EFFECT OF MINERAL PROTEIN SUPPLEMENTS ON LIVE WEIGHT GAIN OF GRAZING CATTLE

Efeito de suplementos minerais protéicos no ganho de peso de bovinos de corte mantidos a pasto

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ABSTRACT

This work was carried out to evaluate the effect of supplements based on non-protein nitrogen (NPN) as: urea, amirea and multinutritional block, on live weight gain and cost analysis for cattle kept in pastures. During a period of 104 days(April to July 2004), 40 crossbreed bulls, uncastrated and initial average weight of 379kg, were allocated into 4 paddocks with *Brachiaria brizantha* cv. Marandu, in continuous pasture system receiving, in troughs, the following treatments: mineral salt (control), protein supplement containing amirea, protein supplement containing urea and multinutritional block. The experimental design used was randomized blocks with repetition within the block. Results of availability bromatological composition of pasture, supplement consumption and daily weight gain of animals were evaluated in two experimental sub-periods: 0 to 45 and 45 to 90 days. In the first sub-period, there was no effect of treatments (P>0.05) on daily weight gain but in the second sub-period, the multinutritional block showed smaller (P<0.05) weight gain than the ones which were similar among themselves, being: 0.60; 0.59; 0.61 and 0.22kg/animal/day, respectively, for the treatments with mineral salt, amirea, urea and multinutritional block. Before these edafoclimatic conditions, the period and duration of the experiment, the supplementation with mineral salt provided the higher profit.

Index terms: Urea, amirea, multinutritional block, *Brachiaria brizantha*, costs.

RESUMO

Conduziu-se, no presente trabalho, avaliar o efeito de suplementos à base de nitrogênio não protéico (NNP), nas formas de uréia, amiréia e bloco multinutricional, sobre o ganho de peso e análise de custos para bovinos de corte mantidos a pasto. Durante um período de 104 dias (abril a julho de 2004), 40 animais machos, sem raça definida, não castrados, com peso médio inicial de 379 Kg, foram alocados em 4 piquetes de *Brachiaria brizantha* cv. Marandu, em sistema de pastejo contínuo, recebendo em cochos coletivos os seguintes tratamentos: sal mineral (controle), suplemento protéico contendo amiréia, suplemento protéico contendo uréia e bloco multinutricional. O delineamento experimental utilizado foi o de blocos casualizados com repetição dentro do bloco. Os resultados de disponibilidade e composição bromatológica da pastagem, consumo dos suplementos e ganho de peso diário dos animais, foram avaliados em dois subperíodos experimentais: 0 a 45 dias e 45 a 90 dias. No primeiro subperíodo, não houve efeito dos tratamentos (P>0,05) no ganho de peso diário, mas no segundo subperíodo, o bloco multinutricional apresentou menor ganho de peso (P<0,05) do que os que foram similares entre si, sendo 0,60; 0,59; 0,61 e 0,22 Kg/animal/dia, respectivamente, nos tratamentos com sal mineral, amiréia, uréia e bloco multinutricional. Diante das condições edafo-climáticas, época e duração do experimento, a suplementação apenas com sal mineral resultou em melhor retorno econômico.

Termos para indexação: Uréia, amiréia, bloco multinutricional, *Brachiaria brizantha*, custos.

(Received in october 4, 2005 and approved in may 8, 2008)

INTRODUCTION

In Brazil, the cattle farming is based on production systems that include native and / or cultivated pastures and livestock subject to quantity and quality of pasture consumed.

The tropical forage, depending on the environmental growth conditions (DEINUM & DIRVEN, 1975) and seasonality in production, does not provide sufficient nutrient quantities to achieve maximum performance of grazing animals. Thus, Euclid (2001) and Paulino (2001) suggest the supplementation of a multiple nature, as a correction of the deficits that may be presented in pasture for grazing cattle system.

Ruminants have a high capacity for carbohydrate digestion, combined with efficient use of dietary protein and the ability to use non-protein nitrogen (NPN) in the synthesis of protein in the rumen. Rumen microorganisms use ammonia (NH_3) in microbial protein synthesis, allowing the replacement of dietary protein by sources of NPN (urea).

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However, it should be emphasized the importance of providing a controlled energy source compatible, for the proper handling can increase the utilization of NPN, by modifying the pattern of ammonia release.

Urea stands out as a source of non-protein nitrogen widely used in feed for ruminants for the low cost of its corresponding protein value. However, its use for ruminants has been restricted by metabolic limitation of the animal, risk of poisoning, low palatability and segregation in food mixtures (STILES et al., 1970). Some of these problems are directly related to the high solubility of urea in the rumen, being quickly hydrolyzed into ammonia under the action of the enzyme urease (DAUGHERTY & CHURCH, 1982, OWENS et al., 1980). In order to improve the use of urea in animal nutrition, amirea has been used to, which is the product obtained by extrusion of a mixture of starch from grain and / or crops (corn, sorghum, cassava etc.) and livestock urea, under conditions of high temperature and pressure, leading to gelatinization (BARTLEY & DEVO, 1975; TEIXEIRA et al., 1988). According to Nocek & Tamminga (1991), starch appears to be the best source of energy for the conversion of ammonia into protein by rumen microorganisms.

The objective of the present study was to evaluate the use of supplements based on non-protein nitrogen for cattle in continuous grazing system.

MATERAILS AND METHODS

The work was conducted in the Taboão farm, located in the city of Bom Sucesso, and the laboratory tests, in the Animal Research Laboratory (DZO - UFLA). The experimental area of 25.84 hectares, covered evenly by *Brachiaria brizantha* (Hochst. ex A. Rich.) Stapf. cv. Marandu, was divided into four paddocks of 6.46 hectares each, by electrified fence, with a fountain and a covered trough in each paddock, so that isles allow simultaneous access of all animals in the paddock to water and supplement.

The experiment lasted 104 days, with the initial 14 days destined for animal adaptation to the treatment (April 1st to 14, 2004) and the remaining 90 days, the trial period (15 April to 15 July 2004) . The experiment began in a period considered to be of transition between the rainy and dry seasons.

A total of 40 animals crossbred, uncastrated, with initial weight of 379 kg, under continuous grazing, equally distributed in four paddocks using a randomized block design, maintaining a stocking rate of 1.5 AU / ha, receiving troughs in their respective treatments.

In these paddocks, the following treatments were allocated: mineral salt (MS-control), protein supplement containing amirea (AM), protein supplement containing urea (UR) and protein supplement in block (BL).

The equivalent levels of protein, total digestible nutrients, calcium and phosphorus if the studied supplements are presented on Table 1.

Table 1 – Levels of protein equivalent (PEq),total digestible nutrients (TDN), calcium (Ca) e phosphorus (P) in the used supplements.

	Treatments			
	MS	AM	UR	BL
PEq, %	—	37.82	37.84	35.00 (mín)
TDN, %	—	38.71	39.73	33.00
Ca, %	10.50	6.00	6.00	6.00
P, %	8.00	3.90	3.90	4.00

MS: mineral salt; AM: protein supplement containing amirea; UR: protein supplement containing urea; BL: multinutritional block.

All supplements were formulated to provide full mineralization, following the recommendations of NRC (1996), attempting to maintain equivalent levels of protein similar and provided free to the consumption was regulated by the animal itself.

The experimental paddocks were kept “sealed” for a period of 35 days before the start of the experiment, to ensure good availability of forage, and this is estimated at the beginning, middle and end of the experimental period (0, 45 and 90 days), because through “Square Technique” (GARDNER, 1986).

Water sample was collected from Taboão farm for quality analysis, with acceptable characteristics for watering the animals and classified as fresh. Therefore, providing no sodium to the animals and not interfering in the consumption of supplements.

The experimental design was a randomized block design with replication within block, two replicates / block / treatment, where 40 animals were divided into five blocks, according to initial weight and randomly in the four paddocks where they received the treatments at random. The Tukey test was used for comparison of means at the 5% level of significance. The data were statistically analyzed using the SAS computer software, according to the recommendations of SAS Institute (2000).

The statistic model was:

$$Y_{ijk} = \mu + t_i + b_j + \varepsilon_{ijk}$$

Where:
Y_{ijk} = value referring to the animals(k) inside the block (j) that received treatment (i);
μ = a constant associated to all observations;
t_i = effect of treatment (i) with i = 1,2,3,4;
b_j = effect of the block (j) with j = 1,2,3,4,5;
ε_{ijk} = experimental error associated to Y_{ijk} with K= 1,2 representing the replicates inside each block, that by hypothesis has normal distribution of average zero and variance σ^2

The mineral and protein supplements containing amirea and urea were prepared in Fodder Factory (DZO - UFLA) and multinutritional block (commercial product) was donated by Jonil Ind. Com de Rações Ltda, a company in the animal nutrition field.

The consumption of supplements was evaluated every two days, in the morning, through the difference between the weight of the supplement provided, and the remains left in the trough. The performance of the animals was evaluated every 14 days, by individual weighing, without fasting, also in the morning.

Collected foraging samples were analyzed for dry matter at 105 °C (DM), crude protein (CP) and mineral matter (MM) according to methodologies described by AOAC (1990), calcium and phosphorus according to Silva (1998), neutral detergent fiber (NDF) and acid detergent fiber (ADF) second Soest et al. (1991).

In the analysis of the costs of the supplements, was considered the market price of the ingredients used in their composition, by the time they were prepared. Costs in reais (R$) of the ingredients, analyzed in July 2004, are presented on Table 2.

Table 2 – Cost of ingredients in Reais (R$) per kg of supplement.

	Traetments		
Ingredientes	MS	AM	UR
Amirea 150	—	0.23	—
Urea	—	—	0.15
Crushed Corn Grain	—	0.08	0.12
Powder Molasses	—	0.19	0.19
Purinafós 160	0.75	0.35	0.36
Regular Salt	0.15	0.03	0.03
Limestone	—	0.01	0.01
Sulfur flower	—	0.01	0.02
Total (R$)	0.90	0.90	0.88

MS: Mineral salt; AM: Protein supplement containing amirea; UR: protein supplement containing urea; BL: Multinutritional Block

The multinutritional Block is sold in a pack of 20kg, and the cost / kg of this block in July 2004, R$0.93.

RESULTS AND DISCUSSION

The results of availability and bromatological composition of forage consumption of supplements and performance of the animal were analyzed in two experimental sub-periods: 0 to 45 days and 45 to 90 days.

Table 3 – Availability of natural matter (NM), dry matter (DM) and average bromatological composition of forage at 0, 45 and 90 days for MS and CP, NDF, ADF, Ca and P in%.

Availability	0 days	45 days	90 days
NM, kg/ha	7444	6692	4765
DM, kg/ha	2283	2378	2154
Composition	0 days	45 days	90 days
DM	28.78	33.55	43.02
CP	8.18	6.64	5.64
NDF	72.87	73.23	73.09
AFD	37.59	43.24	45.64
MM	7.77	7.80	7.76
Ca	0.09	0.08	0.08
P	0.06	0.05	0.05

NM: Natural Matter; DM: Dry Matter; CP: Crude Protein; NDF: Neutral Detergent Fiber; AFD: Acid Detergent Fiber; MM: Mineral Matter; Ca: Calcium; P: Phosphorus.

It is observed with the progress of the trial period, a natural condition of decline in pasture quality, outlining the availability of DM over 2,000 kg / ha, which Minson (1990) described as minimal to not have a decrease in the size of " bits "and the animals have no difficulty in satisfying their consumption, i.e. to ensure maximum selection and forage ingestion

During the experiment, there was a prolongation of the rainy season, with the higher rainfall recorded especially during May and June, which helped to keep the pasture availability satisfactory. Furthermore, the stocking rate (1.5 AU / ha) considered low for the forage in question, which provided a more selective grazing by animals.

The average daily intake of supplements per animal ingredients and CP from 0 to 45 and 45 to 90 days, were not analyzed statistically, since the measurements were made by group of animals per treatment and not individually. The results are presented in Table 4.

Table 4 – Estimated total consumption of ingredients and mineral supplements protein (g / animal / day) in the period from 0 to 45 days and 45 to 90 days.

Tretements (0 a 45 days)				
	SM	AM	UR	BL
Total	63.85	247.21	336.19	151.00
Amirea	—	59.33	—	—
Urea	—	—	42.02	—
Crushed corn	—	56.12	112.62	—
Molasses	—	37.82	51.10	—
Mineral Nucleus	31.92	59.08	80.35	—
Salt	31.92	28.92	39.67	17.58
Limestone	—	5.19	7.40	—
Sulfur flower	—	0.74	3.02	—
PB	—	93.49	127.21	52.88
Treatments (45 a 90 days)				
	MS	AM	UR	BL
Total	51.98	221.30	382.56	154.05
Amirea	—	53.11	—	—
Urea	—	—	47.82	—
Crushed corn	—	50.23	128.16	—
Molasses	—	33,86	58.15	—
Mineral Nucleus	25.99	52,89	91.43	—
Salt	25.99	25,89	45.14	17.93
Limestone	—	4,65	8.42	—
Sulfur flower	—	0,66	3.44	—
CP	—	83.69	144.76	53.92

MS: Mineral salt; AM: Protein supplement containing amirea; UR: protein supplement containing urea; BL: Multinutritional Block; CP: Crude protein.

By the presented values, it is observed that the consumption of protein supplements and the control treatment in both periods, remained virtually constant. Which can be justified by the good availability and quality of pasture during the experimental period (Table 3), thus enabling the selectivity of forage intake.

Increased availability of mass in the pasture allows to amplify the possibility of selection of components with higher nutritional content (DETMANN et al., 2001), reducing the need for supplemental foods, especially NPN.

The average initial live weight, final life weight, weight gain and daily weight gain of animals from 0 to 45 days and 45 to 90 days of the trial period are presented in Tables 5 and 6.

The difference found in weight gain and daily weight gain between treatments in the period from 45 to 90 days of the experiment, is possibly related to a lower intake of the block because of the consistency of, and competition among animals, preventing necessary consumption of the block, which was well below the amount specified by the manufacturer (80 grams product per 100kg live weight / animal / day), thereby compromising intake, not only energy and protein but also minerals, with effects on animal performance (MCDOWELL, 1999).

Table 5 – Average values of initial live weight (ILW), final live weight (FLW), weight gain (WG) and average daily gain (ADG) in kg per animal, from 0 to 45 days.

	Treatments			
	SM	AM	UR	BL
ILW(Kg)	387.20	379.20	377.90	387.80
FLW(Kg)	414.40	402.70	410.10	416.20
WG(Kg)	27.20	23.50	32.20	28.40
DWG(Kg)	0.60	0.52	0.71	0.63

CV%(WG) = 39.86%, DMA = 13.44, CV% (ADG) = 39.87%, DMA = 0.30

MS: Mineral salt; AM: Protein supplement containing amirea; UR: protein supplement containing urea; BL:

Table 6 – Average values of initial live weight (ILW), final live weight (FLW), weight gain (WG) and average daily gain (ADG) in kg per animal, from 45 to 90 days.

	Treatements			
	MS	AM	UR	BL
ILW(Kg)	414.40	402.70	410.10	416.20
FLW(Kg)	441.50	429.20	437.50	426.30
WG(Kg)	27.10 ^{A}	26.50 ^{A}	27.40 ^{A}	10.10 ^{B}
DWG(Kg)	0.60 ^{A}	0.59 ^{A}	0.61 ^{A}	0.22 ^{B}

Averages followed by the same letters in the same row do not differ (P> 0.05) by Tukey test.

CV%(WG) = 33.91%, DMA = 9.36, CV% (ADG) = 33.90%, DMA = 0.21

MS: Mineral salt; AM: Protein supplement containing amirea; UR: protein supplement containing urea; BL: Multinutritional block.

Freitas et al. (2003) outlines the great variability in the multinutritional blocks consumption, also found in some work done by Lobato & Pearce (1980) and Preston & Leng (1989).

Similar results were observed by Oliveira et al. (2002), in an experiment to evaluate two sources of NPN (amirea and urea) compared to a control treatment (mineral salt), using animals with average weight of 374 kg in *Brachiaria brizantha* cv. Marandu. The authors found no advantages in using protein salt based in NPN, alleging that the excellent quality of pastures composing the experimental paddocks would already have given all the necessity for nitrogen of the rumen bacteria.

The lack of response to animal protein supplements resulted in lower cost per animal in the control treatment (only supply of mineral mixture). The description of the costs for the supplements is presented in Table 7.

Table 7 – Evaluation in reais (R $) of cost of the supplements.

	Treatments			
Costs	SM	AM	UR	BL
R$/kg suplement*	0.90	0.90	0.88	0.93
R$/animal /dia	0.05	0.21	0.32	0.14
R$/kg de WG	0.07	0.36	0.45	0.32
R$/animal/90 days	4.50	18.90	28.80	12.60

* Supplement prices verified in July 2004.
MS: Mineral salt; AM: Protein supplement containing amirea; UR: Protein supplementation containing urea; BL: Multinutritional block.

CONCLUSIONS

In the scenario of this experiment, protein supplementation did no affect the animal performance, resulting in a smaller cost/animal in the control treatment (only mineral mixture). The protein supplementation with blocks was proved less efficient.

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