CULTIVAR RELEASE

BRS Sarandi: a new *Andropogon gayanus* cultivar for tropical pastures

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Abstract: *BRS Sarandi is adapted to low and medium fertility soils. Annual DMY is 11 t ha^{-1} and levels of CP and IVDMD are 8.7 and 56.5, respectively. The average daily weight gain is 0.7 kg head^{-1} day^{-1} and the weight gain per area reached 15 @ carcass ha^{-1} year^{-1} without supplementation except for mineral salt.*

Keywords: *Tropical grass, dry matter yield, pastures, live weight gain, livestock*

INTRODUCTION

The area of cultivated pastures in the Brazilian territory represents 150 million hectares (IBGE 2021), with four species of the genus *Urochloa* (*U. brizantha*, *U. decumbens*, *U. humidicola*, *U. ruziziensis*, previously included in *Brachiaria*) occupying approximately 85% of this total (Barcellos et al. 2001). Approximately 88% of the tropical forage seeds produced and commercialized in Brazil are from cultivars of these four species, followed by the species *Megathyrsus maximus* (syn. *Panicum maximum*) (Roveri 2015). Except for *U. ruziziensis*, which is allogamous, the other three species of *Urochloa* and *Megathyrsus* have apomictic reproduction (Valle and Savidan 1996, Valle et al. 2009), so their cultivars are seed clones, generally with low genetic variability. This concentration of few species, cultivated in such large areas, associated with little variability within each species, represents a high-risk situation to the national livestock production systems.

The grass *Andropogon gayanus* Kunth is originated from Africa, and is described as polymorphic, with four botanical varieties, of which the *bisquamulatus* being considered highly productive, well adapted to tropical savannas (Grof and Thomas 1984) and widely used in caatinga, savanna and forest areas (Silva et al. 2014). The species has a basic number of chromosomes n = 10, naturally occurring as diploids (2n = 2x = 20), and tetraploids (2n = 4x = 40), being allogamous (Gould 1956) and anemophilous (Ferguson 1981). Selection has been limited to varieties *squamulatus* and *bisquamulatus*, and cytogenetic reports indicate this variety is tetraploid (Okoli and Olorode 1983). It is, therefore, recalcitrant to the development and maintenance of inbred lines, produced from self-pollination. As a mandatory allogamous species, populations are highly heterozygous, phenotypically heterogeneous and their improvement requires strategies and methods different from those used in the improvement of autogamous and apomictic plants.

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Andropogon gayanus is a short-day species, which presents intense flowering when the photoperiod varies between 12 and 8 hours (Tompsett 1976). It is very drought-tolerant and intolerant to waterlogging (Baruch 1994), it is highly productive in soils with low fertility and high aluminum saturation (Amézquita et al. 1990), and presents fast growth, good forage accumulation and palatability (Resende et al. 2015). It responds positively to mycorrhiza colonization, mainly under low levels of phosphorus (Salinas 1985). It is resistant to rust (Toledo and Fisher 1990) and grows well in systems integrated with legumes and other perennial species, such as eucalyptus, when in arrangements that provide moderate shade (Amésquita 1990, Toledo and Fisher 1990, Harmand 2003). It is a species with an anti-tick effect maintaining a low level of infestation in pastures over time (Thompson 1978).

There is some history of crop selection and breeding in South America, mainly based on CIAT introductions from Nigeria. Selection efforts led to the release of two varieties by Embrapa in Brazil: "Planaltina", with spittlebug resistance and good adaptation to acid and low-fertility savanna soils, in 1980; and "Baetí", selected for greater early vigor in the field, in 1994.

BRS Sarandi

BRS Sarandi is adapted to low and medium fertility soils. It has a medium-high height, with a semi-erect growth habit and a high total number of tillers. The annual productivity of dry matter is 11 t ha^{-1}, concentrated in the rainy season (90%). Of the total DM produced, 60% are leaves. The levels of crude protein (CP), in vitro dry matter digestibility (IVDMD), neutral detergent fiber (NDF) and acid detergent fiber (ADF) are, on average, 8.7, 56.5, 66.7 and 38.2%, respectively. The average daily weight gain was 0.7 kg head^{-1} day^{-1}, the gain per area was 1.7 kg ha^{-1} day with no supplementation except for mineral salt. The weight gain per area (AG) reached 15 @ ha^{-1} year^{-1} with an average stocking rate of 2.5 AU. BRS Sarandi was registered in the Brazilian Cultivar Registry (Registro Nacional de Cultivares - RNC/MAPA) under the number 41670 (10/29/2019) and is protected in the National Cultivar Protection System (Sistema Nacional de Proteção de Cultivares - SNPC/MAPA) under the certification number 20200031 (08/26/2019). Seeds of BRS Sarandi are exclusively commercialized by the group of companies that are part of the Unipasto Association (https://www.unipasto.com.br/).

Genetic origin and development

Evidence of significant genetic variability, ranging from moderate to high in populations from the cultivar Planaltina, has been reported for number of days until flowering, number of reproductive stems, dry matter productivity, leaf width, leaf blade percentage, *in vitro* digestibility, stem and leaf protein, plant height, internode length, among several other characteristics (Miles and Grof 1990). With these characteristics, conventional methods of genetic improvement of populations have great potential to develop varieties that will provide real alternatives to reduce the risks associated with Brazilian pastures.

The breeding program of *Andropogon gayanus* at Embrapa Cerrados was resumed in the rainy season of 2009/2010, with the planting of eight populations originated from the cultivar Planaltina, collected from different locations in the Brazilian Cerrado and Semi-Arid regions. A total of 500 plants from each of the eight populations were planted in blocks, constituting the initial generation in which the selection process started by mass selection.

Five selection cycles (years) were carried out with phenotypic selection for a simple hereditary characteristic. Phenotypic selection is used for characteristics that can be observed visually, directly, without any quantitative measurement. Plants with desired characteristics are selected from a population and crossed with each other in polycross blocks in order to increase their frequency with each generation of selection. The selection criteria adopted sought the development of a new population of *Andropogon* with high tillering number and vigor, increased leaf to stem ratio and semi-erect growth habit of the plants when compared to cultivars Planaltina and Baetí.

Open pollination seeds were collected from all fifth-generation plants and were planted in a block for recombination and initial seed multiplication in 2014. Seeds of this population were used for the trials to establish value of cultivation and use (VCU) for cultivar registration and DUS (Distinctness, Uniformity and Stability). This population originated the new cultivar of *Andropogon gayanus*, named BRS Sarandi.

Morpho-agronomic characteristics

Comparative data on morphological characterization among the cultivars BRS Sarandi, Planaltina and Baetí are presented in Table 1. The most important characteristics that differentiated BRS Sarandi from Baetí and Planaltina cultivars were plant height, growth habit, tillering intensity, and floral axis length.

DMY and forage nutritive value

Table 1. Morpho-agronomic characteristics of cultivars BRS Sarandi, Planaltina and Baetí

Traits	BRS Sarandi	Planaltina	Baetí
Plant height (cm)	178.3	205.4	193.4
Growth habit	Semi-erect	Erect	Erect
Basal tilleing intensity (no.)	155	105	111
Plant diamenter (cm)	2.44	2.33	2.75
Number of stalk internodes	7.16	7.74	7.37
Leaf blade length (cm)	55.45	57.38	59.06
Leaf blade width (cm)	1.79	1.69	1.84
Lenght of floral axis (cm)	78.06	88.79	85.65
Awns length (cm)	3.25	3.38	3.53
Cycle to flowering (days)	141	137	142
Flowering lenght (days)	25.6	25.9	25.5

The VCU trial was conducted in Planaltina/DF (lat 15º 60.03'' S, long 47º 71.04'' W, alt 1050 m asl), in a dark red oxisol (62% clay), over two growing seasons (April 2015 to April 2017), in small plots (3 x 4 m), compared to cultivars Planaltina and Baetí. Dry matter yield (DMY) was evaluated under cuts, with forage harvested at 15 cm stuble height.

Harvest frequency varied from 40 to 56 days in the rainy season (regrowth from October to April) and from 60 to 120 days in the dry season (regrowth from April to October). In the first year, two harvests were carried: 1) at the end of the rainy season (establishment phase - April 2015); 2) at end of the dry season (September 2015). During the second year, four harvests were made in the rainy season and one harvest was performed in the middle of the dry season, since the regrowth of the second half of the dry season was negligible, due to the severity of the drought.

For all harvests, the morphological composition was evaluated (leaf blade, stem and dead material). Ground cover and canopy height were also recorded. The occurrence and severity of the attack by pests and diseases were monitored. Whole plant samples and the leaf and stem fraction were analyzed to determine their nutritive value (crude protein, digestibility and fibrous fractions).

The average annual DMY of BRS Sarandi was 10.9 t ha^{-1} $year^{-1}$ and was similar to the other cultivars (average of 10.3-11.0 t ha^{-1} $year^{-1}$). (Table 2). The seasonality of forage production is quite marked (90% in the rainy season). The highest proportion of leaf blades in the forage of BRS Sarandi was more evident in the early years and at the time of flowering (rainy to dry season transition). In general, the proportion of leaves (blade/stem ratio) in *Andropogon gayanus* cultivars is lower in the rainy season, given the higher growth rate. Even so, in BRS Sarandi the proportion of leaf blades is above 50%.

The nutritive value of the whole plant of BRS Sarandi was superior to cv. Planaltina in relation to the fibrous fractions (NDF, ADF, Cellulose), both in the rainy and dry seasons (Table 3). During the rainy season, averages CP and IVOMD did not differ between cultivars, reaching values of 9.7 and 53.3, respectively. Compared to the cv. Baetí, the forage nutritive value is very similar, presenting differences only to the ADF contents. During the dry season, the nutritive value of the BRS Sarandi was higher, except for the crude protein content.

Regarding the nutritive values of leaf blades, there were no differences among cultivars, in both the rainy and dry periods, except for ADF and cellulose, where BRS Sarandi was superior. Thus, the higher nutritive value of the whole plant of BRS Sarandi for some of the characteristics (NDF, FDA, Cellulose) is more due to its higher proportion of leaf blades, a fraction whose nutritive value is higher than the values of the stems.

Reaction to soil nematodes and spittlebugs

Table 2. Dry matter yield, seasonal distribution and morphological composition (% of total dry matter) of *A. gayanus* cultivars in Planaltina-DF. Average of two growing seasons

Cultivar Season	Total DMY (t ha^{-1})	Seasonality (%)	Leaf blade DMY (t ha^{-1})	%	Stem DMY (t ha^{-1})	%	Dead material (t ha^{-1})	%
BRS Sarandi								
Rainy	10.1	90	5.7	54	3.6	39	0.8	6
Dry	0.8	10	0.6	70	0.04	8	0.10	22
Annual	10.9a		6.4a		3.6a		0.1a	
Planaltina								
Rainy	10.3	92	5.1	46	4.5	49	0.7	5
Dry	0.7	8	0.5	64	0.10	17	0.10	19
Annual	10.9a		5.6b		4.6b		0.8b	
Baetí								
Rainy	9.6	92	4.9	49	4.0	46	0.6	5
Dry	0.6	8	0.4	67	0.08	14	0.10	19
Annual	10.2a		5.4b		4.1ab		0.7b	

[a] Annual averages in the same column followed by the same letters do not differ (P> 0.05; t test).

Table 3. Forage nutritive value of *A. gayanus* cultivars (two-year average)

Plant fraction Season Cultivar	Crude Protein	IVOMD	NDF	ADF	Cellulose
Whole plant			%		
Rainy					
BRS Sarandi	9.7	53.3	70.7a	40.9a	34.6a
Planaltina	9.6	52.9	71.6b	41.8b	35.5b
Baetí	9.6	53.6	70.9a	41.2c	34.9a
Dry					
BRS Sarandi	7.7	61.6a	61.2a	34.3a	28.7a
Planaltina	7.7	58.9b	63.3b	35.9b	30.2b
Baetí	7.6	58.4b	62.5b	35.2b	29.6b
Leaf blades			%		
Rainy					
BRS Sarandi	10.9	58.0	66.4	37.1a	30.7a
Planaltina	11.0	58.1	66.2	36.7b	30.2b
Baetí	10.8	58.4	66.1	36.7b	30.3b
Dry					
BRS Sarandi	7.4	58.5	61.4	33.2	27.7
Planaltina	7.4	58.5	61.5	33.2	27.7
Baetí	7.1	57.1	61.5	33.4	27.9

Dry (April-October): average of two cuts; rain (October-April): 9 (aerial part) or 10 (other fractions) cuts
[a] For each fraction, in each season, means followed by the same letters do not differ (P> 0.05; t test).

Reaction to the soil nematode *Pratylenchus brachyurius* was evaluated in two different bioassays. BRS Sarandi presented an average reproduction factor of 0.75, which indicates that BRS Sarandi is resistant to *P. brachyurus*.

Reaction to *Mahanarva spectabilis* was evaluated in different bioassays during the years 2019/2020. BRS Sarandi presented a low rate of development of adults (<10%) and a long nymphal period (>50 days). For this reason, BRS Sarandi is considered resistant to the spittlebug *Mahanarva spectablis*.

Responses to limestone and phosphorous fertilization

Responses to three doses of phosphorus (20, 60 and 240 kg ha^{-1} of P_2O_5) and two doses of lime (0 and 1.1 t ha^{-1}) were tested comparing cultivars BRS Sarandi and cv. Planaltina. Limestone (PRNT = 80%) and phosphorus (Triple Superphosphate) were applied when preparing the soil in a total area before planting. The test was conducted for 1 year (2017/2018) with four harvests with a stubble height of 20 cm. Throughout the experimental, the equivalent of 100 kg ha^{-1} $year^{-1}$ of N and K_2O were applied, using the formulation 20-0-20.

Total dry matter yield was affected only by the doses of phosphorus. The cultivars showed similar average yields and responded equally to the application of phosphate fertilizer. The results demonstrate that BRS Sarandi has the same soil fertility requirements as cv. Planaltina, as well as the same capacity to respond to phosphorus. In addition, no response to the application of limestone was observed.

Grazing responses and beef production

The average daily weight gain (ADG) of male Nellore cattle, with initial average weight of 250-330 kg, was evaluated in BRS Sarandi pastures, between April 2018 and April 2020, on a grazing trial at Embrapa Cerrados in Planaltina, DF. The cattle were kept at three stocking rates, 1, 2 and 3 AU/ha in each of the three paddocks (1.5 ha), under continuous stocking management, with three replications. The average ADG was 1.10 kg $head^{-1}$ day^{-1} in the rainy season (December-April; 101 days) and 0.68 kg $head^{-1}$ day^{-1} in the transition period between the rainy and dry seasons (April-June; 83 days), with higher values for the lowest stocking rate in the rainy season and the opposite occurring in the rainy-dry transition period. The average gain per area (GA) was 3 and 2 kg LW ha^{-1} day^{-1} in the rainy season and in the transition to the dry period, respectively. When considering the two seasons together (101 + 83 days), the total GA was 225 kg carcass LW ha^{-1} $year^{-1}$, with higher values for the highest stocking rate in both seasons.

Throughout the experiment, the average canopy height remained lower in BRS Sarandi pastures maintained at a higher stocking rate. The flowering of BRS Sarandi occurred on April and there was an increase in stems at the expense of leaves in the canopy in the rainy-dry transition period. On that occasion, even with a higher stocking rate, the lower canopy of BRS Sarandi promoted better conditions for the consumption of forage. The lower canopy on the higher stocking rate also promoted an increase in CP, and probably positively influenced GMD during the transition phase.

Seed productivity

Seeds productivity of mechanically harvested BRS Sarandi varied from 470 kg ha^{-1} (first year) to 130 kg ha^{-1} (fourth year), with a cultural value varying from 20 to 28%. Physical purity was always above 50% in mechanized harvesting. Seed productivity declined with the age of production area and was also associated with a smaller plant population. Despite the low plant height of BRS Sarandi, management to reduce the canopy height to 40-50 cm is necessary in January, when the plants are in the vegetative stage, to facilitate mechanized harvesting and reduce the risk of plant lodging. Late plantings (second half of January) substantially reduced seed productivity (50 kg ha^{-1}).

Technical recommendation

BRS Sarandi is recommended for use in pure or mixed pastures with legumes in the Cerrado region, in low to medium fertility soils, with a texture ranging from sandy to clayey. Its use should preferably occur in cow-calf and stocker operations, with a major contribution to the forage supply occurring in the rainy season. Since it presents a rapid regrowth after the first rains, its use should be prioritized in the property early in the following months: October, November, December and January.

Seed production and commercialization

BRS Sarandi is exclusively licensed by Embrapa to Unipasto (Associação para o Fomento à Pesquisa de Melhoramento de Forrageiras). Therefore, seeds can only be commercialized by the Unipasto Associates (https://www.unipasto.com.br/).

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