ID # 22-49

INFLUENCE OF STOCKING RATE AND GRAZING SYSTEM ON LAMB PERFORMANCE OF MIXED OAT AND RYEGRASS SWARDS IN URUGUAY

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Abstract

An experiment was conducted at INIA-Tacuarembó Research Station (Uruguay) during 15 June to 4 October 1998, using a *Avena Sativa* (oat*)* and *Lolium multiflorum* (ryegrass*)* sward to examine the effect of stocking rate (SR; 25 and 35 lambs/ha) and grazing system (GS; strip and 7 days rotational grazing) on sward and lamb performance. SR had a significant effect on lamb performance, being higher the liveweight gain (LWG; 120 vs 98 g/a/d, $P < 0.01$), hot carcass weight (HCW; 17.7 vs 16.1 kg/a, $P < 0.05$) and carcass fat cover (GR; 12 vs 8 mm, $P < 0.01$) of those lambs managed at the lower SR. At the high SR, lambs increased grazing time (405 vs 376 min., $P < 0.05$). SG did not affect lamb performance, but strip GS reduces lamb grazing time (367 vs 414 min., $P < 0.01$) and biting rates (22 vs 24 bites/lamb/min., $P < 0.01$). Post grazing sward height (SH) was highly associated with LWG ($LW = - 101{,}7 + 32.7\ SH - 1.49\ SH^2$, $R^2 = 0.66$). This experiment demonstrated that: (a) the productive potential of ryegrass and oat swards to produce high quality lamb meat, (b) the relative low impact of using strip GS to increase lamb performance and (c) the potential use of post grazing SH as a practical tool to predict lamb LWG in this type of swards.

Keywords: Ryegrass, oat, lamb performance, lamb behaviour, meat quality.

Introduction

Lolium multiflorum Lom. cv. LE 284 and *Avena sativa* cv. INIA Polaris have been demonstrated to be highly adapted to the soil conditions of the regions located in the north of Uruguay. The use of these grasses for lamb fattening could give the opportunity to the sheep farmers of the Basaltic region to produce for the profitable Uruguayan heavy lambs market. However, there is a lack of research evaluating the lamb productive potential of these grasses, particularly considering the influence of stocking rate and grazing management on sward conditions and animal performance.

Material and Methods

From 15 June to 4 October 1998, the present study was conducted at "Glencoe" Research Unit (latitude 32^0 $01^{'}$ $32^{''}$S, 57^0 $00^{'}$ $39^{''}$ W, and 124 m. above sea level), belonging to INIA-Tacuarembó Research Station, in an extensive region of Basaltic soils in central-north Uruguay. The mixed sward was sown in April 1998 with 20 kg ha^{-1} of annual ryegrass (*Lolium multiflorum* cv. 'LE 284') and 80 kg ha^{-1} of oat (*Avena sativa* cv. 'INIA Polaris') in 2 blocks (1.6 ha each). Experimental plots (0.4 ha) were further sub-divided by electric fences into four sub-plots of 0.1 ha, giving: a) 7 days rotational grazing system (RGS) and b) with extra daily sub-divisions of each sub-plot resulting in a strip grazing system (SGS).

Forty eight castrated Corriedale lambs, approximately 9 months old with mean liveweight of 24.6 ± 2.6 kg and condition score (CS) of 3.0 ± 0.35 grades at the start of the experiment, were used. These lambs were divided randomly into eight groups according to fasted initial liveweight and CS, and then assigned to the 2 blocks used and 4 treatments applied,

which resulted of the combination of 2 factors: stocking rate (SR; 25 or 35 lambs/ha) and grazing system (GS; RGS or SGS). Herbage mass (HM), forage nutritive value and sward surface height (SSH; measured by a common ruler or Rising Plate Meter, RPM), were recorded before and after grazing, being the techniques and procedures used described by Montossi et al. (1998). Animal performance measurements and the four grazing behaviour studies were carried out according to the procedures described by Montossi et al. (1998) and Montossi (1995) respectively.

Animal and pasture results were analysed using the statistical package SAS (1990) based on a complete block design, arranged in a factorial structure, being the main factors: SR and GS at two levels each. Treatment means were compared by LSD test.

Result and Discussion

Sward and animal data are summarised and presented for the entire experimental period in Tables 1 and 2 respectively.

Herbage mass (HM) and sward surface height (SSHR and SSHRP) were significantly higher at the lower SR, while high SR improved forage nutritive value (Table 1). Before and after grazing, SGS tended to increase HM, SSH and forage nutritive value. At the high SR, SGS in comparison with RGS, had a most important effect in increasing the values of pre and post sward variables. Despite of the method used (RPM or ruler), the association between HM and SSH was medium to high, being the relationships; HM = - 35.6 + 98.7 SSHR, R^2 = 0.50 vs HM = 280 + 83 SSHRP, R^2 = 0.57 and HM = 334 + 150 SSHR, R^2 = 0.50 vs HM = 438 + 99 SSHRP, R^2 = 0.58 for before and after grazing respectively. Post grazing SSH was an adequate predictor of lamb performance: LWG = - 101.6 + 37.2 SSHR – 1.49 $SSHR^2$, R^2 = 0.66.

Those lambs managed at the low SR had significant higher values for FLW, LWG, FFLW, CS, ERA, C, HCW and GR than those of the high SR (Table 2). However, lamb wool production and quality, as well as the weight of the high meat quality cuts in the carcass were similar between SRs. The general decline in lamb performance at high SR appears to be related principally to reductions in herbage intake and in the nutritive value of the diet selected. The high grazing time recorded in these lambs (8%) and the lower values HM. SSHR and SSHRP found in the plots grazed at high SR support the hypothesis mentioned. The increase in SR enhanced LW and wool production per unit of area by 19 and 44% respectively, without having mayor changes in the proportions of lambs achieving market specifications.

With the exception of grazing behaviour variables and C, GS did not have mayor influences of lamb performance. Similar results have been reported by Montossi et al. (2001b), which associated these responses with a "grazing behaviour adaptation effect" of the lambs to the strip GS. This effect is reflected in reductions in lamb GT and RB by 13 and 9% respectively. Montossi et al. (1998) suggest than in forage winter crops, the necessary minimum daily LW gains required (> 130 g/lamb) to reach in time the heavy lamb market, giving by low pasture utilisation (< 50%) associated with the use of low SRs in order to enhance lamb intake and performance, probably constrains the potential benefits of the use of strip GS in Uruguayan lamb fattening operations.

The conclusions of the present study are: (a) the high lamb performance potential of winter forage crops in the Basaltic region of Uruguay, where most (> 83%) of the carcass produced achieved market specifications, (b) the limited biological and economical advantages of using SGS to enhance lamb production in this type of pasture and (c) the importance of using sward height to predict herbage mass and animal performance with low cost methodologies, particularly comparing the use of common ruler versus rising plate meter.

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Table 1 - The effect of Stocking Rate (SR; 25 and 35 lambs/ha) and Grazing System ((GS; 7 days rotational (RGS) and strip (SGS)) and their interactions on sward characteristics, before and after grazing.

	SR			GS			INTERACTIO
	25	35	P[1]	SGS	RGS	P	SR*GS
Before grazing							
HM							
SSHR	2745	2549	NS	2888a	2407b	**	NS
SSHRP	27.3a	25.0b	**	29.2[a]	23.1b	**	NS
CP	29.0a	26.1b	**	30.3[a]	24.8b	**	NS
NDF	16.8b	17.9a	**	17.6[a]	17.0b	*	NS
ADF	60.6	58.9	NS	58.4b	61.1[a]	**	NS
	35.4	35.2	NS	35.2	35.4	NS	NS
After grazing							
HM	2114a	1821b	*	2266a	1669b	**	NS
SSHR	11.8a	8.9b	**	10.6	10.2	NS	**
SSHRP	16.7a	12.5b	**	15.2	13.9	NS	NS
CP	14.2	15.1	NS	14.7	14.5	NS	NS
NDF	61.8	62.4	NS	60.8b	63.4a	**	NS
ADF	38.6	39.2	NS	39.4	38.5	NS	NS

[1] Significance = * P <0.05, ** P <0.01 and NS = Not Significant

Herbage mass (HM; kg DM ha^{-1}), Sward surface height measured by ruler (SSHR; cm), Sward surface height measured by rising plate meter (SSHRP; units), Crude protein (CP), Neutral detergent fibre (NDF), Acid detergent fibre (ADF).

Table 2 - The effect of Stocking Rate (SR; 25 and 35 lambs/ha) and Grazing System ((GS; 7 days rotational (RGS) and strip (SGS)) factors and their interactions on animal performance.

	SR			GS			Interactions
	25	35	P[1]	SGS	RGS	P	SR*GS
FLW	37.4a	35.2b	*	35.3	37.4	NS	NS
LWG	120a	98b	**	105	113	NS	NS
FFLW	35.5a	33.0b	*	33.3	35.2	NS	NS
CS	4.3a	3.8b	**	4.0	4.1	NS	NS
CFW	2.9	2.9	NS	3.0	2.8	NS	NS
FD	26.6	25.2	NS	25.3	26.5	NS	NS
FL	3.9	3.6	NS	3.7	3.8	NS	NS
GT	376b	405a	**	367b	414a	**	NS
RT	99	101	NS	96b	104a	*	NS
OA	155[a]	124b	**	159a	212b	**	NS
BR	22	24	NS	22b	24[a]	**	NS
ERA	11.7a	10.7b	*	11.1	11.3	NS	NS
C	3.5a	2.6b	**	2.8b	3.3[a]	*	*
HCW	17.7a	16.1b	*	16.5	17.4	NS	NS
GR	11.9a	7.8b	**	8.6	10.9	NS	**
BLeg	1.74	1.64	NS	1.70	1.69	NS	NS
L	0.46	0.41	NS	0.44	0.43	NS	NS
TL	0.15	0.15	NS	0.15	0.15	NS	NS
FL	89	86	-	83	91	-	-
TWP	66	95	-	77	85	-	-
TLWP	354	420	-	359	416	-	-

[1] Significance = * P <0.05, ** P <0.01 and NS = Not Significant

[2] = Range of specifications for the Uruguayan heavy lambs market on farm: LW = 35 – 45 kg/lamb and CS = 3.5 – 4.5 grades.

Note: Final liveweight (FLW; kg/lamb), liveweight gain (LWG; g/lamb/day), final fasted liveweight (FFLW; kg/lamb), condition score (CS; grades), clean fleece weight (CFW; kg/lamb), fibre diameter (FD; microns), fibre length (FL; cm), grazing time (GT; min./lamb), ruminating time (RT; min./lamb), others grazing activities (OA; min./lamb, resting, walking, drinking, etc.), biting rate (BR; bites/lamb/min), rib eye area (ERA; cm^2), fat depth (C; mm), hot carcass weight (HCW; kg/lamb), GR (mm), boneless leg (BLeg; kg), loin (L; kg), tenderloin (TL; kg), finished lambs (FL; %), total wool production (TWP; kg/ha) and total liveweight production (TLWP; kg/ha).