

## Supply frequency of concentrate as supplement in sugarcane (*Saccharum officinarum*) forage diets and its effect on the productive performance of Holstein crossbred bulls

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Eight crossbred bulls Holstein x Zebu, of 315 kg average liveweight, located in two treatments with four repetitions each and random block design were used to study the effect of the supply frequency of concentrate on the productive performance of the animals. The treatments were: A) supply sugarcane forage, mixed with molasses-urea at 2 %, in a feeder once a day; B) supply the forage in separate feeders, twice a day. The experiment was conducted for 64 d. At the end, 368 and 376 kg of liveweight was proved for the treatments A and B, respectively. Analysis of variance according to completely randomized design was carried out. No differences between treatments were found for the indicators of daily mean gain (840-950 g) and DM intake (9.31-9.12 kg), respectively. There was better ( $P < 0.01$ ) feed conversion (9.6 kg for gaining 1 kg of liveweight) when the concentrate was offered twice a day, in respect to that obtained when supplying it once (11.06 kg). It is concluded that supplying the concentrate twice a day allowed higher efficiency on using the feeds.

Key words: *fattening, conversion, intake, efficiency, gain.*

The sugarcane is a plant of high DM yield per hectare. It is harvested mainly during the dry season, when represents an important feeding source for ruminants (Pinto *et al.* 2010, Freitas *et al.* 2011, Menezes *et al.* 2011 and Álvarez 2012). However, studies of Delgado (2002) point out some nutritional and physiological limitations that may affect the intake and weight gain of animals fed sugarcane forage.

Martín (2005) and Aguirre *et al.* (2010) analyzed a group of aspects on diets supplement with sugarcane that allow diminishing the effects of the nutritional and physiological deficiencies of this forage.

Another aspect studied, although no with sugarcane, is related with the advantages of using fixed feeds and the fraction supply of the supplements in the animals' feeding (Maekawa *et al.* 2002 and Da Costa 2003).

The objective of this research was to study the influence of two supply frequencies of concentrate as supplement on the productive performance of crossbred Holstein animals fed sugarcane forage.

### Materials and Methods

Eight crossbred Holstein x Zebu bulls, of 315 kg of average liveweight, located according to random block

design in two treatments with four repetitions each were used to study the effect of the supply frequency of concentrate during the day.

The treatments consisted of supplying the concentrate in separate feeders: once and twice a day. Table 1 shows the proportions the feeds were offered. Molasses with 2 % of urea was mixed with the sugarcane forage twice a day.

The animals were allocated in pens with grooved concrete floors during the 63 d the experiment lasted, at a rate of two per pen. In the morning, the residual feed was retired and weighed to determine the animals' consumption. Besides, the pens were cleaned and the feed was distributed according to treatment. The animals were weighed every 21 d to determine the weight increase in the period.

The concentrate composition used during the experiment is shown in table 2. The feeds bromatological composition (table 3) was determined according to the analytical techniques described by AOAC (1995).

The sugarcane forage was manually harvested, without eliminating the tops, and chopped in a forage machine. After offering it to the animals, it was spun several times a day to stimulate its intake.

Analysis of variance according to completely

Table 1. Feeds inclusion in the diet (%)

Components	Sugarcane forage (73%) + molasses-urea 2% (10%) mixture			
	Concentrate 17% once a day (A)		Concentrate 17 % twice a day (B)	
	Humid basis	Dry basis	Humid basis	Dry basis
Sugarcane	73	51.4	73	51.4
Molasses-urea 2%	10	16.1	10	16.1
Concentrate	17	32.5	17	32.5

Table 2. Inclusion percentage of the different raw materials for elaborating the concentrate

Ingredients	Inclusion percentages
Maize meal	56.3
Soybean meal	35.2
Minerals	5.5
Common salt	3.5

Table 3. Bromatological composition of the feeds (% DB)

Feeds	DM	CP	Ca	P	NDF	ADF	Lignin	Cellulose
Sugarcane	33.5	4.8	0.24	0.20	64.9	50.3	12.1	36.5
Concentrate	87.3	20.9	0.49	0.17	14.6	6.9	1.2	5.4
Molasses-urea <sup>1</sup> 2%	76.6	11.0	1.31	0.91	---	---	---	---

<sup>1</sup>García Trujillo and Pedroso (1989)

randomized design was carried out when necessary, Duncan (1955) was applied.

### Results and Discussion

No differences were found for the initial and final weight of the animals, either for the daily mean gain reached during the experiment (table 4).

In a study of Pazdiora *et al.* (2011), no differences in the daily mean gain were found when offering the concentrate once, twice or three times a day. These authors proved numerical differences in the weight gain, with values from 100 to 200 g between treatments, superior to those obtained in this research. Besides, no statistical differences were achieved, probably due to the high variability shown by the herd.

The weight gains were superior to those reported by García *et al.* (1990). These authors, in diets where the sugarcane was offered as fresh or silages forage, represented 50 % of the DM, with gains that did not surpassed the 730 g/animal/d.

In spite both studies used the same sugarcane DM percentage in the ration, the superior results in weight gain may be related with the quality of the supplement, as in this study only 13 % of the total protein was used, consumed as non-protein nitrogen in urea form. The authors cited used more than 30 % of the protein consumed from the urea.

Martín (2005) informed that the main effect on the

weight gain of the animals fed sugarcane forage was due to the ingestion of total natural protein. Its repercussion was superior to the gain obtained with the ingestion of non-protein nitrogen.

The intake of sugarcane DM mixed with molasses-urea and the intake of total DM was similar for both treatments. This equality was not shown in feeding conversion. This was better ( $P < 0.01$ ) in the treatment where the concentrate was offered twice a day (table 5).

The fractioning of the concentrate did not show differences in the DM intake. This coincides with the reports of Manso *et al.* (1999), not with that referred Cortes *et al.* (2007) and Pazdiora *et al.* (2011). These last informed that when offering the concentrate twice or three times daily, the DM intake of the animals increased.

The feeding conversion was better when offering the supplement twice a day. However, higher feed intake per gain kilogram was needed. It did not occur like that in a study of Benvenuti *et al.* (2006) in a feeding system, in which the sugarcane DM represented between 62 and 78 % of the DM consumed, superior to the 60 % proved in this study.

The fractioning of the supplement with concentrate diminishes the fermentation peaks of the nutrients in the rumen, so its efficiency is higher and the animals' productivity increases (Da Costa 2003).

The tables 6 and 7 show the excess on consuming

Table 4. Effect of supplementing the concentrate once or twice a day on the productive indicators of crossbred bulls Holstein x Zebu, fed sugarcane forage

Indicators	Sugarcane forage (73 %) + molasses-urea 2 % (10%) mixture		SE ±
	Concentrate 17 % once a day (A)	Concentrate 17 % twice a day (B)	
Initial weight, kg	315	315	2.18
Final weight, kg	368	376	6.86
Mean gain, g/animal/d	840	950	0.09

Table 5. Effect of supplementing the concentrate once or twice a day on the DM intake and the feed conversion of crossbred bulls Holstein x Zebu

Indicators	Sugarcane forage (73 %) + molasses-urea 2 % (10%) mixture		SE ±
	Concentrate 17 % once a day (A)	Concentrate 17 % twice a day (B)	
Sugarcane DM intake + molasses urea 2 %, kg	5.82	5.62	0.25
Total DM intake, kg	9.31	9.12	0.25
Conversion, kg DM/kg LW	11.09	9.6	0.26**

\*\*P &lt; 0.01

Table 6. Nutrients requirements and intake of animals consuming sugarcane with concentrate once a day

	CP <sup>1</sup> g/d	ME <sup>1</sup> MJ/d
Requirement	853	90
Intake	1121	99
Difference	+ 268 (31 %)	+ 9 (10 %)

<sup>1</sup>Martin and Geerken (1983)

Table 7. Nutrients requirements and intake of animals consuming sugarcane with concentrate twice a day

	CP <sup>1</sup> g/d	ME <sup>1</sup> MJ/d
Requirement	894	97
Intake	1112	97
Difference	+ 218 (24 %)	0

<sup>1</sup>Martin and Geerken (1983)

CP in respect to the requirements for gaining weight. In the case of metabolizable energy, there was an excess of its intake when the animals consumed the concentrate once a day.

The results of the CP and ME intake (Fundora *et al.* 1996) indicated that when there is an unbalance between the intake of both nutrients, the diet use efficiency diminishes because the excess of the protein consumed requires an energy waste for its excretion as urea (Fernández *et al.* 1990) or its return to the rumen through the saliva glands.

Da Costa (2003) refers that the increase of the feeding frequency propitiates a more stable ruminal environment. The pH fluctuations in the concentrations of short chain-fatty acids (SCFAS), those of ammoniac and microbial populations are eliminated, increasing the fermentation efficiency in the rumen.

It is concluded that the fractioning the concentrate twice a day, in the proportions studied, allowed higher efficiency on the feeds use, without affecting the rest of the productive indicators.

## References

- Aguirre, J., Magaña, R., Martínez, S., Gómez, A., Ramírez, J.C., Barajas, R., Plascencia, A. Barcena, R. & García, D. 2010. Caracterización nutricional y uso de la caña de azúcar y residuos transformados en dietas para ovinos. *Zootecnia Trop.* 28: 489
- Alvarez, F.J. 2012. Experiencia con la caña de azúcar integral en la alimentación animal en México. Available: <http://www.fao.org/docrep/003/s8850e/S8850E06.htm>. [Consulted: June 2, 2013]
- AOAC. 1995. Official Method of Analysis. 16th Ed. Ass. Off. Agric. Chem. Washington, D.C.
- Benvenuti, M.A., Pavetti, D.R. & Moreno, F.C. 2006. Efecto del tamaño de partícula de caña de azúcar y nivel de suplementación sobre el consumo y ganancia de peso de novillos en confinamiento invernal. *Rev. Argentina Prod. Animal* 26:63
- Cortés, E., Martínez P.A., Sánchez del Real, C. & Lazo, R. 2007. Finalización de corderos con diferente estrategia de ofrecimiento de una misma dieta. V Congreso de Especialistas en Pequeños Rumiantes y Camélidos Sudamericanos. Mendoza, Argentina
- Da Costa, D. 2003. Criacao de Bovino. Consultoria Veterinaria e Publicacoes. Belo Horizonte, Brasil. p. 128-199
- Delgado, D.C. 2002. Restricciones nutricionales y fisiológicas de la caña de azúcar para su utilización en la alimentación de rumiantes. Foro Internacional La Caña de Azúcar y sus Derivados en la Producción de Leche y Carne. La Habana, Cuba
- Duncan, D. B. 1955. Multiple range and multiple F test. *Biometrics* 11:1
- Fernández, J.M., Croom, W.J., Tate, L.P. & Johnson, A.D. 1990. Subclinical ammonia toxicity in steers: Effects on hepatic and portal-drained visceral flux of metabolites and regulatory hormones. *J. Anim. Sci.* 68:172
- Fundora, O., Martín, P.C., Elías, A. & Llerandi, R. 1996. Effect of the protein and energy supplementation of rustic Saccharina based rations on growing-fattening bull. *Cuban J. Agric. Sci.* 30:157
- Freitas, A.W.P., Cipriano Rocha, F., Zonta, A., Fagundes, J.L., Fonseca, R. & De Mello Zonta, M. C. 2011. Desempenho de novillos recebendo dietas à base de cana-de-açúcar in natura ou hidrolisada. *R. Bras. Zootec.* 40:2532
- García, W.G., Neckles, A.F. & Lallo, O.H.C. 1990. Sugar cane forage based diets for beef production. *Cuban J. Agric. Sci.* 24:15
- García Trujillo, R. & Pedroso, D.M. 1989. Alimentos para rumiantes. Ed. Instituto de Ciencia Animal. La Habana,

Cuba

- Maekawa, M., Beauchemin, K.A. & Christensen, D.A. 2002. Effect of concentrate level and feeding management on chewing activities, saliva production, and ruminal pH of lactating dairy cows. *J. Dairy Sci.* 85:1165
- Manso, T., Castro, T., Mantecon, A.R. & Salazar, I. 1999. Utilización digestiva de raciones con paja de cereales por el ganado ovino. Efecto de la frecuencia de administración del pienso concentrado. ITEA. Tomo II. p. 493
- Martín, P.C. 2005. The use of sugarcane for meat and milk production 39:415. *Cuban J. Agric. Sci.* 39:415
- Martín, P.C. & Geerken, C.M. 1983. Some considerations on energy requirements under tropical conditions. Maintenance and growing-fattening requirements of Holstein bulls under stabulation system. *Cuban J. Agric. Sci.* 17:139
- Menezes, G., Filho, S.C.V., Magalhães, F.A., Valadares, R.F., Franco Prados, L., Detmann, E., Pereira, O.G. & Ignez Leão, M. 2011. Intake and performance of confined bovine fed fresh or ensilaged sugar cane based diets and corn silage. *R. Bras. Zootec.* 40:1095
- Pazdiora, R.D., Brondani, I.L., da Silveira, M.F., Arboitte, M.Z., Cattelan, J. & Cordeiro de Paula, P. 2011. Efeitos da frequência de fornecimento do volumoso e concentrado no comportamento ingestivo de vacas e novilhas em confinamento. *R. Bras. Zootec.* 40:2244
- Pinto, A.P., Dos Santos, J.J., Marques, J.A., Gonçalves, W., Perotto, D., Simony, M. & Bernardo, L. 2010. Desempenho e características de carcaça de tourinhos mestiços terminados em confinamento com dietas à base de cana-de-açúcar em substituição à silagem de sorgo. *R. Bras. Zootec.* 39:198

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