habit	16. Inflorescence type
4. Leaf width	17. Primary ramification length
5. Leaf colour	18. Secondary ramification length
6. Toughness of leaf central vein	19. Site of secondary ramification
7. Waxy coating on leafsheath	20. Spikelet distribution
8. Density }	21. Spikelet spot colour
9. Length } of leaf sheath pubescence	22. Spikelet spot percentage
10. Coarseness }	
11. Density }	
12. Length } of leaf blade pubescence	
13. Coarseness }	

[1]Descriptors 1. to 13. are vegetative and 14. to 22. are reproductive.

Figure 1. Dendogram of 432 accessions of *P. maximum* obtained by Ward's minimum variance clustering analysis.



analysis. Sixteen of the 448 accessions were not included due to missing values. Initially, a semi-partial R-squared value of 0.04 was considered, and five distinct groups were formed ; Group I = 41 accessions ; Group II = 19 accessions ; Group III = 40 accessions ; Group IV = 28 accessions ; and Group V = 304 accessions (Fig. 1). Since Group V included 70 % of the accessions, and still showed much heterogeneity among accessions, a further partitioning was attempted. Considering a semi-partial R-squared value of 0.02, Group V was subdivided into 6 groups, whilst groups I to IV remained partitioned as before (Fig. 1). Thus, on the total, 10 distinct groups were formed, where groups V, VI, VII, VIII, IX and X have a common origin, and are, therefore, more similar to each other than to the remainder.

Although the cluster analysis using Ward's method aims at homogeneity within groups and heterogeneity between groups, much morphological variability was still observed in each of the 10 groups. This may be explained as a consequence of the great morphological variability present in the germplasm.

The remaining variability in each group points to the possibilities of finding interesting genetic characteristics within the group to which the cultivar to be improved belongs. This may facilitate the breeding program by reducing the number of crosses necessary to incorporate the desired characteristic due to the small genetic distance between progenitors.

CONCLUSIONS

The utilization of multivariate analysis of factorial correspondence and cluster analysis on the morphological descriptors permitted the subdivision of the *P. maximum* germplasm into 10 morphological groups.

Although the analysis aims at homogeneity within groups and heterogeneity between groups, some variability within the formed groups still persisted. This evidenciates the continuous polymorphism of the germplasm, demonstrated by the presence of all forms of intermediate combinations between extremes of morphological variability.

Taxonumerical studies is a valuable tool in aiding the organization and knowledge of large numbers of accessions in a germplasm. They also introduce a new means of interpreting the agronomical and cytogenetical data of the germplasm.

REFERENCES

CHAUME, R. (1985). Organisation de la variabilité génétique du complexe agamique *Panicum maximum* en vue de son utilisation en amélioration des plantes. Travaux et documents de l'ORSTOM N° 184. Paris.

COMBES, D. et J. PERNÈS (1970). Variations dans les nombres chromosomiques du *Panicum maximum* Jacq. en relation avec le mode de reproduction. *C.R. Acad. Sci.* Paris, Sér. D., 270 : 782-785.

COSTA, J.C.G. et L. JANK (1988). Resultados de avaliação do germoplasma de *P. maximum* introduzido da África. Encontro sobre Recursos Genéticos, Jaboticabal, SP, Brazil, 1988 : 191.

JANK, L., Y.H. SAVIDAN, J.C.G. COSTA and C.B. do VALLE (1989). Pasture diversification through selection of new *Panicum maximum* cultivars in Brazil. *XVI Int. Grassl. Congr., Nice.*

JUDEZ, L.A., A.F.A. DIAS, et L.H.R. CASTRO, (1984). Fundamentos teóricos e aplicações da análise de dados. EMBRAPA-DEP, Brasilia, DF, Brazil.

MILLIGAN, G.W. (1980). An examination of the effect of six types of error perturbation on fifteen clustering algorithms. *Psychometrika*, 45 : 325-342.

SADIVAN, Y.H., L. JANK, F.D.H. de SOUZA and A. BOOCK (1985). Preliminary evaluation of *Panicum maximum* germplasm in Brazil : an international agronomy research program. *Proc. XV Int. Grassl. Congr., Kyoto,* 1985 : 117-118.