Available online at www.sciencedirect.com
ScienceDirect
Small Ruminant Research 75 (2008) 217–225
Small Ruminant Research
www.elsevier.com/locate/smallrumres

Effect of harvesting period on the nutritive value of rice grass (*Echinochloa sp.*) hay given as sole diet to lambs

L.D. Lima, G.V. Kozloski *, L.M. Bonnecarrère Sanchez, A.P. Ruggia Chiesa, C.J. Härter, G. Fiorentini, L. Oliveira, R.L. Cadorin Jr.

Departamento de Zootecnia (Animal Science Department), Universidade Federal de Santa Maria, Campus Camobi, Santa Maria, 97105-900 RS, Brazil

Received 31 August 2007; received in revised form 20 November 2007; accepted 27 November 2007

Abstract

Data regarding the influence of maturity within the vegetative stage of tropical grasses on forage quality are limited and conflicting. The change in chemical composition of rice grass (*Echinochloa sp.*) hay harvested at 32, 46, 72 and 90 days of regrowth, and its effect on intake, digestibility, ruminal fermentation, rumen microbial protein synthesis (Experiment 1) and splanchnic oxygen uptake (Experiment 2) by lambs was evaluated. Except intake of indigestible neutral detergent fibre (NDF) which was similar for all treatments, intake of all hay components and the apparent digestibility of dry matter, organic matter (OM), NDF, N, as well as OM and N true digestibility, N retention and rumen microbial protein synthesis decreased linearly ($P < 0.05$) with increased regrowth age. Rumen fluid pH, ammonia N and peptide concentrations were similar for all treatments while sugars and amino acid concentrations decreased linearly with increased regrowth age of rice grass ($P < 0.05$). Passage rate of particles through reticulum-rumen (PRrr) was quadratically related ($P < 0.05$) to regrowth age. The highest PRrr and, consequently, the lowest retention time in the reticulum-rumen were obtained at 72 days of regrowth. There was a quadratic effect ($P < 0.05$) on net portal-drained viscera (PDV) flux of oxygen and heat production, while OM intake, portal blood flow and heat production as proportion of digestible energy (DE) intake were not affected by the increased regrowth age of rice grass. The highest means of oxygen uptake and heat production by PDV tissues were in 72 days treatment. In the whole splanchnic metabolism assay neither hay intake nor blood flow, oxygen uptake or heat production were affected by forage regrowth age. In conclusion, the nutritive value of rice grass hay decreased as regrowth age increased from 32 to 90 days due to decrease both OM intake and digestibility.

Keywords: Digestibility; Intake; Maturity; Sheep; Splanchnic metabolism; Tropical grass

Abbreviations: ADF, acid detergent fibre; ADIN, acid detergent insoluble N; ADL, acid detergent lignin; DE, digestible energy; DM, dry matter; DOM, digestible OM; EE, ether extract; H, heat of combustion; LW, live weight; NDF, neutral detergent fibre; NDIN, neutral detergent insoluble N; NPN, non-protein N; NFC, non-fibre carbohydrate; OM, organic matter; OMTD, organic matter true digestibility; PRrr, passage rate of particle-phase through reticulum-rumen; PRcc, passage rate of particle-phase through caecum-proximal colon; PDV, portal-drained viscera; PBF, portal blood flow; RTrr, retention time in the reticulum-rumen; RTcc, retention time in caecum-proximal colon; SBF, splanchnic blood flow; TDOM, true digestible OM; TRT, total retention time.

* Corresponding author. Tel.: +55 55 3220 8355; fax: +55 55 3220 8355.
E-mail address: kozloski@smail.ufsm.br (G.V. Kozloski).

0921-4488/$ – see front matter © 2007 Elsevier B.V. All rights reserved.
doi:10.1016/j.smallrumres.2007.11.005

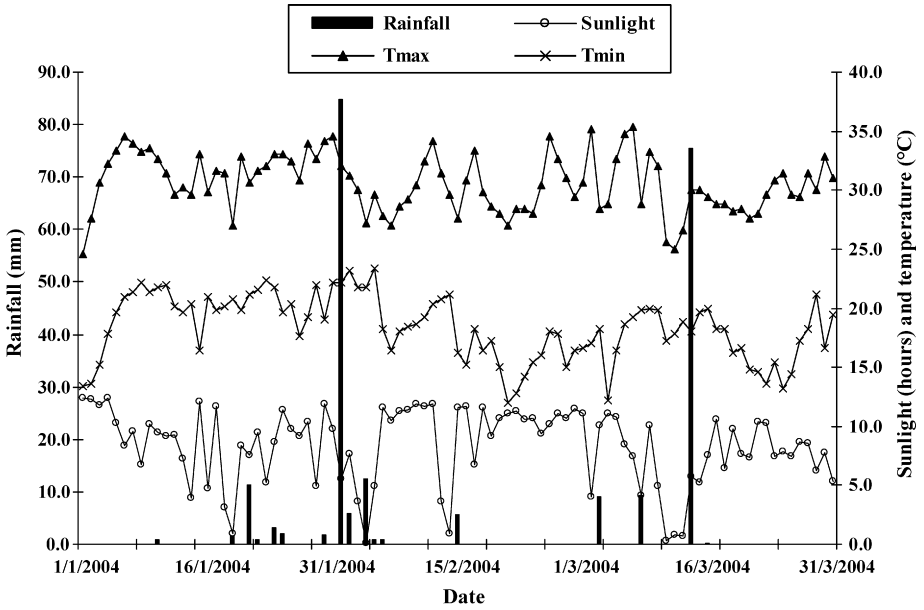

Fig. 1. Sunlight (hours), rainfall (mm) and temperatures (°C) from January to March of 2004 at the Experimental Station of Santa Maria, RS, southern of Brazil. Means of sunlight, rainfall, maximal and minimal temperatures were, respectively, 8.2 h, 2.88 mm, 30.0 °C and 18.3 °C.

1. Introduction

The efficiency of ruminant production systems based on forages as the main source of protein and energy is strongly dependent on forage maturity, which is considered a primary factor decreasing its nutritional quality (Nelson and Moser, 1994). Normally, as plant maturity increases, cell wall increases and total and soluble N contents decrease (Merchen and Bourquin, 1994). These modifications are well evident in forages at different stages of development (e.g. vegetative vs. reproductive or mature). However, there are limited and conflicting data regarding the influence of maturity on forage quality within the vegetative stage of tropical grasses, particularly when no significant changes in the leaf:stem ratio occur (Wilson, 1994). For example, digestibility of dwarf elephant grass (*Pennisetum purpureum* Schum. cv. Mott) hay produced from plants cut between 30 and 60 days of regrowth age and given to cattle were similar (Kozloski et al., 2003). However, digestibility was negatively affected by regrowth age when plants were cut between 30 and 90 days and hays were given to lambs (Kozloski et al., 2005). Moreover, chemical composition of forages is also affected by climate conditions (Van Soest, 1996; Jouven et al., 2006) and chemical differences seem to be modest among green leaves of tropical grasses at different regrowth ages (Kozloski et al., 2003, 2005).

Digestive, absorptive and metabolic functions carried out by the gastro-intestinal tissues have a considerable energetic cost and are influenced by a variety of factors, such as forage quality (Seal and Reynolds, 1993). The use of oxygen by portal-drained viscera, as a proportion of digestible energy intake, was higher in sheep fed a tropical grass hay than in those fed a temperate grass hay (Goetsch and Ferrel, 1995; Patil et al., 1995; Goetsch et al., 1997). Kozloski et al. (2003) showed that the animal energy expenditure associated with digestion by cattle increased linearly as the regrowth age of dwarf elephant grass hay increased from 30 to 60 days. However, a question arises as to whether this trend is similar among other grasses.

The objective of this study was to evaluate if regrowth age within vegetative stage of rice grass (*Echinochloa sp.*) affects intake, digestion and energy use by splanchnic tissues of lambs.

2. Material and methods

2.1. Feedstuffs

Rice grass hays were produced between January and March of 2004, from a pasture previously established in Santa Maria, RS, Brazil (29°43′S lat.; 95 m alt.). Data of rainfall, temperature and light conditions throughout pasture growth periods were obtained from local climate stations and are shown in Fig. 1. Rice grass was cut on January 2 and then the vegetation produced after 32, 46, 72 and 90 days was harvested at 10 cm height from the soil, air-dried, and then baled. The chemical composition of experimental hays is shown in Table 1.