Estimation of the optimal exploitation of Brazilian *caatinga* in the rainy season through five different management systems

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ABSTRACT: The aim of the present work is the study of the potentiality of forage crops production of the Brazilian *caatinga*, which is managed during the rainy season with five different systems: native area, lowered area, thinned out area, lowered and thinned out area and deforested area. The results we obtained are in accordance with the relative bibliography. Indeed, among areas covered by trees and shrubs, the lowered and thinned out area proves to maintain the biggest stocking rate of sheep on the basis of available protein and energy estimates. Besides, this management system is the more suitable to sustain the combined grazing system (cows, and/or sheep, and/or goats) which seems to be the more suitable to the sustainable exploitation of this kind of forest.

Key words: caatinga, grazing, management system

INTRODUCTION: Brazilian natives named *caatinga* the vegetation of the arid regions (*Sertão*). It spreads throughout the North East for 748.000 km^2 and represents the 8,8% of the total territory of Brazil. Overgrazing, deforestation and fire utilisation damage the ecosystem and cause the disappearance of animal and plant species and the reduction of soil fertility (Araújo Filho, 1991). Alternative techniques are necessary to permit a sustainable *caatinga* exploitation. The aim of the present work is the study of the potentiality of the forage crops production of this kind of forest. We compared native (N) and deforested (D) *caatinga* with other management systems. The lowered (L) *caatinga* permits animals to graze bush, shrubs and lowed trees during the arid season too. The thinned out *caatinga* (TO) reduces the shading and improves grass availability. The lowered and thinned out *caatinga* (L & TO) shows the advantages of both the previous techniques and seems to be the most suitable to animal rearing in the North East.

MATERIALS AND METHODS: The present research was carried out, during the rainy season (February – March 1998), on the Crioula Farm of the EMBRAPA-CNPC (Sobral - Ceará – Brazil). This farm is located at 3°42' of South latitude and 40°21' of West longitude. The climate is a BSHw', according to Koeppen classification (FAO-FAOCLIM World Wide Agroclimatic.): a rainy season extending from January to June and a dry season for the rest of the year. The long term average yearly rainfall is of 759 mm, and the temperature varies from 22 ^{0}C (night) to 35 ^{0}C (day). The predominant soil types are litholic and non-calcic brown and the topography is slightly undulated.

The experimental area was divided in five plots (0.5 ha each): native N area, L area, TO area, L & TO area, and D area (deforested without the use of fire). We carried out 15 observations for each part in order to evaluate the soil area covered by vegetation and grass production, using a 0.25 x 1.00 m iron transept. In the same way we carried out 15 observations for each part to measure density of trees and their production of edible foliage (1.6 m below 1.6 m of height), by the use of the Point quarter technique. We analysed samples of grasses (divided into *Leguminosae* and *Graminaceae*) and edible foliage (divided into different species) at the laboratory of the *Dipartimento di Scienze Zootecniche* of Florence. We calculated dry matter and organic matter digestibility (DMD, DMO) with the test of Tilley and Terry (1963) by the use of the rumen liquid of Morada Nova sheep, at the laboratory of EMBRAPA. We calculated nutritive values in ME with the TDN system (NRC, 1975), and in UFL with the INRA (1980) system. We considered the maintenance requirements indicated by NRC (CP, DP and ME), and INRA (UFL) for a 60 kg sheep to calculate stocking rates. Data were analysed by the one-way ANOVA: the management system was considered as independent variable. Differences among the means were evaluated by the Duncan's test (SAS, 1987).

RESULTS AND DISCUSSION: Laboratory analyses demonstrated interesting aspects of the nutritional characteristics. Scarce digestibility, due to high contents of CF, lignin and tannin (not reported data), caused modest values of ME and UFL. Phosphorus rates resulted very low (not reported data).

Table 1 – Chemical analysis (% DM), digestibility and nutritive value.

Edible plants	DM	CP	EE	CF	Ash	OMD%	ME Mcal/ kg DM	UFL /kg DM
Leguminosae	82.5	10.7	3.5	29.1	9.5	48.9	1.7	0.6
Graminaceae	69.6	7.1	1.7	42.8	6.7	31.2	1.1	0.3
Auxemma oncocalyx	75.0	18.2	1.6	28.7	11.0	14.1	0.5	0.1
Bauhinia forficata	64.4	15.0	2.8	20.3	8.0	36.4	1.2	0.4
Cesalpinia pyramidalis	61.0	14.1	5.4	22.6	5.6	43.0	1.6	0.5
Combretum leprosum	62.8	9.4	3.7	18.5	10.0	22.1	0.8	0.2
Mimosa acustipola	61.4	16.6	5.2	11.1	3.4	17.9	0.7	0.2
Mimosa cesalpiniaefolia	68.7	15.6	6.4	18.6	6.2	15.5	0.4	0.1

The DM and CP best productions were registered in the L area, but DP, ME and UFL best productions were found in D and L & TO areas.

On the same way, considering DM and CP requirements, the L area could sustain the biggest stocking rates (sheep/ha/year), but, considering DP, ME and UFL requirements, D and L & TO areas showed the best values.

Table 2 – Total productions (ANOVA).

Analytical Parameters	N	L	Management systems TO	L & TO	D	CV%	Sign.
DM kg/ha	642^{C}	1931^{A}	1425^{B}	1879^{AB}	1823^{AB}	41.4	***
CP kg/ha	81^{C}	202^{A}	144^{B}	192^{AB}	177^{AB}	41.5	***
DP kg/ha	28^{B}	65^{A}	63^{A}	68^{A}	80^{A}	37.6	***
ME Mcal/ha	839^{B}	2300^{A}	2148^{A}	2383^{A}	2765^{A}	38.4	***
UFL/ha	281^{B}	751^{A}	733^{A}	788^{A}	944^{A}	38.4	***

A, B, C on the same row: P≤0.05; ***=P≤0.001

Table 3 – Stocking rates in the rainy season for sheep of 60 kg (ANOVA)

Management systems	Requirements considered DM[1]	CP[1]	DP[1]	ME[1]	UFL[2]
N sheep/ha/year	1.6^{C}	2.2^{C}	1.6^{B}	1.1^{B}	1.1^{B}
L " "	4.8^{A}	5.6^{A}	3.7^{A}	2.9^{A}	2.9^{A}
TO " "	3.55^{B}	4.0^{B}	3.6^{A}	2.7^{A}	2.9^{A}
L & TO " "	4.68^{AB}	5.4^{AB}	3.9^{A}	3.0^{A}	3.0^{A}
D " "	4.54^{AB}	4.9^{AB}	4.6^{A}	3.4^{A}	3.6^{A}
CV% " "	41.4	41.5	37.7	38.4	38.4
Sign.	***	***	***	***	***

[1] NRC, 1975; [2] INRA 1980; A, B, C on the same column: P≤0.05; ***=P≤0.001

Although the D area demonstrated the best productions, we must remember that this technique, even if realised with the use of fire, can reduce soil fertility and pasture productivity, and so it can damage the environment and biodiversity. The L & TO system is the best way to manage *caatinga*, the most suitable to the combined grazing system (cows, and/or sheep, and/or goats), and it seems to be the more interesting for ecological exploitation of this kind of tropical forest (Araújo Filho,1991).

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