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Performance of lambs supplemented with fodder salt *Gliricidia sepium* (Jacq.)

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ABSTRACT - The objective of this experiment was to evaluate productive performance of lambs fed different levels of *Gliricidia sepium* (Jacq.) in the making of gliricidia forage salt. A total of 30 180-day-old male crossbred Santa Inês lambs of 25 kg body weight were confined in 1 m^2 stalls, fed Tifton-85 (*Cynadon spp.*) hay, fodder salts and water *ad libitum*. The experimental design was randomized, composed of six repetitions of five treatments. The formulation of gliricidia forage salt was 0 (100% NaCl), 93, 95, 97 and 99% gliricidia hay with 7, 5, 3 and 1% NaCl, respectively. The experiment was conducted for 74 d, with 14 d for adaptation and 60 d for sampling. Gliricidia forage salt supplementation showed no effect (P>0.05) on dry matter, organic matter or neutral detergent fiber intake, although it affected (P<0.05) crude protein and ether extract intake. The highest performance of animals was observed in gliricidia forage salt with 99% addition of gliricidia.

Key Words: feeding, intake, lambs, weight gain

Introduction

Due to favorable climate, territorial extension and high variety of forage, pasture is the main ovine feed source in Brazil. However, climate change and pasture production seasonality can diminish forage nutritional values, causing losses in weight gain, growth, reproduction efficiency and resistance to disease, which lead to low animal productivity (Lopes et al., 1997; Carloto, 2008).

Animal husbandry requires good sanitary and nutritional conditions; therefore, in pasture system, animals rely on nutritional quality of forage to achieve desirable performance, given that the plant nutrient content diminishes during the dry season (Paulino et al., 2001; Oliveira at al., 2004). High microbial activity and nitrogen availability are necessary components to maintain animal productivity and normal ruminal activities. Ruminants require a minimum of 7% crude protein,which, converted into nitrogen (N), is about 1%. Low quantities of N limit the rumen cellulolytic microorganism activity, consequently decreasing digestibility and gastrointestinal passage rate and reducing feed intake, which leads to low animal productivity (Paulino et al., 1982; Lopes, 1998; S'thiago, 1999; Neto & Paulino, 2000; Kabeya at al., 2002; Valle et al., 2003; Detman et al., 2004).

Supplementation aids the stabilization of animal growth and livestock productivity during pasture scarcity seasons (Tosi, 1999).

Supplementation strategy aims at maximizing feed intake, digestibility and metabolism efficiency (Paulino et al., 2002). The purpose of nutritional supplement manipulation is to supply the nutritional requirements of rumen microorganism and ruminants themselves. Rumen microorganisms (protozoa and fungi) are highly proliferative in favorable conditions, and improve ruminants forage non-soluble fraction (fiber) digestibility.

Forage salt is defined as a mix of mineral salt and milled eudicotyledons hay, preferable with high protein content, and can be used as an alternative supplement in ruminants diet (Oliveira et al., 2010).

Gliricidia sepium is a leguminous plant of medium size, native from Mexico, Central America, and north of South America. It has rapid growth, deep rooting and drought tolerance, and is considered a species of multiple uses, such as for forage, reforestation, fertilization and hedgerow, among others. Due to its high protein content, 20% to 30% of *Gliricidia sepium* is recommend as forage feed for bovine, ovine and caprine (Carvalho Filho et al., 1997).

This experiment aims to evaluate dry matter intake, daily weight gain and feed conversion of ovine fed different levels of *Gliricidia sepium* forage salt.

Material and Methods

The experiment was conducted at Experimental Farm of Agriculture, Environment and Biology Sciences Centre at

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Universidade Federal do Recôncavo da Bahia (UFRB), located in Cruz das Almas, Bahia State, Brazil. Santa Inês crossbred lambs (n = 30), of 180 d of age, not castrated, weighting 25.81 ±1.91 kg, were used in the experiment. Lambs were kept in individual stalls of 1 m^2 provided with individual feeder, salt feeder and drinkers.

Experiment was composed of 74 d: 14 d for adaptation and 60 d for the assay. Before the experiment, all animals received anthelmintic treatment and clostridia vaccine.

Animals were fed Tifton-85 (FCT-85) hay, water, salt and/or *Gliricidia sepium* forage salt *ad libitum*. To measure total intake from each individual, feed, water and salt orts were weighted and subtracted from total initial offered to animals. Diet was offered at 7h00 and 17h00 to allow 10% of orts.

Animals were identified and weighted at the beginning of the experiment, at the end of the adaptation period, on days 30 and 60 of the sampling period, at 7h00 after liquid and solids fasting for 14 hours.

The experiment was analyzed as a completely randomized blocks design with five treatments and six repetitions, in a total of 30 experimental portions. Treatments (Table 1) were constituted of 0 (100% NaCl), 930, 950, 970 and 990 g/kg gliricidia hay added in 70, 50, 30 and 10 g/kg NaCl to formulate gliricidia forage salt , respectively.

Gliricidia forage salt dry matter (DM), organic matter (OM), crude protein (CP), neutral detergent fiber (NDF), ether extract (EE), and water intake, daily weight gain (DWG), feed conversion (FC) and feed efficiency (FE) were evaluated.

Variance analysis and four decomposed orthogonal contrasts were performed and compared: control vs forage salt; linear effect of the level of hay in the salt; quadratic effect of the level of hay in the salt; and cubic effect of the level of hay in the salt, all analyzed through the statistic program AgroEstat (Sistema para Análises Estatísticas de Ensaios Agronômicos, version 1.1.0.668), with 5% as significance level.

Gliricidia was obtained at the experimental farm of UFRB, in low-fertility soil, from branches of 120-day-old plants at vegetative stage. For two days leaves were sun-dried, changing leaf sides to achieve hay preparation of 15% humidity (Cavalcante et al., 2004). Hay material was milled and mixed with salt. To avoid feed animal selection, 0.8-mm sieve was used to standardize the mix mineral salt.

Table 1 - Ingredients and proportions of treatments(g/kg)

Forage salt	Gliricidia hay	*NaCl
100% NaCl	-	1000.00
93% Gliricidia hay	930.00	70.00
95% Gliricidia hay	950.00	50.00
97% Gliricidia hay	970.00	30.00
99% Gliricidia hay	990.00	10.00

* Product guarantee levels (kg): Calcium (Max) - 174 g; chlorine - 178 g; cobalt - 150 mg; copper - 300 mg; sulphur - 6.2 g; iron - 4000 mg; phosphorous - 100 g; iodine - 110 mg; magnesium - 6 g; manganese - 1400 mg; selenium - 20 mg; sodium - 117 g and zinc - 3750 mg.

Feed and orts samples were pre-dried at 55 °C for 72 hours, milled in Wiley mill with 1 mm sieve, and stored for posterior DM, CP, EE and ash analysis according to Silva & Queiroz (2002). Cell wall components and NDF were adjusted for ash and protein (NDFap), ADF and acid detergent lignin (ADL) were determined according to Van Soest et al. (1994). Non-fiber carbohydrates (NFC) content was determined by differences between total carbohydrates and NDFap, according to Sniffen et al. (1992).

FCT-85 and gliricidia chemical composition analysis were conducted at the Animal Nutritional Laboratory at the Veterinary Department of Universidade Federal da Bahia (Table 2).

Table 2 - Chemical analysis of experimental diet feeds composition

Item	Gliricidia hay	Tifton-85 hay
Dry matter[1]	903.0	944.0
Crude protein[1]	211.0	27.6
Ether extract[1]	28.2	1.9
Ash[1]	72.1	59.6
Neutral detergent fiber[1]	347.3	784.7
Acid detergent fiber[1]	258.3	471.7
Lignin[1]	86.6	113.6
Non-fiber carbohydrate[1]	341.4	126.2

[1] Dry matter g/kg.

Results and Discussion

Gliricidia forage salt supplementation showed no effect (P>0.05) on OM or NDF intake (Table 3). Gliricidia forage salt intake 0.103 kg/d (Table 3), was higher than 65.85 g/d, observed by Silva (2005) in Santa Inês crossbred sheep supplemented with Gliricidia forage salt. Lowry (1990) explains the low acceptability of gliricidia in ruminants with volatile compounds causing undesirable odor; however, gliricidia forage salt has good chemical-bromatological composition (Table 2).

Animals fed gliricidia forage salt supplementation showed no effect (P>0.05) on DM intake: 1.016 kg/d (Table 3), value higher than the 803.12 and 943.47 kg/d observed by Silva (2005) in Santa Inês crossbred lambs supplemented with cassava meal and leucaena forage salt, respectively. Gonçalves et al. (2008) observed values of 913.59 and 995.47 kg/d, in Santa Inês crossbred sheep supplemented with cassava meal and leucaena forage salt, respectively. The NRC recommendations are (1985) 1.000 to 1.300 g/d for 20 to 30 kg BW of sheep, respectively.

Gliricidia forage salt supplementation showed effect (P<0.01) on CP and EE (Table 3), with values of 0.043 and 0.004 kg/d, respectively. This difference verified for CP and EE intake was attributed to the intake of gliricidia in the forage salt, once it presented CP and EE content in its chemical composition higher than Tifton85 hay.

No effect was seen on water intake (P>0.05) of animals fed Gliricidia forage salt supplementation (Table 3): 2.00 kg/d, which is lower than the observed by Gonçalves et al. (2008), of 3.39 and 3.40 L/d in leucaena and cassava meal salt, respectively. However, intake study suggested by Teixeira (2003) showed minimum of 2 litters of water per kg of DM intake in confined ovine. Silva (2006) suggested that in ruminants CP intake interferes in water intake by increasing the amount of water due to CP caloric increment on the protein digestive process. According to the NRC (1985), water intake in sheep is directly related to DM, CP and mineral salt intake.

Gliricidia forage salt supplementation showed effect (P<0.01) on daily weight gain; values were higher than in control treatment (Table 4).

Gliricidia forage salt chemical-bromatological analysis presented 211.0 g/kg CP (Table 2) in gliricidia hay DM, which increased ruminal bacteria population, thus improving lambs performance by incrementing FCT-85 hay energy extraction efficiency. S'thiago (1999) explains that rumen high degradable protein releases carbon and ammonia (NPN hydrolyses) uniformly, which increases microbial synthesis efficiency and animal performance.

The average daily gain in sheep supplemented with forage salt with 99% inclusion level of gliricidia, of 104 g (Table 4), is superior to that reported by Gonçalves et al. (2008), of 74.64 and 85.00 g, in crossbred Santa Ines animals, supplemented with leucene forage salt and cassava, respectively. Silva (2005) observed in crossbreed Santa Inês lambs, 85.19 and 71.43 g cassava meal and gliricidia forage salts, respectively. Similar results were observed by Ribeiro (2008) in sheep fed 104 g multiple supplements; furthermore, Pompeu et al. (2009) observed 111 g concentrate supplement in SRD sheep. Linear crescent effect (P<0.01) was observed due to gliricidia inclusion in forage salt formulation.

Ovine supplemented gliricidia forage salt effect (P<0.01) on FC than control treatment (Table 4). Animal fed gliricidia forage salt showed 12.35 FC (Table 4), similarly to the values cited by Silva (2005): 9.48; 9.03 and 8.54 FC in ovine fed cassava meal, gliricidia and leucaena forage salts, respectively. However, Gonçalves et al. (2008) observed values of 15.0 and 10.8 FC in ovine supplemented with leucaena and cassava meal forage salts, respectively.

Table 3 - Gliricidia forage salt (GFS), dry matter (DM), organic matter (OM), crude protein (CP), neutral detergent fiber (NDF), ether extract (EE), and water intake of ovine supplemented with gliricidia forage salt

Item	Gliricidia levels (%)					P value				CV (%)
	0	93	95	97	99	NaCl vs Gliricidia	Linear	Quadratic	Cubic	
GFS	-	0.077	0.131	0.093	0.108	-	0.497	0.277	0.078	52.4
DM	0.929	1.006	1.113	0.934	1.097	0.345	0.834	0.784	0.177	24.3
OM	0.874	0.945	1.045	0.878	1.031	0.355	0.834	0.775	0.175	24.4
CP	0.025	0.040	0.053	0.042	0.049	0.002	0.290	0.255	0.256	26.2
EE	0.001	0.003	0.005	0.004	0.005	0.001	0.272	0.129	0.135	30.9
NDF	0.722	0.755	0.816	0.693	0.814	0.568	0.875	0.683	0.203	23.6
Water	1.98	1.85	1.98	2.16	2.01	0.939	0.461	0.480	0.683	23.9

CV - coefficient of variation.

Table 4 - Daily weight gain (DWG) and feed conversion (FC) in ovine (kg) fed gliricidia forage salt supplementation

Item	Gliricidia levels (%)					P value				CV (%)
	0	93	95	97	99	NaCl vs *Gliricidia*	Linear	Quadratic	Cubic	
DWG	0.042	0.065	0.089	0.087	0.104	0.000	0.002	0.661	0.218	24.2
FC	25.51	16.37	10.72	11.94	10.37	0.000	0.161	0.439	0.412	42.4

	Regression equation	r^2
DWG	$Y = -0.4596083 + 0.00569167x$	0.27

CV = coefficient of variation.

Conclusions

Lambs supplemented with gliricidia forage salt have no changes in dry matter intake; however, crude protein and ether extract intake are affected by the supplemetation. Daily weight gain and feed conversion also increase. Supplementation of forage salt with 99% *Gliricidia sepium* promotes better performance in confined ovine.

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