Scientific Paper

Effect of supplementation with a preparation of corn and wheat bran enriched with torula yeast, in bull fattening under silvopastoral system conditions

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ABSTRACT: The objective of the study was to evaluate the productive effect of a preparation of corn and wheat bran enriched with torula yeast, as alternative to cover 25 % of the total protein requirements of fattening bulls under silvopastoral system conditions. For such purpose, 24 Holstein x Zebu bulls were selected, which were randomly distributed into two groups of 12 animals each: a control group, which did not receive supplementation; and another group called supplement, to which the corn preparation was offered so that 25 % of the total CP requirements was covered. The availability values were 6 550,0 and 13,3 kg DM/ha/rotation for the Guinea grass and the leucaena, respectively. There were significant differences in the mean daily gain: 0,846 vs. 1,08 kg/animal/day; as well as in the live weight, with values of 421 and 440 kg for the control group and the supplement group, respectively. It is concluded that the supplementation with the preparation of corn and wheat bran enriched with torula yeast positively influenced the mean daily gain of bulls during finishing.

Keywords: fattening, weight gain, yeast

INTRODUCTION

The main factors on which the feeding system of cattle in the tropic depends are the quantity of pastures and forages produced in the medium where the rearing occurs, and the annual distribution of yield (Ogunbosoye *et al*., 2015). These factors, along with the bromatological composition of the produced pasture, constitute the fundamental key for a fattening system based on pastures and forages.

In the systems with Guinea grass without fertilization, the mean daily gain of bulls reaches values of 0,300-0,500 kg/animal/day (Simón *et al*., 1990); thus, it is the specialists' task to introduce systematic improvements in the diets to achieve higher gains that reduce the permanence time of the animals during the fattening period.

An option is the inclusion of trees in the pasturelands; because it has been proven that in these systems it is possible to obtain gains of 0,500-0,700 kg/animal/day in fattening bulls (Mahecha-Ledesma *et al*., 2011; Díaz *et al*., 2013).

Another alternative to improve the gain of bulls in the systems based on pastures and forages is the supplementation of the diet with feedstuffs from different sources, such as agroindustrial residues or concentrate feeds elaborated with local raw materials.

In this sense, the Entrepreneurial Basic Unit España Republicana, belonging to the LABIOFAM Enterprise, located in the Perico municipality, Matanzas province, Cuba, elaborated a preparation of corn with wheat bran enriched with torula yeast, for its use in the diets of different animal species, as an energy-protein feedstuff that helps to improve the nutritional balance of the ration.

Based on such antecedents, a study was conducted in order to evaluate the productive effect of this preparation as alternative to cover 25 % of the protein requirements of fattening bulls under silvopastoral system conditions.

MATERIALS AND METHODS

Location. The study was conducted during September-December, 2014, at the Pastures and Forages Research Station (in the Perico municipality, Matanzas province, Cuba), which is located in 20º 50' North latitude and 79º 32' West longitude, at 19 masl.

Climate and soil. The annual rainfall was 1 640 mm, from which 589,3 mm (36 %) occurred in the experimental period (fig. 1). The studied system

was established on a moderately fertile Ferralitic Red soil (Hernández *et al*., 2006).

Description of the grazing area. A 10-ha grazing area was used for the two groups, divided into nine paddocks of approximately 1,1 ha each. The permanence time was five days, and the resting time, 40 days. The prevailing pasture species was *Megathyrsus maximus* cv. Likoni, which represented 80 % of the floristic composition; and the tree *Leucaena leucocephala* cvs. Cunningham and Peru, more than 15 years after being established, at an average distance of 6 m between rows and 3 m between plants, with a density of 236-364 plants/ha and an average height of 8 m.

Animals, treatments and design. Twenty-four Holstein x Zebu bulls (365 kg LW and 24 months of age) were used, which were randomly distributed in two groups of 12 animals: a control group, which did not receive supplementation; and another group called supplement, to which a preparation of corn and wheat bran enriched with torula yeast was offered, to cover 25 % of the total protein requirements according to the statistical program CALRAC® –version 1.0, 1996–, elaborated by the Institute of Animal Science (ICA for its initials in Spanish) –Mayabeque, Cuba–. The stage of adaptation to the supplement consumption was 15 days, and the trial lasted three months.

In order to perform the initial nutritional balance of the rations, the chemical composition of Guinea grass and leucaena reported by López-Vigoa *et al*. (2014) was considered, and in the case of the preparation of corn and wheat bran the statement by the manufacturer was taken into consideration (CP: 27,13 %; DM: 86,10 %; CF: 6,10 %).

Measurements in the pastureland

Pasture availability. The pasture availability was evaluated through the alternative method proposed by Martínez *et al*. (1990). The sampling was carried out upon the entrance of the animals to each paddock, and 80 observations per hectare were made.

L. leucocephala availability. The *L. leucocephala* availability was randomly estimated in 10 of the trees present in the paddock; the browsing made by the animals up to a height of 2 m was simulated, through the technique of milking the leaves and fresher stems –of approximately 3 mm of diameter–, and it was sampled upon the entrance of the animals to each paddock (Lamela-López, 1998).

Laboratory analyses. After estimating the availability samples were taken and sent to the laboratory in order to determine the percentages of dry matter, crude protein, calcium and phosphorus, following the methodology of the AOAC (2000).

Measurements on the animals

Live weight and mean daily gain. The live weight was measured with a digital scale in 100 % of the animals, with monthly frequency. The mean daily gain in the evaluation period was calculated.

Calculation of the retrospective feeding balance. The feeding balance was calculated in both treatments through the statistical program CALRAC®.

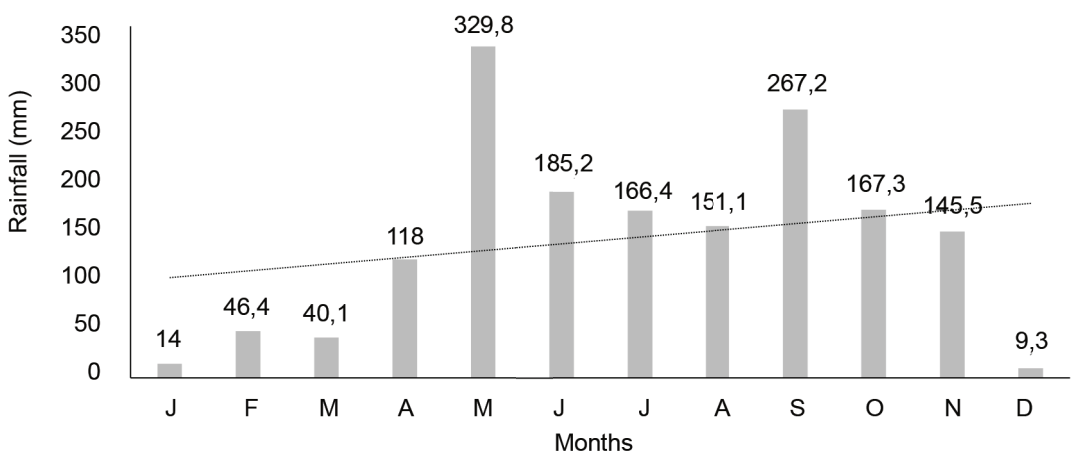

Fig. 1. Rainfall in the experimental period.
Source: "Meteorological bulletin" of the Meteorological Station Indio Hatuey.

Statistical processing

Descriptive statistics (arithmetic mean and standard deviation) was applied to the variable availability; while for the analysis of the live weight and the mean daily gain the t-Student test was used for independent samples, and it was carried out with the statistical package SPSS® version 20 for Windows.

RESULTS AND DISCUSSION

The dry matter availability of Guinea grass and leucaena during the experimental period is shown in table 1. The Guinea grass values were high, which allowed offers higher than 50 kg DM/animal/day, which in turn allowed a better selection of the diet by the animal and an acceptable productive response, according to Sossa and Barahona (2015); while the availability of leucaena was low due to the height of the plants (more than 8 m), hence the need to perform the pruning in order to increase the offer of the legume and its intake.

The availability of the grass in the association during the evaluation period was similar to the one reported by López-Vigoa *et al*. (2015); the Guinea grass had been established for more than 15 years and maintained high dry matter offers, which proved its higher resilience and resistance to the climate change. Hence the importance of including trees in the cattle production ecosystem, because they contribute to the sustainability of the system; nevertheless, attention must be paid to management because a high DM offer can bring about quality loss in the forage due to undergrazing.

In this sense, the presence of the tree species has other beneficial effects on the system, because it contributes to increase the CP content of the pastures which are present in the association (Barros-Rodríguez *et al*., 2012).

Table 2 shows the chemical composition of the feedstuffs. The crude protein content of *M. maximus* was similar to the one reported for this grass in a silvopastoral system with high density of leucaena (Molina *et al*., 2015); However, it exceeded the values reached in systems with improved grasses without fertilization (Iglesias-Gómez, 2003).

Leucaena showed a high crude protein content, with a value similar to the one reported by Molina *et al*., (2015) in an intensive silvopastoral system. Regarding the supplement, its CP value was considered acceptable for this type of feedstuff.

Table 3 shows the productive performance of the bulls during the research period. A higher gain was achieved in the ones that received the preparation of corn and wheat bran enriched with torula yeast, with significant differences (p = 0,001); hence a favorable effect was found of the supplement on the productive response. Nevertheless, there were no significant statistical differences for the final live weight, for which it is considered that this study should be replicated with a higher number of animals.

Gallo *et al*. (2013), when evaluating the effect of supplementation with an energy concentrate feed based on rolled corn, also found a positive performance in the carcass characteristics and yield of grazing fattening steers during finishing.

In turn, the gain obtained with the preparation was similar to the one found by Rodríguez *et al*. (2013) with diets in which an energy-protein concentrate feed was used (1,03 kg/animal/day). It is valid to state that the basis diet of that experiment

Table 1. Dry matter availability and offer.

Availability (kg DM/ha/rotation)	Offer (kg DM/animal/day)
L. leucocephala	
13,3 (± 2,8)	0,11 (± 0,02)
M. maximus	
6 550,0 (± 353,6)	54,6 (± 2,9)

Table 2. Bromatological composition of the feedstuffs of the diet.

Nutrient (%)	Feedstuff		
	M. maximus	*L. leucocephala*	Supplement
DM	30,5	31,1	87,0
CP	11,5	25,2	27,1

Table 3. Effect of supplementation with corn and wheat bran enriched with torula yeast on the productive indicators of finishing bulls.

Indicator	Treatment		SE ±	Significance
	Control	Supplement		
Initial weight (kg)	366	368	9,93	0,797
Final weight (kg)	421	440	12,21	0,148
Weight increase (kg)	56	72	4,28	0,001
Mean daily gain (kg)	0,846	1,08	0,07	0,001

was sugarcane, which has lower crude protein content than the Guinea grass in this study; for such reason, a higher quantity of concentrate feed (3 kg/animal/day) was supplied to achieve similar productive performance.

This gain was higher than the one reported for different genotypes by Iglesias *et al.* (2015), who achieved between 0,500 and 0,524 kg/animal/day with animals that grazed grasses during the day, using also supplementation with Northgold and wheat bran at a rate of 1,0-1,5 kg, but with lower pasture availability.

The use of this supplement type is an option for feeding grazing bulls, as long as there is a pasture with abundant availability and quality, which guarantees the necessary dry matter levels for a better productive performance and maximizes the selection capacity.

It must be emphasized that the gain in the two treatments was higher than the one obtained with cultivated grasses without fertilization (Simón *et al*., 1990), which are the beef production systems that prevail in Cuba (ONEI, 2015).

The gain obtained in the group which received the supplement is ascribed to the incorporation in the diet of an energy-protein concentrate feed, which propitiated a favorable environment to improve the rumen environment and microbial synthesis.

In this sense, Castellón and Elías (2015) concluded that to obtain a mean daily gain of 1 200 kg, it would be necessary to increase the energy concentration of the diet through the inclusion of amylaceous energy sources, fermentable or not in the rumen, or rumen undegradable protein, or both.

When analyzing the retrospective feeding balance of the animals from the control group, it was observed that the ME and CP requirements were covered for a gain of 0,846 kg/animal/day. The main limitation to obtain higher gains was the energy contribution of the ration; in spite of the adequate pasture offer in quantity and quality, it was not possible to cover higher nutritional requirements, because for such purpose supplementation with an energy concentrate feedstuff is needed (table 4).

In the feeding balance of the bulls that received the supplement, it was observed that the ME and CP requirements for a mean daily gain of 1 kg/animal/day were covered. The animals received a concentrate feed that contributed to this result; however, when using supplementation the feeding costs during fattening are increased, hence it is necessary to evaluate in future research whether the gain equates the expenses incurred for the utilization of this supplement.

In both groups intakes of 11-12 kg DM were estimated due to the high availability of the Guinea grass, which allowed an offer of 55 kg DM/animal/day with 50 % utilization, taking into consideration the season and the characteristics of the pasture. Hence the DM intakes estimated in the balance can be made. In addition, there was a CP excess, which was more marked in the group that received the supplement, because it contributes ME but also CP, aspect that should be considered in other studies.

It is valid to specify that in the floristic composition of the pastureland there was 80 % of Guinea grass (López-Vigoa *et al*., 2015), species that has high percentage of leaves over 20 cm of height, which facilitates the selection of the animals; this, along with the high dry matter offer, guaranteed this productive response of the bulls during finishing in both treatments.

It is concluded that the supplementation with the preparation of corn and wheat bran enriched with torula yeast positively influenced the mean daily gain of bulls during finishing under silvopastoral system conditions.

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Table 4. Retrospective feeding balance.

Feedstuff	DM intake (kg)	ME (MJ/kg DM)	CP (g)
Control[1]			
Guinea grass	11,2	103,3	1 339,2
Total contribution	11,2	103,3	1 339,2
Requirement		98,7	853,1
Difference		4,6	486,1
Supplement[2]			
Guinea grass	11,8	108,4	1 413,6
Protein-energy concentrate feed	0,87	10,5	235,8
Total contribution	12,7	118,9	1 649,4
Requirement		118,4	913,2
Difference		0,5	736,1

[1]live weight: 421 and 0,800 kg/animal/day; [2]live weight: 440 and 1,000 kg/animal/day.

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