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EVALUATION OF GUINEAGRASS (*Panicum maximum* JACQ) HYBRIDS IN BRAZIL

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Abstract

Guineagrass (*Panicum maximum* Jacq.) is responsible for a high percentage of cattle finishing and milk production in Brazil, but presents problems of pasture degradability due to high soil fertility requirements and uneven production distribution. In order to search for new varieties to reduce these problems, over four hundred apomictic accessions of guineagrass and several sexual plants were introduced to Brazil in 1982. Agronomic evaluation took place at the National Beef Cattle Research Center of the Brazilian Agricultural Research Corporation (Embrapa Beef Cattle), in Campo Grande, MS, Brazil. Breeding of the apomictic species began in 1990 using sexual x apomictic crosses. Three sexual plants and five apomictic accessions were used in the crosses. Seventy-nine hybrids were evaluated in small plots, for forage yield, regrowth after cuts, flowering and vigor during three years. The best families were identified for each characteristic evaluated. Multivariate analysis using principal components grouped the hybrids into six clusters according to their production. Due to superior performance, hybrids in groups 6 and 2 (22 hybrids) were indicated for future regional trials in small plot evaluations and grazing studies, aiming at releasing new cultivars for pasture diversification in Brazil.

Keywords: *Panicum maximum*, guineagrass, selection, grass breeding, apomixis

Introduction

Guineagrass (*Panicum maximum* Jacq.) is a very important forage grass in the beef and dairy industry of many tropical countries of the world and especially in Brazil. It is responsible for a significant percentage of cattle finishing and milk production in these countries due to its high yield and quality. However, pasture degradability is common due to considerable requirements in soil fertility and uneven seasonal distribution (poor growth during the dry winters) and mismanagement.

To search for new genotypes, over four hundred apomictic accessions and several sexual plants of guineagrass were introduced to Brazil in 1982 and evaluated in Campo Grande, MS (Jank et al., 1989) and in regional trials (Jank et al., 1993). Two cultivars, Tanzânia-1 and Mombaça, were released commercially in 1990 and 1993, respectively and represent the majority of the commercialized seed of *Panicum maximum* in Brazil. These are apomictic cultivars, i.e., asexual reproduction by seed, therefore their lack of intrapopulational diversity represents a risk whenever planted in extensive areas.

Breeding is underway at Embrapa Beef Cattle with the objectives of identifying new varieties adapted to specific niches and to contribute with pasture diversification in the country. The present study was undertaken to evaluate the performance of different progenitors in a breeding program and to select hybrids for further evaluation phases.

Material and Methods

The 426 apomictic accessions received from IRD (Institut de Recherche pour le Developpement, former ORSTOM) were collected in East Africa (Combes & Pernès, 1970). Diploid sexual plants were also collected, underwent chromosome doubling and were crossed to apomictic ecotypes to produce selected sexual di- and tri-hybrids before being sent to Brazil.

Breeding was conducted in Campo Grande, Brazil, according to Savidan et al. (1989). Five apomictic accessions were used. These were part of the 25 accessions selected for their performance in regional trials (Jank et al., 1989) and are: T72 (tall with wide leaves), T74 (medium with medium width leaves), and KK10, T60 and T110 (short with thin leaves). The three sexual plants (S) are tall with wide leaves and had been selected visually for vigor and leafiness from the original sexual pool. The crosses yielded 50 to100 progenies that were planted as spaced plants. A 10% selection pressure was applied based on plant vigor and leafiness. Ten clones of each selected progeny were planted onto a field in November 1995 (two rows of five plants) in two replications.

The number of progenies planted from each cross were: 14 S8 x KK10, 6 S10 x T60, 8 S10 x T74, 17 S10 x T110, 11 S12 x T60, 16 S12 x T72 and 7 S12 x T110. In October 1997, plots were cut to 20 cm, and forage evaluation began in December 1997. Plots were cut at 6-week intervals in the rainy season and once in the end of the 6-month dry season. Before each cut, plots were rated for vigor (1=excellent, 2= good, 3= regular and 4= weak), and flowering (0 = < 5 panicles per plant (p); 1 = 5 to 10 p; 2 = 10 to 25 p; 3 = 25 to 50 p; 4 = 50 to 100 p; 6 = >100 p.). Seven days after each evaluation, plots were rated for speed and quantity of regrowth (minimum = 0 and maximum = 6). The experiment was conducted for three years. Data was analyzed using SAS.

Results and Discussion

Differences between families (P<0.05) were found for yield of fresh matter, total and leaf dry matter, leaf percentage, flowering, regrowth after cuts and vigor. Means and variation for leaf dry matter yield for the seven families can be found in Table 1. The most productive families were S10 x T74, S8 x KK10 and S10 x T110. The least productive family was S12 x T110. Most hybrids performed better than the progenitors for leafiness and vigor (Table 1), traits strongly selected for in the progenies.

Since the mating design was not a diallel, best progenitors could not be assessed. However, for the crosses involving S10 and S12 with apomictics T60 and T110, interaction (P<0.05) occurred between the progenitors. The least productive combination was S12 x T110. No differences were found between the other combinations.

The hybrids were grouped into 6 groups using principal component analysis (PRINCOMP) of SAS. Variations for agronomic characteristics in each group are displayed in Table 2. Hybrids in group 6 (# 2, 24, 38, 61) presented the highest year-round and dry season yields, leaf percentages, best regrowth and vigor characteristics and least flowering intensity. Hybrids (19) in group 2 had the second highest year-round and dry season yields. Group 5, with four hybrids and five progenitors (KK10, T60, T110 S8 and S10), had the lowest yields and leaf percentages, worst regrowth and vigor characteristics. Group 4 presented the second lowest yields and vigor, and grouped fourteen hybrids and two progenitors T72 and S12. Groups 1 and 3 (23 and 14 hybrids, respectively) were similar and intermediate for the characteristics studied.

In conclusion, interaction between progenitors suggests that in future breeding, specific combination of parents may yield superior progeny. It was possible to separate the hybrids into performance groups. Selected hybrids in groups 6 and 2 were recommended for further small plot evaluations and evaluation under grazing. These hybrids are promising for pasture diversification in Brazil.

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Table 1 - Leaf dry matter yields (LDMY) and range of variation of families and progenitors in Campo Grande, MS. Mean of 3 years.

Family	Number of progeny	Mean leaf dry matter yield (kg/ha)				Number and (% selected)
		Mean of progeny[1]	Variation of progeny	Female progenitor	Male progenitor	
S10 x T74	8	11.4 a	4.7 - 14.5	4	-	4 (50%)
S8 x KK10	14	10.8 ab	3.8 - 17.2	2.5	1.1	8 (57%)
S10 x T110	17	9.5 abc	4.5 - 18.9	4	3.2	3 (18%)
S12 x T72	16	9.3 bc	5.8 - 12.2	4.8	3.6	5 (31%)
S12 x T60	11	8.9 bc	4.4 - 13.1	4.8	0.9	2 (18%)
S10 x T60	6	8.4 c	6.1 - 11.2	4	0.9	0
S12 x T110	7	5.4 d	2.8 - 9.9	4.8	3.2	1 (14%)

[1] Means followed by different small letters in a column differ statistically at $P<0.05$ (Waller-Duncan).

Table 2 - Variation in agronomic characteristics of hybrids in each group.

Agronomic Characteristic	Group Number (number of hybrids in group)					
	1 (23)	2 (19)	3 (14)	4 (17)	5 (9)	6 (4)
Fresh weight (t/ha)	61-75	79-92	50-58	31-47	7-28	101-115
LDMY[1] (t/ha)	7-11	10-15	6-10	4-10	1-4	12-19
LDMY[1] dry season (t/ha)	0.6-1.8	1-2	0.7-1.6	0.7-1.6	0.1-0.6	1.8-2.6
Leaf percentage	59-72	63-75	61-72	67-71	48-67	66-75
Regrowth after cuts (1-6)[2]	2.8-4	2.8-4	2.3-4	2-3	1.4-3	3.3-4.2
Plant vigor (1-4)[3]	1.8-2.8	1.8-2.7	1.9-2.8	2-3.5	2.9-4	1.6-1.8
Flowering (0-5)[4]	1.8-2.3	1.8-2.8	1.7-2.6	1.5-2.3	1.3-2.6	1.5-2.1

[1]Leaf dry matter yield; [2]Regrowth: minimum = 0 and maximum = 6; [3]Vigor: 1 = high and 4 = low; [4]Flowering: 0 = <5 to 5 = >100 panicles per plant.