



# Optimizing the use of spineless cactus in the diets of cattle: Total and partial digestibility, fiber dynamics and ruminal parameters

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## ABSTRACT

The effects of the inclusion of spineless cactus (0; 147; 294; 441 and 588 g kg<sup>-1</sup>) in replacement of Tifton hay on intake, total and partial (ruminal and intestinal) digestibility obtained from samples of digesta collected in reticulum and omasum, fiber dynamics, and rumen parameters were evaluated. Five rumen fistulated crossbred steers with an average body weight of 380 ± 5.3 kg were assigned to a 5 × 5 Latin square design. The nutrient intake showed a quadratic effect, with a maximum intake of dry matter (8.89 kg d<sup>-1</sup>; *P* = 0.012) and digestible organic matter (5.75 kg d<sup>-1</sup>; *P* = 0.013) estimated with 339 and 418 g kg<sup>-1</sup> of inclusion, respectively. The total (*P* < 0.01) and ruminal (*P* < 0.05) digestibility of dry matter (DM), organic matter (OM), crude protein (CP), and degradation rate (Kd) of DM increased linearly. There was no effect on the total and ruminal digestibility, ingestion rate (Ki), passage rate (Kp) and Kd of neutral detergent fiber (NDF; *P* > 0.05). The maximum pool of NDF (2.46 kg; *P* < 0.05) was estimated with 201 g kg<sup>-1</sup> of spineless cactus inclusion. Except for the proportion of volatile fatty acids that did not differ (*P* > 0.05) with the inclusion of spineless cactus, there was a linear decrease (*P* = 0.001) of rumen pH, and a quadratic effect (*P* < 0.001) of ammonia nitrogen. It is recommended to include 418 g kg<sup>-1</sup> of spineless cactus on a DM basis as a replacement of Tifton hay in the diet of cattle to maximize energy intake.

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## 1. Introduction

Climate changes have caused frequent and prolonged droughts, with losses to ruminants reared in degraded pastures or supplemented with low-quality roughage (Ben Salem, 2010). Under these conditions, the farmer depends on roughage importing (hay or silage) from other regions, burdening the production system.

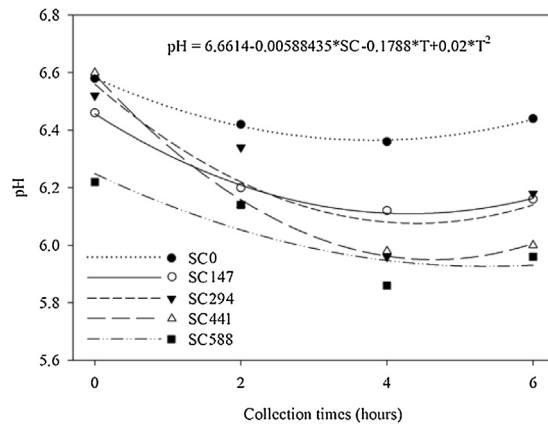
**Abbreviations:** DM, dry matter; OM, organic matter; CP, crude protein; EE, ether extract; aNDFom, neutral detergent fiber assayed with a heat stable amylase and corrected for ash and nitrogenous compounds; iNDF, indigestible neutral detergent fibre; NFC, non-fibre carbohydrates; DOM, digestible organic matter; BW, body weight; Ki, ingestion rate; Kp, passage rate; Kd, digestion rate; Kpi, passage rate of iNDF; RAN, rumen ammonia-nitrogen.

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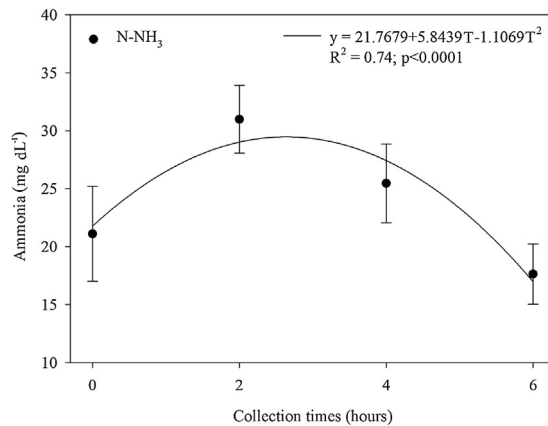
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**Fig. 1.** Estimate of ruminal pH on the collection times (T) for the respective dietary spineless cactus (SC) levels ( $\text{g kg}^{-1}$ ).



**Fig. 2.** Estimate of rumen ammonia nitrogen (RAN) concentration on the collection times (T).

Spineless cactus use can reduce concentrate supplementation effective cost in the dry season due to being able to withstand prolonged droughts and having high production potential in these regions (Nefzaoui et al., 2014). Currently, spineless cactus has the cost of US\$0.13  $\text{kg}^{-1}$  dry matter (DM) to the producer. It is cheaper if compared to other roughages, such as corn silage and Tifton hay, which cost US\$0.27  $\text{kg}^{-1}$  DM.

Among attributes, spineless cactus has low crude protein (40–50  $\text{g kg}^{-1}$  dry matter (DM)) and neutral detergent fiber (NDF; 170–280  $\text{g kg}^{-1}$  DM) contents, but high non-fibrous carbohydrate content (NFC; 640–710  $\text{g kg}^{-1}$ ) (Nefzaoui and Ben Salem, 2002; Ferreira et al., 2012) and a rapid NDF degradation rate (associated with low lignin content). Due to this composition, spineless cactus presence in the diet associated with protein and fiber sources promotes nutrient degradability increase (Batista et al., 2009).

The use of non-protein nitrogen compounds (urea) aims to raise the protein content of the diet, and its use is justified by its low cost if compared to true protein sources (Felix et al., 2014). According to Ben Salem and Abidi (2009), total replacement of concentrated feeds (such as corn or barley) by spineless cactus can be performed without causing any negative effect in ruminants. However, it is suggested that forage replacement (such as hay, silage or straw) does not exceed 50% dry matter, since digestion and animal performance may be impaired. Thus, it was hypothesized that providing more digestible feeds (rich in NFC), such as spineless cactus associated with urea, replacing the diet roughage (Tifton hay), could interfere with cattle ruminal metabolism.

Therefore, this study aimed to evaluate the effects of spineless cactus inclusion replacing Tifton hay on intake, total and partial (ruminal and intestinal) digestibility of nutrients, fiber dynamics and ruminal parameters in cattle. In addition, to identify the ideal ratio of Tifton hay:spineless cactus that would maximize the use of this forage in cattle systems (Figs 1 and 2).

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