

COUNTRY: BRAZIL**SESSION:** RUMINANT NUTRITION

SUGAR CANE (*Saccharum officinarum* L.) SILAGE TREATED WITH *Lactobacillus buchneri* OR CHEMICAL ADDITIVES ON PERFORMANCE OF HOLSTEIN HEIFERS.

A.F. Pedroso, L.G. Nussio, M. Zopollatto and L.J. Mari, University of São Paulo/ESALQ, 13418-900-PO Box 09, Piracicaba, SP, Brazil.e-mail:nussio@esalq.usp.br

ABSTRACT

Sugar cane forage was burned at field, chopped and ensiled in pit silos with 12 t capacity each. Sugar cane silages (SCS) treatments consisted of Control (no additives); Urea (0.5% -fresh basis); sodium benzoate (SB, 0.1% -fresh basis) and *Lactobacillus buchneri* 40788 (LB, 3.64×10^5 cfu g⁻¹) applied onto forage during ensiling. Thirty-two Holstein heifers, 388 kg, were randomly allocated in 4 treatments, 4 replications each, in a block design. During the feeding period (60d), the animals were fed once daily with total mixed rations containing 45.92% SCS; 15% pelleted citrus pulp; 35.71% ground pearl millet grain; 0.92% (urea treated silage) or 1.55% urea and 1.84% premix as DM basis. The amount of silage unloaded daily, averaged 140kg (10cm layer), from which, spoiled and feedable silage percentage were calculated. There was a trend ($P=0.15$) for increased DMI (kg/d) in LB-SCS (9.6) over Control SCS (8.71). The mean daily weight gain (DWG) showed an increase of 21% for SB ($P<0.05$) and 32% for LB ($P<0.01$), when compared to the Control treatment (0.94 kg/d). Better feed conversions (DMI/DWG) were observed for SB (7.63) and LB (7.72) when compared to Control (9.37). The DMI (%BW) and the percentage of feedable silage measured daily during unloading (80%) did not differ ($P>0.10$) across treatments. It suggests that an improved animal performance might be achieved either by adding *L. buchneri* or sodium benzoate at the ensiling of sugar cane.

KEYWORDS

Sugar cane silage, urea, sodium benzoate, *Lactobacillus buchneri*

INTRODUCTION

The ensilage of sugar cane has been done to facilitate the livestock feeding management and to prevent forage losses in the case of unexpected field burning and frosts. However, the untreated sugar cane silage will result in low quality forage. Appropriate animal performance is not accomplished with untreated sugar cane silage, because of excessive losses of dry matter and nutritive value during the preservation (Kung, Jr. and Stanley, 1982; Coan et al., 2002). The application of additives, such as urea, can improve the quality of the sugar cane silage, by inhibiting yeast and molds counts, reducing ethanol yield, and therefore, avoiding carbohydrates losses (Alli et al., 1983; Lima et al., 2002). The application of sodium benzoate has demonstrated an improved capacity of conservation and aerobic stability and an inhibitory effect on yeast and molds (Lättemäe and Lingvall, 1996).

The heterofermentative bacteria *Lactobacillus buchneri* which produces acetic acid besides the lactic acid, have shown the ability to reduce the yeast population and to increase the aerobic stability of maize silage and temperate grass silage (Taylor et al., 2002). The current trial aimed to evaluate the performance of Holstein heifers fed rations containing sugar cane silage treated with urea, sodium benzoate or bacterial inoculant (*Lactobacillus buchneri*).

MATERIALS AND METHODS

The sugar cane variety RB78-5841 at mature stage, was burned at field, harvested with 5 to 10 mm mean particle size and ensiled in pit silos with 12 t capacity each. The additives tested at ensiling were: 1) urea, applied manually in a 0.5% dose (fresh basis); 2) sodium benzoate, sprayed in 0.1% dose (fresh basis), using 13 L solution/t and; 3) inoculant, containing *Lactobacillus buchneri* 40788 – Lallemand® a heterolactic strain, applied according to the manufacturer recommendation (1.89 L of solution/t), to obtain 3.64×10^5 CFU/t of fresh material. The experiment was carried out, from January until March 2003, at the Department of Animal Science/ESALQ – University of São Paulo, in Piracicaba, SP. Thirty-two Holstein heifers, with ages from 7.5 to 24 months and 388 kg of mean BW, were allocated on 4 blocks (8 animals each), with 2 animals per pen. Diets were formulated according to NRC Dairy Cattle (2001) program to be isoproteic (12%CP) and isoenergetic (70%TDN), aiming 0.850 kg mean daily weight gain, considering a hypothetically value of 53% TDN for sugar cane silage. The rations containing silage without urea consisted of 45.9% sugar cane silage, 35.7% ground pearl millet grain, 15% pelleted citrus pulp, 1.55% urea and 1.84% premix, as dry matter (DM) basis. The ration with 0.5% urea consisted of 46.2% sugar cane silage, 35.9% ground pearl millet grain, 15.1% pelleted citrus pulp, 0.92% urea and 1.85% premix, DM basis. Diets were fed once daily, and weight backs of each pen were recorded daily. The 60 days experimental period consisted on two 30 days intermediate periods for animal performance measurement. The daily weight gain was calculated by weighting the animals at the first day and at the end of the two experimental subperiods, after a 12 hours feed fasting. Samples of burned and chopped sugar cane, before and after ensiling, and of orts were obtained once a week, for chemical composition (water-soluble carbohydrates - WSC, pH and ethanol). Diets and weight backs DM contents were determined weekly, by drying samples in forced-air drying oven (60°C) for 48 hours. Dried samples were grounded (1mm) and subsequently analyzed by the near infrared reflectance spectroscopy (NIRS) method (Berzaghi et al., 1997; Cozzolino et al., 2001). The four treatments were assigned in a randomized block design, with four replications, two animals per pen and analyzed according to the GLM procedure of SAS program (SAS, 1988). Treatment comparison was performed by using least square test (LSMEANS).

RESULTS AND DISCUSSION

In general, daily weight gain values of 1.81 kg are found for animals receiving ration with 48% (DM basis) fresh sugar cane (Hernandez, 1998). Intake of sugar cane silage diets without additives (13.3 kg/animal/day) were higher than those reported by Silvestre et al. (1976) for steers with 200 kg initial weight (11.5 kg/animal/day). Feed conversion was also higher than that obtained by Valvasori et

al. (1998), which observed intake of 12.4 kg DM/kg LBW, for calves (97 kg initial body weight) receiving diets with 60% sugar cane silage. Animals fed rations with LB treated silage showed tendency ($P=0.15$) for higher intake (17.5%), a increased ($P<0.05$) average daily gain (31.9%) associated with better feed conversion ($P<0.05$) than animals fed Control diet (Table 1). Results indicate that LB treated silages presented lower fiber contents, higher WSC concentration and higher in vitro dry matter digestibility (IVDMD) as compared to the Control silage, resulting on significant difference in performance. The ration containing SB treated silage resulted in better feed conversion ($P<0.05$), due to a lower DM intake (18.6%), as compared to animals fed Control diet. Performance of the animals fed urea treated silage was not different to the animals fed Control silage (Table 1). By using the silage chemical composition and mean body weight values obtained, intake and weight gain values were predicted by the NRC- Dairy Cattle (2001) program for each treatment, which can be compared with the observed values (Table 2). The DM intake was 18% lower and the body weight gain 20% higher than that predicted by the program. Data analysis suggests that sugar cane silages should have presented higher nutritive value than that considered by the program, in order to match the daily weight gain observed. It might be explained because NRC does not consider any energetic value for ethanol or volatile fatty acids (VFA), lactic acid, and other products of fermentation.

CONCLUSIONS

Growing cattle fed rations containing sugar cane silage treated with sodium benzoate or inoculant containing *L. buchneri*, showed better performance than that observed for animals fed urea treated or untreated silages.

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COUNTRY: BRAZIL

SESSION: SMALL RUMINANTS PRODUCTION

ANIMAL PERFORMANCE OF PREGNANT OR LACTATING EWES GRAZING ANNUAL RYEGRASS PASTURES AT THREE PHENOLOGICAL STAGES IN SOUTHERN BRAZIL¹

C. E. Pedroso¹ R.B.Medeiros² M. A. Silva²J. B. Jornada²J. C. Saibro²
1 Part of a Master of Science Dissertation of the first Author – UFRGS. Supported by CAPES – Brazil.

²Department of Forage Crops and Agrometeorology, Federal University of Rio Grande do Sul , Av. Bento Gonçalves 7712, Porto Alegre, RS, CEP 91540-000, Brazil.

ABSTRACT

The study was conducted at the Federal University of Rio Grande do Sul (UFRGS) Agronomic Research Center, in southern Brazil (30°05'22" S; 51°39'08" W). The performances of "Corriedale" ewes at the end of pregnancy or early lactation, and lambs were evaluated on annual ryegrass (*Lolium multiflorum* Lam.) pastures at three phenological stages: a) vegetative; b) pre-flowering and c) flowering. From July 3 to November 18, 2000, ewes were kept in a continuous grazing, variable stocking rates regime in order to maintain a level of forage dry matter (DM) on offer equivalent to 15% of liveweight (LW). Liveweight gain (LWG), average daily gain (ADG) and stocking rates were determined. On average, a level of forage dry green leaves on offer equivalent to 7.2% LW was achieved, whereas at the flowering stage the percentages of stems and dead material were higher, limiting the animal's selective action. Pasture crude protein content decreased from 23.7% at the vegetative stage down to 19.4% at flowering. In vitro forage organic matter digestibility decreased from 80.5% (vegetative) to 60.7% (flowering). Satisfactory ADG levels were obtained for ewes (103 g and 87 g) and lambs (289 g and 279 g) at the vegetative and pre-flowering stages, respectively. At flowering, ADG decreased both for ewes (-112 g) and lambs (89 g). These results highlight the productive potential of the high-quality forage provided by annual ryegrass pastures in terms of sheep liveweight gain/area at the vegetative (225 kg/ha) and pre-flowering or boot (145 kg/ha) stages.

KEY WORDS

Animal production, *Lolium multiflorum* Lam., lactation, phenological stages, pregnancy, sheep.

INTRODUCTION

Sheep production in southern Brazil gives an important contribution to the regional economy since the early settlement days. However, very high mortality rates and low live weight gain of newborn lambs is a major concern about this animal production system. This problem is linked to a forage deficiency of the native pasture during the cool season, which coincides with the period of highest nutritional requirements of ewes at pregnancy or early lactation. In general, annual or Italian ryegrass (*Lolium multiflorum* Lam.) pastures are often recommended to provide high quality forage to breeding ewes and, therefore, to reduce lamb mortality rates. The main objective of this work was to evaluate the productive performance of 'Corriedale' ewes and lambs grazing annual ryegrass pastures at three phenological stages.

MATERIALS AND METHODS

The study was conducted at the Federal University of Rio Grande do Sul (UFRGS) Agronomic Research Center, in southern Brazil (30°05'22" S; 51°39'08" W). The performances of "Corriedale" ewes at the end of pregnancy or early lactation, and lambs were evaluated on annual ryegrass (*Lolium multiflorum* Lam.) pastures at three phenological stages: a) vegetative; b) pre-flowering (boot) and c) flowering. From July 3 to November 18, 2000, ewes were kept on a continuous, and variable stocking rates grazing regime, in order to maintain a level of forage dry matter (DM) on offer equivalent to 15% of DM/100 kg of liveweight (LW), using the "put & take" technique (MOTT & LUCAS, 1952). Liveweight gain (LWG), average daily gain (ADG) and stocking rates were determined. Forage samples were taken at regular

intervals; the green leaf to stem ratio, CP content and in vitro organic matter digestibility (IVOMD) were also determined.

RESULTS AND DISCUSSION

In this study, the amount of annual ryegrass green leaves on offer was adequate during the whole experimental period (Figure 1), being 5.5% on average. However, the leaf:stem ratio sharply decreased over the same period (Figure 2). Also, forage quality of green leaves decreased with increased plant maturity. At the vegetative stage, very high values for crude protein (CP) content (36%) and 88% for the in vitro organic matter digestibility (IVOMD) were found, while at the flowering stage these figures were reduced, down to 23% and 59% respectively (Figure 3). These differences on pasture quality affected animal performance all over the grazing period. At the early vegetative stage, ewe's average daily gain (ADG) were 164g and 265g at the first and second evaluation dates (early and mid winter) respectively (Figure 4). At late winter, with the beginning of the lambing season, ewe's ADG decreased to 109g, due mainly to the expelling of the placenta after birth. At the same period, lambs fed almost entirely on maternal milk had ADG of 289g. With the forage still at the vegetative stage, at peak of the lambing season, ewe's ADG was negative (-126g), while lambs kept a positive gain of 292g per day. By the time the breeding season was over, plants were at boot stage and forage was still at a good quality level. These conditions allowed ewes to gain 87g daily while maintaining adequate milk production to feed suckling lambs gaining 279g per day, on average. At the flowering stage, ewe's ADG was negative (-112g), while lambs had a positive ADG (89g). In essence, these responses were due probably to the reduction of ewe's milk production and lower forage quality. Significant differences ($P < 0.05$) between pasture growth stages on liveweight gain per area were found: 225 kg/ha at vegetative, 145 kg/ha at boot and 1.2 kg/ha at flowering. In addition, average lamb's liveweight at birth was 3.86 kg and the survival rate reached 91.5%. SMITH ET AL. (1986) and SLADDEN & BRANSBY (1992), reported higher gains by weaned lambs grazing annual ryegrass pastures, probably as a consequence of a better corporal conditions of the younger lambs used in their trials and to a higher forage nutritive value of pastures during the grazing period.

CONCLUSION

Sheep performance was highly improved by grazing high-quality annual ryegrass pastures at the vegetative or boot stages, clearly showing an opportunity to optimize the local current sheep production system by minimizing newborn lamb losses while keeping ewe's milk production and animal gain per area at high levels.

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COUNTRY: BRAZIL

SESSION: SMALL RUMINANTS PRODUCTION

Ingestive behaviour of lactating 'corridale' ewes as affected by grazing frequency categories¹

M.A. Silva¹, C.E. Pedroso², R.B. Medeiros¹, J.C. Saibro¹

²Part of Master Thesis of 1st author – UFRGS. Supported by CAPES – Brazil

¹Department of Forage Crops and Agrometeorology, School of Agriculture, UFRGS, P.O.Box 776, 90012-970, Porto Alegre, Brazil

ABSTRACT

This work was carried out from October 04 to 07, 2000, at the Federal University of Rio Grande do Sul, Agronomic Research Center, Brazil (30°05'22" S; 51°39'08" W). The objective was to evaluate the influence of different grazing diurnal frequencies (grazing intensities) (less than 50% (F1); from 50 to 80% (F2), and over 80% (F3)) of lactating "Corriedale" ewes grazing annual ryegrass (*Lolium multiflorum* Lam), under the descriptive parameters of ingestive behavior and quality of the "ingested" forage. Daily grazing time of higher occurrence of F1, F2 and F3, grazing time, bite rate, bite weight and crude protein content (CP) of "ingested herbage estimated by the "hand plucking" method were evaluated. When less than 50% of ewes were in grazing activity, the highest grazing frequencies were between 11:30 AM to 02:30 PM; when 50 to 80% were in activity the highest grazing frequencies were between 02:30 PM; and when over 80% were in activity the highest frequencies were between 5:20 PM and 7:30 PM. For the grazing percentages F1, F2 and F3, daily grazing time of 1.65, 3.31, and 1.43 hours, rates of 52.2, 53.9, and 55.6 bites/minute, forage intake rates equivalent to 0.29%, 0.67%, and 0.42% of body weight were respectively recorded. CP content of "ingested" herbage was not affected ($P>0.05$) by different grazing frequencies, however, the highest pasture CP content was obtained when less than 50% of ewes were in grazing activity, signaling the importance of a reduced percentage of ewes at the activity to get a high quality diet.

KEY WORDS:

animal behavior, ewes, grazing frequency, hand plucking, ryegrass

INTRODUCTION

The animal ingestive grazing behavior can be interpreted as a constant process of adaptation, implemented by the animal, in search to satisfy its physiological functions in response to physical and nutritional environmental variations. The grazing intensity or percentage of ewes in grazing activity and the animal relationships with the diurnal environment determines their nutritional behavior. The strategies implemented by the animals to maintain their constant adaptation involves variations in bite size, bite rate or grazing time. High relationship between grazing intensity and forage quality was observed by PARSONS et al. (1994). This author also registered higher bite size with sheep under high pasture stocking rate,

which leads the animal to ingest forage of low quality with high proportions of colms and dead leaves. However, at lower stocking rate the dynamic of ingestive process allows satisfactory balance between ingestion and the animal nutritional needs, which can include diurnal variations in the forage quality ingested. PARSONS et al. (1994) observed higher consume of low forage quality by at sunset. In spite of this knowledge, animal forage ingestion strategies have not been fully explored to obtain the maximum pasture efficiency and animal production. The objective of this work was to describe the diurnal variation pattern of grazing ewes behaviour and their grazing strategies in order to better understand the ingestive animal processes.

MATERIALS AND METHODS

The experiment was carried out in 1,3 ha of annual ryegrass pasture ('*Lolium multiflorum*' Lam) at the Federal University of Rio Grande do Sul, Agronomic Research Center (30°05'22" S; 51°39'08" W), Brazil. Evaluations of ingestive behavior were registered from 04 to 08 October, 2000, in 17 lactating "Corriedale" ewes with their respective lambs. The animals were kept in a continuous and variable stocking rates grazing regime, in order to maintain a level of forage dry matter (DM) on offer equivalent to 15% of DM/100 kg of liveweight (LW), using the "put & take" technique. At regular time the leaf:stem ratio, green leaf on offer and "ingested" forage DM estimated by the "hand plucking" technique were determined. Percentage of crude protein (CP) of ingested forage of the different grazing intensities of lactation ewes were also determined.

The treatments were three different percentages of ewes on grazing activity: a) less than 50%; b) from 50 to 80%, and c) over 80%. Diurnal grazing times were estimated registering the frequency of animals on this activity at an interval of 10 minutes; bite/minutes were determined directly (JAMIESON & HODGSON, 1979) and bite weight by "hand plucking" technique. The number of bite rates and bite weight were determined on diurnal periods. The "hand plucking" technique calibration was obtained by comparing hand collected weight forage with the extrusa weight of an esophageal fistulated animal. The registered data resulted in a linear equation which was used to correct the collected hand weight values. The total time of the three animal grazing frequencies distributions were also evaluated. The data of ingestive behavior and CP content were submitted to variance analysis, taking the ewes frequencies (grazing intensity) as treatments, and evaluation days as replications. The average data were compared by the DMS test at the level of 0.05 of significance.

RESULTS AND DISCUSSION

During the evaluation period, the different percentage of ewes in grazing activity (grazing intensity) concentrated their diurnal distribution at different times (FIGURE 1). When less than 50% of ewes were in grazing activity, the highest grazing intensity was between 8:00 AM to 9:30 AM and 11:30 AM to 02:30 PM; for 50 to 80% the highest grazing intensity was between 02:30 PM; and when over 80% were grazing the highest grazing intensity was between 5:20 PM and 7:30 PM. The highest intensity registered for F3 represented 48 % of the diurnal time in grazing activity. This intense ingestive behavior is probably due to the occurrence of mild temperatures at sunset, that proportionates a better environment to animal grazing (ABREU DA SILVA, 1995). However, the grazing activity in F2 category showed a

spread frequency pattern and represented 36% of the diurnal time. The short time in grazing activity registered for F1 category, from 8:00 AM to 9:30 AM, was, probably, due to the necessity to rest after an intense period of grazing at sunrise. The second shortest grazing activity registered for F1 category, from 11:30 AM to 14:30 PM, can be attributed to the occurrence of higher temperatures at noon. The frequency patterns of grazing activity did not affect neither the bite weight nor the bite/minutes. Despite that, these variables were positively associated with the frequency of ewes in grazing activity. These findings probably reflect the potential capacity of the ewes selective behavior, which reach its maximum level when the percentage of ewes in grazing activity fell below 50% (Figure 2). In this condition of selection, the CP content of the ingested DM reached 28%, around three percent higher than the values registered for F2 (24%) and F3 (26%). High relationship between grazing intensity and forage quality was observed by PARSONS et al. (1994). MILNE et al. (1979), relating different liveweight pressures with selective capacity of sheep, concluded that selective efficiency reduces as the animal pressure increases. A similar effect can be observed in day hours when a high percentage of animals are in grazing activity such as in sunset and sunrise hours. The day time dedicated to grazing varies according to the ewes frequency in grazing activity and with the occupation time during the F1, F2 and F3 evaluations. The frequency category F1, in spite of having a higher proportion of occupation time during the evaluation period (44%), showed the lower number of ewes in grazing activity (< 50%), which resulted in 1.65 h/day. However, the frequency category F2, that had similar daily occupation time (42%), presented higher percentage of ewes in grazing activity (50 to 80%) and, in consequence, had the highest daily time in grazing (3.31 h/day). Even having the highest percentage of ewes in grazing activity (over 80%), the category F3 showed only 15% of occupation, limiting the grazing time to 1,43 h/day. In consequence of these variations, the consume was 0.29, 0.67 and 0.37 % of the liveweight for F1, F2 and F3, respectively.

CONCLUSION

The pattern of grazing activity varies during the time of the day showing peaks of fast and intense grazing early in the morning and late in the afternoon. The highest consume occurs at the intermediate animal grazing frequency (50 to 80%), while in the lower frequency of animal in grazing activity (<50 %) the bite weight and the bite rate tends to diminish, allowing the ingestion of pasture with higher protein content.

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COUNTRY: BRAZIL

SESSION: SMALL RUMINANTS PRODUCTION

INGESTIVE BEHAVIOR OF LACTATING EWES GRAZING ANNUAL RYEGRASS PASTURES AT THREE PHENOLOGICAL STAGES¹

R. B.Medeiros²; C.E. Pedroso²; M.A.Silva²; J.B.Jornada²; J.C.Saibro²
¹Part of M.Sc. Dissertation by the 1st. Author – UFRGS. Supported by CAPES – Brazil.

²Department of Forage Plants and Agrometeorology, Federal University of Rio Grande do Sul, Av. Bento Gonçalves 7712, Porto Alegre, RS, CEP 91540-000, Brazil

ABSTRACT

This work was carried out at the Federal University of Rio Grande do Sul, Agronomic Research Center, in southern Brazil (30°05'22" S; 51°39'08" W). The grazing behavior of "Corriedale" ewes at the end of pregnancy or early lactation stages were evaluated during a 5 day period, in a 1.3 ha pasture of annual ryegrass (*Lolium multiflorum* Lam.) at three phenological stages: a) vegetative, in July; b) pre-flowering, in October; and c) flowering, in November. Five ewes kept under a continuous grazing, variable stocking rate regime, at 15% level of forage DM on offer, were evaluated in terms of grazing time, bite size and bite rate, and the leaf:stem ratio of the ingested forage estimated by the "hand plucking" technique. Daily grazing periods of 9.65, 10.97 and 10.68 hours, bite rates of 52.65, 51.93, and 40.63 per minute and bite weights of 0.064, 0.055 and 0.048 g/bite were observed at vegetative, pre-bloom and flowering stages, respectively. Accordingly, this behavior resulted in forage intake rates of 4.48%, 3.91%, and 2.72% of body weight. These behavioral changes resulted from reductions of the leaf:stem ratio of the available forage (4.36:1, 1.11:1, and 0.17:1) as plant phenological stages advanced. These findings brought up a better understanding of the adaptation mechanisms involved with sheep behavior when annual ryegrass forage quality changes, and allow for better management practices for pasture utilization under the subtropical environmental conditions of southern Brazil.

KEY WORDS

Animal behavior, hand plucking, *Lolium multiflorum* Lam., phenological stage, sheep.

INTRODUCTION

In southern Brazil, the native pastures are considered to provide good forage quality to livestock during the warm season. However, its forage production distribution over the year is markedly reduced at the cool season period, particularly during the winter, a time when generally a very high mortality rate of newborn lambs occurs.

The use of annual ryegrass (*Lolium multiflorum* Lam.) pastures has been recommended to fill in the forage gap and to improve this animal production system. However, little is known about the interactions between the animal behavioral responses and forage plants grazed at different phenological stages, considering that forage quality can be strongly reduced as plant age advances (AKIN, 1989). Under these circumstances, the grazing animal seeks different strategies to increase forage intake, either by changing bite size, bite rate or grazing time. Therefore, the main objective of this study was to evaluate the ingestive behavior of sheep when grazing Italian or annual ryegrass pastures at three phenological stages.

MATERIALS AND METHODS

From July 03 to November 18, 2000, a grazing trial using 'Corriedale' sheep was conducted at the Agronomic Research Center, Federal University of Rio Grande do Sul, located in southern Brazil (30°05'22" S; 51°39'08" W). Mature pregnant or at early lactation ewes were kept on a 1.3 ha pasture of annual (also called Italian) ryegrass (*Lolium multiflorum* Lam.) grazed at three different phenological stages: a) vegetative; b) pre-flowering or boot; and c) flowering. Forage dry matter on offer was kept around 15% liveweight/ha, adjusted every 21 days, according to the "put & take" methodology (MOTT & LUCAS, 1952). Behavioral parameters were evaluated during three periods of five consecutive days each, the first from 21 to 25 July, with the pasture at the vegetative stage, the second from 04 to 08 October (boot stage), and the third period from 07 to 12 November, with plants at flowering. Grazing time was determined with "Ethosys" devices attached to three animals; bite rate was estimated by direct observations, according to JAMIESON & HODGSON (1979) and bite size was determined using the "hand plucking" technique. Bite size and number were determined during the diurnal period, collecting forage samples by hand and counting the number of bites/minute of five animals having the same liveweight and mouth size. A comparative calibration of the "hand plucking" technique was performed using an esophageal-fistulated animal to generate a linear regression equation to further adjust data from hand-collected forage samples (Figure 1). Forage intake was estimated by the product between the grazing time x bite rate x bite size.

RESULTS AND DISCUSSION

Forage quality progressively declined along the pasture growing season, the average leaf:stem ratios being 4.36:1, 1.11:1, and 0.17:1 at the vegetative, boot and flowering stages, respectively (Figure 2). Accordingly, grazing time increased from 9.65 to 10.97 and 10.68 hours/day at the respective forage growth stages, probably indicating the development of a compensatory mechanism by the animals to increase the quality of ingested forage. Similar results were reported by PENNING et al. (1991) for lactating ewes grazing pastures at 30, 60, 90, and 120 mm height. Grazing time was 13.15, 10.62, 9.5, and 8.9 hours/day at each pasture height, respectively. This trend shows that lactating ewes compensated for the shorter pasture profile by increasing the grazing time. The highest bite rates – 52.65 and 51.93 bites/minute – were achieved at the vegetative and boot stages, respectively, while a lower rate was found at flowering (40.63 bites/minute). This information indicates a high selective grazing action by the animal when the pasture quality

declined (Figure 3). These data falls within the interval of 52 and 30 bites/minute reported by PRACHE (1997) for lactating ewes grazing pastures at the vegetative and reproductive stages of plant growth. Bite weights were 0.064, 0.055, and 0.048 g/bite at the vegetative, boot and flowering stages, respectively (Figure 3), which are lower than those reported by BOTH (1999) – 0.108 and 0.081 g/bite – for mature dry 'Corriedale' ewes grazing improved native pastures in southern Brazil. This different behavior probably can be accounted for by the highest forage selection level of sheep used in our trial, due to their higher nutritional requirements. As a final consequence, forage DM intake was reduced along the pasture growing season, showing significant differences ($P < 0.05$) between plant phenological stages. These differences are probably associated with interactions between reductions on bite rate and bite weight, used by the animals as a strategy to increase the quality of ingested forage. On the other hand, these responses could also result from a longer transit time of the coarser and larger forage particles in the rumen-reticulum, and to some other behavioral and physiological limitations that further prevent increases of the grazing time.

CONCLUSION

The highest forage DM intake was achieved when the pasture was at the vegetative stage and was directly associated with larger bite weights, which allowed for the grazing animals to accomplish a great proportion of their green forage ingestive potential. When grazing a lower quality pasture, at the boot stage, grazing animals developed a compensatory mechanism in order to maintain high quality forage intake by decreasing bite weight and increasing the grazing time. With very low forage quality, at the flowering stage, these grazing strategies were not able to keep an adequate forage DM intake.

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