Grazing sulla and/or ryegrass forage for 8 or 24 hours daily. Effects on ewes feeding behaviour

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Abstract

This experiment aimed to examine the effects of the utilization of monocultures of ryegrass (R), sulla (S) or both of them (RS), and the prolongation of daily grazing from 8 h (8:00-16:00) to 24 h, evaluating behaviour, selectivity, intake and milk yield of ewes at pasture. The experiment involved 42 Comisana ewes divided into 6 homogeneous groups which, since 19th April for 42 d, continuously grazed under a stocking rate of 34 ewes/ha. Ewes involving in eating activity were higher in R and for 24-h grazing, in relation to lower intake rate. RS ewes reduced eating time and increased lying activity. During daytime, the eating gradually decreased in R and RS, whereas was constant in S; during night, eating was concentrated at sunset, especially in R. In RS, ewes showed higher selectivity for sulla than ryegrass. DM intake and corrected milk yield were favoured by S and the 24-h permanency at pasture.

Keywords: ewes, sulla, ryegrass, daily grazing time, feeding behaviour

Introduction

The timing and duration of grazing are management practices greatly affecting the performance of animals. Accordingly, 24-h grazing showed to improve body condition of animals, reduce heat stress, increase DM intake, digestibility of selected herbage and milk production (Iason *et al.*, 1999). Despite of these benefits, manpower constraint, insecurity or damage to vegetation by animals are conditions that could suggest avoiding night grazing. In a recent experiment (Di Miceli *et al.*, 2005), positive effects emerged on milk yield from ewes when grazing sulla pasture compared with ryegrass. The sulla forage, widespread in the southern Italy, is known for its positive impact on animals productivity (Molle *et al.*, 2003), attributed to its high protein content and ratio between degradable and structural carbohydrates (Burke *et al.*, 2004), and also to its moderate presence of condensed tannins (CT) that decreases protein degradation in the rumen (Min *et al.*, 2003). In the same experiment (Di Miceli *et al.*, 2005), 24-h grazing, respecting the more common daily time of 8 h, improved milk yield from ewes utilizing sulla or ryegrass forage. However, in that study, the behaviour and feed intake of ewes were not taken into account. For this reason, another experiment was planned with the aim to investigate the effects of grazing ryegrass, sulla or both of them, for 8 or 24 h, on behaviour, selectivity, intake and milk yield of ewes at pasture.

Materials and methods

The field experiment was carried out in a semi-arid hilly area of Sicily (37°37'N; 13°29'E; 178 m a.s.l.). Three adjacent plots, each of 4080 m^2, were fenced and sown with Italian reygrass (R) (*Lolium multiflorum* Lam. subsp. *Westerwoldicum*, var. Elunaria), sulla (S) (*Hedysarum coronarium*, L.) or the association of both of them (RS); in this last case, half of the plot surface was occupied by ryegrass (R_S) and the other part by sulla (S_R), without any

fence. A total of 42 ewes of Comisana breed, averaging 146±55 days in milk and 44.6±7.3 kg of live weight, were blocked on milk yield and live weight and randomly assigned to 6 groups. For 42 days from 19th April 2005, every plot was continuously grazed by two groups, one for 8 h, during the interval between morning and afternoon hand-milking (8:00-16:00), and the other one for 24 h. Twice weekly measurements and sampling were executed, regarding forage (available mass and botanic composition) and ewes (live weight, BCS, behaviour, selected hergage, feed intake, individual milk yield). Ewes' behavioural activities (eating, specifying if R_S or S_R for the RS groups, ruminating, walking, standing, lying and other) were monitored continuously over 24 h by direct observations and recorded every 15 min, both at pasture and in box for groups grazing 8 h. DM intake of ewes was assessed by the *n*-alkane technique, using simultaneous equations equating the amount of each species consumed to produce 1 kg of faeces to estimate botanical composition and digestibility (Dove and Mayes, 1991).

Analyses for DM, CP, fat, ash and structural carbohydrates were carried out on available and selected forage. The net energy for lactation (NE_L) of forage was calculated using the estimated digestibility and the equations proposed by Van Soest and Fox (1992). Milk samples were analysed for fat and protein, and milk corrected for fat (6.5%) and protein (5.8%) (FPC milk) was calculated according to the equation of Pulina and Nudda (2002).

Data were statistically analysed by GLM procedure of SAS 9.1.2 software, using models including the effects of period (P), forage species (F) and interaction P*F for data regarding available forage, and the effects of P, F, grazing time (T) and interaction F*T for behavioural activities of ewes. For ewes performance, a randomized complete block model was used, including the effects of block, F, T and F*T. Treatments means were compared by Student's t-test.

Results and discussion

On average, the biomass availability was lower in R than RS and S (2.6, 4.2 *vs.* 4.2 t DM/ha; $P<0.001$); in RS, S_R vegetation was predominant over R_S (61 *vs.* 39 %). The contribution to RS botanic composition was higher from sulla species than other components (53.4, 30.7, 13.0 *vs.* 3.2 % from sulla, ryegrass, dead matter and other species, respectively).

Available herbage was more proteic and less fibrous ($P<0.001$) in S plots (14.5 and 13.9 % CP, 47.7 and 49.2 % NDF in S and S_R) than in R plots (8.3 and 7.0 % CP, 55.0 and 57.0 % NDF in R and R_S).

Eating and ruminating activity involved mainly R ewes (Table 1), that reduced time spent in standing and lying respect to other groups. RS ewes spent less time eating and increased lying activity, presumably because they needed a major rest as consequence of the longer movements for passing from one forage species to other one. Obviously, the longer permanency at pasture increased the incidence of ewes eating and reduced all other activities.

Table 1. Effects of forage species (R=ryegrass; S= sulla; RS=ryegrass and sulla) and grazing time (8 or 24 h) on behavioural activities of ewes over 24 h (% of observations).

	Forage species (F)			Grazing time (T)		Significance (1)			
	R	RS	S	8 h	24 h	Period	F	T	F*T
Eating	32.9 Aa	27.1 Bc	29.3 Bb	23.2	36.3	***	***	***	*
Ruminating	9.5 Aa	7.8 Bb	8.1 ABb	10.6	6.4	***	**	***	NS
Walking	1.3	1.2	1.5	1.2	1.5	***	NS	NS	NS
Standing	11.5 B	14.3 A	14.6 A	15.7	11.3	***	***	***	NS
Lying	43.4 B	46.5 A	44.8 AB	47.3	42.6	***	**	***	NS
Other	1.3 B	3.0 A	1.7 B	2.1	1.9	***	***	NS	+

(1) +=$P\leq0.10$; *=$P\leq0.05$; **=$P\leq0.01$; ***=$P\leq0.001$; NS=not significant. A, B: $P\leq 0.01$; a, b, c: $P\leq 0.05$.

With regard to eating activity (Figure 1), during daytime it decreased for R and RS groups, whereas remained constant for S ewes. This almost uniform trend of eating on sulla forage is presumably connected to its CT content that seems to favour a decreasing time spent in main meals and an increasing number of small meals (Landau *et al.*, 2000). Night grazing was concentrated at sunset, as reported in other studies (Penning *et al.*, 1997), and it was particularly intense for R 24 h ewes. In RS plot, both ewes grazing 8 h or 24 h spent more time over the day to assume sulla herbage (55.5 *vs.* 44.5 % in RS 8 h and 54.3 *vs.* 45.7 % in RS 24 h), whereas ryegrass was more preferred in the evening (59.2 vs. 40.8 %), as similarly found by Harvey *et al.* (2000); this pattern of preference was probably a result of exigency to balance diet with higher fibrous intake.

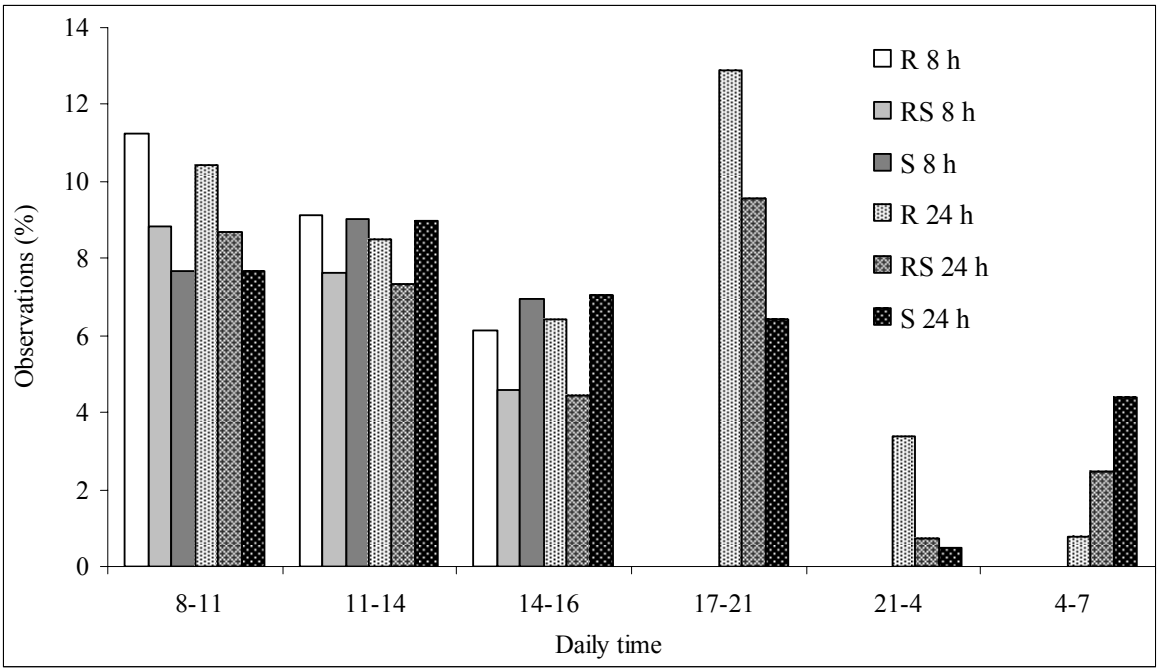

Figure 1. Effects of forage species (R=ryegrass; S= sulla; RS=ryegrass and sulla) and grazing time (8 or 24 h) on the eating activity pattern of ewes over 24 h (% of observations).

Table 2. Effects of forage species (R=ryegrass; S= sulla; RS=ryegrass and sulla) and grazing time (8 or 24 h) on botanical composition and intake of selected hebage, and FPC milk yield (LSM).

	Forage species (F)			Grazing time (T)		Significance (1)	
	R	RS	S	8 h	24 h	F	T
Ryegrass (% DM)	95.2	23.9		58.3	60.9	***	NS
Sulla (% DM)		63.3	100.0	83.6	79.7	***	NS
Other species (% DM)	4.8	12.8		5.4	6.3	***	NS
DM intake (g day^{-1})	1126 B	1210 B	1464 A	1184	1349	***	***
CP intake (g day^{-1})	175 C	243 B	373 A	249	279	***	*
NDF intake (g day^{-1})	498 A	413 B	388 B	401	464	***	**
EN_L intake (Mcal d^{-1})	1.8 B	1.8 B	2.2 A	1.8	2.1	***	**
Intake rate (IR) (g DM min^{-1})	2.7 B	3.8 A	4.0 A	4.1	2.9	***	***
FPC milk yield (g day^{-1})	593 Bc	706 Ab	791 Aa	645	748	***	***

(1) *=$P\leq0.05$; **=$P\leq0.01$; ***=$P\leq0.001$; NS= not sgnificant. A, B, C: $P\leq 0.01$; a, b, c : $P\leq 0.05$. (1) F*T= NS.

According to botanical composition of selected herbage (Table 2), the RS ewes consumed more sulla than ryegrass, preference confirmed by selectivity indexes of, being 1.2 and 0.9, respectively, whereas the grazing duration had no effects. Intake of S ewes was higher in DM, CP and EN_L, and lower in NDF than R ewes, being herbage selected by S grazing ewes more proteic (15.5, 19.5 *vs.* 25.2% DM for R, RS and S ewes; $P<0.001$) and less fibrous (NDF: 44.4, 36.1 *vs.* 28.2% DM for R, RS and S ewes; $P<0.001$), whereas RS group showed intermediate levels. Ewes had lower intake rates (IR) of R than RS and S, since grass was

shown to require most bites for unit mass (Orr *et al*., 2001). In RS, IR was analogous to S as a result of decreasing IR in R_S (2.4 g DM/min) and increasing IR in S_R (5.1 g DM/min). Grazing 24 h instead of 8 h (Table 2) increased DM intake but reduced IR, confirming that ewes are able to regulate IR according to time allowance at pasture (Iason *et al*., 1999). Similarly to the DM intake trend, grazing S and 24 h improved FPC milk yield (Table 2), as well as increased variation in body condition score of ewes (+0.12, +0.21 *vs.* +0.30 for R, RS and S, $P<0.01$; +0.12 vs. +0.31 for 8 h and 24 h, $P<0.001$).

Conclusion

With regard to the grazed species, a major preference of ewes emerged for sulla forage, the intake of which was almost constantly diluted over diurnal grazing and occurred with higher intake rate than ryegrass forage. Moreover, sulla forage allowed the grazing ewes to increase feed intake and milk yield, demonstrating as it may constitute an exclusive forage source in the diet. When ewes grazing 24 h instead of8 h, they spent more time for eating; accordingly, despite to lower intake rate, they increased feed intake and milk yield and improved body condition.

Acknowledgements

Research financially supported by the Sicilian Regional Government (project SiForMe) and the Italian Ministry of University and Research (MIUR 2005075887) .

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