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Production and quality of *Brachiaria* forage plants in southwestern Goiás state

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ABSTRACT. The sowing season has great influence on the establishment of forage, as spreading seeds out of season tends to harm productivity. Consequently, the aim of this study was to evaluate sowing seasons, production and bromatological quality of *Brachiaria* forage species in Mineiros-GO. The experiment was held at IPAF/FIMES, in a typical Quartzarenic Neosol. The experimental treatments consisted of five sowing dates and five cultivars/species of forage grass (*Brachiaria brizantha* (Hochst) cv. Marandú, *Brachiaria brizantha* cv. Xaraés, *Brachiaria hybrid* cv. Mulato, *Brachiaria decumbens* Stapf and *Brachiaria ruziziensis*). The experiment was designed in randomized blocks with sub-plots, with four replications, each block represented by a sowing date. Dry matter production was higher in the first and second sowing dates. Cultivar Mulato achieved the highest productivity among the assessed cultivars. The sowing season and cultivars influenced the levels of crude protein, neutral detergent fiber and acid detergent fiber. It is concluded that a marked decrease occurs in dry matter production and bromatological quality of *Brachiaria* species when the sowing is done after mid-March.

Keywords: cutting time, cerrado, NDF, CP, ADF.

RESUMO. Produção e qualidade de forrageiras do gênero *Brachiaria* na região Sudoeste do Estado de Goiás. A época de semeadura tem grande influência no estabelecimento das forrageiras, em que, semeaduras realizadas fora da época adequada tendem a trazer prejuízos à produtividade. Com isso, objetivo deste estudo foi avaliar épocas de semeadura, a produção e a qualidade bromatológica de espécies forrageiras do gênero *Brachiaria* no município de Mineiros, Estado de Goiás. Instalou-se o presente experimento no IPAF/FIMES em um Neossolo Quartzarênico típico. Os tratamentos experimentais consistiram em cinco épocas de semeaduras (10/2/2006; 25/2/2006; 13/3/2006; 27/3/2006 e 12/4/2006) e cinco cultivares/espécies de forrageiras (*Brachiaria brizantha* (Hochst) cv. Marandú, *Brachiaria brizantha* cv. Xaraés, *Brachiaria híbrida* cv. Mulato, *Brachiaria decumbens* Stapf e *Brachiaria ruziziensis*). Utilizou-se delineamento experimental em blocos casualizados em parcelas subdivididas, com quatro repetições, sendo cada bloco representado por uma data de semeadura. A produção de matéria seca foi superior na primeira e segunda época de semeadura. A cultivar Mulato obteve a maior produtividade entre as cultivares avaliadas. A época de semeadura e as cultivares influenciaram os teores de proteína bruta, fibra em detergente neutro e fibra em detergente ácido. Conclui-se que, ocorre acentuada diminuição na produção de matéria seca e na qualidade bromatológica de espécies de *Brachiaria* quando a semeadura é realizada após meados do mês de março.

Palavras-chave: época de corte, Cerrado, FDN, PB, FDA.

Introduction

The cattle raising business in Brazil is based almost exclusively on pasture production as the principal food source for cattle. A total of 350 million hectares are intended for agricultural activity and, more than 170 million hectares of those are used as grazing areas, where most Brazilian cattle herds are distributed.

Around 35% of the bovine population in Brazil is concentrated in the Center West region, the largest

producer of beef in the country (ANUALPEC, 2007). In this context, the state of Goiás has a herd of 20,727,000 heads and annual milk production of 2,649,000,000 gallons. It has the third largest cattle herd in the country and is the second state in milk production, which demonstrates the importance of this activity.

Nevertheless, many pastures destined for the cattle business are undergoing a process of degradation. Low soil fertility, poor pastures,

attack by pests and/or fire are the main causes of pasture degradation in Brazil, indicating that these areas need rehabilitation to achieve a satisfactory support capacity (ANUALPEC, 2007). The integration of production systems of grains and livestock farming with the cultivation of forage plants is emerging as a viable option to achieve the desired sustainability in trinomial soil-plant-animal ecosystems such as the Cerrado. This integration can be, if well conducted, an alternative to solve certain problems in production systems, such as seasonality of forage production, land idleness between agricultural harvests, diseases, high production costs, both in the recovery of pastures and for low productivity rates. Another point is the possibility of obtaining support from the sale of animals produced under integration for financial resources at the beginning of the grain harvest sowing, which may contribute to improve economic efficiency of properties and provide straw to implement a no-tillage system as well (ZANINE et al., 2006).

Another important point is soil, as forage may contribute to summer crops when managed properly, not only for straw production (MELLO et al., 2004) but also by the benefits that the grasses bring in relation to area occupation, leading to a reduction in the incidence and multiplication of weeds, reduction of the cycle of pests and diseases, and reduction in erosive processes (IKEDA et al., 2007; PACHECO et al., 2009).

Summer crops may contribute to the supply of remaining nutrients, making it available for forage, which becomes significant as *Brachiaria* pastures have shown a gradual reduction in productivity after their establishment. So, the integration between crops and pastures may constitute an important factor for improving their quality.

Moreover, sowing time has great influence on the establishment of forage in that sowing out of the appropriate season tends to harm productivity and quality. Thus, the adequacy of each species to the best time of sowing time is necessary to achieve the best management for higher productivity. Accordingly, it is expected that sowing earlier tends to promote greater productivity and bromatological quality of species and cultivars.

In that sense, the aim of this study was to evaluate the influence of seeding dates on production and bromatological quality of cultivars of forage from genus *Brachiaria* in the Mineiros municipal district.

Material and methods

The experiment was conducted in a typical Quartzarenic Neosol (EMBRAPA, 1999) at an area of the Mineiros municipal district. The climate in Mineiros is hot, semi-moist and remarkably seasonal, with rainy summers and dry winters, with average annual temperature of 24°C, annual maximum 30°C and a minimum of 15°C, characterized by a marked dry season from April to September, with mean annual rainfall ranging between 1570-1734 mm (Figure 1). The soil samples for chemical analysis were collected with the help of a screw gauge at 0-20 cm and analyzed at the Laboratório de Análises de Solos/FIMES, located at the Instituto de Ciências Agrárias (Table 1).

For the experiment, the soil was prepared after the corn crop by using a harrow disk on February 9, 2006 and a leveling harrow disk the day before sowing, for each planting season, distributing the seeds manually, and using a rake to cover them. No fertilizer was applied at sowing or in the covering of grass, using only residues from the fertilization of the previous crop (corn ears).

An experimental design of randomized blocks in split plots was used, with four replications. Each plot comprised an area of 12.5 m² (2.5m x 5m) with 0.5 meters of edging eliminated, resulting in a useful area of 6m². The treatments consisted of five sowing times for five cultivars/forage species from genus *Brachiaria* (*Brachiaria brizantha* (Hochst) cv. Marandú, *Brachiaria brizantha* cv. Xaraés, *Brachiaria hybrid* cv. Mulato, *Brachiaria decumbens* Stapf, and *Brachiaria ruziziensis*). The quantity of seeds used for the installation of the same forage was the same one usually recommended for pasture areas in the region. For each time, five cultivars/species of grass were seeded, in four replications, randomly distributed. The sowing dates started on February 10, 2006 and thereafter at 15-days intervals: February 10, 2006; February 25, 2006; March 13, 2006; March 27, 2006; and April 12, 2006. Cutting height was set 30 cm above ground level to simulate animal grazing, and allow formation of straw for the no-tillage system. It was decided to cut to a determined height because the sample collection based on the total availability of dry matter, i.e. at ground level, does not represent the diet selected by the animal, because it overestimates the fiber content and underestimates the levels of CP of the pasture. To this end, a 0.25 m² square (0.5 x 0.5 m) was used, placed twice at random in each band within each experimental unit.

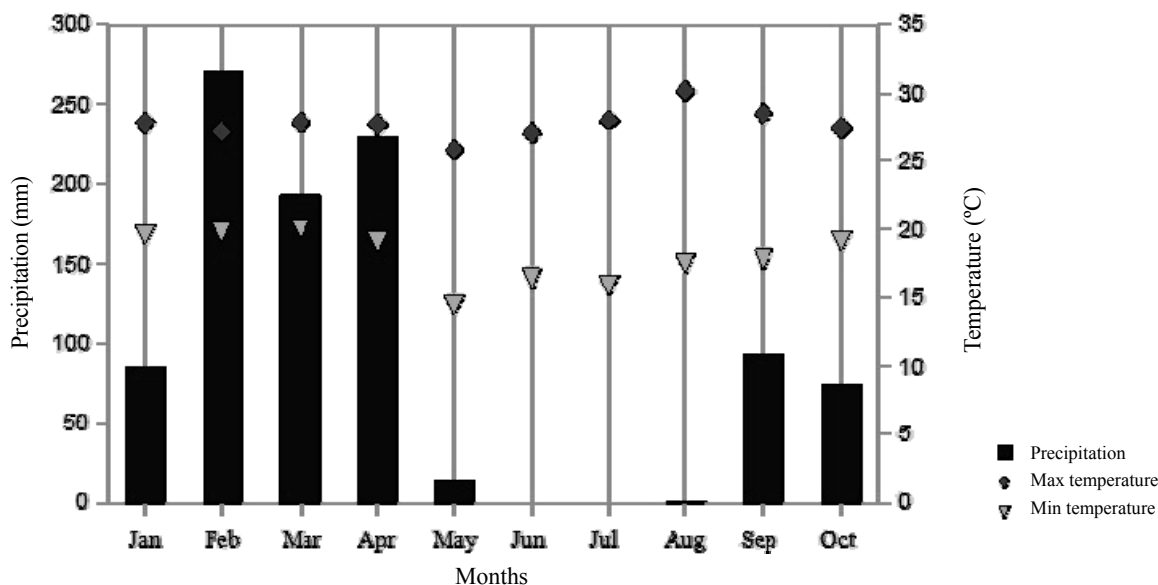


Figure 1. Precipitation, maximum and minimum temperatures, monthly average during the experiment. Source: Simehgo (2008).

Table 1. Chemical and particle attributes of a typical Quartzarenic Neosol in the municipality of Mineiros, Goiás State.

Depth cm	pH CaCl ₂	MO g.dm ⁻³	P* mg.dm ⁻³	K	Ca	Mg	Al cmol _c .dm ⁻³	H+Al	CTC	V %	Sand	Clay g.dm ⁻³	Silt
0-20	5.9	19	8.0	0.28	2.5	1.1	0.4	1.9	5.78	67.1	820	160	20

*Extractor: ion-exchange resin.

The first cuttings for the qualitative and quantitative determination of the species were made 72 days after sowing for all five seasons. The second cutting took place 45 days after the first, and the third cut occurred on October 27, 2006, prior to desiccation for soybean sowing, the latter being collected to measure the remaining biomass.

The collected green matter were combined and weighed; from it, we took a sample to be weighed and dried in a forced-air oven at 65°C for 72h. After drying to constant weight, samples were again weighed to determine DM content, in kg DM ha⁻¹. Then, all samples were ground in a Willey-type mill, with 40 mesh sieve for chemical evaluation. CP was estimated by analysis of nitrogen (N) multiplied by the total factor of 6.25. Total N was determined by the method proposed by Sarruge and Haag (1974). Analysis of NDF and ADF were performed using the method of Goering and Van Soest (1970). Analysis of variance ($p < 0.05$) was undertaken to determine the effect of sowing dates on the evaluated attributes. In case of significance in the analysis of variance, Tukey's test was applied ($p < 0.05$) to discriminate the difference among more than two means.

Results and discussion

The production of total dry matter of the species of *Brachiaria* studied (Table 2) was higher in the

first and second sowing seasons, with values greater than 14 mg ha⁻¹ year⁻¹ DM, while the fourth and fifth sowing times were less than 3 mg ha⁻¹ year⁻¹ of similar DM.

This result is probably due to less competition with weeds, considering that before the second sowing date and in the others, a light harrowing was made in the area, which destroyed the germinated weeds after the initial preparation of the area for the first sowing time, as well as due to climatic conditions encountered in that period.

Table 2. Production of dry matter from forage of the genus *Brachiaria* influenced by seeding time.

Seeding time	Dry matter			
	1 st cutting	2 nd cutting	3 rd cutting	Total
	mg ha ⁻¹			
Feb. 10	2.34 b	0.50 b	12.03 a	14.87 a
Feb. 25	3.64 a	1.86 a	9.33 b	14.83 a
Mar. 12	1.41 c	0.36 b	5.91 c	7.68 b
Mar. 27	0.33 d	0.78 b	1.80 d	2.91 c
Apr. 11	0.04 d	IMA	0.63 c	0.67 d

Means followed by the same letter in the column do not differ ($p > 0.05$) for Tukey's test. IMA = Insufficient material for analysis. 1st cutting = 72 days after sowing; 2nd cutting = 117 days after sowing; 3rd cutting = 260 days after 1st sowing.

It was observed that the February 25 planting was significantly higher in dry matter production compared to the others, a result expected by the smaller presence of weeds after sowing, which allowed a better recovery after cutting. Thus, in the February 10 seeding, the pressure competition of

weeds prevented adequate recovery of forage, and this fact was noticed by the reduced production of DM in the second cutting.

There was forage recovery in the third cutting, and the treatments sown on February 10 showed values of dry matter greater than 12 mg ha⁻¹, followed by the second season with values higher than 9 mg ha⁻¹. Thus, for the sowing performed in the last three seasons it was not possible to obtain the same amount of plant matter, possibly due to climate restriction during their vegetation process, either by irregular rainfall, decrease in average minimum temperature in the months April to September, and the type of soil with low water storage capacity which prevented speedy recovery. Still, it was observed that when using that fodder for animal grazing, only the grasses sown in the first three sowing dates reached a satisfactory production of dry matter at the end of the experiment (Table 2). As the intake of dry matter by cattle grazing is directly related to the availability and quality of fodder, which may alter the time of grazing, satisfactory results may not be obtained for weight gain of animals included in the system, depending on the time of sowing and productivity of forage.

This reinforces the need to study the behavior of forage in the various agricultural regions because, in addition to climatic variations, there were different responses of grasses, not only with regard to quality, but production as well.

Animal handling must be done with adequate care in order to have appropriate biomass production for the no-tillage system at the end of intercrop season, in the case of integrated production systems.

The production of dry matter showed different results among the studied forages in the first and third cuts (Table 3). In these cuttings the cultivar Mulato achieved higher forage production than the others, with average production of 2.50 and 8.16 mg ha⁻¹ DM, respectively, for the first and third cuttings. In the third cut all cultivars/ species showed a considerable increase in dry matter production, especially cv. Mulatto which had the highest DM yield, while cv. *Marandu ruziziensis* had the lowest response. This ability to recover after the

onset of rains demonstrates the importance of the choice of forage in order to have better results for the formation of straw for the no-tillage system, not only with regard to its formation, but also in relation to its resilience at the beginning of the rainy season.

Table 3. Production of dry matter for forage of the gender *Brachiaria*.

Forage	Dry matter			Total Production
	1 st cutting	2 nd cutting	3 rd cutting	
	mg ha ⁻¹			
Marandú	0.91 b	0.69 a	5.16 c	6.75 c
Mulato	2.50 a	0.84 a	8.16 a	11.48 a
Decumbens	1.86 a	0.54 a	6.45 b	8.85 b
Xaraés	1.70 a	0.92 a	5.56 bc	8.18 b
Ruzizienses	1.73 a	1.38 a	4.37 c	7.48 bc

Means followed by the same letter in the column do not differ ($p > 0.05$) for Tukey's test. 1st cutting = 72 days after sowing; 2nd cutting = 117 days after sowing; 3rd cutting = 260 days after 1st sowing.

In total dry matter production of all three cuttings, the cultivars that produced higher dry matter were, respectively, cv. Mulato, decumbens, Xaraés ruziziensis and Marandú (Table 3). In addition, the quantity of dry matter produced throughout the year evidenced the possibility of combining agricultural production and livestock, with the possibility of producing animals and still produce straw for annual crops, as long as the characteristics of cultivars/species used, restrictions of climatic region and the ability of the cultivar recovery are respected.

With regard to the nutritional value of the sowing times in the first cutting (Table 4), there was effect for CP and seeding for the fourth time (March 27, 2006) and for ADF only in the second time of sowing (February 25, 2006), both with values lower than the other sowing dates, while the NDF in the first cut was not influenced by sowing dates.

It was observed that the values of CP presented lower values for the second cutting, higher than in the first and third cuts. This fact can be linked to the structural composition of the forage plant, since according to Meinerz et al. (2008), crude protein content and *in vitro* digestibility of organic matter of tropical pastures are generally high at the beginning of the vegetative stage.

Table 4. Crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), in DM%, of forage from genus *Brachiaria* influenced by seeding and cutting times.

Seeding time	1 st cutting			2 nd cutting			3 rd cutting		
	CP	NDF	ADF	CP	NDF	ADF	CP	NDF	ADF
Feb. 10	8.2 a	71.0 a	38.4 a	8.7 a	68.8 a	39.5 a	8.8 a	69.0 a	35.3 c
Feb. 25	8.3 a	68.3 a	35.4 b	7.9 a	69.3 a	38.9 a	8.8 a	66.7 b	36.9 abc
Mar. 12	8.3 a	67.5 a	38.1 a	7.1 a	69.8 a	38.0 a	7.9 c	69.9 a	38.0 a
Mar. 27	7.9 b	70.1 a	38.8 a	6.3 a	70.0 a	34.4 a	7.2 d	69.5 a	36.3 bc
Apr. 11	8.0 a	IMA	IMA	IMA	IMA	IMA	8.4 b	68.5 a	37.5 ab

Means followed by the same letter in the column do not differ ($p > 0.05$) for Tukey's test. IMA = Insufficient material for analysis. 1st cutting = 72 days after sowing; 2nd cutting = 117 days after sowing; 3rd cutting = 260 days after 1st sowing.

This makes clear the need for correct grazing, because according to Meinerz et al. (2008) the deferment of tropical pastures for use in the dry season, can provide an abundant of supply low nutrition value forage, sufficient only for the maintenance of animal life, resulting in weight loss due to low intake of digestible dry matter.

CP content in the fourth sowing date was lower than the others (Table 4). This is probably due to the lack of water after the month of April, when the region normally has a reduction of rainfall.

This interrupts growth and increases the rate of senescent material in forage plants, reducing their quality. These results show that sowing later in soils with low water storage capacity may lead to production of forage of lower quality and volume.

For the fifth sowing date, CP values did not change in two assessment seasons (first and third cuttings), which may be related to the process of the activities paralyzing plant growth, between the two cuttings due to climatic conditions which are recovered, with forage production quality, as soon as the environmental conditions are appropriate.

This fact requires technicians to plan the relocation of both the stocking rate during the dry season and the time of animal entry into the integration area. Otherwise it the straw production for direct sowing in the subsequent culture may be impossible.

In the second forage cutting date there was no influence for the levels of CP, NDF and ADF (Table 4), probably influenced by hydric stress and low temperature, which likely made it impossible that the quality characteristics could be expressed by the different forage cultivars/species.

However, just the first seeding season presented an increase in CP content, as a result of the first cutting date, which may have contributed to greater production of less lignified materials, and, and thus with higher CP levels. CP was lower than that cited by Cowan et al. (1981). However, it was near the minimum recommended by Valadares Filho et al.

(2006) at 7%, a value regarded as the lowest possible so that microorganisms can have satisfactory activity in rumen fermentation. Attention should be paid to the fact that after the first harvest, the cultivars sown in the first date received more than 200 mm rainfall in April and about 40 mm in May (Figure 1), which certainly affected the quality of the grasses sown at that time.

In the third season of cutting, differences were observed in CP, NDF and ADF for the different sowing dates (Table 4). The highest values of CP were found in the first and second sowing dates, which show similar values. This demonstrates the importance of weather conditions in the initial formation of grass, in order to have a proper recovery after the beginning of the rainy season, not only the quantity of dry matter produced, but also forage quality.

For NDF, the highest values were found in the first, third, fourth and fifth seasons of sowing, higher than the second sowing date, reflecting the environmental conditions and forage development. NDF values are consistent with those observed by Gomide et al. (2001) and Silva et al. (2007), which determined the levels of neutral detergent fiber of tropical grasses to range from 45% to 82% DM.

With respect to ADF, it is clear that the highest value was found in the third sowing date, but no difference was found between the second and fifth sowing dates (Table 4). Still, ADF values were similar in the second and fourth sowing dates.

Regarding bromatological behavior of five species of *Brachiaria*, it was observed that there was influence of sowing dates in all cuttings (Table 5), indicating that there are qualitative differences among species and cultivars, which can generate different results in relation to animal weight gain. For CP there was influence of sowing time on all cuttings. For NDF sowing time influenced the second and third cuts and the ADF in all three cuttings.

Table 5. Crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), in DM%, of forage from genus *Brachiaria*.

Forage	1 st cutting			2 nd cutting			3 rd cutting		
	CP	NDF	ADF	CP	NDF	ADF	CP	NDF	ADF
Marandu	8,5 b	72,2	37,9 a	7,7 b	71,3 a	40,2	8,5 b	69,8 a	37,1 a
Mulato	10,3 a	67,8	36,3 b	9,5 a	67,2 b	39,0	10,4 a	66,7 b	35,3 b
Decumbens	7,3 c	65,8	39,2 a	6,8 c	69,5 a	36,0	7,5 c	68,3 b	36,6 ab
Xaraés	7,6 c	67,1	36,2 b	6,5 c	69,0 a	35,8	7,5 c	69,5 a	37,3 a
Ruziziensis	7,5 c	71,9	38,3 a	7,0 c	69,8 a	39,0	7,2 c	69,3 a	37,6 a

Means followed by different letter in the column are different ($p > 0.05$) for Tukey's test. IMA = Insufficient material for analysis. 1st cutting = 72 days after sowing; 2nd cutting = 117 days after sowing; 3rd cutting = 260 days after 1st sowing.

Cultivar Mulato showed the highest value of CP, followed by Marandú. The cultivars decumbens, ruziensiensis and Xaraés did not show any difference among themselves but the values of CP were lower than the others, a result that was repeated in all three evaluations (Table 5). Attention should be paid to the fact that, except for one species Xaraés and decumbens and the second cutting period, the CP levels are shown to be adequate for the proper functioning of rumen microflora (VAN SOEST, 1994). This fact makes clear the need for appropriate choice of cultivar in order to have greater use of forage by rumen microorganisms.

Conclusion

There was a marked decrease in dry matter production for *Brachiaria* species when sowing takes place after mid-March.

Brachiaria hybrid cv. Mulatto showed higher production of air part biomass and the most desirable qualitative characteristics in relation to the other grasses studied.

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