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Grass Availability in Ultramafic Cattle Areas

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ABSTRACT

Availability of grass in ultramafic cattle areas in Camaguey, Cuba, was determined. The research comprised the 2004 – 2013 period in the rainy and dry seasons. The area has Brown Fersialitic Ferromagnesial Soil (Inceptisol-Cambisol). Total and individual species' availabilities were tested using the practical variant of the Haydock and Shaw visual method for production areas. Sampling was made at the beginning of each rotation (five in the rainy season and three in the dry season) at a rate of 100 observations/ha. Forage balance was determined for the rainy and dry seasons, and the botanical composition was assessed using the steps method, and dry matter yields were determined in situ. SPSS 15.0.1 was used to make the statistical analysis. Descriptive statistical analysis for Mean and Standard deviation were determined for availability of each species. Grass availability in the ecosystems is 5.15 t MS/ha, distributed in 2.83 t MS/ha in the rainy season; and 2.31 t MS/ha in the dry season. The forage balance showed a deficiency in feedstuffs in the two seasons, affecting milk production and the reproduction indicators.

Key Words: *grass availability, forage balance, feedstuff deficiency*

INTRODUCTION

Camagüey is the largest province of Cuba, with roughly 322 080 ha dedicated to cattle raising. Only 5% of the land is classified as agro-productive type 1 (MINAGRI, 2009). Grassland productivity is limited in these areas, among other factors, by low soil fertility, which affects milk and beef yields.

In the ultramafic savannahs of the central and northern parts of Camagüey, soil conditions are especially adverse to develop highly productive grasslands (Gandarilla, 1988). In addition to it, cattle exploitation in those areas is made regardless of the native edaphic vegetation that leads to grass deterioration (Curbelo, 2004).

Camagüey has about 1 030 km^2 of serpent-like soils (ultramafic), and the areas for cattle raising account for 69 454 ha; it is an essential economic activity for the local settlers, with a long tradition in cattle management, as a way to meet their milk demands. Sustainable development of cattle systems in the area is critical from the social, economic and environmental points of view (Curbelo, 2004).

In order to revert deterioration of these cattle systems, it is important to know the elements that are part of it, and their interrelations; as well as the potentiality of integrating native graminaceae and legumes as an alternative to benefit tropical cattle ecosystems (Palma, 2005).

Loyola *et al*. (2009a) conducted a prospective study of the main graminaceae and legumes present in these ecosystems, and assessed their botanical compositions. However, there is still little knowledge about feed availability in the area, which can sustain cattle raising in that particular agro-ecosystem.

The purpose of this research is to determine grass availability in cattle systems in the ultramafic areas of Camagüey.

MATERIALS AND METHODS

The study was performed in grazing areas of the municipality of Minas, Camagüey, on Brown Fersialitic Ferromagnesial soil (Inceptisol, according to the Soil Taxonomy, 1994); Cambisol, according to FAO-UNESCO (1990), cited by Hernández *et al.* (1999), between 21º 28' 50"-21º 29' 15" north latitude, and 77º 39' 50"-77º 40' 20" west longitude, 80 meters above sea level.

The climate of the area is tropical humid of interior plains, with seasonal humidity and high evaporation levels (Rivero, 2010). The mean evaporation and rainfall values are 1 956.2, and 1 306.5 mm, respectively. Mean air temperature is high, between 25.0 and 27.5 ^{0}C, and top temperatures in the warmest month of 34 ^{0}C.

Availability of the main species

Availability was determined in grazing lands at the *Finca Habana*, during the nine years of study (2004 - 2013) in the rainy and dry seasons, using

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the Haydock and Shaw visual method for these production areas, according to Senra and Venereo (1986). Sampling took place at the beginning of each rotation (five in the rainy season, and three in the dry season), at a rate of 100 observations/ha. Legume and graminaceae materials previously cut from the five reference samplings were weighed, and the dry matter percent was determined, drying the samples at 70 °C, in forced air circulation drying oven, until reaching constant weight. Species´ availability was determined, considering the number of times each frame appears, multiplied by the weight of each of them, and divided by the total number of observations. Total availability per frame would be the sum of all species' availabilities.

In the case of *Ateleia cubensis* (DC) Dietr. *cv. Cubensis*, availability was estimated in 40 trees in the rural areas, simulating browsing the animals do at the height of 2 m. The softest parts of the plants were squeezed, including leaves, stems and the thinnest stems, of up to 3 mm diameter, according to the methodology proposed by Lamela (1998).

Forage balance for the rainy and dry seasons

To know the feed deficit for cattle in the area in each season, forage balance was made. The duration of the rainy season (155 days) and the dry season (210 days), consumption of 12 kg of MS/livestock unit/day, for a 400 kg live weight livestock unit; 40 and 50 % grass use for both periods, were taken into account, based on observations in the working areas. The botanical composition and yielding of dry matter were assessed in the area, according to Guevara (1999) for commercial dairies.

Statistical procedure

The descriptive statistics were determined (Mean and ES) for each specie's availability. The statistical analyses were made using SPSS, version 15.0.1 (2006).

RESULTS AND DISCUSSION

Availability of the main species

Table 1 shows the mean availabilities (t MS/ha) of the main species per season, in the assessment years. The species in the study are the base for further management proposals in those areas.

Inappropriate management mostly causes low availability of *A. cubensis* in those ecosystems, as it is considered undesirable, and therefore eliminated together with sicklebush. It was included in the group of promising species, because it is arborescent, used by animals as feed, and there are large populations in the adjacent natural area where there is no cattle. Preliminary assessment in those areas show that this species produce 0.68 ± 0.035 kg green foliage of MV/tree/cut, meaning 2.72 kg of MV per plant in four annual cuts, two in each season (Loyola *et al*., 2011).

Within the legume species with the largest contribution (t MS/ha) are *S. viscosa*, *S. hamata*, *D. incanum* and *C. virginianum*. The superiority of the first one owes mainly to its morphological features and adaptation to these ecosystems. Contrary to the rest of legumes, *C. virginianum* reaches top availability in the dry season (73.47 % of annual availability), which is an important behavior for this ecosystem management.

The most contributing graminaceae are *Sporobolus pyramidatus* (Lam.) Hitchc. ssp. *Pyramidatus* (21.94% total availability), *Dichanthium annulatum* (Forsk.) Stapf., and *Dichanthium caricosum* (L.) A. Camus.

These graminaceae species are invaluable to cattle raising in ultramafic savannahs, and usually regarded as undesirable plants, or weeds, but these species can withstand intensive grazing and lasting droughts. Studies made in other regions of Cuba show that they cover more than 80% of grasslands and account for almost more than 70% of the diet, reaching 4.1 PB alone, and up to 10.8% when associated with legumes; the annual milk production of 3.3 kg/cow/day alone, and up to 6 kg/cow/day in association (Guillot *et al*., 2005).

Figure 1 shows the estimated total production for these ecosystems (5.15 t MS/ha), for the rain season (2.83) and the dry season (2.31), similar to results achieved by Machado and Seguí (1997), cited by Hernández *et al.* (2000) for native pastures in 24 regions of Cuba. The main contribution is made by graminaceae, with 1.12 t, and 1.51 t of MS/ha in the rainy and dry seasons, respectively. The main legumes combined yielded 1.47 in the rainy season, and 0.74 t MS/ha in the dry season, which accounted for 51.94 and 32.03 % total availability for either season.

The effect of season on tropical grassland availability is evident; however, in the dry season 45% of annual availability is achieved, which is associated with the large legume population in the area, and with a more stable annual behavior, even in the absence of water. In addition to it, rainfall values were low in the rainy season during the years of study, when evaporation was higher than precipitation, causing negative effects to grasslands in the area (Curbelo, 2004; Curbelo, Loyola y Guevara, 2009).

Soil analysis performed in the area (Loyola *et al.,* 2011) showed high magnesium contents and low phosphorous contents. Evaluation of native vegetation in those aeas by Borhidi (1988) and Méndez *et al.* (2003) referred to natural physiological xerophytism observed in the local species, consisting in lack of cell permeability due to calcium lack, caused by antagonisms with magnesium; thus leading to water and nutrient absorption.

Furthermore, serious phosphorous (essential for root development) deficits are observed. Considering what Padilla (2002) said, P is an element that decides proper plant growth and development. Low P levels may produce stunting, which causes reduced root permeability leading to a decrease in water and nutrient absorption.

These results may facilitate assessment on native grass significance, by establishing adequate manegement strategies to keep stability, and increase the number of crawling and arborescent legume species, which is feasible, considering their survival rate under such hostile conditions, that foreign species could not prosper.

Forage balance

It is a valuable tool to know the real possibilities of grass in a given area for livestock feeding (García López, 2003). The application of the results in the area studied (Table 2) showed high feed deficit in the two seasons of the year, which mainly affected the productive unit, characterized by low milk yields. Additionally, reproduction problems and high mortality were observed in the season with the highest feed deficit, coinciding with García Trujillo (1988), in different tropical areas. The above mentioned suggests the need to rescue grassland productivity, and rethink animal handling situations and excess feed supplies into the system, also studied by other authors in these and other scenarios (García Vila, 2000; Villarreal, 2000; Guevara *et al.*, 2003; Curbelo, 2004; Loyola *et al.,* 2011).

CONCLUSIONS

The results observed in grass availability show high feedstuff deficit in the two seasons of the year, affecting both milk yields and reproduction indicators.

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Table 1. Promising graminaceae and legume availability (t MS/ha) per season in the experimental area (Mean ± ES)

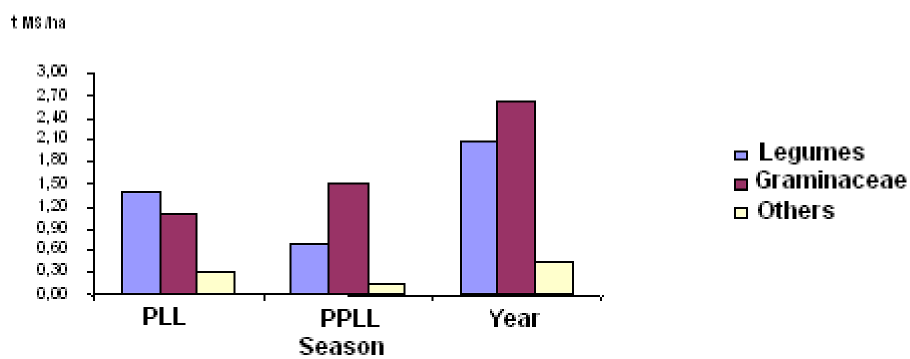
Species	Season	
	Rainy	Dry
Stylosanthes viscosa Sw.	0.44±0.005	0.17±0.004
Stylosanthes hamata (L.) Taubert	0.39±0.003	0.09±0.003
Desmodium incanum DC. *var. incanum*	0.44±0.004	0.06±0.003
Centrosema virginianum (L.) Benth.	0,13±0.003	0.36±0.004
Ateleia cubensis (DC) Dietr. *var. cubensis*	0,07±0.034	0.06±0.006
*Graminaceae**	1.12±0.005	1.51±0.006
Others	0.24±0.003	0.058±0.003

*Mainly grouping *Sporobolus pyramidatus* (Lam.) Hitchc. *ssp. pyramidatus*, *Dichanthium annulatum* (Forsk.) Stapf. and *Dichanthium caricosum* (L.) A. Camus.

Table 2. Forage balance (t MS) on a 100 ha ranch for the rainy and dry seasons

Indicators	Season	
	Dry	**Rainy**
Area (ha)	100	100
Availability (t MS/ha) /season	2.3	2.8
Availability for the area (t MS) [1]	231	283
% pasture land use [2]	50	40
Possible forage to use in the area (t MS)	115.5	113.2
Number of livestock units (UGM) [3]	90	90
Forage/herd needs (t MS) [4]	226.8	167.4
Forage balance (Used/necessary forage)	-113.3	-54.2

(1) Accumulated availability is defined after three applications in the dry season and five in the rainy season.
(2) This criterium was assumed due to the features present in a low animal stocking rate system
(3) According to herd
(4) Calculated as 12 kg MS/UGM/d x 90 UGM x 155 days in the rainy season, and 210 days in the dry season.



PPLL: Dry season PLL: Rainy season
Fig.1. Annual and season availability (t MS/ha) of the main plant groups