ID # 22-53

Stocking rate and supplementation effects on performance of lambs grazing triticale and ryegrass sward in Uruguay

R. SAN JULIÁN[1], F. MONTOSSI[1], L. GUARINO[1] and F. PITTALUGA[1]

[1]*Programa Nacional de Ovinos, Estación Experimental del Norte, Instituto Nacional de Investigación Agropecuaria (INIA), Ruta 5, km 386, Tacuarembó, Uruguay.*

ABSTRACT

An experiment was carried out from 9 June to 2 October 1997, using a *Lolium multiflorum Lom.* (Ryegrass) and *X Triticosecale Wittmack* (triticale) sward to evaluate the effect of stocking rate (SR; 20, 30 and 40 lambs/ha), and supplementation (S; with or without) on Corriedale lamb performance. SR had a significant effect on: liveweight gain (160, 130 and 90 g/an/d, P<0.01); greasy fleece weight (2.8, 2.7 and 2.3 kg, P<0.01); fiber diameter (28, 27, and 26 microns, P<0.05); rib eye depth (2.4, 2.1 and 2.0 cm, P<0.05); fat cover (3.2, 2.1 and 1.5 cm, P<0.01); hot carcass weight (17.7, 15.6 and 13.5 kg/an, P<0.01); GR (10.5, 6.6 and 4.2 mm, P<0.01) and boneless leg weight (1.56, 1.42 and 1.24 kg, P<0.05), for 20, 30 and 40 lambs per ha, respectively. At the highest SR, lambs increased grazing time (59 vs 52%) and biting rate (29 vs 26 bites/lamb/min). The mayor influence of S on lamb performance was found in grazing behavior variables: (grazing time (63 vs 50%, P<0.01); biting rate (26.8 vs 28.4 bites/lamb/min, P<0.01)), carcass characteristics: (hot carcass weight (15.3 vs 16.0 kg, P<0.05); GR (7.9 and 6.3 mm, P<0.05)) for with and without supplement, respectively. Over the experimental period (115 days), liveweight production and wool production ranged from 358 to 437 kg/ha for 20 and 30 lambs/ha respectively, and wool production from 55 to 93 kg/ha for 20 and 40 lambs/ha respectively. These results show the potential use of mixed ryegrass and triticale swards to produce high quality lamb meat even at high SRs, and the convenience of using supplements only when sward conditions are not sufficient to maintain an adequate lamb performance, particularly when high lamb SRs are used.

KEYWORDS: Animal behavior, meat quality, live weight gain, body conditions

INTRODUCTION

Some factors during the last decade (low wool prizes and more exporting opportunities for Uruguayan lamb meat) have increased the interest of sheep farmers for new technologies to enhance lamb production in their enterprises (Montossi *et al.,* 1998).

Triticosecale Wittmack cv. INIA Caracé and *Lolium multiflorum* cv. LE 284 are two forage options very well adapted to the sandy soils of the north-east region of Uruguay. These and other grasses have been studied in mixed swards, demonstrating very important productive potential for meat production for the basaltic (Montossi et al., 1998) and the granitic (Scaglia et al., 1997) regions of Uruguay.

However, considering the productive conditions of the sandy soils, there is a lack of information about the potential benefit of using these grasses for lamb production under different stocking rates and supplementation levels.

MATERIAL AND METHODS

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

The mixed sward was conventionally sown in April 1997 with 10 kg ha^{-1} of annual ryegrass (*Lolium multiflorum* cv. LE 284) and 150 kg ha^{-1} of triticale (*Triticosecale Wittmack* cv. INIA Caracé) and subdivided into 6 plots of about 0.583 ha each. All plots were also subdivided into four equal sized sub-plots to allow a rotational grazing system with 21 days of resting time. 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 body condition score (BCS) of 2.92 ± 0.5 grades grazed the mixed sward in a rotational grazing system from 9th June to 2nd October 1997. The lambs were divided randomly into six groups according to their initial fasted liveweight and BCS.

The experiment consisted in six treatments, resulting from combining three stocking rates (SR: 20, 30 and 40 lambs per hectare) and two supplementation levels (S: with or without). The supplement used was wheat bran at a daily allowance of 1.2 % of lamb liveweight.

Over the total experimental period, four grazing behavior studies were carried out during daylight hours (0800 to 1800 hours), in all the lambs and treatments applied, recording at 15 minute interval: grazing, ruminating and resting times, water and supplement intakes and other grazing activities (walking, standing, feeding, etc.). During each of the 4 studies it was estimated the rate of biting, using the 20-bite technique. Montossi (1995) provides more precise information about the grazing behavior techniques used in this experiment.

Animal variables (final live weight (FLW), liveweight gain (LWG), final body condition score (BCS), greasy fleece weight (GFW), fibre diameter (FD), fibre length (FL), hot carcass weight (HCW), GR, boneless leg weight (BLeg), tenderloin weight (TL) and loin weight (L)) were measured according to the procedures described by Montossi (1995) and Montossi et al. (1998). Before slaughter, rib eye depth (RED) and fat depth (C) were determined on each lamb by ultrasound technique (Russell, 1995).

Animal data was analyzed by SAS (1990) based on a randomized complete design, arranged in a factorial structure, where the main factors were: stocking rate (SR) at three levels and supplementation (S) at two levels. Treatment means were compared by LSD test.

RESULTS AND DISCUSSION

A summary of the animal results is presented for the whole experimental period (Table 1).

Stocking rate was the factor that showed a more important effect over the variables assessed. Most of the animal performance variables studied decreased with increasing SR. Lambs managed at the lowest SR had significant higher values for FLW, LWG, BCS, FD, FL, HCW, CY, Bleg, TL and L, than those under the highest SR, while the medium SR were much closer to those of the lowest SR (eg. FBCS, GFW, etc.). A possible explanation for the declining in lamb performance in relation with increasing SR appears to be associated with decreases forage intake due to a decreased herbage mass (San Julián et al., 2001a). The higher grazing time and biting rate observed in lambs maintained at the high SRs, in part, support the previous explanation.

Wheat bran supplementation had less effect on animal performance than SR. In general, supplementation increased the values of some animal characteristics (GFW, RED and GR), particularly in those lambs grazing under the highest SR. The efficiency of conversion (supplement to liveweight) reached a maximum value at the highest SR with 5.6 kg of wheat bran to produce an extra kg of liveweight.

Table 1 - The effect of stocking rate (SR) and supplementation (S) and their interactions on final liveweight (FLW; kg/lamb), liveweight gain (LWG; g/lamb/day), final body condition score (FBCS; grades), greasy fleece weight (GFW; kg/lamb), fibre diameter (FD; microns), fibre length (FL; cm), grazing time (GT; %), biting rate (BR; bites/lamb/min), rib eye depth (RED; cm), fat depth (C; mm), hot carcass weight (HCW; kg/lamb), GR (mm), boneless leg (BLeg; kg/half carcass), loin (L; kg/half carcass), tenderloin (TL; kg/half carcass), finished lambs (FL; %) and total wool production (TWP; kg/ha) and total liveweight production (TLWP; kg/ha).

	SR [3] (lambs/ha)				Supplementation [4]			Interaction
	20	30	40	P[1]	no	yes	P	SR*S
FLW	39.6a	35.4b	31.1c	**	35.8	34.8	NS	**
LWG	160a	130b	102c	**	120	130	NS	**
FBCS	4.40a	4.03a	3.14b	**	3.62	3.81	NS	**
GFW	2.8a	2.7a	2.3b	**	2.5b	2.7a	*	*
FD	28a	27b	26c	*	26.9	27.3	NS	**
FL	4.3a	4.1a	4.0b	*	4.13	4.15	NS	**
GT	52c	56b	59a	*	63a	50b	**	**
BR	26b	28a	29a	**	28.4a	26.8b	**	*
RED	2.4a	2.1b	2.0c	*	2.0b	2.2a	*	*
C	3.2a	2.1b	1.5c	**	2.2	2.3	NS	*
HCW	17.7a	15.6b	13.5c	**	16.0a	15.3b	*	**
GR	10.5a	6.6b	4.2c	**	6.3b	7.9a	*	*
BLeg	1.56a	1.42a	1.24b	*	1.36	1.45	NS	**
L	0.41a	0.36b	0.30c	*	0.33b	0.38a	*	**
TL	0.13a	0.13a	0.11b	*	0.12	0.13	NS	**
FL[2]	91	53	19	—	49	42	—	—
TWP	55	80	93	—	74	79	—	—
TLWP	358	437	403	—	364	420	—	—

a, b and c = columns within SR and S with different letters are different (P<0.05)

[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.

[3] SR: 20, 30 and 40 lambs/ha

[4] Supplementation (S): with (yes) and without (no)

Animal production per unit of area was strongly affected by SR (358, 437 and 403 kg liveweight/ha and 55, 80 and 93 kg fleece weight/ha for 20, 30 and 40 lambs/ha respectively).

Two of the animal variables (FLW and FBCS) were highly correlated with some of the post slaughtering (HCW and high quality meat cuts), being FLW more precise than FBCS to estimate carcass weight (HCW (kg) = 1.67 + 0.49 x FLW (kg); $R^2 = 0.92$, $P<0.01$), boneless leg weight (BLe (kg) = 0.066 + 0.04 x FLW (kg); $R^2 = 0.79$, $P<0.01$) and loin weight (L (kg) = 0.017 + 0.01 x FLW (kg); $R^2 = 0.75$, $P<0.01$).

This study shows that it is possible to reach high levels of production of high quality sheep meat and wool per unit of area on a mixture of *Triticosecale Wittmack* cv. INIA Caracé and *Lolium multiflorum* cv. LE 284 sward under high stocking rates. In order to achieve this productive potential other additional important aspects have to be considered, like adequate grazing management and animal health care. The inclusion of supplement is biologically and economically justified when high stocking rates are used, particularly using this tool to increase stocking the rate capacity of the fattening system.

The use of this lamb fattening technology will make it possible to increase the level of production and profit of the farmers located at the "Región de Areniscas" of Uruguay, complementing the traditional products generated in their systems (eg. wool and beef).

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The use of open communal grazing designs to screen options for grazing management

D.R. KEMP[1], D.L. MICHALK[2], P.M. DOWLING[2] and G.D. MILLAR[2]

CRC for Weed Management Systems. [1]University of Sydney, Faculty of Rural Management, david.kemp@orange.usyd.edu.au. [2]NSW Agriculture, Orange Agricultural Institute, Orange, NSW, 2800, Australia.

ABSTRACT

An open communal grazing design is described that enables a large number of grazing tactics to be concurrently evaluated in small plots under common grazing conditions. Pasture data indicated that the same level of utilisation occurred inside the experimental plots as in the surrounding field. However, differential grazing may occur where plots have divergent composition. The open communal design was economical using <5% of the land, livestock and fencing resources of alternative designs. The limitations of the open communal design as a research tool are also discussed.

KEYWORDS: Grazing management, experimental design, communal grazing

INTRODUCTION

The complexities of grazing ecosystems are such that the relative merits of different grazing tactics can only be conclusively established in comparative experiments. Due to expense and logistics, conventional grazing experiments are limited to simple factorial-type designs (Michalk and McFarlane 1978). While these types of design enable comparisons of whole systems to be made including collection of animal production data, they have to be somewhat rigid which means that the impacts of components of each system are difficult to tease out (Kemp and Dowling 2000). As a cost-effective alternative to the conventional approach, small plot trials have been used to examine the impacts of different utilisation levels on major pasture species. Such experiments often use cutting techniques to simulate the effects of grazing animals, but this does not always produce the same pasture composition as results from grazing.

Communal grazing designs have proven useful to simulate grazing in small plot experiments. Michalk and McFarlane (1978) used a closed communal design with treatment plots arranged in a 'wagon wheel' configuration around a common watering point to evaluate a range of grazing options for lucerne (*Medicago sativa*). A comparison with a conventional grazing design showed no significant differences for the same treatments in pasture growth and composition. However, for the closed communal design to work, animal numbers needed to be continually adjusted to maintain the desired stocking rate as plots were opened and closed to grazing, and the total grazing area available at any time to be large enough to maintain at least 5 adult sheep, the minimum required for sheep to behave as a flock.

To overcome these limitations, an open communal design was developed by placing small fence, plots within a larger grazing field. This also enabled the area of plots to be reduced to less than the 0.05 ha advocated by Michalk and McFarlane (1978) and removed the need to continually adjust livestock numbers. This paper describes an open communal design that has been successfully used as a tool to screen simple grazing tactics in on-farm locations. It discusses its merits, costs compared to alternative designs, and addresses the major criticism that the results achieved in the small plots of the open communal grazing design are not the same as those measured at the paddock scale.

MATERIAL AND METHODS

In this design, plots were laid out within a phalaris (*Phalaris aquatica*)-legume (*Trifolium repens, T. subterraneum* and *M. sativa*) pasture that was stocked at 16 DSE (dry sheep equivalents) / ha over the 4-year study that commenced in June 1989. Plots were opened or closed to grazing as specified by a range of treatments designed to compare the impact of strategic rest based on season or plant phenology with a continuously grazed control treatment. Continuous grazing is the management most commonly practiced by producers in the high rainfall zone (>600 mm/yr) of temperate Australia. The ratio of plot size (10 x 15 m) to the paddock (2.3 ha) was small so that the opening and closing of plots had an insignificant effect on the overall grazing pressure. Plots were arranged in a nearest neighbour design in 4 separate blocks spaced around the field.

Within each plot a randomly chosen permanent diagonal transect with 10 fixed equidistant sampling points along it was established to measure pasture yield (using rising plate meter method) and composition (dry weight ranking procedures described by Tothill *et al.* 1992). Measurements were taken every 6 weeks. Permanent transects were also established at random locations in the field surrounding the small plots and measured using the same procedures. Three treatments (continuous grazing; spring rest and spring short where addition grazing pressure was applied) are presented in this paper to compare results obtained in small plots with those measured in the surrounding field using regression analysis to assess grazing uniformity within the design.

Resources required for conventional, closed communal and open communal designs were estimated for an experiment consisting of 12 treatments, 3 replicates and a stocking rate of 10 DSE/ha. Fencing including input and erection costs was estimated at $A 5000/km.

RESULTS

Comparison of pasture yield (both green dry biomass and total dry biomass) between the continuously grazed control and the surrounding field showed that most of the points measured over the experimental period clustered around the 1:1 line (Figure 1). Linear relationships explained 77% and 67% of the variation in green and total dry matter yield between the continuously grazed plots and the surrounding field.