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# Morning and afternoon sampling and herbage chemical composition of rotationally stocked elephant grass cv. Napier

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## Introduction

Nutrient intake by grazing animals depends on the amount of dry matter consumed and its chemical composition. Forage grasses produce assimilates during the day via photosynthesis to sustain live tissues, plant growth and organic reserves (Taiz and Zeiger 2013). In that context, herbage chemical composition may vary according to variations in the photosynthesis-respiration balance throughout the day. From dawn to dusk photosynthesis predominates and herbage dry matter content and concentration of soluble carbohydrates increase; the reverse happens from dusk to dawn. That could influence nutritive value and nutrient intake of grazing animals (Delagarde et al. 2000), since for a given bite volume the amount of herbage and its composition could vary depending on the time of the day. This phenomenon could have implications for rotationally managed pastures, with time of changing animals from one paddock to the other assuming greater importance.

Against that background, the objective of this experiment was to evaluate dry matter (DM) content and the concentrations of soluble carbohydrates (SC), crude protein (CP), neutral (NDF) and acid (ADF) detergent fiber in herbage samples harvested during the morning and afternoon periods from rotationally stocked elephant grass (*Pennisetum purpureum*) cv. Napier.

## Methods

The experiment was carried out at the Escola Superior de Agricultura "Luiz de Queiroz", University of São Paulo, Piracicaba, SP, Brazil (22°43' S, 47°25' W; 554 m asl), from October 2011 to April 2012 (mid-spring and summer). Treatments corresponded to combinations between 2 post-grazing (post-grazing heights of 35 and 45 cm) and 2 pre-grazing (95% and maximum canopy light interception during regrowth – $LI_{95\%}$ and $LI_{Max}$) conditions, and were allocated to experimental units (850 $m^2$ paddocks) according to a 2 x 2 factorial arrangement and in a randomized complete block design, with 4 replications.

Monitoring of canopy light interception was carried out with a canopy analyzer LAI 2000 (LI-COR, Lincoln, NE, USA). Herbage samples (one composite 1000 g sample per paddock) of *P. purpureum* were harvested by hand plucking at the pre-grazing condition late in the afternoon before grazing (18.00 h) and early in the morning of the grazing day (06.00 h). Samples were separated into 2 subsamples, weighed, and one dried in a forced-draught oven at 65 ºC until constant weight and the other frozen at -18 °C for future chemical analysis. In this case samples were lyophilized and ground using a 1 mm sieve in preparation for laboratory analysis of concentrations of soluble carbohydrates (SC) using the total 80% Ethanol-Soluble Carbohydrate method (Hall 2000), neutral (NDF) and acid (ADF) detergent fiber (Van Soest et al. 1991) and crude protein (CP) (Leco Nitrogen Analyzer, Leco Corporation, St. Joseph, MI, USA).

Analysis of variance was carried out using SAS®, version 8.2 for Windows® using time of the day (morning and afternoon sampling) as the only cause of variation (n = 16), since there was no treatment effect. When appropriate, means were calculated using the "LSMEANS" statement and comparisons made with the Student t-test at 5% probability.

## Results and Discussion

DM content ($P<0.0001$) and concentrations of SC ($P<0.0001$) and CP ($P=0.0048$) varied between morning

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**Table 1.** Dry matter content (DM) and concentrations of soluble carbohydrate (SC), crude protein (CP), neutral (NDF) and acid (ADF) detergent fiber in herbage samples harvested during the morning and afternoon periods from rotationally stocked elephant grass cv. Napier.

| Period of the day | DM (%) | Chemical composition (%) | | | |
|---|---|---|---|---|---|
| | | SC | CP | NDF | ADF |
| Afternoon | 20.5 | 7.6 | 16.7 | 56.8 | 30.2 |
| Morning | 16.8 | 4.1 | 18.9 | 57.9 | 31.5 |
| s.e.m. | 0.21 | 0.25 | 0.45 | 0.35 | 1.26 |
| P-value | <0.0001 | <0.0001 | 0.0048 | 0.0549 | 0.4558 |

and afternoon samplings ($P<0.0001$), with lower values of DM and SC and higher values of CP recorded during the morning. There was no variation in NDF and ADF concentrations (Table 1). The results reflect the absence of photosynthesis during the night period relative to respiration (Taiz and Zeiger 2013), a condition that results in carbohydrate consumption (Lunn and Hatch 1995) and decrease in SC and DM concentrations. Further, the decrease in SC results in a relative increase in CP concentration, explaining the differences between the morning and afternoon samplings. The magnitude of variations results in large changes in the CP:SC ratio (4.6 and 2.2 for the morning and afternoon samplings, respectively) that, associated with % increase in DM content in the afternoon sampling, may have an impact on nutrient intake, considering the circadian rhythm and foraging strategies of grazing animals (Delagarde et al. 2000).

## Conclusion

Since time of day influences DM content and chemical composition of the consumed herbage, particularly the CP:SC ratio, nutrient intake of grazing animals will also vary, particularly under rotational stocking management, suggesting potential benefits of changing animals to a new paddock in the afternoon period.

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