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Growth performance, body composition, carcass traits and meat quality of young Nellore bulls fed freshly cut or ensiled sugar cane

Cláudio Teixeira Lombardi[a], Carlos Augusto de Alencar Fontes[a], Tiago Cunha Rocha[b,*], Elizabeth Fonsêca Processi[a], Laila Cecília Ramos Bendia[a], Clóvis Carlos Silveira Filho[a], Ronaldo Lopes Oliveira[b], Leilson Rocha Bezerra[c]

[a] State University of North Fluminense Darcy Ribeiro, Campos dos Goytacazes, 28013602, Rio de Janeiro, Brazil
[b] Federal University of Bahia, Department of Animal Science, Av. Adhemar de Barros, 500, Ondina, 40170110, Salvador, Bahia, Brazil
[c] Federal University of Piauí, Campus Professora Cinobelina Elvas, Department of Animal Science, Rodovia Bom Jesus-Viana, km 135, Bom Jesus, Piauí, Brazil

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ABSTRACT

The objective of this study was to compare the effects of diets with two levels (20 and 50% dry matter (DM) basis) of sugar cane (*Saccharum officcinarum*), either chopped fresh or ensiled with calcium oxide (CaO) and *Lactobacillus buchneri* as additives, in combination with two concentrate levels (80 and 50% DM basis) on the animal performance, body composition and gains, carcass characteristics and meat quality of young Nellore bulls. Treatments were arranged in a 2 × 2 factorial design: 50% freshly cut sugar cane +50% concentrate, 20% freshly cut sugar cane +80% concentrate, 50% sugar cane silage +50% concentrate and 20% sugar cane silage +80% concentrate. Twenty-nine Nellore bulls (300 ± 4.8 kg BW) were used; five bulls were slaughtered at the beginning of the experiment and used as reference animals. Bulls remained in the feedlots for 84 days after an adaptation period of 25 days. The interaction of roughage and concentrate was significant for dry matter intake, daily gain of body weight fasting, daily gain of empty carcass weight, daily gain of carcass, slaughter weight and weight of carcass. Dry matter intake was greater in bulls receiving freshly cut sugar cane. Daily gain of carcass, slaughter weight and carcass weight were lower in bulls fed 50% sugar cane silage +50% concentrate. There were no differences in carcass yield ($P = 0.4027$) and loin eye area ($P = 0.1005$) among the treatments. Backfat thickness was greater ($P = 0.0406$) with 80% concentrate. The interaction of concentrate level and roughage type was significant for daily gain of fat and energy, with lower values for bulls fed 50% sugar cane silage +50% concentrate. Thawing ($P = 0.0149$), cooking ($P = 0.0352$) and total losses ($P = 0.0059$) were greater in diets that contained sugar cane silage. There was an increase in shear force ($P = 0.0103$) and a decrease in sarcomere length ($P = 0.0061$) in bulls fed sugar cane silage, although they remained within the limits that characterized the flesh as soft. Diet was not found to affect the myofibrillar fragmentation index, color index (L*, a* and b*) or the amount of collagen (total and soluble) in beef. Ensiled sugar cane combined with 50% concentrate in bulls fattening in feedlots yielded lower animal performance than 80% concentrate and diets containing freshly chopped sugar cane with 50 and 80% concentrate levels.

* Corresponding author.
E-mail addresses: tiagoticuro@yahoo.com.br, tiagocunroc@gmail.com (T.C. Rocha).

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1. Introduction

Sugar cane is important because of its large cultivated area and its expansion in many parts of the world. Sugarcane is used as supplemental forage during the dry season due to its favorable characteristics compared to other forage, including its high productivity of green mass (80–120 t/ha), low cost per unit of dry matter (DM), preserved nutritional value at physiological maturity, high availability of DM and sugars with high potential for energy use in animal feed (Silva et al., 2015; Souza et al., 2015).

In situations such as feedlots, the practice of cutting sugarcane daily becomes unviable. Ensiling sugarcane is an interesting alternative to optimize daily work and to minimize such problems, allowing the harvesting of large areas in a short time and at the time at which it has its best nutritional value. However, the production of sugarcane silage has been linked to high losses of dry matter (DM) resulting from intense alcoholic fermentation when the forage is ensiled without additives. Because of this undesirable fermentation, sugarcane silage presents low nutritional values.

Additives have been recommended during ensiling to minimize alcoholic fermentation. Furthermore, chemical treatment with calcium oxide (CaO) may improve the nutritional value of forage by reducing fiber content and increasing digestibility as the addition of alkaline additives is related to the action of alkaline hydrolysis (Romão et al., 2013; Chizzotti et al., 2015; Martins et al., 2015). In this context, feeding cattle in feedlots with freshly cut or ensiled sugar cane may be feasible, especially in sugar cane producing regions.

Thus, it was hypothesized that Nellore bulls fed with sugar cane preserved as silage with added CaO and *Lactobacillus buchneri* along with a higher concentrate level (50% DM) could increase performance, carcass characteristics and meat quality compared to chopped fresh sugar cane.

This study aimed to compare the effects of diets with two levels (20 and 50% DM basis) of sugar cane (*Saccharum officcinarum*) that was either chopped fresh or ensiled with calcium oxide (CaO) and *Lactobacillus buchneri* as additives in combination with two concentrate levels (80 and 50% DM basis) on the animal performance, body composition and gains, carcass characteristics and meat quality of young Nellore bulls.

2. Materials and methods

2.1. Ethical considerations

This study was performed in strict accordance with the recommendations found in the Guide for the National Council for Animal Experiments Control and was approved by the Ethics Committee of Animal Experiments of State University of North Fluminense, Rio de Janeiro State, Brazil (Permit Number: 168-2012).

2.2. Animals, diets and experimental treatments

Twenty-nine young Nellore cattle, not castrated, with an average weight of 300 ± 4.8 kg and an average age of 16 months were used. Bulls were allocated into individual 10.2 m^2 (1.7 × 6.0 m) pens with cement feeders and automatic water troughs for 84 d, preceded by a 25 d period of adaptation. During the adaptation period, 29 animals were weighed, treated for internal and external parasites (Ivomec Gold, Merial Brazil) and administered subcutaneous vitamin A (1,500,000 IU per animal). After the adaptation period, five representative Nellore bulls were randomly selected from this group and slaughtered to enable estimation of the empty body weight and initial body composition of each animal.

Treatments were a combination of two roughage sources (freshly cut sugar cane and sugar cane silage with added CaO and *Lactobacillus buchneri*) and two levels of concentrate inclusion in a 2 × 2 factorial arrangement (all values DM): 50% freshly cut sugar cane +50% concentrate, 20% freshly cut sugar cane +80% concentrate, 50% sugar cane silage +50% concentrate and 20% of sugar cane silage +80% concentrate.

Ensiling of sugarcane was performed in combination with 1.6% DM calcium oxide and 30,000 CFU/g DM *Lactobacillus buchneri* to stabilize the fermentation process (Chizzoti et al., 2015). The chemical additive (CaO) was applied in its commercial form (a micro-powder), and the organic additive *Lactobacillus buchneri* was applied using a hand sprayer. The silo was opened at 60 days. The sugar cane variety used was RB855536. Sugar cane was freshly cut (at 15 months) from the same location and was kept in bundles and stored in the shade in well-ventilated areas. Sugar cane was cut and chopped daily to feed the animals. For silage preparation, sugar cane was immediately chopped to 1- to 2-cm and was ensiled in trench silos close to the containment facilities.

The concentrate used was composed of ground corn, soybean meal, sodium bicarbonate, urea and a commercial mixed mineral supplement formulated based on the composition of DM to meet the requirements of bulls according to the NRC (2000) for the maintenance and weight gain of 1.2 kg and 1.4 kg/d when included at levels of 50% and 80%, respectively (Table 1). Nellore bulls received TMR diets of their respective treatments (to ensure refusals of 10%) once per day at 9:00 h, and intake was measured daily. Before each weighing, the bulls were fasted for 16 h (Table 2).