Digestibilidade aparente dos 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 a digestibilidade aparente (DA) dos nutrientes da silagem 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. Foi determinada a digestibilidade aparente da matéria seca, proteína bruta (PB), fibra em detergente neutro, fibra solúvel em detergente ácido, hemicelulose e celulose. Os níveis de adição do SPCD na silagem de capim elefante não influenciaram (P>0,05) os coeficientes de DA das dietas. Embora a adição de SPDC tenha incrementado algumas características químicas das silagens, i.e., o conteúdo de PB, essa alteração não foi suficiente para prover um melhor uso destes alimentos pelos animais. O conteúdo de lignina das silagens aumentou à medida que o SPDC foi adicionado à silagem de silagem elefante. Deste modo, a inferior DA dos nutrientes obtida nesse estudo pode ser consequência tanto da baixa disponibilidade de nitrogênio nas silagens, devido ao aumento do nitrogênio insolúvel em detergente ácido, como o aumento da lignina nas silagens com a adição do SPDC. O pedúnculo de caju desidratado pode ser adicionado até 140 g/kg, com base na matéria natural, na silagem de capim elefante, contudo os elevados níveis de nitrogênio insolúvel em detergente ácido podem comprometer o uso e disponibilidade do nitrogênio aos animais.

Palavras–chave: agroindústria, *Anacardium occidentale*, *Pennisetum purpureum*, pequenos ruminantes

Apparent digestibility of nutrients of elephant-grass silage with different levels of by-products from the cashew juice industry

Abstract: This study was conducted to evaluate the apparent digestibility (AD) of elephant grass (*Pennisetum purpureum* Schum) silages containing 0; 35,0; 70,0; 105,0 e 140,0 g/kg of by-product from dried cashew apple (DCBP) in the fresh matter. A completely randomized design with four replicates was adopted. The AD of dry matter, crude protein (CP), neutral detergent fiber, acid detergent fiber, hemicellulose, and cellulose were evaluated of the silages were determined. The levels of addition of DCBP to the ensilage of elephant grass did not affect (P>0,05) the coefficients of DA of the nutrients of the diets. Although the addition of DCBP improved some chemical characteristics of the silages, e.g., the CP content, this alteration was not sufficient to provide a better use of these feeds by the animals. The lignin contents of the silages also increased as the inclusion of DCBP in the ensilage of elephant grass was increased. Thus, the low AD contents of the nutrients obtained in this study may be a consequence of both the low availability of nitrogen in the silages, through the increased acid detergent insoluble nitrogen, and the increased amounts of lignin in the silages with addition of DCBP. Dried cashew apple can be included at up to 140 g/kg, on a fresh matter basis, in silages of elephant grass, but high levels of acid detergent insoluble nitrogen may compromise the use and availability of nitrogen to animals.

Keywords: agroindustry, *Anacardium occidentale*, *Pennisetum purpureum*, small rumiants

Introduction

The by-products resulting from the extraction of the juice from the cashew apple and from the cashew apples unsuitable for human consumption are already being used in animal feeding (Borges et al., 2001). Yet some studies describe that the presence of high lignin, tannin and acid detergent insoluble nitrogen (ADIN) contents in the cashew apple may influence the intake and apparent digestibility (AD) of these materials. Other limitations for the use of by-products originating from the extraction of the juice from the cashew apple are the high moisture and

fiber contents, which may adversely affect its direct use in animal feeding. Thus, forms of use that improve the exploitation of the by-product, such as drying and ensilage, require further studies. Evaluating chemical and fermentative traits of elephant grass (*Pennisetum purpureum*) ensiled with increasing levels of by-product from the cashew agro-industry (0; 120,0; 240,0; 360,0 and 480,0 g/kg), Ferreira et al. (2004) observed that the addition of cashew bagasse improved the nutritive value and preservation of silage, displaying potential to be used in the nutrition of sheep. 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 AD of nutrients.

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 AD 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 the apparent digestibility. The levels of DM, CP, NDF, ADF, hemicellulose, and cellulose were determined in the samples of leftovers and feces. Analyses were conducted according to methodologies described by Silva and Queiroz (2002).With the values obtained in the chemical composition analysis, the intakes of nutrients and the coefficients of AD of the nutrients were determined.

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 levels of addition of DCBP to the ensilage of elephant grass did not affect (P>0,05) the coefficients of DA of the nutrients of the diets (Table 2). Although the addition of DCBP improved some chemical characteristics of the silages, e.g., the CP content (Table 1), this alteration was not sufficient to provide a better use of these feeds by the animals. A possible explanation to this fact is the high percentage of NDIN and ADIN, which have their use limited by the rumen microorganisms (Van Soest, 1994). Thus, because a great portion of the nitrogen present in the feed formed complexes with fibrous components (NDIN and ADIN), this might have contributed to the low digestibility values of the silages' nutrients. In diets with low availability of nitrogen compounds and rich in NDF,

the supply of rumen-degradable protein is limiting to microbial growth; thus, the cell wall digestion is compromised and feed intake is reduced (Van Soest, 1994).

The lignin contents of the silages also increased as the inclusion of DCBP in the ensilage of elephant grass was increased (Table 1). Diets rich in lignin may limit the potential of digestion of fibrous carbohydrates. Hence, even if the partially digestible components were increased by elevating the inclusion of DCBP, the indigestible components were also increased, which might have contributed to the lack of alterations in the AD of the nutrients from the silages when assessed *in vivo*.

Thus, the low AD contents of the nutrients obtained in this study may be a consequence of both the low availability of nitrogen in the silages, through the increased ADIN, and the increased amounts of lignin in the silages with addition of DCBP. Evaluating levels of addition (0; 40,0; 80,0; 120,0 and 160,0 g/kg; fresh matter basis) of dried cashew apple in the ensilage of elephant grass, Teles et al. (2010) also did not observe effects of the by-product on the AD of DM, CP, NDF, EE or total carbohydrates, although they observed a linear decrease in the AD of the silages' ADF.

Table 2 – Apparent digestibility of nutrient and coefficient of determination (R^2) of the silages.

Nutrient	DCBD[1]					R^2
	0,0	35,0	70,0	105,0	140,0	
Dry matter[2]	475,0	417,6	452,4	437,7	437,5	ns
Crude protein[2]	244,1	50,6	190,8	234,7	162,2	ns
Neutral detergente fiber[2]	518,4	502,6	511,4	461,5	483,0	ns
Acid detergente fiber[2]	483,4	442,7	476,5	418,1	459,0	ns
Hemicelulose[2]	569,2	613,5	574,4	546,8	540,5	ns
Celulose[2]	619,5	660,6	797,0	833,1	891,6	ns

[1]DCBP - by-product from dried cashew apple; [2]g/kg; [3]Mcal/kg DM; [4]g/d; ns - non-significative;

Working with pineapple, acerola, guava, passion fruit, and melon by-products, Lousada Jr. (2003) found AD values of NDF and ADF of 508,0 and 518,0; 168,0 and 82,0; 177,0 and 130,0; 562,0 and 654,0; and 386,5 and 387,4 g/kg DM, respectively, stressing that the highest AD values of NDF were observed in the by-products with the lowest lignin content.

Conclusions

Dried cashew apple can be included at up to 140 g/kg, on a fresh matter basis, in silages of elephant grass, but high levels of acid detergent insoluble nitrogen may compromise the use and availability of nitrogen to animals.

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