Consumo de nutrientes da silagem de capim elefante com diferentes níveis de subprodutos da indústria do suco de caju[1]

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Resumo: O presente estudo foi conduzido objetivando avaliar o consumo de nutrientes das silagens de capim elefante (*Pennisetum purpureum* Schum) contendo 0; 35,0; 70,0; 105,0 e 140,0 g/kg de subproduto do pedúnculo do caju desidratado (SPCD) com base da matéria natural. Foi adotado delineamento inteiramente casualizado com quatro repetições. Foram determinados os consumos de matéria seca (CMS), proteína bruta (CPB), fibra em detergente neutro (FDN), fibra solúvel em detergente ácido (FDA), hemicelulose e celulose. O CMS das silagens aumentaram a medida que o SPCD foi adicionado. Os níveis de inclusão de SPCD apresentaram efeito linear (P<0,01) sobre o consumo de proteína bruta, o qual aumentou em 0,04 g/d ou 0,04 g/kg/d $PV^{0,75}$ a cada 10,0 g /kg de SPCD adicionado à silagem (com base na matéria natural). O consumo de FDN e FDA, considerando g/d e g/kg/d $PV^{0,75}$, aumentaram linearmente (P<0,01) de acordo com os níveis de SPCD utilizados na silagem de capim elefante. Com relação ao consumo de hemicelulose e celulose, não foram observados efeitos dos níveis de adição do SPCD na silagem do capim elefante. O SPCD adicionado à silagem de capim elefante influencia o consumo de nutrientes.

Palavras–chave: agro-indústria, *Anacardium occidentale*, *Pennisetum purpureum*

Nutrient intake of elephant-grass silage with different levels of by-products from the cashew juice industry

Abstract: This study was conducted to evaluate the nutrient intake of elephant grass (*Pennisetum purpureum* Schum) silages containing 0; 35,0; 70,0; 105.0 and 140,0 g/kg by-product from dried cashew apple (DCBP) in the fresh matter. A completely randomized design with four replicates was adopted. Intake of dry matter (DM), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), hemicellulose and cellulose of the silages were determined. The dry matter intake (DMI) from the silages increased as DCBP was added. The levels of DCBP had a linear effect (P<0,01) on crude protein intake (CPI), which increased by 0,04 g/d or 0,04 g/kg/d $LW^{0,75}$ with every 10,0 g /kg DCBP added to the silage (fresh matter basis). The intake of neutral detergent fiber (NDFI) and acid detergent fiber (ADF), in both g/d and g/kg/d $LW^{0,75}$, increased linearly (P<0,01) according to the levels of DCBP used in the ensilage of elephant grass. Regarding the intake of hemicellulose and cellulose, no effect of the levels of addition of DCBP in the ensilage of elephant grass was recorded. Dried cashew apple included in silages of elephant grass influences the nutrient intake of sheep.

Keywords: agro-industry, *Anacardium occidentale*, *Pennisetum purpureum*

Introduction

Among the numerous existing agricultural by-products, the waste from the cashew (*Anacardium occidentale L.*) processing industry has an important place in the agro-industry of the northeast region of Brazil. According to Luciano et al. (2011), even considering the use of the cashew apple in its natural state, or in the form of juices, pastries, jams, nectars, meals, and dried and candied fruit, only 15% of the production of cashew apple is utilized commercially in human feeding. It is noteworthy that the production of this fruit is concentrated in the dry season of the year, the period of low roughage production and during which the prices of grains and commercial concentrates increase. Thus, this experiment was conducted to evaluate the effect of levels of the by-product from dried cashew apple (DCBP) added to the ensilage of elephant-grass on the nutrient intake of sheep.

Material e Methods

Five levels of inclusion of DCBP (0; 35,0; 70,0; 105,0 and 140,0 g/kg, in the fresh matter) were used in the ensilage of the elephant grass, which was harvested manually, at approximately 70 days of growth, and processed through a conventional forage shredder machine to a particle size of 1 to 2 cm (Table 1). Later, the chopped grass was mixed with the DCBP, which was acquired from the processing of the fruit for the extraction of juices and pulps at the company MAISA, located in Mossoro, RN. The by-product was composed basically of the cashew bagasse resulting from the processing of the apple for juice making. The material was dried in the sun on a cemented floor for 48 h, scattered in layers of approximately 7 cm in thickness, and turned over at least three times daily until it reached 130,0 to 160,0 g/kg of moisture. At night, the material was piled and covered with canvass to avoid accumulation of moisture. The experimental silos consisted of plastic drums with 210 L capacity. After weighing and homogenizing the elephant grass with the DCBP, the material was inserted in the silos (126 kg silage, at a density of 600 kg/m^3) and compressed. After the silos were filled up, they were closed with plastic canvas secured with rubber bands. To evaluate the intake of the silages, 20 uncastrated sheep of an undefined breed, with an average live weight (LW) of 24 kg, were distributed in a completely randomized design with five levels and four replicates, considering each animal an experimental unit. For each animal, the silage from a single experimental silo was used. Animals were weighed at the onset and end of the experiment, dewormed, and distributed randomly into each level of DCBP evaluated. Animals were kept in individual metabolic cages provided with collectors and separators of feces and urine, troughs, and drinkers to supply the feed, mineral mixture, and water *ad libitum*. The experiment lasted 21 days, 14 of which were used for the animals to acclimate to the diets and experimental period, and seven to evaluate voluntary intake.

Table 1. Chemical composition of the silages

Item	DCBP[1]				
	0,0	35,0	70,0	105,0	140,0
DM[2]	198,4	210,4	221,2	253,5	270,5
CP[3] (g/kg DM)	46,7	54,4	70,8	81,2	91,0
NDF[4] (g/kg DM)	731,3	738,7	740,0	714,3	719,4
ADF[5] (g/kg DM)	453,5	487,8	482,4	470,6	493,2
Hemicellulose (g/kg DM)	277,8	250,9	257,6	243,7	226,2
Cellulose (g/kg DM)	314,3	314,9	290,6	255,8	234,6
Lignin (g/kg DM)	133,4	165,1	181,8	202,9	243,6
NIDN[6]	269,8	419,5	459,4	466,3	574,6
NIDA[7]	117,1	214,0	192,1	210,8	247,5

[1]DCBP - by-product from dried cashew apple; [2]DM – dry matter; [3]CP – crude protein; [4]NDF – neutral detergent fiber; [5]ADF - Acid detergent fiber; [6]NDIN - neutral detergent insoluble nitrogen (g/kg of total nitrogen); [7]ADIN - acid detergent insoluble nitrogen (g/kg of total nitrogen).

Results and Discussion

The dry matter intake (DMI) from the silages increased as DCBP was added (Table 2). In the regression analysis, a linear effect (P<0,01) of the levels of DCBP was observed on the silage DMI, which increased by 20,47g/d with every 10,0 g/kg DCBP added to the silage (fresh matter basis).

Despite the low CP (68,0 g/kg DM) and high ADIN (196,0 g/kg DM) contents of the silages, which may restrict intake by reducing the availability of nitrogen to the rumen microflora, and the high NDF levels (728,0 g/kg DM) of the silages, which reduce intake by the accumulation of fibrous mass in the rumen (Van Soest, 1994), the highest level of DCBP (140,0 g/kg) provided an increase of approximately 80% in DMI as compared with the silage of elephant grass alone. Thus, DCBP seems to have improved the nutritional properties of the elephant grass silage. In this sense, it is likely that the low voluntary intake of the silages was a combined effect of the nutritional value of the elephant grass and the concentrations of NDF and ADIN in DCBP.

The levels of DCBP had a linear effect (P<0,01) on crude protein intake (CPI), which increased by 0,04 g/d or 0,04 g/kg/d LW^{0,75} with every 10,0 g /kg DCBP added to the silage (fresh matter basis). The linear effect of DCBP on CPI may be a consequence of both the elevation in the CP contents and the DMI from silages containing DCBP.

The intake of neutral detergent fiber (NDFI) and acid detergent fiber (ADF), in both g/d and g/kg/d LW^{0,75}, increased linearly (P<0,01) according to the levels of DCBP used in the ensilage of elephant grass. The greater intakes of NDF and ADF result from the increase in the DMI from silages with DCBP. It is possible that this result also contributed to the increase in DMI from silages, since, according to Mertens (1992), the ideal NDF level in the diet is not fixed, and it varies according to the net energy requirements of the animal.

Table 2. Regression equations and coefficient of determination (R^2) for the nutrient intake from silages

Item	DCBP[1]					R^2
	0,0	35,0	70,0	105,0	140,0	
			Dry matter			
(g/d)[2]	325,7	337,9	493,4	647,5	529,2	0,34*
(g/d/ kg $BW^{0,75}$)[3]	33,5	34,4	49,0	65,2	51,3	0,32*
			Crude protein			
(g/d)[4]	17,4	20,6	40,2	59,7	55,7	0,67*
(g/d/ kg $BW^{0,75}$)[5]	1,8	2,1	4,0	6,0	5,4	0,67*
			Neutral detergent fiber			
(g/d)[6]	240,8	261,1	373,3	468,8	388,4	0,31*
(g/d/ kg $BW^{0,75}$)[7]	1,2	1,2	1,7	2,2	1,7	0,28*
			Acid detergent fiber			
(g d^{-1})[8]	144,0	169,4	241,4	310,4	270,1	0,42*
(g d^{-1} kg^{-1}BW)[9]	0,7	0,8	1,1	1,5	1,2	0,40*
			Hemicelulose			
(g/d)	96,8	91,9	132,0	158,4	118,2	ns
(g/d/ kg $BW^{0,75}$)	0,5	0,4	0,6	0,7	0,5	ns
			Celulose			
(g/d)	100,0	108,6	137,0	152,4	111,8	ns
(g/d/ kg $BW^{0,75}$)	0,5	0,5	0,6	0,7	0,5	ns

[1]DCBP - by-product from dried cashew apple; [2]$Y = 323.44 + 20.47X$; [3]$Y = 33.43 + 1.89X$; [4]$Y = 1.22 + 0.04X$; [5]$Y = 0.23 + 0.04X$; [6]$Y = 246.09 + 14.36X$; [7]$Y = 1.19 + 0.06X$; [8]$Y = 148.47 + 11.23X$; [9]$Y = 0.72 + 0.05X$; *(P<0,01) by the t test (student); ns - non-significative.

Regarding the intakes of hemicellulose and cellulose, no effect of the levels of addition of DCBP in the ensilage of elephant grass was recorded. The mean values observed for hemicellulose intake were 119.49 g/d and 5.5 g/kg/d $LW^{0,75}$. Mean values for hemicellulose intake were 122,01 g/d and 5,7 g/kg/d $LW^{0,75}$.

Conclusions

Dried cashew apple included in silages of elephant grass influences the nutrient intake of sheep.

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