Stockpiling forage in fall to be utilised in winter has shown to be an advisable strategy for winter scarcity (Pigurina et al., 1998). Besides, nutritive value of fall stockpiled basaltic native pastures has been reported to be relatively adequate for backgrounding young stock in winter (Montossi et al., 2000).

Adequate utilisation of winter forage is a key element in proper management of these extensive systems with traditional continuous grazing. Should a more intensive and cost and/or labour demanding grazing system benefit either animal gain or productivity (animal product /ha), farmers would adopt it rapidly.

The objective of this study was to determine the effectiveness of intermittent grazing systems to improve gains of young stock under continuous winter grazing of stockpiled native forages.

MATERIAL AND METHODS

The following experiment was conducted during winter of 1998 at "Glencoe" Research Unit (latitude 32° 01' 32" S, 57° 00' 39" W) of INIA Tacuarembó Research Station, in an extensive region of basaltic soils in NW Uruguay, South America. An area of 52 ha of native pastures growing on shallow, medium and deep basaltic soils was closed during 90 days in fall (1/4/98 to 1/7/98) to stockpile forage. Typical species composition, productive potential, nutritive value and seasonal patterns of growth of native pastures utilised in the experimental area have been documented by Berretta and Bemhaja (1998).

A completely randomised design was used to study the effect of three grazing systems during 84 days of winter (1/7/98 to 23/9/98) on the growth rate of 66 Hereford heifers. Eleven heifers were used in each of two replicates of three experimental plots of 8.5 ha. The following treatments were allocated: continuous grazing, no subdivisions (CG); seven day change (C7), where the experimental plot was divided in 12 subplots of 0.71 ha each and each subplot was grazed for 7 days at 7 SU/ha and 28 day change (C28), where the plot was divided in 3 subplots of 2.8 ha each and heifers grazed for 28 days at an instant stocking rate of 1.75 SU/ha. Water and mineralised salts were available throughout the experimental period.

Herbage mass (HM) and nutritive value (NV) were estimated pre and post-grazing by randomly clipping 10 lines (5 m x 0.07 m) at ground level using an electric shearing device. Sward surface height (SSH) readings were recorded in each line using a common ruler (Montossi et al., 1999). Samples were collected in plastic containers, dried in a forced draft oven at 60°C, ground in a Wiley mill with 1 mm sieve and analysed to determine: crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF) and ash.

Heifers were weighed every 14 days and grazing behaviour was studied five times during the experimental period. Grazing time (GT), rumination time (RUT) and resting time (RET) as well as bite rate (BR) were recorded every 15 minutes during day time in 6 heifers (adequately identified with paint) of each replicate.

Sward data and animal weight data were analysed using the statistical package SAS (1990) based on a randomised complete design, evaluating the effect of the grazing systems on sward characteristics and animal gain during the experiment. Treatment means were compared by LSD test.

RESULTS AND DISCUSSION

Herbage mass obtained by stockpiling fall growth of native pastures was relatively low due a short drought, and was greater ($P<0.05$) in C7 and C28 than in CG. SSH was sensible to detect HM differences (R^2 0.51). HA was greater ($P<0.01$) in CG due to the greater area/animal. Post-grazing HM was greater ($P<0.01$) in C28 and post-grazing SSH was not able to detect such differences. Nutritive value was similar ($P>0.05$) in all pastures for all constituents (CP, NDF, ADF and ash) and in accordance with results of previous work (Montossi et al., 1999; Pigurina et al., 1998).

Similar ($P>0.05$) gains of approximately 25 kg were recorded regardless of treatments in the experimental period. A very mild winter without frosts favoured the exceptional daily gains which tended to be higher in CG than in C28 and C7. The greater HA and apparent dry matter intake (AIA) in CG could have been responsible for this trend, although estimated feed efficiency did not favour CG. CG heifers gained more at the beginning of the experimental period due to higher HA and probably to selective grazing. Later in the period, when HA diminished in CG,

Table 1 - Sward characteristics and herbage chemical composition.

	Treatments			
	C7	C28	CG	P[1]
Herbage mass (HM), kg DM/ha)	988 a	912 a	604 b	*
Postgrazing herbage mass (PGHM), kg DM/ha	552 b	745 a	561 b	**
Sward surface height (SSH), cm	5.6 a	5.8 a	4.1 b	**
Postgrazing sward surface height (PGSSH), cm	3.1 a	3.2 a	3.5 a	NS
Herbage allowance (HA), kg DM/100 kg LW/day)	5.9 b	6.6 b	11.7 a	**
Crude protein (CP), %	10.2 a	10.2 a	10.2 a	NS
Neutral detergent fibber (NDF), %	70.5 a	71.3 a	71.8 a	NS
Acid detergent fibber (ADF), %	41.0 a	41.8 a	41.8 a	NS
Ash, %	15 a	14.1 a	14.1 a	NS

[1]Level of significance: * $P<0.05$, ** $P<0.01$ and NS non significant

Table 2 - The effect of grazing system on animal performance and grazing behaviour

	Treatments			
	C7	C28	CG	P[1]
Initial liveweight (ILW), kg	135 a	135 a	135 a	NS
Final liveweight (FLW), kg	162 a	160 a	167 a	NS
Daily gain (DG), kg/animal/day	0.305 a	0.278 a	0.353 a	NS
Apparent intake (AIA), kg DM/animal/day	6.8	6.1	12.4	
Apparent intake (AILW), kg DM/100 kg LW/day	4.6	4.3	8.3	
Feed efficiency (FE), kg DM:kg product	22	22	35	
Grazing time (GT), min	435 b	444 b	474 a	*
Rumination time (RUT), min	174 a	145 b	142 b	**
Resting time (RET), min	64 b	87 a	59 b	*
Bite rate (BR), bite/min	59 a	54 b	57 a	*

[1]Level of significance: * $P<0.05$, ** $P<0.01$ and NS non significant

C7 and C28 had greater gains than CG and compensated. CG heifers spent more ($P<0.05$) time grazing, C7 spent more ($P<0.01$) time ruminating and C28 spent more ($P<0.05$) time resting. Bite rate was smaller in C28 than in C7 and CG heifers.

Grazing management did not affect daily gains of heifers. Nevertheless, in C28 and more so in C7, total remaining HM was more than double that in CG. Undoubtedly more animals could have grazed in both treatments, with increasing total productivity.

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Lamb stocking rate and supplementation effects on mixed triticale and ryegrass swards characteristics

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ABSTRACT

An experiment was carried out from 9 June to 22 October 1997, using a *Lolium multiflorum L.* (ryegrass) and *Triticosecale Wittmack* (triticale) mixed sward grazed by lambs in a rotational grazing system, to determine the effect of stocking rate (SR; 20, 30 and 40 lambs/ha) and supplementation (S; with or without) on herbage production, composition and nutritive value. SR affected significantly before and after grazing herbage mass and sward height, being higher the values of these variables at the lower SR (3232, 2611 and 2345 kg DM ha^{-1}, $P < 0.05$; 2557, 1761 and 1612 kg DM ha^{-1}, $P < 0.01$; 17, 11 and 9 cm, $P < 0.01$ respectively). Increments in SR had an effect on post grazing sward composition, increasing the proportion of ryegrass (32, 36 and 47%, P<0.05) and decreasing triticale contribution (68, 64 and 55%, P<0.05) for 20, 30 and 40 lambs/ha. The effect of SR on sward nutritive value was not very clear. Before grazing, S affected significantly herbage mass, being higher the values at the supplemented treatments (2787 vs. 2672 kg DM ha^{-1}, $P < 0.10$). This experiment showed the high potential of forage production and nutritive value of ryegrass and triticale swards for lamb production in the sandy soil region of Uruguay, and the dominant effect of SR, compared to S, on most of the sward variables considered.

KEYWORDS: Sward height, herbage mass, nutritive value

INTRODUCTION

The combined effect of some factors during the last decade (low international wool prizes and increased demand for lamb meat with good prizes at the external markets) produced a high interest of Uruguayan sheep farmers for new technologies adapted to different productive situations for enhancing lamb production in their enterprises (Montossi *et al.,* 1999).

Triticosecale Wittmack cv. INIA Caracé and *Lolium multiflorum* cv. LE284 are two forage options very well adapted to the sandy soils, which are dominant in the north-east region of Uruguay. These grasses have been studied in mixed pastures and have demonstrated a very important potential for meat production for the basaltic soils (Montossi et al., 1998).

It is very important to generate more information about the influence of stocking rate and supplementation on sward structure, production, composition and nutritive value of these mixed grasses pastures grazed by lambs.

MATERIAL AND METHODS

This experiment was carried out at "La Magnolia" Research Unit (latitude 31°45´05" S, 55° 49´05" W), belonging to INIA Tacuarembó Research Station, located in an extensive region of sandy soils in the north-east part of Uruguay.

The mixed sward under study was conventionally sown in April 1997 with 10 kg ha^{-1} of annual ryegrass (*Lolium multiflorum* cv. LE284) and 150 kg ha^{-1} of triticale (*Triticosecale Wittmack* cv. INIA Caracé) and subdivided into 6 plots of about 0.583 ha each one. All plots were also subdivided into four equal sized sub-plots to allow a rotational grazing system (RGS). The experimental area received an initial fertilization of 130 kg ha^{-1} (18-46-46-0) with an additional 150 kg ha^{-1} (46-0-0) after the first grazing period.

One hundred and two castrated Corriedale lambs aging from 9 to 10 months, with a mean liveweight of 22.4 ± 2.3 kg and a body condition score (BCS) of 2.92 ± 0.5 grades grazed the mixed sward in a rotational grazing system from the 9 June to 2 October of 1997. The lambs were divided randomly into six groups according to their initial fasted liveweight and BCS. The supplement used was wheat bran at a daily allowance of 1.2% of liveweight.

The experiment consisted in a completely randomized design with six treatments, resulting from combining three stocking rates (SR: 20, 30 and 40 lambs per hectare) and two supplementation levels (S: with or without).

Herbage mass (HM) and its botanical composition was determined twice a month in each treatment by cutting quadrats to ground level, using an electric shearing handpiece, before and after grazing. The samples were dried in a forced-drought oven at a temperature of 60 to 70°C until constant weight. In each quadrate, readings of sward surface height (SSH), using a common ruler, were recorded before and after grazing. Additional fresh samples were clipped adjacent to each before grazing quadrat, bulked in each sampling for each treatment and divided into 2 groups of samples to estimate sward botanical composition and nutritive value. All the procedures have been reported by Montossi et al. (1998). Sward results were analyzed using the statistical package SAS (1990) based on a randomized complete design, arranged in a factorial structure, being the main factors: SR (3 levels) and S (2 levels). Treatment means were compared by LSD test.

RESULTS AND DISCUSSION

A summary of sward results is presented for the whole experimental period (Table 1). Results show that, before and after grazing, HM and SSH were significantly higher at the lower SR, reducing the proportion of triticale (TT) and increasing for ryegrass (RG) particularly after grazing. The use of S, produced increased HM ($P < 0.10$). Supplementation affected significantly, the contribution of the different species after grazing, reducing ryegrass proportion (35 vs. 54%, P<0.01) and increasing triticale contribution (66 vs. 59%, P<0.1). S did not affect any of the sward nutritive value variables in before and after grazing samples. The proportions (on DM basis) of ryegrass and triticale components changed through time, being 32 vs. 37% and 68 vs. 62% at the beginning and at the end of the experiment respectively, showing the complementary productive cycles of both species. The relationships between HM and SSH were; HM = 972.82 + 77.737 SSH, $R^2 = 0.48$ and HM = 590.04 + 109.52 SSH, $R^2 = 0.47$ for before and after grazing respectively.

Table 1 - Herbage mass (HM; kg DM ha^{-1}), sward surface height (SSH; cm), proportions (% of DM) of ryegrass (RG), triticale (TT), total green leaf (TGL), total green stem (TGS), reproductive stem (RS), triticale green leaf (TGL), and chemical composition ((% of DM; crude protein (CP), neutral digestible fibre (NDF) and acid digestible fibre (ADF)) for Stocking Rate (SR; 25 and 35 lambs/ha) and Supplementation ((S; with (W) or without (WH)) factors and their interactions before and after grazing.

	SR				S			Interaction
	20	30	40	P[1]	WH	W	P	SR*S
Before Grazing								
HM	3232a	2611b	2345b	**	2672	2787	N.S.	*
SSH	22.6	20.0	18.9	N.S.	20	21	N.S.	N.S.
RG	29	33	35	N.S.	33	32	N.S.	N.S.
TT	71	67	65	N.S.	67	68	N.S.	N.S.
TGL	47	50	53	N.S.	49	51	N.S.	N.S.
TGS	45	47	45	N.S.	47	45	N.S.	N.S.
RS	7.3a	2.3b	1.8b	***	4.5	3.0	N.S.	N.S.
CP	14.6	14.0	14.5	N.S.	14.5	14.1	N.S.	N.S.
NDF	77	76	75	N.S.	75	77	N.S.	N.S.
ADF	41	41	41	N.S.	41	41	N.S.	N.S.
After Grazing								
HM	2557a	1761b	1612b	***	1905	2049	N.S.	N.S.
SSH	17a	11b	9b	***	12	13	N.S.	N.S.
RG	32a	36b	45c	**	41a	34b	***	***
TT	68a	64ab	55b	**	59	66	N.S.	N.S.
TGL	57	53	49	N.S.	51	55	N.S.	N.S.
TGS	40	44	48	N.S.	47	41	N.S.	*
RS	3.7	2.3	2.2	N.S.	2.2	3.2	N.S.	N.S.

Significance = * P<0.10, ** P<0.05, *** P<0.01 and NS = Not Significant
a, b and c = columns within SR and S with different letters are different (P<0.05)

This experiment demonstrated the high forage productive potential, nutritive value and SR capacity of triticale and ryegrass mixed sward for lamb production in the sandy soils region of Uruguay and the dominant effect of SR on sward production and composition compared with supplementation.

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