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# Live Yeast Supplementation for Heifers (F1 Angus × Nellore) in Intensive Grazing Finishing System

Research Article

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## ABSTRACT

The objective of the experiment was to evaluate the weight gain, digestibility and carcass quality characteristics of heifers supplemented with live yeast, in an intensive finishing system on grassland. The work carried out at a commercial farm, lasted 60 days. Sixty-two crossbred heifers (F1 Nellore×Angus): 13 ± 1.5 months, body weight of 404.85 ± 18.77 kg was allocated to two dietary treatments on bread grass (*Brachiaria brizantha*) *cv.* Marandu grassland. The dietary treatments were: control diet (CON) without the inclusion of live yeast and a diet supplemented with live yeast (LY) at the level of 15 g/day. The diets were formulated and adjusted according to daily weight gain for beef cattle, with an intake of 1.2% body weight. The protein values of the grassland areas grazed by the C and LY heifers were observed as 5.08% and 6.75%, respectively. The LY heifers consumed less diet (4.46 *vs.* 5.31 kg) and had a higher performance (438.5 *vs.* 431.2 kg) compared to the C heifers. Also, the studied carcass parameters, the digestibility of dietary starch and providing improvement in rumen health in the LY treatment were higher than those in the CON treatment. In conclusion, the dietary LY enhanced growth performance and carcass traits of crossbred (Nellore/Angus) heifers, which are likely linked with improvement in the rumen health and the starch digestibility of the diet in an intensive finishing system on grassland.

KEY WORDS antibiotics free, carcass attributes, clean production, performance, prebiotic.

## INTRODUCTION

The literature is well aware of the harm that the dry season does to the grassland system (Gomide *et al.* 2009). Periods of plenty and shortage can be seen in these places due to factors including the seasonal production of fodder plants, which causes a significant shift in carrying capacity (Fernandes *et al.* 2017). Tropical grasses have little nutritional value during the dry season, and much of the time, their CP levels fall below the minimum value of 7% that Van Soest (1994) determined was necessary for cellulolytic bacteria to develop properly. As a crucial tool to correct or alleviate potential nutritional deficiencies that may interfere with the performance of animals in grazing, whether quantitatively or qualitatively, the use of concentrated supplements in a grazing system can provide an increase in animal performance while increasing stocking, allowing an increase in the productivity of the system (Barbero *et al.* 2021). An intensive finishing system on grassland is an excellent method for managing between extensive and intense systems because of how it is supplemented and managed (Fernandes *et al.* 2017).

In contrast to confinement, where the animals are totally confined and dependent on forage, intense finishing on grassland introduces beef cattle with the goal of maximizing the animals' weight gain and a suggestion of lower costs by integrating the entire production system. Large-scale grassland offerings replace the forage provided in traditional confinement in the semi-confinement method (Pinto *et al.* 2017). Supplementation tactics are regarded as a vital zootechnical practice due to the quick weight gain, shorter production cycles, earlier slaughter, and improvements in meat quality.

Through the manipulation of ruminal fermentation patterns, generation of changes in the composition of microorganisms, improvement of the synthesis of products from digestion in the rumen, reduction of energy losses, and reduction of harmful gases, the use of additives in animal feed makes it possible to potentiate gains in productive performance (Oliveira *et al.* 2019). Animal performance can be improved by using additives in food by improving energy metabolism efficiency and reducing energy lost during food fermentation (Soares *et al.* 2015).

Like bacteria and fungi, yeasts are microorganisms that have been employed in human and animal nutrition. These single-celled organisms are the first sources of unicellular proteins used by humans in natural goods including meals, drinks, and fermented foods (Costa, 2004).

Live yeast supplementation in ruminant diets seeks to help keep ruminal parameters under control at levels that are good for maintaining a healthy rumen environment, enhancing the animal's nutritional intake and availability and resulting in higher productivity. However, it is still unclear how yeast affects ruminal fermentation and animal performance as well as how it works (Noschang *et al.* 2019). Live yeast is crucial because it increases bacterial viability and rumen fermentation while also removing oxygen from the rumen environment. According to Newbold *et al.* (1996), adding *Saccharomyces cerevisiae* cultures to the diet increases the number of bacteria in the rumen and improves ruminal fermentation. This is because yeasts are active in preventing anaerobic bacteria from being damaged by oxygen through the oxidation of the rumen's glucose through aerobic respiration, which removes the oxygen that is currently present in the medium.

The present trial aimed to evaluate the use of live yeast (LY, Levumilk® Kera Animal Nutrition) in diets of crossbred heifers submitted to intensive finishing on grassland.

## MATERIALS AND METHODS

The experiment was carried out at the commercial farm, located in the municipality of Eldorado, in Mato Grosso do Sul, in partnership with the Faculty of Agricultural Sciences of the Federal University of Grande Dourados (FCA-UFGD), in Dourados/MS, the experiment took place in the period from April to June 2019, with a duration of 60 days.

### Animals, grassland and treatments

Sixty-two crossbred heifers (F1 Nelores×Angus) were used, aged 13 ± 1.5 months, with an average weight of 404.85 ± 18.77 kg of body weight.

The grassland area consisted of *Brachiaria brizantha cv. Marandu*, closed for 45 days before the beginning of the experiment, the animals were rotated according to the availability of the property, and the feed was placed in troughs separated by treatment, consisting of 30x84cm plastic material, and arranged in a line of 8.40m and water supply *ad libitum*. The experimental treatments were: Control (CON: without the inclusion of yeast in the semi-confinement); LY (15 g/day live yeast addition of Levumilk® Kera Nutrição Animal); the supplement was formulated and adjusted according to weight gain, according to the NRC (2016) for beef cattle (Table 1), with an intake of 1.2% body weight.

**Table 1** Composition and characteristics of the supplement offered to heifers

| Ingredients | (%) |
|---|---|
| Cornmeal | 69.00 |
| Soybean meal | 25.00 |
| Urea | 1.00 |
| Mineral mix[1] | 5.00 |
| **Nutrient composition (% of DM)** | |
| Drymatter | 86.62 |
| Organicmatter | 89.15 |
| Crudeprotein | 19.60 |
| Ether extract | 3.50 |
| Ash | 10.85 |
| Starch | 47.85 |
| Neutral detergent fiber | 16.54 |
| Acid detergent fiber | 12.45 |
| Non-fiber carbohidrate | 49.51 |
| Total digestible nutrients[2] | 71.68 |
| Net energy to gain (Mcal/kg)[3] | 1.64 |

[1] Levels (kg/product): Calcium: 120 g; Phosphor: 88 g; Iodine: 75 mg; Manganese: 1300 mg; Sodium: 126 g; Selenium: 15 mg; Sulfur: 12 mg; Zinc: 3630 mg; Cobalt: 55.50 mg; Copper: 1530 mg and Iron: 1800 mg.
[2, 3] Calculated accordingwith (NRC, 2016).

### Sample collection and chemical composition

Grassland collections were carried out at the entrance and exit of the animals in the paddock, at the cutting height of 5 cm, by the square method of 0.25 m² and were used to calculate the availability of grassland dry matter (kg/ha) according to com (Table 2 and Figure 1).

Samples of forage were collected daily during the sampling period and pooled per period for further analyses. Samples were analyzed for DM (method 950.15), ash (method 942.05), OM (DM − ash), crude protein (N×6.25; method 984.13), and ether extract (method 920.39) according to AOAC (2000). Samples were also assessed for neutral detergent fiber (NDF) and acid detergent fiber (ADF) according to Van Soest (1994). Dietary contents of total digestible nutrients and net energy were calculated according to NRC (2016).

### Fecal starch

Feces were collected on D0 and D60, collected directly from the animal's rectum to avoid contamination by soil residues Samples were analyzed for DM (method 950.15) and fecal starch according to the methodology described by Hendrix (1993) to measure starch digestibility in the diet. Starch digestible was calculated according (Zinn, 2007).

### Weighing and ultrasound

The animals were weighed on an electronic balance attached to the trunk at the beginning of the experimental period and posteriorly at 30-day intervals. Before weighing, the animals were fasted for approximately 12 hours. Carcass ultrasound was performed on all animals at average weight on the $30^{th}$ experimental day using soybean oil to improve device coupling thus, the transducer was positioned between the $12^{th}$ and $13^{th}$ ribs on the *Longissimus muscle* and thus, taken the ultrasound image to obtain rib eye area (AOL) and subcutaneous fat thickness (ECG). The ultrasound equipment used was the Aloka SSD 500 with an 18 cm 3.5 MHz transducer and an acoustic guide.

### Statistical analysis

The data were submitted to SAS (Version 9.1.3. SAS Institute. Cary. NC 2004) verifying the normality of the residues and the homogeneity of the variances by PROC UNIVARIATE. Then, these data were submitted for analysis of variance with repeated measures in time using the SAS command PROC MIXED version 9.4 (SAS. 2004) adopting a significance level of 5%.

## RESULTS AND DISCUSSION

Lower dry matter content and higher crude protein (P≤0.024) content were observed for total grassland in the paddocks where heifers were supplemented with YEAST in relation to CON. However, higher dry matter content was observed for the leaves (P=0.018) and stems (P=0.026) of the grassland for YEAST in relation to CON (Table 2).

The LY heifers showed (P=0.001) lower concentrate intake compared to the C animals. The animals supplemented with YEAST presented concentrate intake 16.00% lower than the heifers on the CON diet. Heifers supplemented with YEAST showed higher average weight (P=0.050), final weight (P=0.032) and daily weight gain (P=0.001) in relation to animals not supplemented (Figure 2 and Table 3).

The heifers supplemented with LY presented 7.3 kg higher final weight in relation to the non-supplemented animals. Additionally, animals supplemented with live yeast showed 23.65% higher daily weight gain compared to CON.

Heifers supplemented with LY showed higher total starch digestibility compared (P=0.044) to non-supplemented animals. There was a 4-percentage point increase in total starch digestibility for animals supplemented with LY between the beginning and end of the trial (Figure 3). Additionally, heifers supplemented with LY showed 5% more starch digestibility when compared to animals not supplemented.

Heifers supplemented with LY had greater loin eye area ($cm^2$ e $cm^2$/ 100kg) (P=0.003) and subcutaneous fat thickness (mm/100 kg) P=0.018) compared to non-supplemented animals. For loin eye area the superiority was 7.21% and for subcutaneous fat thickness it was 12.21% higher compared to CON.

Grassland CP levels were less than what was predicted. As seen in table 2, 7.0% corresponds to a microorganism's ideal mode of activity. This, according to Barbosa *et al.* (2007)'s findings, which were similarly carried out in a transition period and employing *Brachiari abrizantha cv.* Piatã can be explained by the lack of rain in the transition period and the nutritional deficits in this time. In May, Marandu had values of 8%. However, the average was around 6.80% in general. Similar levels of NDF content were reported in *Brachiaria brizantha cv.* Piatã at a time of transition to water by Lima *et al.* (2012), as well as the values of NDF content discovered in the grassland, which were 70.51% and 68.89 from the CON and LY treatments, respectively. With the lack of rain, the forage physiological system is affected, grasslands in this period tend to have a high fiber content, a consequence of the accumulation of dry material caused by senescence and/or low regrowth, hence the need to use supplementation strategies.

Table 3 shows that the animals in the group that included live yeast (LY) consumed less concentrate than the animals in the control group (CON). The effectiveness with which beef cattle turn feed into carcasses is the true test of their performance. However, one can see that there was no appreciable difference between the treatments (Neumann *et al.* 2016). Despite the fact that consumption does not differ statistically. Even with less supplement intake, the LY group still shown a favorable outcome not hurting performance negatively.

**Table 2** Chemical composition of forage according to experimental supplements

| Item | Experimental supplement | | SEM | P-value | | |
|---|---|---|---|---|---|---|
| | CON | LY | | SUP | TIME | INT |
| **Whole plant (% fresh matter)** | | | | | | |
| Dry matter | 42.96 | 35.32 | 1.969 | 0.024 | 0.004 | 0.616 |
| Crude protein | 5.08 | 6.75 | 0.320 | 0.036 | 0.002 | 0.056 |
| Neutral detergent fiber | 70.51 | 68.89 | 0.774 | 0.094 | 0.001 | 0.002 |
| Total digestible nutrients | 54.37 | 55.05 | 0.322 | 0.094 | 0.001 | 0.002 |
| **Leaf (% fresh matter)** | | | | | | |
| Dry matter | 18.47 | 25.59 | 1.526 | 0.018 | 0.001 | 0.228 |
| Crude protein | 7.75 | 7.90 | 0.511 | 0.863 | 0.014 | 0.206 |
| Neutral detergent fiber | 60.92 | 63.46 | 1.429 | 0.207 | 0.001 | 0.088 |
| Total digestible nutrients | 58.37 | 57.31 | 0.596 | 0.207 | 0.001 | 0.088 |
| **Stems (% fresh matter)** | | | | | | |
| Dry matter | 22.74 | 27.12 | 1.192 | 0.026 | 0.001 | 0.451 |
| Crude protein | 7.56 | 7.31 | 0.402 | 0.734 | 0.066 | 0.129 |
| Neutral detergent fiber | 70.01 | 66.51 | 0.870 | 0.036 | 0.360 | 0.089 |
| Total digestible nutrients | 54.58 | 56.04 | 0.363 | 0.036 | 0.360 | 0.089 |
| **Senescent material (% fresh matter)** | | | | | | |
| Dry matter | 56.13 | 54.57 | 2.591 | 0.734 | 0.004 | 0.549 |
| Crude protein | 5.79 | 6.19 | 0.446 | 0.674 | 0.642 | 0.549 |
| Neutral detergent fiber | 72.39 | 72.98 | 0.538 | 0.488 | 0.017 | 0.003 |
| Total digestible nutrients | 53.59 | 53.34 | 0.224 | 0.488 | 0.017 | 0.003 |

CON: without additive and LY: addition of live yeast 15 g/day of Levumilk® Kera Animal Nutrition.
SUP: effect of supplement and INT: effect of supplement × time interaction.
SEM: standard error of the means.

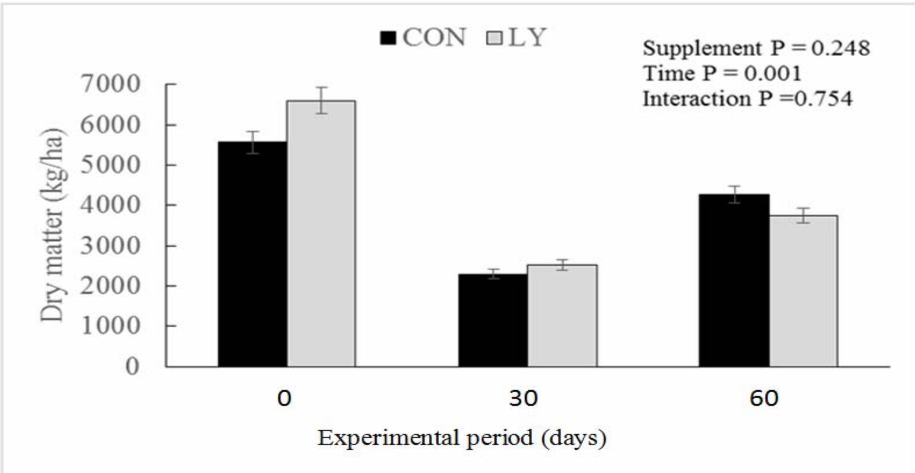


**Figure 1** Availability (kg/ha) of forage according to experimental treatments throughout the experimental period

For grazing finishing steers the use of live yeast in large amounts of concentrate with high starch and energy levels as in this trial to alter rumen fermentation to improve nutrient digestion, N utilization, reduce the risk of rumen acidosis and improve animal performance.

Fereli *et al*. (2010) working with Holstein males castrated and in individual basis, attempted to investigate the effects of the ionophore (sodic monensin) and prebiotic (*Saccharomyces cerevisiae*) on production parameters observed that while using in diets with a high concentration of calories associated with the melodic monensin or prebiotic increases the ruminal digestion of cell phone screen carbohydrates compared to using only one ionophore, which may have an impact on weight gain.

In line with Gattass *et al*. (2008) feeding crossbred cattle (half Red Angus, half Nellore) meals made out of 50% DM-based concentrate. Intake and apparent nutritional digestibility were unaffected by yeast supplementation (1 g/100 kg/BW). But it draws attention to the lack of reaction that can be caused by the quantity of yeast used and the kind of diet. Gains were 27.6 kg and 32.4 kg, respectively, for the CON and LY groups.

**Table 3** Performance and carcass ultrasound of the experimental groups

| Item | Experimental supplements | | SEM | P-value |
|---|---|---|---|---|
| | CON | LY | | |
| Supplement intake (kg/day) | 5.31 | 4.46 | 0.541 | 0.001 |
| Initial weight (kg) | 403.60 | 406.10 | 2.346 | - |
| Average weight (kg) | 416.47 | 425.59 | 2.388 | 0.050 |
| Final weight (kg) | 431.20 | 438.50 | 2.534 | 0.032 |
| Daily gain (kg/day) | 0.465 | 0.575 | 0.017 | 0.001 |
| Starch digestible (%) | 93.21 | 97.85 | 0.753 | 0.044 |
| **Carcass ultrasound** | | | | |
| Loin eye area ($cm^2$) | 47.20 | 50.56 | 0.579 | 0.003 |
| Loin eye area $cm^2$/100 kg | 11.37 | 11.89 | 0.157 | 0.044 |
| Subcutaneous fat thickness (mm) | 4.93 | 5.53 | 0.127 | 0.018 |
| Subcutaneous fat thickness mm/100 kg | 1.18 | 1.30 | 0.030 | 0.033 |

CON: without additive and LY: addition of live yeast 15 g/day of Levumilk® Kera Animal Nutrition.
SEM: standard error of the means.

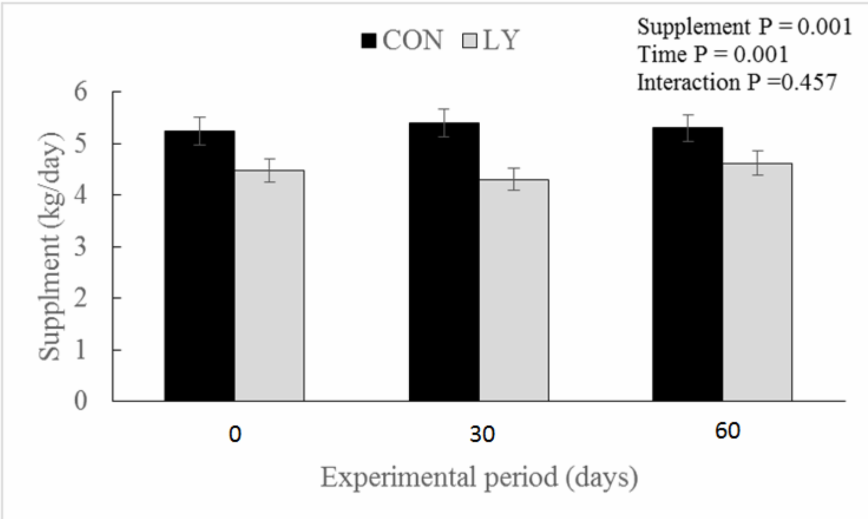


**Figure 2** Supplement intake according to experimental treatments throughout the experimental period

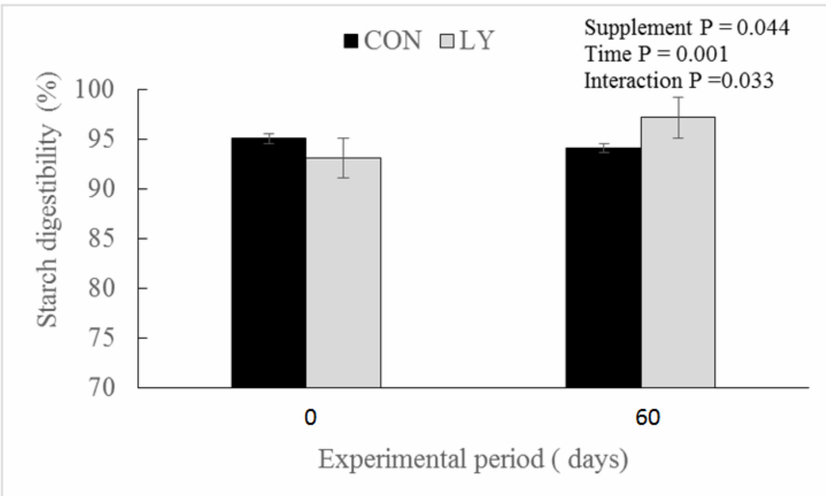


**Figure 3** total starch digestibilities (%) according to experimental treatments throughout the experimental period

Heifers in the LY group had an ADG differential of 0.110 g/day higher. This result results from improved starch utilization. Fecal starch analysis can provide information that can be used to determine the total amount of food that can be digested, according to Zinn (2007). In the current study, the LY group had a reduced concentration of fecal starch demonstrating improved utilization of nutrients and dietary components. The outcome was the inclusion of live *Saccharomyces cerevisiae* yeasts at a rate of 8 g/animal/day even on diets that contain a lot of roughage. Beef steers completed in confinement showed improvements in daily weight gain and feed conversion (Neumann *et al*. 2013), but the carcass attributes.

Steers from the Canchim and Brangus breeds retained their original meat quality and carcass yield components. The findings indicated the effectiveness of yeast in rumen pH stabilization by encouraging ciliated protozoa that can swiftly digest starch granules and consume lactate battling with amylolytic bacteria for this substrate (Noschang *et al*. 2019).

Starch made up 47.85% of the supplement (Table 1). Therefore, the addition of yeast allowed for greater use of this ingredient and favored the therapeutic benefits for the animals. When we compare the starch digestibility value (%) shown in table 3, where a difference of 4.64% across treatments is found, this fact may be demonstrated. According to research by Neumann *et al*. (2015), Holstein feed lot steers were fed 3 g/animal/day of the probiotic *Saccharomyces cerevisiae* strain NCYC 996 ($1\times10^{10}$ UFCg$^{-1}$). through the average daily increase, which supports the additive's ability to positively improve performance not just in animals of specific breed used for cutting.

Loin-eye area (LEA) characteristics are linked to carcass muscularity, while subcutaneous fat thickness (SFT) indicates precocity in carcass finishing.

The study's results indicate a little variation between the LEA values. This can be accounted for by the animals treated with yeast gaining weight more effectively. The greater total weight increases of the animals during the finishing period as well as the greater intake of nutrients may have had an impact on the bigger loin eye regions obtained from the animals fed with the greatest amount of supplementation enhancing the substrate availability to promote larger muscle growth (Bento *et al*. 2019).

The improvement of the digestion of neutral detergent fiber for heifers supplemented with LY provides higher concentrations of acetate and butyrate that have the capacity to modulate the lipid metabolism of ruminants, mainly in finishing systems where they can increase Se bioavailability in the muscles, leading to lower oxidation of intramuscular fat and protein, contributing to better meat tenderness, as well as improved organoleptic parameters in the meat, directly related to its appearance and the customer's purchasing decision.

Values for fat thickness in the yeast-supplemented group were greater. The STF values in the standard demanded by the livestock slaughter system are 4 to 6 mm, though, thus it is important to note hence, there are no cooling losses, this manner the quantity of fat the animals in this experiment produced was within what was needed by the meatpacking industry (Bento *et al*. 2019).

## CONCLUSION

LY supplementation for heifers (F1 Angus×Nellore) positively influenced the performance and carcass attributes of the animals. The use of high doses of live yeast in diets with high starch inclusion has great potential for use in grazing cattle finishing systems and more work must be done to contribute and prove this grazing production system.

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