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Pasture characteristics and animal performance in a silvopastoral system with *Brachiaria decumbens*, *Gliricidia sepium* and *Mimosa caesalpiniifolia*

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Introduction

Grasslands are the major source of feed for ruminants (Zanine 2005). Seasonality of production, however, is a constraint in forage-based systems. Silvopastoral systems combine different components (animals, trees and forages) into an integrated system and may improve forage distribution across seasons. Resource use is usually more efficient both spatially and temporally, increasing land use efficiency (Nair 1993). Tree legumes present potential for silvopastoral systems because they can fix N from the atmosphere, improve cattle diets and lead to a faster N cycle. In addition, trees provide shade and may reduce heat stress for grazing animals in tropical and subtropical grasslands. Leguminous trees are commonly found in these climates and present potential for use in silvopastoral systems.

This research studied the pasture characteristics and animal performance of signal grass (*Brachiaria decumbens*) in a pure stand or in silvopastoral systems with *Gliricidia sepium* or *Mimosa caesalpiniifolia*.

Materials and Methods

The grazing experiment was carried out at the IPA Itambé Research Station located in the coastal region of Pernambuco State, Brazil. Treatments were: (1) *B. decumbens* (signal grass) + *M. caesalpiniifolia* (sabiá); (2) *B. decumbens* + *G. sepium* (gliricídia); and (3) *B. decumbens* in pure stand. Experimental plots were 1-ha paddocks. The experimental design was randomized blocks, with 3 replications. Leguminous trees were planted in double rows (15.0 m x 1.0 m x 0.5 m) and tree population was 2,500 trees/ha. Signal grass was planted between the double rows. Crossbred Holstein x zebu steers with an average initial weight of 175 kg were used as experimental animals. Cattle were weighed every 28 days after a 16-h fast. Herbage mass of signal grass was determined every 28 days using the double sampling technique described by Haydock and Shaw (1975). Herbage components were fractionated into green herbage and dead/senescent material. Herbage accumulation rate was determined using exclusion cages moved every 14 days (Sollenberger and Cherney 1995). Continuous stocking with a variable stocking rate, adjusted according to herbage allowance (HA), occurred over 12 grazing cycles of 28 days, totaling 336 experimental days (February 2012–January 2013). Two animal testers were allocated to each paddock. A target HA of 3 kg of green-herbage dry matter per kg of live weight (LW) was used. Data were analyzed using SAS (SAS 2003) and means compared by Tukey at 5% probability level.

Results and Discussion

Accumulation rate of signal grass herbage varied among cycles and ranged from 19.7 to 48.5 kg DM/ha/d ($P>0.05$) (Figure 1). Green herbage mass varied between grazing cycles and treatments ($P<0.05$), but HA was affected only by grazing cycle, ranging from 0.74 kg (May 2012) to 4.16 kg green DM/kg LW (October 2012) (Table 1). Average green herbage mass ranged from 321 kg/ha in May 2012 to 3,923 kg/ha in August 2012. Stocking rate followed a similar pattern to green herbage mass, with an interaction between grazing cycles and treatments. Stocking rate within each grazing cycle

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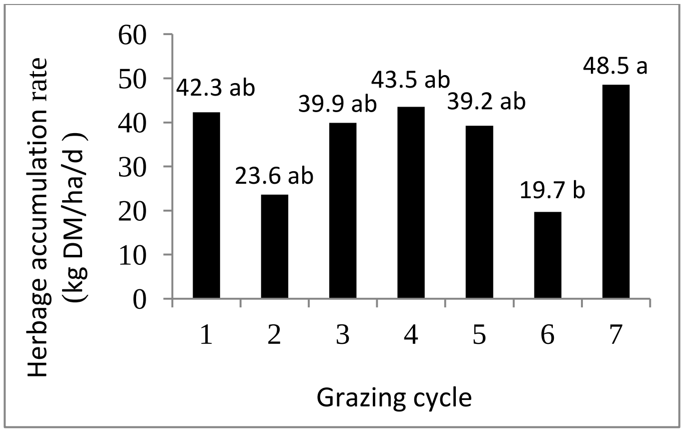

Figure 1. Herbage accumulation rate (kg DM/ha/d) of *Brachiaria decumbens* for different grazing cycles; average of 3 blocks.

Table 1. Green herbage mass of *Brachiaria decumbens* and herbage allowance in different grazing cycles; average of 3 blocks.

Grazing cycle (date)	Green herbage mass (kg DM/ha)			Herbage allowance (kg green DM/kg LW)
	Signal grass	Signal grass + gliricídia	Signal grass +sabiá	
1 (Feb 2012)	2,994 aB[1]	2,805 aB	2,957 aAB	3.05 B
2 (Mar 2012)	1,874 aBC	1,914 aBC	1,900 aB	2.95 BC
3 (Apr 2012)	1,682 aC	1,627 aBC	1,682 aB	3.03 B
4 (May 2012)	327 aD	316 aC	319 aC	0.74 D
5 (Jun 2012)	991 aCD	978 aC	957 aBC	2.18 BC
6 (Jul 2012)	2,193 aBC	2,093 aBC	1,903 aB	2.89 BC
7 (Aug 2012)	4,249 aA	4,080 aA	3,441 aA	3.40 AB
8 (Sep 2012)	1,145 aCD	1,146 aC	1,099 aBC	2.06 C
9 (Oct 2012)	2,511 aBC	2,504 aB	2,283 aAB	4.16 A
10 (Nov 2012)	1,962 aBC	2,010 aBC	1,941 aB	2.94 BC
11 (Dec 2012)	867 aCD	890 aC	892 aBC	2.47 BC
12 (Jan 2013)	1,338 aCD	1,147 aC	1,204 aBC	2.77 BC
s.e.			477	0.41

[1]Means followed by the same letter, lower case within rows and upper case within columns, do not differ by Tukey test (P>0.05).

did not vary among treatments, but differences occurred among cycles (Table 2). Animal performance (gain per animal and gain per unit area) was not affected by treatment, but varied among cycles. Average daily gain (ADG) ranged from 0.21 to 0.86 kg/hd/d.

Conclusion

Animal performance and pasture characteristics were similar for signal grass in pure stand and in silvopastoral systems with *Gliricidia sepium* or *Mimosa caesalpiniifolia*. Timber production, particularly in the case of *Mimosa*, is considered a major benefit of planting leguminous trees in pastures. Pastures with *Mimosa* had similar animal performance to the others but have a timber stock with the potential to double the net profit for the cattle producer. Soil organic matter build-up and long-term improvement of pasture productivity are also expected to occur in silvopastoral systems with leguminous trees. Potential environmental and economic benefits from the tree component must be analyzed. Long-term results are also important in order to make a conclusive decision regarding the benefit of each system.

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Table 2. Stocking rate, average daily gain per head (ADG) and gain per unit area (GPA) in the different grazing cycles; average of 3 blocks.

Grazing cycle (date)	Stocking rate (AU[1]/ha)			ADG (kg/d)	GPA (kg/ha)
	Signal grass	Signal grass + gliricídia	Signal grass + sabiá		
1 (Feb 2012)	2.99 aA[2]	2.81 aA	2.64 aAB	0.69 AB	56.25 AB
2 (Mar 2012)	1.75 aBC	1.77 aB	1.77 aBC	0.60 AB	29.82 ABC
3 (Apr 2012)	1.53 aBC	1.51 aBC	1.45 aBC	0.43 B	17.98 BC
4 (May 2012)	1.19 aC	1.21 aBC	1.06 aC	0.54 B	17.49 C
5 (Jun 2012)	1.24 aC	1.26 aBC	1.09 aC	0.21 B	7.27 C
6 (Jul 2012)	1.95 aB	1.81 aB	1.97 aB	0.60 AB	33.01 ABC
7 (Aug 2012)	3.51 aA	3.14 aA	2.65 aA	0.72 AB	63.82 A
8 (Sep 2012)	1.36 aBC	1.51 aBC	1.33 aBC	0.86 A	34.93 ABC
9 (Oct 2012)	1.48 aBC	1.52 aBC	1.36 aBC	0.26 B	9.38 C
10 (Nov 2012)	1.67 aBC	1.72 aBC	1.68 aBC	0.71 AB	36.26 ABC
11 (Dec 2012)	0.97 aC	1.04 aC	0.97 aC	0.33 B	9.65 C
12 (Jan 2013)	1.33 aBC	1.09 aC	1.11 aC	0.31 B	8.90 C
s.e.		0.24		0.11	7.44

[1]AU = 450 kg.
[2]Means followed by the same letter, lower case within rows and upper case within columns, do not differ by Tukey test (P>0.05).

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