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Production and nutritive value of piatã grass and hybrid sorghum at different cutting ages

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ABSTRACT. The influence of cutting age on production and nutritive value of piatã grass (*Brachiaria brizantha* cv. BRS Piatã) and hybrid sorghum (*Sorghum* spp. cv. BRS 801) under an integrated crop-livestock system was evaluated. The trial was carried out at the Embrapa Beef Cattle (20°27′ S; 54°37′ W) in Campo Grande, Mato Grosso do Sul State, Brazil, between April and October 2009. Experimental design consisted of randomized blocks with four replicates. Treatments were distributed across a split-plot design, which included three production systems (single piatã grass; single hybrid sorghum; mixed cultivation of sorghum and piatã grass). Half-plots consisted of three forage ages at harvest (with 70, 90 and 110 days after seeding). Variables included agronomical characteristics, productivity and nutrition value. Regardless of the evaluated systems, cutting age affected agronomical characteristics and *in vitro* digestibility of organic matter (IVDOM). Production was highest (4,048 kg ha^{-1}) within the integrated system. Regardless of cutting age, monoculture sorghum had the highest crude protein level. Results showed that integrated sorghum and piatã grasses were an asset for forage productivity. Forages had higher values in crude protein and in *in vitro* digestibility of organic matter on the 70^{th} day after seeding.

Keywords: *Brachiaria brizantha*, crop-livestock integration, mixed pastures.

Produtividade e valor nutritivo de capim-piatã e sorgo de corte e pastejo em diferentes idades de corte

RESUMO. Objetivou-se avaliar a influência da idade de corte sobre a produtividade e valor nutritivo de capim-piatã e sorgo de corte e pastejo, em sistema de integração lavoura-pecuária. O experimento foi realizado na Embrapa Gado de Corte, Campo Grande, Estado do Mato Grosso do Sul, no período de abril a outubro de 2009. Utilizou-se o delineamento em blocos ao acaso, com quatro repetições. Os tratamentos foram dispostos em esquema de parcelas subdivididas, com três sistemas de cultivo na parcela (capim-piatã em monocultivo; sorgo de corte e pastejo em monocultivo; consórcio de sorgo de corte e pastejo + capim-piatã), e três idades de corte na subparcela (70, 90 e 110 dias após a semeadura). As variáveis avaliadas foram: características agronômicas, produtividade e valor nutritivo. Observou-se efeito da idade de corte, independente dos sistemas avaliados nas variáveis de características agronômicas e digestibilidade *in vitro* da matéria orgânica (DIVMO). A produtividade foi de 4.048 kg ha^{-1} no sistema de integração. Independentemente da idade de corte, o sorgo em monocultivo apresentou os maiores teores de proteína bruta (PB). A integração de sorgo e capim-piatã foi vantajosa para produtividade de forragem. Aos 70 dias após a semeadura, as forrageiras apresentaram maior teor de PB e DIVMO.

Palavras-chave: *Brachiaria brizantha*, integração lavoura-pecuária, consórcio.

Introduction

Tropical regions are characterized by a great number of forage grass species with high potential value in ruminant production (OLIVEIRA et al., 2010). Extensive arable land and many grass species make Brazil an important competitor in the meat and dairy world markets. However, monoculture and poor agricultural practices are the primary cause in productivity loss and in soil and natural resources degradation. Continuous monoculture increases the occurrence of diseases and pests, such as the brown burrower bug, nematodes and soybean fungus, with heavy economic and ecological liabilities.

In the case of growers in the interior of Brazil, soil conservation is a priority due to shallow soils with relatively low organic matter and high soil-erosion. However, soil degradation may be avoided or decreased through no-tillage farming technologies that are characterized by minimum soil preparation, crop rotation and integrated crop-livestock systems (MACEDO, 2009). Interest in and the use of cover crops are on the increase in the region owing to the above concerns (MIRSKY et al., 2012).

Integrated crop-livestock systems aim at producing forage and hay for no-tillage farming in regions with a history of drought during the Autumn-Winter period. In these cases, the use of *Brachiaria* grass is widespread. The integration of crop-livestock systems has the potential benefits of enhancing nutrient cycling efficiency, adding value to grain crops and providing a use for forages and crop residue (HENDRICKSON et al., 2008).

After a 16-year research effort by Embrapa Beef Cattle, *Brachiaria brizantha* cv. BRS Piatã was selected from among materials collected in Welega, Ethiopia, in the 1980s, and launched as a pasture grass in Brazil since May 2007. This forage plant flourishes early in the summer and shows a greater accumulation of leaves than those produced by the cultivars *Brachiaria brizantha* cv. BRS Xaraés or *Brachiaria brizantha* cv. BRS Marandu. Although it produces less forage mass than the xaraés cultivar, its stalks are slimmer, which favors management during the dry season. Its slow growth during the initial phase is an asset in an integrated planting system with annual crops. It also has favorable management features, such as low stalk lengthening rate, higher leaf blade:stalk ratio, forage accumulation during the dry period, less seasonality in production, when compared to Marandu and Xaraés grasses with high forage volumes during the dry season and high animal performance (EUCLIDES et al., 2008).

Harvest and grazing sorghum (*Sorghum* ssp. cv. BRS 801) is an alternative feed crop in drought-stricken regions (OLIVEIRA et al., 2010). Due to its unique characteristics, it produces high quality forage at competitive costs. Neumann et al. (2002) confirmed its viability in regions either with great cultivation or with corn limitations.

The present study evaluates the influence of cutting age on yield and feed value of the grass piatã (*Brachiaria brizantha* cv. BRS Piatã) and hybrid sorghum (*Sorghum* spp. cv. BRS 801) under crop-livestock integration systems.

Material and methods

The experiment was performed at the Embrapa Beef Cattle Unit in Campo Grande, Mato Grosso do Sul State, Brazil (20°27’ S; 54°37’ W; altitude 530 m). According to Köppen’s classification, the region lies within the Cfa and tropical humid Aw transition band. Soil from the experimental unit may be characterized as dystrophic Red Clayey Oxisol (SANTOS et al., 2006), which has been cultivated continuously for 16 years with soybean and forage grass during the inter-harvest period, following the yearly culture (Table 1).

The experiment was conducted from April to October 2009, with 360.88 mm of rainfall during the period. Climate data during the experimental period were retrieved from the Embrapa Beef Cattle Unit meteorological station (Figure 1).

Table 1. Chemical characteristics of the field soil at a depth of 0–0.20 m.

System	pH		Ca	Mg	Al^{+3}	H+Al	S	T	V	C	K^+	P
	$CaCl_2$	SMP	cmol$_c$ dm^{-3}						%		mg dm^{-3}	
Monocultured Grass	5.82	6.74	4.16	2.06	0.01	2.57	6.70	9.27	72	0.36	187	6.99
Integrated	5.82	6.76	4.07	2.08	0.00	2.49	6.52	9.01	73	0.36	146	4.57
Monocultured Sorghum	5.69	6.70	3.50	1.82	0.00	2.64	5.67	8.32	68	0.36	138	4.82

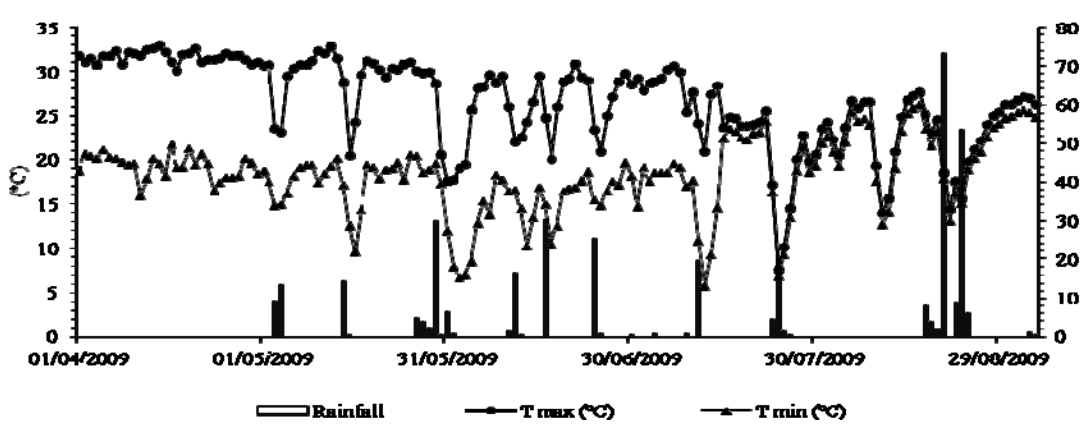

Figure 1. Variation in maximum (T max) and minimum (T min) temperatures and rainfall (mm) during the experimental period.

A randomized block design with four replicates was employed. Treatments were organized in split-plot parcels, with parcels comprised of piatã grass (*Brachiaria brizantha* cv. BRS Piatã) and harvest and grazing sorghum (*Sorghum* spp. cv. BRS 801); half plots were forage age 70, 90, and 110 days after seeding.

Plots had a total area of 8.6 × 110 m, with a usable area of 400 m^2. In April, forage grass and sorghum were seeded consecutively on top of soybean culture residues using a no-tillage system, with two consecutive mechanized operations seeding in which forage grass was followed by sorghum. The two crop systems had piatã grass and sorghum with an inter-row spacing of 0.25 m and 0.45 m respectively. Seeding density was 250 agricultural value (AV) points for piatã grass, with 50% AV (5 kg viable pure seeds) (PARIZ et al., 2011) and 54 seeds per square meter for sorghum (11 kg viable pure seeds), following Gontijo Neto et al. (2004). Piatã grass had an average of 17 and 16 plants in the plot, respectively for monoculture and integrated systems, whereas sorghum had an average of 26 plants per m^{-2} in the two crop systems. Fertilization was not performed due to previous soybean residual manuring.

After seeding, sorghum emergence took place after 2 to 4 days, whereas grass emergence occurred after 5 to 7 days. Forage cutting was undertaken at 0.20 m from soil level to simulate forage cutting for silage. The above height was also considered a post-grazing residue. At 70, 90 and 110 days after seeding, plant sampling was performed at eight points within the plot, using a steel square to delineate exactly 1.0 m^2. At each point, plant height (four plants of each species per m^{-2}) was measured from the soil to the insertion point of the last expanded leaf. In addition, the area was visually evaluated in terms of soil and forage dossel coverage, taking into account foraging and weed vegetation within the sample area. The main weeds were *Euphorbia heterophyla* (poinsettia), *Acanthospermum hispidum* (goat's head), *Raphanus raphanistrum* (wild radish) and residual plants of *Brachiaria brizantha* cv. Marandu.

Prior to forage cutting, photosynthetically active radiation interception was estimated by a portable ceptometer at four representative points on each plot. Readings were undertaken in the open air and light intensity on the sorghum and grass dossel was measured. Two readings were performed at ground level (dossel base).

At 70, 90, and 110 days, forage was cut at 0.20 m above the soil to simulate silage forage cutting. Cutting height was similar to that observed on post-grazing residue. Cut grass was divided into the following morphological components: blade, stalk with seam and senescent matter; sorghum was divided into blade, stalk, inflorescence and senescent matter. These components were dried in a forced-air oven at 55ºC until a constant mass was obtained and then ground in a Willy mill with a 20-mesh sieve. Rates for dry matter (DM), used to calculate the productivity of total dry mass (PTDM), productivity of total green dry mass (PTGD) and productivity of leaf blade dry mass (PLDM), in units of kg ha^{-1}, were obtained.

Leaf area index (LAI) was determined by the equation.

Fractions of pre-dried leaf blades from each forage species were analyzed for crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), and *in vitro* digestibility of organic matter (IVDOM) using near infrared reflectance spectroscopy (NIRS) and performed by calibration and validation data for CP, NDF and IVDOM, as shown in Table 2. Sample reflectance within wavelengths 1100–2500 ηm was analyzed with spectrometer (NR 5000; NIRSystems, Inc., USA) linked to a microcomputer. Table 2 shows parameters of equations based on the lowest calibration (EC) and validation (EV) standard errors, high determination coefficients (R^2) and regression coefficients (ß) close to 1.0.

$$LAI = [(\text{leaf area} * 0.0001) * (PLDM\ (kg\ ha^{-1}) * 0.1)] / [(\text{green mass of blade}) * (\%\text{total dry matter}/100)]$$

Table 2. Calibration (c) and validation (v) statistics to determine dry matter (DM), crude protein (CP), neutral detergent fiber (NDF) and *in vitro* digestibility of organic matter (IVDOM) of grass samples by NIRS.

Parameters	Calibration					Validation			
	n	Mean (%)	Deviant	Ec	R^2	N	Ev	R^2	ß
DM	167	92.5	0.7	0.2	0.90	50	0.2	0.88[a]	1.0
CP	163	5.00	2.1	0.3	0.98	52	0.3	0.98	1.0
NDF	158	73.6	4.3	0.9	0.96	49	1.1	0.89	0.9
IVDOM	145	38.2	9.5	2.3	0.94	48	3.0	0.89	1.0

[a] Coefficient of determination from the linear regression of estimated rates against rates from the chemical analysis; ß is the coefficient of regression of estimated rates against those from the chemical analysis; n is the number of samples; E is the standard error. Source: Almeida et al. (2003) adapted.

Rates for total digestible nutrients (TDN) were calculated by

data were non-normal, the transformation of √x+1 was used to analyze these data.

Results and discussion

Regardless of the cutting age, significant differences were detected ($p < 0.05$) among the three production systems for the variables dossel coverage, productivity of green dry matter, productivity of leaf blade dry matter, neutral detergent fiber and *in vitro* digestibility of organic matter (Table 3).

The dossel coverage of the piatã grass was higher ($p < 0.05$) than that in the other systems. The above was expected since forage shoot capacity, low spacing among plants and leaf architecture led towards a more rapid closing of gaps.

On the other hand, sorghum systems showed the lowest rates in terms of dossel coverage ($p < 0.05$). In fact, it should be emphasized that the integrated agriculture-pasture system showed better overall soil coverage for the maintenance of the soil's chemical, physical and biological qualities. Consequently, more forage would be available for animal intake.

The productivity of green dry matter (PGDM) reached 4,048 kg ha^{-1} in the integrated system and rate was higher than that of the other cropping systems evaluated. Productivity of sorghum and piatã grass in monoculture was respectively 3,443 kg ha^{-1} and 1,930 kg ha^{-1} of PGDM. More sorghum plants were extant in the system, or rather, mean 26 and 17 respectively for sorghum and piatã grass.

The productivity of leaf blade dry matter (PLDM) was similar in systems with integrated and monoculture piatã grass, respectively with 1,093 kg ha^{-1} and 1,308 kg ha^{-1}. However, sorghum monoculture showed decreased productivity. In fact, results showed that, due to the plant's architecture, or rather, its basal and lateral shoot capacity, piatã

equation: TDN = 74.49 – 0.5635 ADF (CAPPELLE et al., 2001); ADF rates were estimated by NIRS. Productivity in terms of dry mass, percentage of senescent material in the forage dry mass and TDN (kg ha^{-1}) were expressed on a dry basis.

Data underwent variance and regression analyses for cutting age by using SAEG 9.1. Tukey's test ($p < 0.05$) was used to compare means among the systems. Since weed density grass demonstrated higher blade production when compared to sorghum. Machado and Assis (2010) reported lower blade productivity for *Brachiaria brizantha* cv. Marandu during the dry period (761 kg ha^{-1}).

NDF was highest in monocultured and integrated piatã grass cultivation, with rates at 68.48 and 68.42%, respectively. Since NDF rate of monocultured sorghum reached only 61.58%, the sorghum system appeared to generate higher quality forage when compared to that of grass systems.

Since IVDOM in monocultured sorghum was higher than that in the integrated system and in monocultured piatã grass, low digestibility for forage from the integrated system was indicated. This may have been due to greater competition among plants in the integrated system, leading to increased leaf senescence and stalk lengthening, with a subsequent decrease in forage digestibility. The presence of panicles in the sorghum crop, affecting its nutritive value, is also another relevant fact.

Regardless of the production system (Table 4), cutting age affected dossel coverage, soil coverage, productivity of green dry matter (PGDM), productivity of leaf blade dry mass (PLDM) and *in vitro* digestibility of organic matter (IVDOM).

Dossel coverage was affected by cutting age and was significantly higher when cutting occurred after 90 and 110 days post-seeding. This was directly affected by PLDM. Since soil coverage was greater on the 70th day after seeding (56.33%), it may be inferred that hay on the ground was decomposing during the days under evaluation, or rather, it covered only 19.58% of the soil on the 110th day after seeding.

Table 3. Dossel coverage, productivity of green dry matter (PGDM), productivity of leaf blade dry matter (PLDM), rates of neutral detergent fiber (NDF) and *in vitro* digestibility of organic matter (IVDOM), according to cropping system.

Variable	System			CV (%)[1]
	Sorghum	Sorghum+grass	Grass	
Dossel coverage (%)	28.67 c	56.17 b	76.50 a	14.62
PGDM (kg ha^{-1})	3,443 b	4,048 a	1,930 c	23.10
PLDM (kg ha^{-1})	559 b	1,093 a	1,308 a	30.11
NDF (%)	61.59 b	68.42 a	68.48 a	3.57
IVDOM (%)	72.26 a	66.08 b	69.30 ab	4.46

Means followed by the same letter across a row indicate that rates do not differ significantly according to Tukey's test ($p > 0.05$). [1] CV: coefficient of variance.

Table 4. Productivity of green dry mass (PGDM), productivity of leaf blade dry mass (PLDM) and *in vitro* digestibility of organic matter (IVDOM), according to forage cutting age in days after seeding.

Variable	Days after seeding			CV (%)[1]
	70	90	110	
Dossel coverage (%)	40.50 b	60.00 a	60.83 a	14.62
Soil coverage (%)	56.33 a	39.17 b	19.58 c	37.83
PGDM (kg ha^{-1})	1,865 b	3,571 a	3,984 a	23.55
PLDM (kg ha^{-1})	706.00 b	1,040 a	1,214 a	30.11
IVDOM (%)	75.73 a	67.87 b	64.04 c	4.46

Means followed by the same letter across a row indicate that rates do not differ significantly according to Tukey's test (p > 0.05). [1] CV: coefficient of variance.

Highest productivity in terms of PGDM and PLDM occurred respectively at 70 and 110 days after seeding. PLDM greatly contributed towards increase in forage production and correlation with dossel coverage by the coverage of a greater area. Leaves are photosynthesizing organs where the interception of solar radiation occurs. The latter is used in plants' metabolism for their growth and development. Increase in forage and leaf blade productivity may be explained by the plant's development and by increased photo-assimilation in the plant's adult life. It should be emphasized that pastures had a higher than average rainfall during the experimental period, with a consequent enhancing of this effect.

In contrast to results in current study, previous work by Mota et al. (2010) reported higher dry matter productivity in a monoculture system (16,821 kg ha^{-1}) when compared to that in an integrated sorghum + xaraés system (13,472 kg ha^{-1}). Machado and Assis (2010) reported productivity of 852 and 2,540 kg ha^{-1}, respectively, for Marandu and Xaraés grasses during the dry season, following soybean cultivation.

It may be observed that there was a decrease in IVDOM with age increase, perhaps due to the fact that, with increasing plant maturity, an increase in structural carbohydrates, relative to soluble fractions, caused an overall decrease in digestibility. Increasing age might have also caused an increase in the vegetal cell wall, which may also have contributed towards a decrease in forage digestibility.

A significant interaction ($p < 0.05$) between the cropping system and the cutting age of the forage grass was registered with regard to leaf area index (LAI), dossel height, photosynthetically active radiation (PAR), weed density, crude protein (CP) levels and acid detergent fiber (ADF) (Table 5).

Table 5. Agronomical characteristics and nutritive value according to integration system and cutting age in days after seeding.

System	Days after seeding		
	70	90	110
	Leaf Area Index		
Sorghum	1.44 aA	1.93 bA	1.21 cA
Sorghum+Grass	2.12 aA	2.74 abA	2.67 bA
Grass	2.15 aB	3.08 aB	4.39 aA
	Dossel height (m)		
Sorghum	0.88 aA	0.90 aA	0.77 aA
Sorghum+Grass	0.90 aAB	1.01 aA	0.76 aB
Grass	0.27 bB	0.50 bA	0.56 bA
	Light interception (%)		
Sorghum	68.75 bAB	69.50 bA	58.50 cB
Sorghum+Grass	82.50 aA	88.25 aA	83.75 bA
Grass	80.75 aB	91.50 aA	95.75 aA
	Weeds (m^2)		
Sorghum	2.81 cB	2.81 bB	4.48 aA
Sorghum+Grass	4.15 bA	3.56 bA	4.23 aA
Grass	5.27 aA	5.09 aA	3.90 aB
	Crude Protein (%)		
Sorghum	20.96 aAB	21.67 aA	19.14 aB
Sorghum+Grass	18.98 abA	15.81 bB	13.82 bB
Grass	17.89 bA	14.91 bB	14.45 bB
	Acid Detergent Fiber (%)		
Sorghum	28.47 aA	27.03 bA	26.99 bA
Sorghum+Grass	29.77 aB	32.96 aA	34.88 aA
Grass	29.45 aC	33.92 aB	36.60 aA

Means followed by the same small letter in the column and by capital letters in the line do not differ by significantly according to Tukey's test (p > 0.05).

No variation in LAI was observed in sorghum monoculture or in integrated system at any of the three cutting dates. Evaluations began at 70 days after seeding and at this stage the total leaf area was already fully developed. In fact, approximately 30 days after emergence, differentiation occurred at the vegetative growth point (leaf production), shifting towards reproductive development (panicle emergence).

Monocultured grass showed maximum LAI after 110 days after seeding. This fact was corroborated by an increase in light interception. The three production systems did not differ in terms of LAI ($p > 0.05$) after 70 days after seeding. However, on the 90 and 110th day after seeding, monocultured piatã grass showed a significantly higher LAI. Consequently, besides the quantification of the pasture's total leaf area, knowledge on how the leaf area was distributed in the plant population is required for a better understanding of the forage dossel's LAI dynamics (CARVALHO et al., 2007).

Dossel height in sorghum monoculture was greater than that in piatã grass monoculture at each of the three cutting ages under analysis. This occurred because of the piatã grass's slow growth rate in its initial stage when compared to that of sorghum. It should be emphasized that the system had a growth potential due to the 16-year-old residual fertility of the area with its integrated crop-livestock activity, or rather, due to the balanced system of soil conditions. Employment of grass in systems associated with no-tillage farming has an important role in the maintenance of soil quality. Flores et al. (2008) stated that the adequate height for *Brachiaria brizantha* management lies between 0.20 and 0.40 m.

When forage was cut at 90 and 110 days after seeding, the sorghum crop had already passed into its reproductive stage, as indicated by panicle emergence. The flowering period was characterized by growth interruption and by the modification of the source-sink relationship in which photo-assimilated factors, which were previously prepared for the growth of the aerial sector, were now used for the development of production organs and fruits.

Age at the time of cutting did not appear to affect dossel height in the monocultured sorghum system ($p > 0.05$). At 90 days after seeding, dossel heights in the integrated system and in monocultured sorghum were 1.01 and 0.90 m, respectively, whereas monocultured piatã grass reached only 0.50 m. According to Mota et al. (2010), monocultured sorghum and sorghum+xaraés grass were similar in terms of dossel height (2.29 and 2.44 m, respectively). According to Leonel et al. (2009), highly competitive dossel shades imply higher allocation of photo-assimilated factors and their derivatives for the production of stalks to the detriment of leaves. Consequently, there was a higher participation of the structural components to increase the forage's height. In the monocultured grass system, the greatest heights observed only after the 90th day after seeding were due to stalk lengthening and its development according to age.

Integrated and monocultured grass had a higher PAR rate on the 70th and 90th day after seeding than monocultured sorghum. Space among sorghum plants in the integrated system was filled by piatã grass, with 56.14% dossel coverage. Monocultured sorghum had only 28.65% dossel coverage. Dossel development tended towards an increase in LAI to raise PAR capacity and make the light interception process more efficient. Further, crop development benefitted an accumulation of biomass, which, in turn, favored light interception. On the 110th day, only the monocultured piatã grass had a rate close to 95.75% of PAR. Light interception was essential as a follow-up reference of the re-shoot process since it permitted that forage could be harvested (either by cutting or by grazing) always in the same physiological conditions (PEDREIRA et al., 2007). At the 70 and 90th day after seeding, weed density was higher in the monocultures. This was unexpected given that all production systems were seed under similar no-tillage conditions and the monocultures showed the highest rates in dossel coverage (76.46%). The latter was probably due to the residual marandu grass during the evaluation of the experiment. On the other hand, no effect of the evaluated system was reported on the 110th day with regard to the number of weed plants. This may have been caused by the progressive increase of the grass's leaf area index and dossel coverage since the weed population remained constant in the other two systems.

Regardless of the cutting period, monoculture sorghum had the highest crude protein levels. Further, crude protein levels decreased as the forage matured in all three systems under analysis, after the 110th day of seeding. Crude protein results in current experiment were higher than those reported by Velásquez et al. (2010) for marandu grass, at the cutting age of 42 days (9.88%), between April and June. In spite of the above, all production systems for all three cutting dates had crude protein rates higher than 7%, or rather, the minimum rate required for the maintenance of the animal. A System × Age interaction affected acid detergent fiber (ADF) levels. Whereas no statistical difference occurred in the sorghum system between cutting ages ($p > 0.05$), an increase in ADF occurred in the integrated system and in maturing monocultured piatã grass. Almeida et al. (2003) reported that available forage's crude protein rate did not vary during the dry season, although it decreased at the end of the rainy season (April) when the grasses were in the final process of stalk lengthening. NDF was consequently on the rise. In the case of IVDOM, changes during the dry season failed to occur, even though IVDOM was lower in the rainy season (January), when climate conditions favored the growth of pasture and thus a high deposition on the cell wall, when compared to that in April.

The three production systems did not differ in ADF rates ($p > 0.05$) on the 70th day after seeding. However, sorghum showed lower ADF values on the 90 and 110th day after seeding. This effect might have been caused by panicles, since an evolution of panicle proportion from 26.48 to 53.35% occurred during the interval from 70 to 110 days after seeding. According to Neumann et al. (2002), who evaluated four non-tannin sorghum hybrids, the panicle is the sorghum's component that defines its nutritional quality. This is due to its high values for DM, CP and IVDDM and low rates for NDF, ADF and cellulose, when compared to the stalk-leaf complex.

Conclusion

Integrated sorghum and piatã grass was an asset for the productivity of forage. At the 70th day after seeding, the forages showed higher values in crude protein and in vitro digestibility of organic matter.

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