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Supplementation with Norgold Concentrate + Molasses-Urea at 3% to Grazing Zebu Bovines During the Growing or Fattening Stages in the Dry Season

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Abstract

To determine the production potential of grazing Zebu bovines, using Norgold concentrate + molasses-urea at 3% during the growing and fattening stages, 60 young bulls with similar weights and breed characteristics were used. Four experimental groups were made, which grazed for 9h daily, on marvel grass (Dichantium annulatum) + bahiagrass (Paspalum notatum) average quality, 3kg of Pennisetum Cuba CT - 115; 1.0; 1.5; and 2.0 kg of Norgold concentrate for groups I, II, III, and IV, respectively, along with mineral salt and water ad libitum. Initial and final live weight, absolute weight, mean daily gain, and consumption were determined. Cost/benefit was also estimated. The animals in treatment 4 reached 401 kg of live weight (47.43% of their weight in comparison to initial live weight at 180 days); the average daily gain and conversion were 716.66 g and 10.37 kg of feed/kg of live weight, respectively. It was concluded that the treatment including 12.0 and 1.5 kg of Norgold concentrate, respectively, had mean daily gains and feed conversion ($P < 0,05$) higher than the traditional systems based on molasses-urea, and other by-products. The meat production achieved showed a positive cost/benefit ratio, which means that the system is feasible, productive and cost-effective.

Key words: *cattle, grassland, fattening, supplementary feedstuffs, cost-effectiveness, environment*

Introduction

Beef production has always been appealing, especially due to the capacity of rumnants to use high fiber volumes as sources of energy. The exploitation of pastures and forages, with locally-produced feeds can be made throughout the year in tropical regions (Guevara et al., 2012; Cino *et al*., 2014; Mulliniks et al., 2015).

The commercial cattle fattening in Cuba has undergone significant limitations, including the use of crossbred dairy studs with live weight losses above, or gains below 200 g/animal/day in some periods of the year (Cino *et al*., 2014).

The search for alternative protein sources for beef production continues to be a permanent task, since not all the advantages provided by the Cuban climate have been explored. Accordingly, the application of effective techniques of grassland management, legume use, supplement application, and the animal type, remains a challenge (Milera, 2013).

The goal of this study was to assess the effect of productive, economic and environmental indexes of molasses-urea at 3% + Norgol concentrate, used as a supplement during the growing-fattening stage of Zebu cattle in grazing systems, in the dry season, in Cuba.

Materials and Methods

The experiment took place at the Grito de Yara Cattle Company, province of Granma, from October 16, 2010, to April 8, 2011, covering 180 days.

Treatment and experimental design

A completely randomized design was used, in four experimental groups of 15 bulls each, receiving common and mineral salt and water ad libitum. The animals were clinically healthy, with equal live weights.

Treatments

Treatment I (control): 9h grazing + 2.00 kg of molasses-urea at 3% + 3.00 kg of *Pennisetum purpureum* cv. Cuba CT-115.

Treatment II: 9h grazing + 1.00 kg of Norgold concentrate + 2.00 kg of molasses-urea at 3% 3.00 kg of *Pennisetum purpureum* cv. Cuba CT-115.

Treatment III: 9h grazing + 1.50 kg of Norgold concentrate + 2.00 kg of molasses -urea at 3% + 3.00 kg of *Pennisetum purpureum* cv. Cuba CT-115.

Treatment IV: 9h grazing + 2.00 kg of Norgold concentrate + 2.00 kg of molasses-urea at 3% + 3.00 kg of *Pennisetum purpureum* cv. Cuba CT-115.

Experimental procedure

A semi-stall intensive fattening system was implemented, based on grass + supplements. Sixty Zebu young bulls averaging 18 months old were included, which grazed for 9h daily (7:00 am - 12:00 pm), and (2:00 pm - 6:00 pm). During both grazing sessions, the animals were placed in stalls and received supplementation. Diet adjustment lasted 14 days. The grazing area was divided into 12 enclosures of 2ha each. A rotation system of 5-day occupation each was established. Resting time was 60-120 days, depending on the season time.

Variables assessed

Grass consumption was estimated, and supplement consumption was determined, based on weight differences between the offer and refusal. Live weight was estimated monthly, separately. Dry matter determination and the chemical composition analysis were made in the Soil and Agrochemistry Laboratory, in Bayamo. Dry matter (DM) content and crude protein (CP) were determined according to the AOAC methodology (2000). The animal nutritional requirements of NRC (2000) were used. Cost/benefit was determined for the group of animals, using the standards and procedures for planning and determination of beef and milk costs of productions, recommended by Luening (1998).

Concerning the environmental impact, life cycle analysis (LCA) was used, (IPCC, 2010), to estimate methane emissions as CO_2 equivalent, for which the IPCC (2010) coefficients were used, according to initial-final live weights as a difference daily mean gain/bull. The estimates were presented as daily production (kg) of methane eq Co_2, per live weight kg gain in each treatment.

Statistical analysis

Simple Variance Analysis was performed. The Duncan´s Multiple Range Test (1955) was performed to find the difference between the means, using STATISTIC, 9.0 (2000).

RESULTS AND DISCUSSION

The Norgold concentrate has 89.50 % of dry matter (DM); 27.0% of crude protein (CP); 2.95 Mcal/kg of DM, metabolizable energy (ME); 0.35% of calcium (Ca), and 0.95% of phosphorus. These values correspond to feedstuffs recommendations for bovine fattening (NRC, 2000).

From the start and until day 120, the difference in crude protein percent (4.8 and 7.2%, respectively), and metabolizable energy contribution for marvel grass (*Dichantum annulatum*) + bahiagrass (*Paspalum notatun*), and king grass (*Pennisetum* Cuba CY-115) were remarkable. At 60 days both the native grass and the forage were above 5% of protein; therefore, they can be considered as grass and/or forage with acceptable quality, because less than 5-7% of crude protein affects digestibility of the other nutrients.

Several authors note that when enough grass is available in the rainy season (more than 7% CP), and it is provided with mineral-protein-energy supplementation, live weight gains of 700 g/animal/day may be expected.

To define the success of bovine production, there must be a perfect match between the quantitative maximum and the best quality, at the lowest production prices. To achieve that, the nutritional system applied will be crucial. Norgol concentrate is the costliest of all.

The animals´ initial weight was 272 kg, then it increased considerably ($P < 0,05$), until final weight was accomplished at 180 days, between 351-401 kg live weight). Some authors have had similar results with animals consuming grass and forages supplemented with molasses-urea, and other by-products. Castillo et al. (2013) reported a similar experience with final weights (403 kg) in male bovines. They may be associated to the nutritional system that originated favorable effects on animal behavior.

Table 3 shows the evolution of the indicators assessed in the experiment, and the development of animals, regarding their life stages. Breeders must achieve efficient growing-fattening. Equally important is to diminish the fattening time (Cino *et al.*, 2014; Milera, 2013; MacDonald *et al.*, 2015).

Other authors found similar values, using different alternative supplements. Cino et al. (2014), when studying grazing male bovines, supplemented with molasses-urea, indicated that live weights of 400 kg can be achieved at 20 months, with weight gains of 520 g/animal/day, whenever the amount of urea in molasses is 10%.

These results were also similar to reports by Milera *et al.*, (20123), with associated graminaceae, or in legume protein reservoirs. They also coincided with Cino et al. (2014), when Leucanena cv. Perú associated with African Bermuda-grass were supplemented, with gains of 798 g/animal/day. Similar results were reported by Ray (2000), when dairy crossbred bovines were fattened in a segregation area (30 % of a dairy farm in the rainy season), with 520 g/animal/day gains during 161 days of grazing on *Brachiaria humidicola* and native legumes, which led to improvements in grass dry matter, total feed and its nutrients, like energy.

All the treatments (Table 3) were observed within that acceptable range for fattening animal requirements, though the best nutritional efficiency was achieved in treatment IV (10.37 kg DM/kg of increased live weight). The value of methane emissions was improved, as kg/CO_2/kg of weight increase (1.02 kg for treatment IV), close to values reported by IPCC (2010) for final bovine fattening (0.82 and 1.06 kg/ eq-CO_2 of methane), and it was also similar to reports for fattening cattle in Argentina, by INTA (2015), Cederberg and Stadig (2003), and Kristensen *et al*. (2011), for two-purpose farms in north Europe, and by Mulliniks *et al*. (2015), in American fattening companies.

Table 4 shows the cost chart for animals, feedstuffs and materials used in fattening. The following indicators were taken into account: cost/benefit, cost/Cuban peso produced, and cost/kg of increased LW, as established in the chart for the general system, for each treatment.

CONCLUSIONS

The treatments including Norgold concentration achieved mean daily gains and feed conversion significantly higher than the traditional systems, based on molasses-urea and other by-products. The beef production produces s positive cost/benefit relation, which means that the system is feasible, productive and cost-effective.

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Table 1. Behavior of climatic parameters (October 2010-April 2011)

Month	Min. temp. (^{0}C)	Temp. (^{0}C)	Temp. (^{0}C)	Relative humidity (%)	Precipitations (mm)
October	18.5	26.4	32.5	78	23
November	17.4	25.3	33.2	89.0	178.2
December	17.2	26.5	33.8	88.3	142.5
January	15.4	22.1	28.8	78.6	32.5
February	18.8	26.9	33.0	81.0	39.0
March	19.8	27.2	34.2	86.0	93.0
April	19.5	27.0	34.0	84.5	138.0

Source: Weather Station, CITMA, Granma

Table 2. Assessment of initial and final LW (kg), and daily weight gains (g/a/d), per treatment

Treatments	0-60 days				60-120 days				120-180 days			
	IW	FW	CA	DM	IW	FW	CA	DMG	IW	FW	CA	DMG
I	272	291	19	316.66	291	317	26	433.33	317	351	34	566.6
II	272	298	26	433.33	298	328	30	500.0	3.28	367	39	650.0
III	272	304	32	533.33	304	343	39	650.0	343	389	46	766.6
IV	272	310	38	633.33	310	353	43	716.66	353	401	48	800.0

IW: initial weight, FW: final weight, DMG: daily mean gain

Table 3. Initial and final live weight (5 kg), DMG (g), and methane emission per treatment, for all the period

Treatment 1.	ILW (kg)	FLW (kg)	Methane emission (eq-CO2/kg)	DMG (g)
I	272.0[a]	351.0[a]	1.96[a]	438.88[a]
II	272.0[a]	367.0[b]	1.40 b[b]	527.77 b
III	272.0[a]	389.0 c	1.17 c	650.0 c
IV	272.0[a]	401.0[d]	1.02 d0[d]	716.66 d0[d]

Means with different letters in the same column differ significantly for P ≤ 0.05, according to Duncan (1955).

Table 4. Cost chart for animals, feeds and materials used in the experiment

Indicators	U/M	Price	Qty.	Imprt.	Treatm. I I	Treatm. II	Treatm. III	Treatm. IV
Expenses								
Animals	kg	4.25	8 160	34 680.0	8 670.00	8 670.00	8 670.00	8 670.00
Norgold concentrate	t	227.33	12.15	2 762.06	---	613.79	920.69	1 227.58
Penisetum Cuba CT-115	t	32.00	32.4	1 036.80	259.20	259.20	259.20	259.20
Molasses	t	64.80	21.6	1 399.68	349.92	349.92	349.92	349.92
Urea	t	639.37	0.648	414.32	103.58	103.58	103.58	103.58
Mineral salt	t	69.70	0.1	6.97	1.74	1.74	1.74	1.74
Salaries	$	225.00	---	1 350.00	337.5	337.5	337.5	337.5
Other expenses	$	--	--	289.25	72.32	72.32	72.32	72.32
Total expenses	$	--	--	41 939	9 794	10 678	10 714	11 021
Gains	$	--	--	132 288	29 166	30 059	35 965	37 098
Cost/kg LW	$	--	--	0.86	1.12	0.99	0.76	0.71
Cost per Cuban peso produced	$	--	--	0.24	0.25	0.26	0.23	0.23