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Nutritive Value of Brachiaria Forage Intercropping with Eucalyptus in a Silvopastoral System in the Brazilian Savannah Biome

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ABSTRACT

The silvopastoral systems have the potential to replace benefits of the current cultivated grassland ecosystems, which mostly consist of monocultures of grasses. The experiment was conducted in a silvopastoral system, located in a farm called Fidalgo in the county of Confins in Minas Gerais, Brazil. The pasture in the SPS and in the adjacent control area, were planted at the same time as the silvopasture establishment. This SPS was established in 1994, without the use of fire. The experimental area consists of 1.5 hectares. Cattle grazing practices depended on forage production during the seasons. The animals grazed for three days followed by a 30-day rest period. In the implantation of the experiment was done a cut for standardization of forage at 30 cm above soil. Twelve random points were selected in each system (SPS and pasture), with a total of 24 points. Conducted the evaluation ADF, NDF, CP and Ca in systems. Observed that there are differences between the seasons of the year and between systems. This study suggests the presence of the tree species *Eucalyptus* interfere in system only forage. Periods of climatic variations observed promoted differentiation in ADF, NDF, CP, and calcium.

Keywords: Tree species, fodder, degraded areas, shading, sustainability

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1. INTRODUCTION

Silvopastoral systems have the potential to replace benefits of the current cultivated grassland ecosystems, which mostly consist of monocultures of grasses, making the activity more sustainable economically and environmentally (FRANKE et al., 2001). The Cerrado biome, which is sensitive to rainfall changes, could increase animal production by the use of SPS's (BRASSARD et al., 2005). However, the impact of animal production in AFSs on global climate change has not been investigated. Indeed, if sustainable silvopastoral systems could be developed as viable alternatives to conversion of forest lands to support animal production, the above-stated high levels of ''carbon footprint'' of animal production in developing countries could be reduced considerably (NAIR et al., 2008).

The profitability of silvopastoral systems has been demonstrated by several studies, exemplified by the study conducted by Marlats et al. (1995), quoted by Silva (2003), who compared monoculture pastures and silvopastoral system with approximately 250 and 416 trees per hectare. This system showed the best internal rates of return on the investment made, exceeding the net income obtained in monocultures. In agroflorestry systems need to choose fodder they can be used under conditions of low light (Castro et al., 1999). The Brachiaria grasses are largely used to pasture in tropical America and according to Carvalho et al. (1997), can be used in shading conditions natural.

During dry periods, the quantity of water in the soil surface is low, which makes it difficult for forage roots to obtain nutrients. On the other hand, deeper soil layers remain wet. Thus, trees with deeper roots would have access to water stored in the underground (KANEGAE et al., 2000). Another benefit of the system during the dry period is that, according to Carvalho et al. (1999), in the dry season the protein content of grass under the canopy of trees is much higher than the protein content of grass that is in full sun .

In Systems Agroflorestry Carvalho et al. (1997), by working with six tropical grasses grown in the understory of angico-red, found that the production of crude protein the B. brizantha. Marandu was 47% higher high when it is shaded. Sousa et al (2007) observed in crude protein the B. brizantha Marandu in understory of Z. TB was 29% higher that in your control. Similar trend was observed by Carvalho et al. (1995), found that the shaded grass had higher concentrations of N that grasses planted in full sun.

The objective of this study was to evaluate a SPS located in the Cerrado, in relation to forage nutritive value during the drought summer period and beginning of the rainy season.

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2. MATERIALS AND METHODS

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The experiment was conducted in a silvopastoral system, located in a farm called Fidalgo in the county of Confins in Minas Gerais, Brasil. The geographic coordinates of the experimental area of this typical Cerrado biome are 19º54'32" South and 43º58'18" West and the average maximum daily temperature in the SPS was 31.4ºC and relative humidity averaged 42%. The pasture in the SPS and in the adjacent control area, were planted at the same time as the silvopasture establishment. This SPS was established in 1994, without the use of fire.

The land was cleared, and eucalyptus seedlings were planted at a density of 150 trees/hectare.The trees used in the experiment were15 to 25 meters high, with diameter at breast height (DBH) of 40 to 60 cm. The soil in the SPS is classified as a Latossolo Vermelho Amarelo (Oxisol), with 651 g/kg of clay, 211 g/kg of silt and 138 g/kg of sand.

The experimental area consists of 1.5 hectares. Cattle grazing practices depended on forage production during the seasons. The animals grazed for three days followed by a 30-day rest period.

Brachiaria brizantha cv. Marandu productivity was measured quantitatively and qualitatively for three distinctive periods: the beginning of the drought (May 15th, 2009), the middle of drought (July 25th, 2009), period of greatest drought stress, and after the drought (November 23rd, 2009).

In the implantation of the experiment was done a cut for standardization of forage at 30 cm above soil. Twelve random points were selected in each system (SPS and pasture), with a total of 24 points. One meter squared collectors made of steel grids were used to prevent animal interference and were placed at each identified location for forage evaluation.

After collection, the forage was weighed, dry mass in an oven at 60ºC for 72 hours, and then ground to pass through a1 mm sieve. All bromatologic compositions of crude protein (CP) were analyzed by Kjeldahl's methodology (CUNNIFF, 1995). Calcium (Ca), phosphorus (P) and potassium (K) were determined using permanganometric techniques, colorimetric and flame photometry, respectively. Forage composition was evaluated for neutral detergent fiber (NDF), acid detergent fiber (ADF) and lignin separately (ROBERTSON et al., 1982).

Acid detergent fiber (ADF), neutral detergent fiber (NDF), crude protein (CP) and calcium (Ca) variables had an interaction effect between the production systems and the months of collection (Table 3). Kephart and Buxton (1993), observed that forage subjected to shading had a significant positive correlation between SLA (Specific Leaf Area) and in vitro organic matter digestibility and N content in leaf blades, and a negative correlation between SLA and cell-wall lignin and neutral-detergent fiber.

3. RESULTS AND DISCUSSION

It is notable that NDF and CP in both cropping systems and ADF in the full sun, were significantly higher in May (beginning of the drought period) compared to the forage collected in July and November (during and immediately after the drought). However, Ca was significantly different in the forage collected in July in both cropping systems.

But ADF in SPS and Ca, in full sun, was not significantly different during the three periods in this study ($P<0.05$). In this present work, levels of ADF were higher in SPS in the forage collected in November while NDF did not differ among systems during any of the collection periods.

Table 1 – Means of acid detergent fiber (ADF), neutral detergent fiber (NDF), crude protein (CP) and calcium in silvopastoral (SPSs) and forage production in the full sun (FPSs) systems during the beginning, middle, and end of the drought periods. Confins, Minas Gerais, Brazil.

Collect	ADF(%)		NDF(%)		CP(%)		Ca(%)	
	SPS	FPS	SPS	FPS	SPS	FPS	SPS	FPS
May	36.56^{aA}	38.1^{aA}	79.07^{aA}	79.17^{aA}	9.34^{aA}	8.69^{aA}	0.66^{aB}	0.64^{aA}
July	34.84^{aA}	34.83^{aB}	65.49^{aC}	71.44^{aC}	7.48^{aB}	5.74^{bB}	0.82^{aA}	0.66^{bA}
November	35.62^{aA}	31.02^{bC}	76.53^{aB}	74.47^{aB}	8.98^{aA}	6.00^{bB}	0.38^{bC}	0.58^{aA}
CV(%)	6.02		4.88		27.15		18.57	

Means followed by different letters differ ($P<0.05$) by SNK test. SPS (Silvopastoral system); FPS (Forage production system, without trees).

Crude Protein and Ca levels were the highest in forage under shade in the silvopastoral system, compared to forage in full sun, during the drought and immediately after the drought seasons. To Ca, levels were higher for SPS in July, but the contrary in November. ADF was higher in the forage in the SPS only after the dry period ($P<0.05$).

The high protein value observed in forage in shaded SPS is of great importance for animal nutrition. In general, the forage production system, in cerrado, has low protein values in the dry season . The SPS has shown that even in times of drought this value has not decreased, showing its potential beneficial effect in improving nutrition of shaded pastures for cattle. According to Van Soest (1994) 1% of nitrogen (N) is equal to 6.25% of CP considering this to be the minimum which satisfies rumen fermentation. Study on availability of shade for dairy cows led by Carvalho (1991), showed increases in milk production and the percentage concentration of solids not fat. The results of this work are in agreement with Reis (2007), who found that shaded pasture with Ipê Felpudo (Zeyheria tuberculosa) had 8.62% CP compared to a (B. brizantha) pasture with 5.19% CP. Andrade *et al*. (2002), found in shaded pasture a level of CP 50%

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higher than that found in full sun areas, suggesting increase in soil N with increase in OM under trees. This study suggests that it is possible to observe a considerable increase in nutrient concentrations in shaded forage using silvopastoral systems. This increase was witnessed even in drought conditions, where forage protein values were high, which is important in meeting the maintenance requirements of ruminants.

4. CONCLUSION

This study suggests the presence of the tree species *Eucalyptus* interfere in system only forage. Periods of climatic variations observed promoted differentiation in ADF, NDF, CP, and calcium.

5. ACKNOWLEDGEMENTS

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