ISSN 2359-6562 (ONLINE) 2359-6562 (CD-ROM)

# TEORES DE EXTRATO ETÉREO DE *Brachiaria brizantha* SOB ADUBAÇÃO DE CAMA DE FRANGO

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**RESUMO:** O objetivo deste estudo foi avaliar os efeitos de diferentes doses de cama de frango e da adubação mineral NPK nos teores de extrato etéreo de forragem das cvs. de *Brachiaria brizantha* Xaraés, BRS Paiaguás e Marandu, em um Latossolo Vermelho distroférrico de Cerrado. O estudo foi conduzido no Instituto Federal Goiano, Rio Verde - Goiás. O delineamento experimental foi o de blocos ao acaso, com 15 tratamentos e quatro repetições, em esquema fatorial 5 × 3. Os tratamentos foram cinco níveis de adubação orgânica ou mineral: Sem adubação (solo natural); 8 t $ha^{-1}$ de cama de frango; 16 t $ha^{-1}$ de cama de frango; e 24 t $ha^{-1}$ de cama de frango; e 250 kg $ha^{-1}$ do formulado NPK 08-28-16, e três cvs. de *Urochloa brizantha*: cv. Marandu, cv. BRS Paiaguás e cv. Xaraés. Os tratamentos foram avaliados no período das águas e da seca, em seis cortes consecutivos, aos 83, 111, 139, 167, 213 e 268 dias após a emergência das plantas, mediante o corte a altura de 0,20 m do solo. A cultivar BRS Paiaguás considerando todos os cortes, apresenta o máximo teor de extrato etéreo de 1,38%, na dose de aproximadamente 10 t $ha^{-1}$ de cama de frango.

**Palavras-chave:** Marandu, Paiaguás, Xaraés, forragem.

## ETHEREAL EXTRACT CONTENT OF *Brachiaria brizantha* UNDER CHICKEN MANURE FERTILIZATION

**ABSTRACT:** The aim of this study was to evaluate the effects of different doses of chicken manure and NPK mineral fertilizer on the ether extract contents of cvs. of *Brachiaria brizantha* Xaraés, BRS Paiaguás and Marandu, in a dystroferric Cerrado Red Latosol. The study was conducted at the Instituto Federal Goiano, Rio Verde - Goiás. The experimental design was randomized blocks, with 15 treatments and four replications, in a 5 × 3 factorial scheme. The treatments included five levels of organic or mineral fertilization: no fertilization (natural soil), 8 t $ha^{-1}$ of chicken manure, 16 t $ha^{-1}$ of chicken manure, 24 t $ha^{-1}$ of chicken manure, 250 kg $ha^{-1}$ of the formulated NPK 08-28-16, and three hp. from *Urochloa brizantha*: cv. Marandu, cv. BRS Paiaguás and cv. Xaraés. The treatments were evaluated during the rainy and dry periods in six consecutive cuts, at 83, 111, 139, 167, 213 and 268 days after plant emergence, by cutting at a height of 0.20 m from the ground. The cultivar BRS Paiaguás, considering all cuts, presented a maximum ether extract content of 1.38% at a dose of approximately 10 t $ha^{-1}$ of chicken manure.

**Keywords:** Marandu, Paiaguás, Xaraés, forage.

## 1. INTRODUCTION

Cattle farming has great relevance within the Brazilian socioeconomic environment, with a wide variety of breeds, production systems, productivity indices and sanitary conditions, according to the particularities and requirements of each region and the market for which production is intended (Cinquini Filho *et al.*, 2011).

In pasture management, forage yield must be reconciled with the nutritional value of the plant to obtain greater animal production per unit area. The nutritional value of forage

Recebido em 05/09/2023 e aprovado para publicação em 11/09/2023
DOI: http://dx.doi.org/10.17224/EnergAgric.2023v38n3p60-67

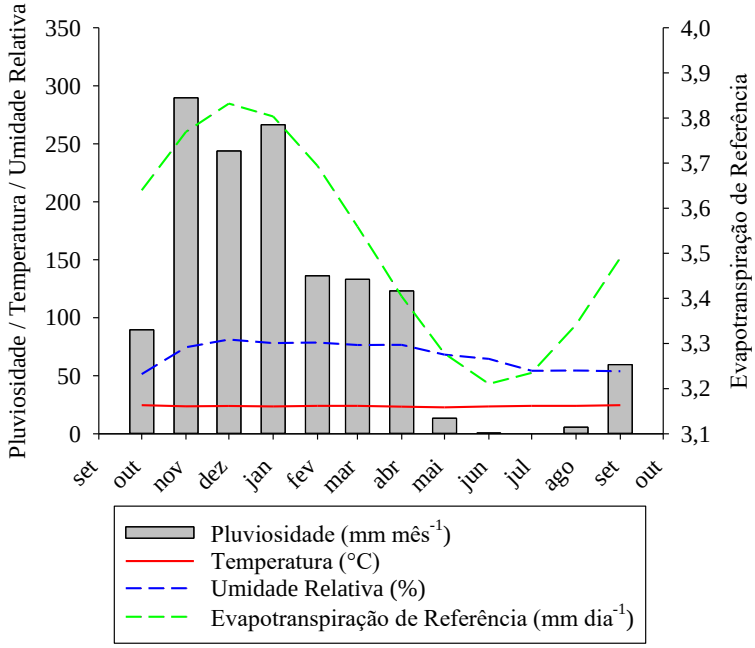
plants is affected by their physiological and structural development and can be assessed through their chemical composition and digestibility. Factors such as species, plant fraction, physiological age, soil fertility, climatic factors and management influence the nutritional value of the forage plant (Van Soest, 1994). By managing and using forage grasses according to their ecophysiology, forage mass production can be improved, ensuring their stability and persistence (Duarte *et al.*, 2019).

The objective of this study was to evaluate the effects of different doses of chicken litter and NPK mineral fertilizer on the forage ether extract contents of cvs. from *Brachiaria brizantha* Xaraés, BRS Paiaguás and Marandu in a distroferric Red Oxisol from the Cerrado.

## 2 MATERIALS AND METHODS

The experiment was conducted under field conditions in the experimental area of the Instituto Federal Goiano – Campus Rio Verde. The geographic coordinates of the installation site are 17°48'28" S and 50°53'57" W, with an average altitude of 720 m above sea level. The region's climate is classified according to Köppen and Geiger (1928) as Aw (tropical), with rain occurring from October to May and drought occurring from June to September. The average annual temperature varies from 20 to 35°C, the rainfall varies from 1,500 to 1,800 mm annually, and the relief is gently undulating (6% slope). The meteorological data for the municipality of Rio Verde and the reference evapotranspiration during the experimental period are shown in Figure 1.

**Figure 1.** Meteorological data from the municipality of Rio Verde and the reference evapotranspiration during the experimental period.




**Source:** INMET Normal Station – Rio Verde - GO.

The soil in the experimental area was classified as distroferric Red Latosol (LVdf), in the savanna phase, with a medium texture (Santos *et al.*, 2018). The area has a history of Brachiaria decumbens cultivation for more than 15 years.

For soil determinations, undisturbed soil samples were collected from Uhland rings measuring 6.34 cm in diameter and 5 cm in height, and deformed samples were collected at depths of 0 to 20 and 20 to 40 cm. for physical determinations and chemical analyses of the soil.

Soil density was determined using the volumetric ring method according to Teixeira *et al.* (2017). Particle density (Dp) was determined using distilled water and vacuum elimination of air from the pycnometer

according to Blake and Hartge (1986); total porosity (TP) was obtained from the values of soil density (Ds) and particle density (Dp) using the equation proposed by Vomocil and Floker (1961).

Microporosity (Micro) was determined considering the water content retained at a matrix potential of 6 kPa; macroporosity (Macro) was calculated based on the difference between total porosity and microporosity, and particle size analyses were carried out using the pipette method (Teixeira *et al.*, 2017). The physical-chemical characteristics of the soil are shown in Table 1.

**Table 1.** Physical-water and chemical characteristics of the soil in the experimental area in layers 0–20 and 20–40 cm deep before the installation of the experiment.

| **Physical-water characteristics [1]** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Layer** | **Granulometry g kg $^{-1}$** | | | **θCC** | **θ PMP** | **DS** | **PT** | **Textural classification** | | | |
| **cm** | **Sand** | **Silt** | **Clay** | **- m $^{3}$ m $^{-3}$ -** | | **g cm $^{-3}$** | **cm $^{3}$ cm $^{-3}$** | | | | |
| 0–20 | 458.3 | 150.2 | 391.5 | 51.83 | 30.5 | 1.27 | 0.55 | Clay Frank | | | |
| 20–40 | 374.9 | 158.3 | 466.8 | 55 | 31.33 | 1.28 | 0.51 | Argila | | | |
| Chemical characteristics | | | | | | | | | | | |
| Litter | pH | M.O. | Q | K | AC | Mg | To the | H+Al | Yes | CTC | V |
| cm | $H_2 0$ | g $kg^{-1}$ | mg dm $^{-3}$ | ---------- mmol $_c$ dm $^{-3}$ ---------- | | | | | | | % |
| 0–20 | 6,2 | 53,4 | 7,1 | 2,0 | 20,4 | 16,8 | 0,0 | 57,8 | 41,8 | 99,6 | 42 |
| 20–40 | 6,6 | 44,4 | 2,7 | 4,1 | 14,4 | 13,2 | 0,0 | 44,5 | 31,7 | 76,2 | 41 |

[1] θCC, field capacity (10 kPa); θPMP, permanent wilting point (1,500 kPa); Ds, soil density; PT, total porosity; pH in distilled water. P and K, Mehlich-1 extractor. MO - Organic matter. V - Base saturation.
**Source:** Author (2023)

Initially, the area was mowed, with a mower attached to a tractor. Subsequently, the soil was initially prepared by means of prior harrowing, with the aim of eliminating existing vegetation and then distributing dolomitic limestone at a dosage of 2.0 t ha $^{-1}$, based on the results of the analysis of soil, with the intention of increasing saturation by 60% (Sousa; Lobato, 2004). The corrective was applied using a tractor-driven limestone distributor, and later, another harrowing was carried out with the purpose of incorporating the limestone and breaking up the soil. Finally, leveling grading was carried out.

The experimental design used was randomized blocks, with 15 treatments and four replications, analyzed in a 5×3 factorial scheme. The treatments included combinations of five levels of organic or mineral fertilizer: no fertilizer (natural soil), 8 t ha $^{-1}$ of chicken litter, 16 t ha $^{-1}$ of chicken litter, 24 t ha $^{-1}$ of chicken litter, 250 kg ha $^{-1}$ of formulated NPK 08-28-16, and three hp. from *Urochloa brizantha*: cv. Marandu, cv. BRS Paiaguás and cv. Xaraés. Each experimental unit (plot) was 5 m wide by 8 m long.

Analyses of the macro- and micronutrient contents in the residue were carried out prior to the application of chicken litter, and the results are presented in Table 2.

**Table 2.** Physicochemical characteristics of the chicken litter used in the experimental evaluation.

| Determinations | Results | |
|---|---|---|
| | **Dry Base (65°C)** | **Wet Base** |
| pH ($CaCl_2$ 0.01 M) | - | 8.5 |
| Density (Organic Residue) | - | 0.56 g $cm^3$ |
| Humidity (Organic Residue) 60 - 65° C | - | 13.56% |
| Humidity (Organic Residue) 110°C | - | 3.02% |
| Total Organic Matter (Combustion) | 53.37% | 46.13% |
| Organic Carbon | 28.07% | 24.26% |
| Total Mineral Residue (RMT) | 43.14% | 37.29% |
| Mineral Waste (RM) | 40.06% | 34.63% |
| Insoluble Mineral Residue (RMI) | 3.08% | 2.66% |
| Total Nitrogen | 2.44% | 2.11% |
| Phosphorus ($P_2O_5$) Total | 3.17% | 2.74% |
| Potassium ($K_2O$) Total | 4.28% | 3.70% |
| Calcium (Ca) Total | 13.12% | 11.34% |
| Total Magnesium (Mg) | 1.86% | 1.61% |
| Sulfur (S) Total | 0.62% | 0.54% |
| C/N Ratio | - | 11 |
| Copper (Cu) Total | 515 mg $kg^{-1}$ | 445 mg $kg^{-1}$ |
| Manganese (Mn) Total | 848 mg $kg^{-1}$ | 733 mg $kg^{-1}$ |
| Zinc (Zn) Total | 711 mg $kg^{-1}$ | 615 mg $kg^{-1}$ |
| Iron (Fe) Total | 14430 mg $kg^{-1}$ | 12473 mg $kg^{-1}$ |
| Boron (B) Total | 16 mg $kg^{-1}$ | 14 mg $kg^{-1}$ |
| Total Sodium (Na) | 8459 mg $kg^{-1}$ | 7312 mg $kg^{-1}$ |

**Source:** Author (2023)

Methods: potentiometric determination of pH in 0.01 M $CaCl_2$; potentiometric determination of density (m/v); humidity of 60-65°C; humidity of 110°C; total humidity; organic carbon (CO) dichromate oxidation followed by titration; total nitrogen sulfur digestion (Kjeldahl); phosphorus (P2O5) determination via spectrophotometry via the vanadomolybdica solution method; potassium (K2O) and sodium (Na) flame photometry; sulfur (S) gravimetric barium sulfate; calcium (Ca), magnesium (Mg), copper (Cu), manganese (Mn), zinc (ZN), and iron (Fe) extraction with HCl via an atomic absorption spectrophotometer; boron (B) azomethine-H spectrophotometry; C/N ratio calculation of total organic matter, insoluble mineral residue (RMI), mineral residue (RM) and total mineral residue (RMT) via combustion in a muffle furnace (Alcarde, 2009).

To calculate the quantities of chicken litter to be applied to the soil, the respective contents of total nitrogen and available N (N-$NH^{4+}$ and N-$NO^{3-}$) were considered, considering that only 50% of the N is made available in the first year, 20% in the second year and the remaining 30% in subsequent years (Arruda *et al.*, 2014), with the aim of providing 50, 100 and 150 kg $ha^{-1}$ of N in the first year of pasture. These doses are equivalent to approximately 50%, 100% and 150% of the dose of mineral N recommended for forages in the demanding group (Sousa; Lobato, 2004).

The chicken litter was distributed through mechanical broadcast application one week before sowing the grasses, considering the respective dose of residue in each plot according to the treatments. Next, the waste was incorporated into the soil using a closed leveler. Mineral fertilizer (formulated NPK 08-28-16, at a dose of 250 kg $ha^{-1}$) was also applied by broadcasting and then incorporated into the soil, similar to the procedure described for organic residues, one week before sowing the grasses. .

The sowing of the cvs. from *Urochloa brizantha*: Marandu, BRS Paiaguás and Xaraés were carried out by distributing a quantity of

seeds according to the recommendation for each cultivar and according to the cultural value of the seeds. Subsequently, the seeds were incorporated into the soil.

Forty days after emergence (DAE), a standardization cut was made across the entire experimental area at a height of 10 cm, with the aim of stimulating tillering and starting the regrowth periods. Subsequently, at the end of six consecutive regrowth periods, the material was harvested to measure dry matter mass productivity. The cuts were made at two random points in the useful area of each plot, using a 0.5 × 0.5 m metal frame (Salman; Soares; Canesin, 2006), with the plants cut at a height of 0.20 m from the ground (Euclides *et al.*, 2009), with the aid of a cleaver.

During the rainy season (January to April), cuts were made at intervals of 28 days after the first cut, which was carried out at 83 DAE, while in the dry period (May to September), cuts were made at intervals of 56 days, with the exception of the fifth cut, which was carried out 46 days after the previous cut, which comprises common grazing intervals in the region of this study (Costa *et al.*, 2007; Euclides *et al.*, 2009). Therefore, assessments were carried out at 83, 111, 139, 167, 213 and 268 DAE.

The collected material was packed in paper bags and placed to dry in circulation and forced air renewal ovens at a temperature of 55°C until it reached a constant mass. Two representative subsamples were then taken from this material from each plot, and the samples were ground in a Willey mill with a 1 mm thick sieve, placed in polyethylene bottles with airtight lids and duly identified.

Subsequently, the chemical composition of the forage collected from the six cuts was determined using the Van Soest method (1965). The ether extraction was carried out according to AOAC (1980).

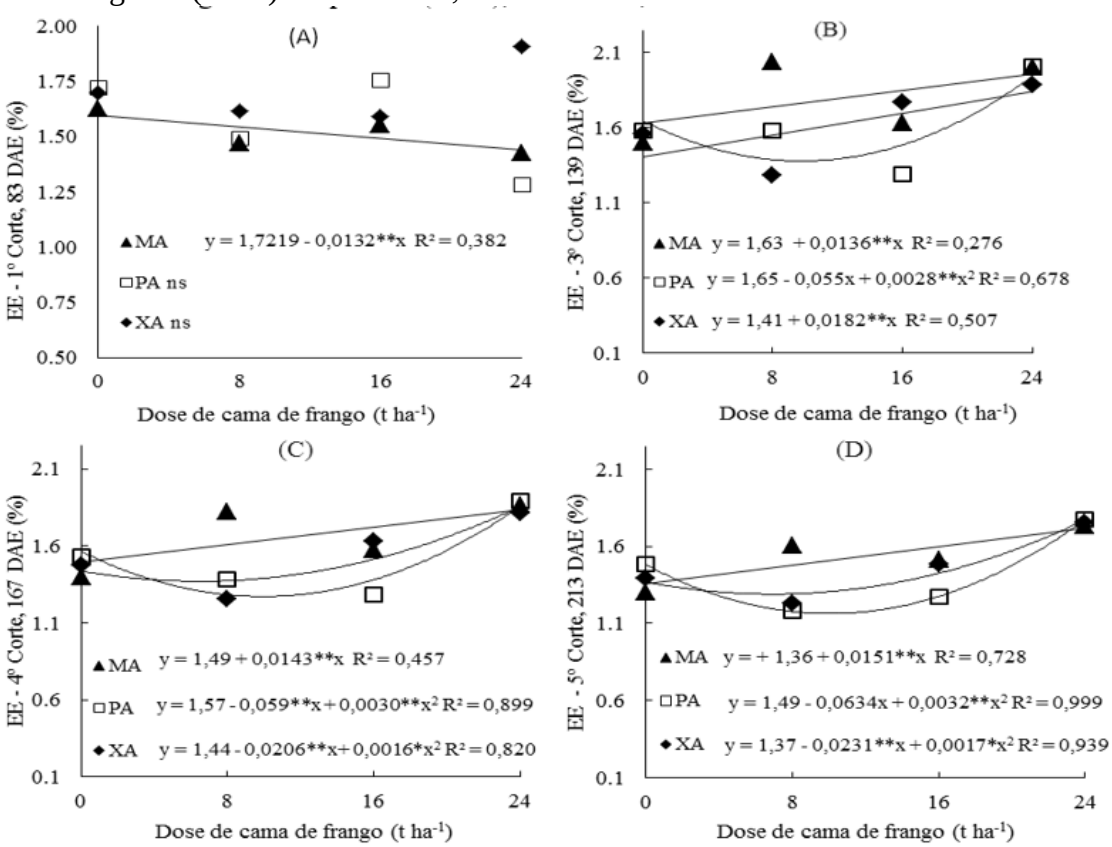
After each cut, all vegetation present in each plot was cut using a brush cutter at the same cutting height to evaluate dry matter productivity (0.20 m). Next, the material was removed from the experimental area.

The data obtained were subjected to analysis of variance, applying the F test, at a level of 5% probability; in the case of significance, the Tukey test was performed for the cultivar variable, and polynomial regression analyses were performed at 5% probability for the factors of chicken litter dose. The statistical program used was SISVAR (Ferreira, 2011).

## 3 RESULTS AND DISCUSSION

Regarding the ether extract contents in MS, in the first cuttings, a significant effect was observed only for cv. Marandu, whose data fit a linear decreasing trend in relation to the dose of chicken litter, with a decrease of 0.11% in response to each increase of 8 t ha $^{-1}$ of chicken litter (Figure 2A). In the second cuttings, no significant effect of chicken litter dose was observed for any of the cvs., whose overall average was 1.64%. In the third cuttings, an increasing linear effect of chicken litter dose was observed for the cvs. Marandu and Xaraés, with increases of 0.11 and 0.15%, respectively, for each 8 t ha $^{-1}$ increase in chicken litter. For the BRS Paiaguás cultivar, there was a quadratic effect, the maximum content of which (1.38%) was estimated at a dose of 9.82 t ha $^{-1}$ of chicken litter (Figure 2B). Studies carried out by Lara *et al*. (2015) showed that alternative fertilization of *Brachiaria brizantha* with chicken manure was more efficient than conventional fertilizer.

**Figure 2.** Ether extract (EE) contents in the dry matter of *Urochloa forage brizantha* and cultivars Marandu (MA), BRS Paiaguás (PA) and Xaraés (XA) fertilized with different doses of chicken litter at the first (A), third (B), fourth (C), fifth (D) and sixth (E) cuts after plant emergence (DAE) in Rio Verde, Goiás.




**Source:** Author (2023)

For the ether extract content in the fourth, fifth and sixth cuts, data from the three cvs. presented similar adjustment models in relation to chicken litter dose, linearly increasing for cv. Marandu, with increases of 0.11, 0.12 and 0.13%, respectively, in response to each 8 t ha $^{-1}$ increase in chicken litter (Figure 2). At the same time, the data were adjusted to a model, whose maximum levels for cv. BRS Paiaguás, 1.28% in the fourth, 1.18% in the fifth, and 0.95% in the sixth cut, which were estimated, respectively, with doses of 9.83, 9.91 and 10.29 t ha $^{-1}$ of chicken litter, while for cv. Xaraés, the maximum levels, 1.37, 1.29 and 1.13%, respectively, were estimated with lower doses of chicken litter, 6.44, 6.79 and 7.78 t ha $^{-1, \text{respectively}}$. In this way, it is possible to mention the importance of using chicken litter in production.

## 4 CONCLUSIONS

The BRS Paiaguás cultivar, considering all cuts, had a maximum ether extract content of 1.38% at a dose of approximately 10 t ha $^{-1}$ of chicken litter.

The Marandu cultivar presented the greatest amount of ether extract at a dose of 24 t ha $^{-1}$ of chicken litter. The Xaraés cultivar presented the greatest amount of ether extract (1.37%) at the lowest dose of chicken litter (8 t ha $^{-1}$).

## 5 ACKNOWLEDGMENTS

The authors would like to thank the Ministry of Science, Technology and Innovation (MCTI), the Financier of Studies and Projects (FINEP), the Goiás State Research Support Foundation (FAPEG), the National Council for Scientific and Technological Development (CNPq), the Coordination for the Improvement of Higher Education Personnel

(CAPES), the Center for Excellence in Exponential Agriculture (CEAGRE) and the Instituto Federal Goiano (IF Goiano) for financial assistance with this research project.

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