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Fiber bioavailability in four grazing grasses at different regrowth ages under complementary fertilization with zinc metallosite

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Abstract: The present investigation was carried out in the Laica University "Eloy Alfaro" of Manabí, El Carmen, Province of Manabí - Ecuador, in the premises of La Granja Experimental Río Suma, in Km 30 of the road Santo Domingo El Carmen. The goal was the in vivo digestibility of four grazing grasses (Panicum maximum cv. Tanzania, Panicum maximum cv. Mombaza, Brachiaria Brizantha cv. Xaraes, Brachiaria Brizantha cv. Marandú) under foliar fertilization with zinc metallosite. A 4 x 4 Square Latin design was used. A total of 4 rows (regrowth ages), 4 columns (sheep) and 4 treatments (grazing grass varieties) were used. The factors under study were cut or regrowth age (20, 25, 30 and 35 days) and grazing grass varieties under foliar fertilization with 2 lts ha^{-1} of zinc metallosite (Tanzania, Mombaza, Xaráes and Marandú) and the variable under study were: fiber content and fiber bioavailability (Digestibility of fiber in vivo). The digestibility of the fiber in grazing grasses under complementary fertilization with 2 liters ha^{-1} of zinc metallosite showed positive effects, highlighting the Xaraes, Marandú and Mombaza varieties. Cutting age did not infer the fiber digestibility of grazing grasses.

Keywords:fiber, bioavailability, grasses.

Introduction

Throughout the year, tropical grasses present variations in their nutritive value, decreasing their quality especially in the dry season, producing a deficient animal biological response and as a consequence the presence of deficient productive and reproductive systems (Garmendia, 1998). Digestibility is found mainly in order to make comparisons of foods, diets or ingredients that are part of them (Duarte, 2011), the determination is made through different methods, one of them is the total collection of ingested food and the excreta. Among the indirect techniques is the relationship between the chemical composition of forage and digestibility (Flores, 2003).

The digestibility, yield, and forage structure of the pasture offered to the animal are likely to exert significant effects on the rate of metabolizable energy intake (Holmes, 2004).

Chelates today attract a lot of attention because they are an excellent alternative to add metals in an edaphic and foliar way to plants. They can be applied with the following considerations in mind: 1) increase the solubilization of zinc (Zn), 2) transport it to the root and / or leaf of the plant; 3) once there, yield the metal (Zn), and, 4) the organic part of the chelate must re-solubilize more metal (Zn) (Nowack, 2002).

The use of zinc metallosite positively inferred in agronomic variables such as leaf weight (5.4 g), stem weight (4.76 g), leaf length (55.39 cm), biomass (3369.76 MS kg ha-1) and material dry (30.03%), increasing its content until when 2 L ha-1 of zinc metallosite was added at 28 and 42 days of harvest (Nivela et al., 2017).

The use of zinc metallosite highlighted the 2 lts ha-1 level in bioavailability of the inorganic matter of the mombaza grass at all times of ruminal incubation. (Nivela et al., 2018 b)

The digestibility of the protein in grazing grasses under complementary fertilization with 2 liters ha^{-1} of zinc metallosite showed positive effects, highlighting the Xaraes, Marandú and Mombaza varieties. (Nivela et al., 2018 a)

According to Mufarrage (2000) indicates that zinc deficiencies in diets are associated in all animal species with a severe lack of appetite, lack of growth and impairment of reproductive function, especially in the male. The enzymatic processes in which Zn intervenes, have their main action in tissues of high speed of cell formation, hence their deficiency damages the growth of calves, decreases the production of sperm in rams and bulls and favors diseases of the skin.

Materials and Methods

Study site

This investigation was framed in the Cattle Program of the Cattle Line, it was executed in the Experimental Farm Rio Suma of the Agricultural Engineering Career of the Laica Eloy Alfaro de Manabí University, in the Carmen, Province of Manabí, located in the Km 30 of the road Santo Domingo- Chone, right margin.

Experimental design

A 4 x 4 square Latin design was used, arranged as a row effect (4 Ages), column effect (4 meat sheep) and treatments effect (4 Varieties of grasses with zinc fertilization). The average treatments will be analyzed using the Tukey test at 5%. For the processing of the information, the INFOSTAT statistical software version 2008 was used (Di Rienzo *et al.*, 2008).

Treatments correspond to grassland varieties, Tanzania Mombaza, Marandú, and Xaraes. Row effect at cutting ages (20, 25, 30 and 35 days). Column effect on sheep 1, 2, 3,4.

Table 1. Description treatments used for in situ digestibility.

	Columns effect (Semovientes)			
Rows effect (Cutting ages)	Sheep 1	Sheep 2	Sheep 3	Sheep 4
20 days	Mombaza	Tanzania	Marandú	Xaraes
25 days	Tanzania	Marandú	Xaraes	Mombaza
30 days	Marandú	Xaraes	Mombaza	Tanzania
35 days	Xaraes	Mombaza	Tanzania	Marandú

Factors under study

Cutting or regrowth ages
Varieties of grass grazing.

Variables in study

Fiber bioavailability (In vivo digestibility of fiber).

Experiment management

In the area where the experiment was carried out, an equalization cut was made both of the plot and the edge effect, with a respective weed cleaning on the first day, after this work the cuts were started according to the phenology established for each plot. After the equalization cut, fertilization was carried out with zinc metallosite at leaf level, with two applications, each at a dose of 2 liters ha^{-1}. The sample was taken according to the established schedule, the cuts were made for each plot in different pastures, cutting the grass of each plot, performing the same procedure to the experimental units that were programmed. After having cut the grass, it was introduced in a plastic sleeve previously identified to be weighed the respective coding and recorded their data, they were supplied to the sheep to measure their digestibility. The faeces were collected and they were introduced in a plastic sleeve in different treatments and proceeded to refrigeration until obtaining a sample of 200 grams. Four metabolic cages made of wood with dimensions of 45cm * 130 cm were built. The supply was

1500 gr of food per day of each corresponding variety, 2000 ml of water was also supplied, daily cleaning was carried out. Sampling for the digestibility analysis was carried out after adapting the seeds to the three days and then proceeded to evaluate for two days, taking a sample of 200 grams each day at the end the two samples were mixed and a sub sample of 200 grams that were sent to the laboratory for the respective proximal analysis.

Results and Discussion

In vivo digestibility of fiber (Fiber bioavailability)

Variety of grass effect

The effect of the variety of grasses on grazing on the digestibility of the variable fiber showed a statistical difference ($p < 0.05$), obtaining the highest result Marandú and Tanzania varieties with 79.87 and 79.68%, respectively., being statistically like the Xaraes variety, coinciding these results with what Pinargote (2017) achieved, which achieved the same average fiber digestibility.

Table 2. Percentage of fiber digestibility of four grass varieties.

Varieties of grasses	**Fiber digestibility (%)**
Mombaza	70,74 b
Xaraes	76,13 ab
Tanzania	79,68 a
Marandú	79,87 a
Average	**76,61**
CV (%)	**4,28**

Different letters indicate statistical differences ($p < 0.05$)

Cutting age effect

The digestibility of the fiber material did not show statistical differences ($p > 0.05$).

Table 2. Percentage of fiber digestibility according to cut age or regrowth.

Cutting ages	**Fiber digestibility (%)**
20	76,60 a
25	75,84 a
30	76,63 a
35	77,35 a
Average	**76,61**
CV (%)	**4,28**

Different letters indicate statistical differences ($p < 0.05$)

Conclusion

The digestibility of the fiber in grazing grasses under complementary fertilization with 2 liters ha^{-1} of zinc metallosite showed positive effects, highlighting the Marandú, Tanzania and Xaraes varieties.

Cutting age did not infer the fiber digestibility of grazing grasses.

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