

Ability to concentrate minimum support to ensure development microbiota ruminal

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ADDITIONAL KEYWORDS

Urochloa brizantha.

Supplementation.

Degradation.

Dry matter.

SUMMARY

The in situ dry matter degradability (DDM) of two cultivars of *Urochloa brizantha* cvs. Xaraés and Piatã in their respective components: leaves and stem, in the same incubation period of 6 hours and at different levels of concentrate supplementation based on animal live weight (LW). The experimental design was a completely randomized design with four replicates in a 4x2 factorial arrangement (four levels of concentrate in the animal diet 0.0%, 0.33%, 0.67% and 1.0% LW for two cultivars of *Urochloa brizantha*). It was observed that the DDM of the Piatã grass leaves did not differ when the animal consumed the concentrate at levels 0.0%, 0.33% and 0.67% for the stems, the level of 0.00% LW presented lower DDM. The leaves of the Xaraés grass presented lower DDM in the consumption of concentrate in 1.0% LW and in the stem the highest values were in the levels 0,00%, 0,33% and 0,67% LW. The regression equation obtained higher values of concentrate allied to the higher DDM of forages. For the Xaraés grass stem the ideal level of supplementation was 0.38% of concentrate LW. For leaves, this value was 0.41% PV. For Piatã grass, leaf and stem values were 0.62% and 0.44% LW respectively.

Capacidade de suporte mínima para desenvolvimento da microbiota ruminal

RESUMO

Foi avaliada a degradabilidade in situ da matéria seca (DMS) de duas cultivares de *Urochloa brizantha* cvs. Xaraés e Piatã em seus respectivos componentes: folhas e haste, no mesmo período de incubação de 6 horas e a diferentes níveis de suplementação com concentrado com base na porcentagem de peso vivo (PV) animal. O delineamento experimental utilizado foi o inteiramente casualizado com quatro repetições em arranjo fatorial 4x2 (quatro níveis de concentrado na dieta animal 0,0%, 0,33%, 0,67% e 1,0% PV por duas cultivares de *Urochloa brizantha*). Foi observado que o DMS das folhas de capim Piatã não diferiu quando o animal consumiu o concentrado em níveis 0,0%, 0,33% e 0,67%, para as hastes, o nível de 0,00% PV apresentou menor DMS. As folhas do capim Xaraés apresentaram menor DMS no consumo de concentrado em 1,0% PV e no colmo os maiores valores foram nos níveis 0,00 %, 0,33 % e 0,67% PV. Realizada a equação de regressão foram obtidos maiores valores de concentrado aliados a maior DMS das forrageiras. Para a haste do capim Xaraés o nível ideal de suplementação foi 0,38% do PV de concentrado. Já para as folhas este valor foi 0,41% PV. Para o capim Piatã, os valores de folha e colmo foram de 0,62% e 0,44% PV, respectivamente.

PALAVRAS CHAVE ADICIONAIS

Urochloa brizantha.

Suplementação.

Degradação.

Matéria seca.

INFORMATION

Cronología del artículo.

Recibido/Received: 09.09.2017

Aceptado/Accepted: 13.07.2019

On-line: 15.07.2019

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INTRODUCTION

In Brazil has more than 15 million sheep and great part of this effective is created in the Northeast region, mainly in the semi-arid. Despite the great flock, the

productivity rates, production and profitability show that the Brazilian Semi-Arid has much to move forward in this segment. Currently, the systems of creation are characterized as extensive, having as base feeding

the native vegetation of the Caatinga. Created in these conditions, the animals had low indexes of weight gain, high mortality rates and low reproductive efficiency (Voltolini et al., 2009).

In practice of creation of ruminants, power is responsible for most of the costs, is of fundamental importance to know the basic principles on food, their characteristics and chemical composition, aiming the formulation of diets balanced to meet the needs of the animals, exploring their maximum capacity reached its entire digestive genetic potential for exploitation of the diet intake (Dutra et al., 1997).

The estimate of consumption is directly related to three factors: limitation relating among animals, quality of the food supplied and the supply conditions. The formulation of rations with high fiber content, or when there is low energy quantity in relation to the requirements, the food will have a slow digestion and the limitation of intake becomes the effect of filling of the rumen-reticulum. If the energy density is high, or the concentration of fiber is low in relation to the requirements, the intake becomes be limited by physiological demand of energy. For rations of high digestibility (above 66%), rich in concentrated (above 75%) and low content of NDF (below 25%), the power intake will be lower the more digestive tract is the food and, in rations of low quality (above 75% NDF), intake will be greater with better is the digestibility of the food (Cardoso et al., 2000).

For obtaining gains that compensate for economically the practice of containment, the diet must be of high energy and contain adequate levels of protein, with views to reduce residence time of animals in termination phase, raise the rates of weight gain, feed efficiency and, consequently, reduce the production costs (Haddad & Husein, 2004).

With the purpose to indicate levels of dietary supplementation animal that stimulates the development of the population of micro-organisms ruminal and increasing the degradation and exploitation of voluminous for small ruminants, were evaluated increasing levels of concentrate in diet of a sheep in feedlot fistulado technique, by "in situ" with two forages.

MATERIAL AND METHODS

The experiment was conducted in the sector of foraging located in the Center of Agrarian Sciences and Environmental Federal University of Maranhão, in Chapadinha- MA. The work had the opinion approved by the Committee of Ethics in Animal Experimentation of the Institution (Protocol: 23115.003553/2012-74).

EXPERIMENTAL DESIGN, ANIMALS AND HOUSING

Were evaluated in situ degradability of dry matter of two cultivars of *Urochloa brizantha* cvs. Xaraes and Piatã in their respective components: leaf blade and stem, at the same time 6 hours incubation on consumption of different levels of concentrate based on percentage of live weight (LW) animal 1.00; 0.67; 0.33 and 0.00% LW.

The quantity field were harvested approximately 2.0 kg (green material) of both forage, this quantity harvested from four different experimental plots, the forage plants were harvested at 42 days of regrowth, with cutting height of 15 cm of soil. Were conducted in laboratory process of separation of leaf blade and stem, then both were placed in an oven of forced ventilation air at 55°C during 72 hours, after, the material was ground coffee with 5 mm sieves in milltype Willey, each component of grass was weighed and packed in plastic bags closed to subsequently be incubated.

SAMPLING AND MEASUREMENTS

The dry matter content (DM), crude protein (CP) and pH were calculated according to the recommendations of the AOAC (1990), the neutral detergent fiber (NDF) and acid (AFD) following the procedures of Van Soest et al. (1994). The hemicellulose was calculated by the difference between the NDF and ADF and the cellulose content by the difference between the AFD and the lignin. It was used a Santa Inês sheep with live weight of approximately 60 kg and fistulado in the rumen. During the entire experimental period, the same was confined receiving a diet the basis of grass hay Xaraes and concentrated in different levels of addition, thus was evaluated their relationship in the DMS of forage. The concentrate was used for goats and sheep ration containing 20% CP and 70% TDN.

The degradability of dry matter (DDM) was estimated by in situ technique using nylon bags measuring 14x9 cm and with a pore size of 40 to 60µm (Nocek, 1988). The percentage of disappearance of dry matter (DDM) was calculated by the proportion of food that has disappeared in the bags after incubation in the rumen. For the adjustment of the curve of degradation of DM was used the Brody model modified (Sampaio, 1998). %Deg DM = $A - B \exp(-C \cdot \text{Time})$ where: A = potential degradation of the forage harvester. B = percentage of material deposited in the rumen that will be degraded. C = constant rate of degradation of the remaining material in the rumen at any time of incubation.

Each experimental stage had duration of nine days, followed by the respective time line: 1° day and 2 day adaptation. 1° Day: the treated animal with hay and concentrate (supply of hay at ease, concentrated 1% LW). 2° day: repeated the treatment of day 1. 3° day: repeated the treatment of day 1, but at 8:00 hours of the morning were incubated four bags with 5 g of forage harvester tested, incubation was until 14:00 hours, then the material was removed, flushed, oven-dried and weighed. 4° day: was reduced the concentrate 0.67% LW animal, and incubated with the four bags with the forage harvester. 5° Day: The procedure adopted was equal to day 4. 6° Day: 0.33% was supplied LW animal of concentrate and incubated with the four bags of the forage harvester. 7° day: was maintained the procedure of day 6. 8° day: was not supplied concentrated on this day 0.00% LW animal, and was incubated four bags of the forage harvester. 9° day: was repeated the procedure of day 8.

This way was a step of the experiment for the two grasses in its two components (leaf and stem) were

Table 1. Mean values of disappearance of dry matter of the leaf according the forage harvester and the level of supplementation (Valores medios de desaparición de la materia seca de la hoja según la cosechadora de forraje y el nivel de suplementación)

Cultivars	Level of supplementation			
	0.00%	0.33%	0.67%	1.00%
<i>U. brizantha</i> cv. Xaraes	27.00 Bb	32.38 Aa	28.14 Bb	24.36 Bc
<i>U. brizantha</i> cv. Piatã	31.57 Aa	33.48 Aa	33.21 Aa	30.04 Ab

Means followed by capitalization equal in columns do not differ by the Fisher test ($P < 0.05$). Means followed by lowercase letters equal in lines do not differ by the Fisher test ($P < 0.05$).

necessary 4stages of incubation for 9 days, getting 36 days as the total duration of the experiment.

STATISTICAL ANALYSES

The experimental design used was the completely randomized design, with factorial arrangement 4x2 (four levels of supplementation and two forage cultivars). The data were submitted to normality and homoscedasticity tests to verify the basic prerogatives to be submitted to analysis of variance.

Then the data were submitted to analysis of variance and compared by Fisher’s test ($P < 0.05$) using PROC GLM procedure of the SAS® statistical program (Edition University, SAS Institute Inc., Cary, NC, USA), using the following statistical model: $Y_{ijk} = \mu + S_i + G_j + (S_i \times G_j) + \epsilon_{iik}$, where Y_{ijk} is the dependent variable of the experiment measured in experimental unit “k” of supplement “i” and grass “j”; μ is the general constant; If it is the effect of supplements “i”; G_j is the effect of grasses “j”; $S_i \times G_j$ is the interaction effect; and ϵ_{ijk} is the effect of random error.

The degradation parameters were generated through the procedure PROC NLIN of the statistical program SAS® (Edition University, SAS Institute Inc., Cary, NC, USA).

RESULTS AND DISCUSSION

Table I shows the values of the disappearance of dry matter of leaves of both cultivars. For the morphological component sheet to *Urochloa brizantha* cv. Piata presented better results of disappearance of dry matter (DDM) in relation to the Xaraés grass in the following levels of concentrated beyond 0.00%, 0.67% and 1.0% LW, with greater efficiency in the degradation in 4.57% for supplementation of (0.00%LW), 5.07% (0.67%LW) and 5.68% (1.00%LW). At the level of 0.33% supplementation LW both had higher disappearance, however the level 1.00% LW forage presented lower DDM.

The microorganisms fibrolíticos present greater efficiency in degradation of structural carbohydrates, thus, its growth is associated to the particles rich in pulp plant. In the present study, in greater level of inclusion of concentrate were obtained lower rates of the DDM of leaf. It is justified, that with the elevation of the levels of concentrate in diet was favoring the population of microorganisms that digest the non-structural carbohydrates, however, the degradation of the forage harvester is decrease dby less action of microorganisms fibrolíticos, that degrade the structural carbohydrates. In the evaluation of the effect of grain processing on

the population of ruminal protozoa of sheep, Abraão et al. (2017) pointed out that the greater participation of grains in the diet favors the growth not only of bacteria but also of protozoa in the rumen, due to the greater availability of the starch to the microorganisms.

The curve of degradation that best fits the two forage was quadratic, in which there is an increase in the percentage of degradation up to a certain level of supplementation, that occurs a decrease. Through the regression equation, was obtained the optimum level of concentrate in diet animal for greater degradation of the leaf blade. Thus in the situation in which the pasture presents good relationship leaf/stem ratio, the level of concentrated supplementation indicated for grass Xaraes was 0.41% LW providing a potential degradation of 32% dry matter (DM) of the leaf blade. The grass Piatã in turn, needed a quantity of 0.44%BW of concentrate to achieve the greatest degradation, thus achieve 34% of DDM the leaf of the forage harvester (Figure 1).The leaf is the favorite part by animals for consumption, due to its high nutritional value when the pasture is well managed. The morphological and nutritional value characteristics of vegetative tillers can be modified by the management actions employed, which makes it better the utilization of the fibrous fraction by the ruminal microorganisms (Santos et al., 2018)

In Table II it was observed the values of disappearance of dry matter for the stem component of both cultivars. The cultivar Piatã without supplementation had a lesser disappearance (29.80), and the highest value was observed in level 0.67% LW (35.72). Already for the Xaraes grass were not observed statistical difference in

Equation Piatã: $0.3154 + 0.0992C - 0.1136C^2$ Spot maximum = 0.44%
 Equation Xaraes = $0.2748 + 0.1759C - 0.2167C^2$ Spot maximum = 0.41%

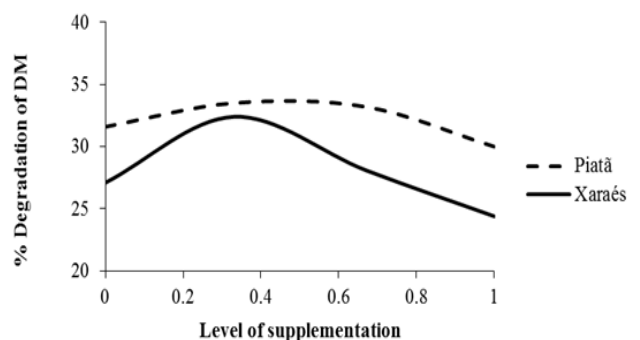


Figure 1. Degradation of DM the leaf of grasses *Urochloa brizantha* cvs. Xaraes and Piatã (Degradación de DM la hoja de plantas *Urochloa brizantha* cvs. Xaraes y Piatã).

Table II. Mean values of disappearance of dry matter of the stem according the forage harvester and the level of supplementation (Valores medios de desaparición de la materia seca del tallo según la cosechadora de forraje y el nivel de suplementación):

Cultivars	Level of supplementation			
	0.00%	0.33%	0.67%	1.00%
U.brizantha cv. Xaraes	31.41 Aa	32.92 Aa	34.08 Aa	23.07 Bb
U.brizantha cv. Piatã	29.80 Bbc	32.70 Ab	35.72 Aa	32.09 Ab

Means followed by capitalization equal in columns do not differ by the Fisher test (P<0.05). Means followed by lowercase letters equal in lines do not differ by the Fisher test (P<0.05).

the following levels of concentrate 0.00%, 0.33% and 0.67% already to 1.00% LW the disappearance of DM was lower (23.07). In the stem component of grasses the slow rate of degradation is justified by the high quantities of structural carbohydrates. In situation of grazing in that the forage harvester presents high proportions of stem, the use of the concentrated supplementation will supply the nutritional deficiency of the animal and greater efficiency of degradation. The harnessing of DM of the stem of grasses was positively influenced by appropriate levels of concentrate (**Figure 2**).

The curve of disappearance of DM of the stem of Piatã grass was more accentuated, with greater DDM in intake of 0.62% LW of concentrate, thus earned degradation in around 36% of DM. The Xaraes grass presented greater DDM stem when coupled to the intake of 0.38% LW of concentrate, for a degradation of around 32%. In chemical analyzes of forage the values of crude protein (CP) the leaf had difference as the forage harvester before and after being incubated, already in the other variables analyzed was not evidenced difference (**Table III**).

The material after incubated presented lower values of CP, which is justified by the degradability of CP during the 6hours that this material has remained in the rumen of the animal. The values of CP of fodder does not meet the minimum requirements of protein for a ruminant animal that is 7% CP. However the amount of concentrate in diet animal favors the complementation of requirements. The low nutritive value of tropical forages is frequently mentioned in the literature, this values associated with reduced crude protein content, minerals, high content of cell wall (lignin, cellulose, hemicellulose, cutícula and silica) and consequently decrease in digestibility are expected.

In the present study the values of NDF and ADF did not differ statistically (P<0.05), however the NDF presented high value compared to Euclides et al. (2009), who analyzed the leaf blade dry period with 28 days of regrowth of the Piatã grass and Xaraes and found the results for NDF of 71.8% and 72.1%, respectively. The NDF content is an important parameter of quality forage harvester, because high values in the diet may limit the ability of animal intake (Pereira et al., 2011).

The values of lignin the leaf of the forages before incubated were on average of 6.94%, relatively high values in comparison to Euclides et al. (2009) who recorded values of lignin of 3.2% for the Piatã and 3.5% for the Xaraes. The main mechanism inhibition of lignin is as a mechanical barrier to ruminal microorganisms and hydrolases secreted by these (Jerbaet

Equation Piatã= 0.2948 + 0.1724C - 0.1398C² Spot maximum = 0.62%
 Equation Xaraes= 0.3085 + 0.2024C - 0.2690 C² Spot maximum = 0.38%

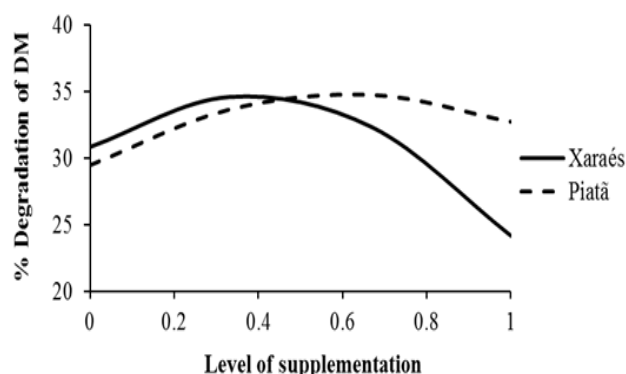


Figura 2. Degradation of DM the stem of grasses Urochloa brizantha cvs. Xaraes and Piatã (Degradación de DM el tallo de plantas de Urochloa brizantha cvs. Xaraes y Piatã).

Table III. Mean percentages of the chemical composition of leaf of the Piatã grass and Xaraes before and after incubation (Porcentajes medios de la composición química de la hoja de la hierba de Piatã y Xaraes antes y después de la incubación).

Cultivars	Chemical composition(%)						
	Crude Protein	NDF	ADF	LIG	HC	DM	Ash
Piatã leaf	5.14 a	88.61 a	71.06 a	7.48 a	17.55 a	18.25 a	4.31 a
Xaraés leaf	4.27 a	87.31 a	74.05 a	7.53 a	13.26 a	18.52 a	3.95 a
After incubation							
Piatã leaf	2.95 b	90.29 a	69.15 a	6.61 a	21.14 a	19.45 a	4.51 a
Xaraés leaf	2.73 b	92.88 a	72.83 a	6.17 a	20.05 a	18.92 a	4.95 a
CV %	18.64	5.94	4.67	28.3	24.1	18.25	4.31

Means followed by capitalization equal in columns do not differ by the Fisher test (P<0.05).

Table IV. Mean percentages of the chemical composition of stem of the Piatã grass and Xaraes before and after incubation (Porcentajes medios de la composición química del tallo de la hierba de Piat y Xaraes antes y después de la incubación).

Cultivars	Chemical composition (%)						
	Crude Protein	NDF	ADF	LIG	HC	DM	Ash
Piatã stem	3.94 a	83.64 a	73.95 a	3.94 a	9.69 a	18.19 a	3.03 a
Xaraés stem	3.50 a	87.06 ab	74.51 a	8.05 b	12.55 ab	18.29 a	2.56 a
After incubation							
Piatã stem	1.86 b	91.19 b	70.98 a	8.93b	20.21b	18.97 a	3.76 a
Xaraés stem	1.75 b	89.96 b	72.04 a	8.19 b	17.92b	19.19 a	2.87 a
CV %	22.75	3.21	6.59	23.3	24.3	12.4	15.7

Means followed by capitalization equal in columns do not differ by the Fisher test ($P < 0.05$).

al., 2004). The variable hemicellulose of grasses before incubated, Piatã (17.55%) and Xaraes (13.26%), showed no difference and are values considered normal compared the Paciullo et al. (2001) that was 23.4% for *Urochloa decumbens*. The values of dry matter (DM) and ash of the forages did not differ statistically and are in agreement with those found by Lopes et al. (2010) for the cultivar of *Urochloa brizantha* that were 21% DM and 4.7% ash.

For the chemical analyzes of the stem of forage the CP, NDF and HC showed difference ($P < 0.05$) when compared before and after incubation material (Table 4). After incubation the two forage presented greater values of NDF with a difference of 8,28% in relation to the material before incubation, the time that this grass was in the rumen of animal waste in the sample might have favored this greater amount of NDF after incubation. In this same sense, Oliveira et al. (2013) pointed out that the potential for degradation is greater as lower age due to the lower carbohydrate ratio of the cell wall and its lignin content. For the values of ADF of samples obtained means around 72%, and were not statistically different ($P < 0.05$).

The lowest value of lignin was found for the Piatã before incubation (3.94) that differed in relation to the Xaraes. The lignin by be a fraction indigestível, there is reduction in their value after incubation. In this sense, Campos et al. (2016) reported that the lignin content in forage plants increases with plant growth and maturity. The values of HC are also considered elevated, which represents the advanced age of the grasses. It is justified by the fact that the greater quantity of lignin and HC in the Xaraes grass favored this grass present lower rates of degradation in relation to Piatã. Already the values for dry matter and mineral material did not differ ($P < 0.05$).

CONCLUSIONS

Piatã grass presented the best values of degradability of dry matter in comparison to Xaraes, mainly in leaf blade component. The optimum levels of supplementation concentrated to greater degradation of leaf of capins Xaraes and Piatã are 0.41% LW and 0.44% W, respectively.

ACKNOWLEDGMENTS

The authors thank FAPEMA (Fundação de Amparo à Pesquisa e ao Desenvolvimento Científico e Tecnológico do Maranhão) for the financial support granted for this study; and the Group for Study, Research, and Extension at FOPAMA for the development of the field part of the experiment and assistance in the laboratory.

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