EFFECT OF STOCKING RATE AND SUPLEMENTATION ON LAMBS GRAZING *LOTUS CORNICULATUS* CV. INIA DRACO DURING SUMMER IN URUGUAY

Montossi, F*., Luzardo, S., De Barbieri, I., San Julián, R., Franco, R., Gutiérrez, D., and Brito, G.

Meat and Wool Research Program
National Institute of Agricultural Research, Uruguay, Ruta 5, km 386, INIA Tacuarembó, Uruguay
*E-mail address: fmontossi@tb.inia.org.uy

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Introduction

Several research studies carried out by INIA showed the potential biological and economical benefits of using different technological alternatives for fattening heavy lambs in the main intensive and extensive regions of Uruguay (Montossi *et al*., 2003). New forage options, released by INIA, highly adapted to the Basaltic soil conditions of the northeast region of Uruguay, are now available for the summer, which is a critical period to deliver early heavy lamb to accomplish the requirements of the international market. The potential use of high nutritive value legumes during summer appears as an alternative to produce early heavy lambs. There is lack of information of the potential of using *Lotus corniculatus* cv. INIA Draco during summer and the influence of its carrying capacity and supplementation with concentrate on fattening lamb performance and carcass and meat quality.

Materials and methods

This experiment was carried out at the Basaltic region of Uruguay, using *Lotus corniculatus* cv. INIA Draco, grazed by 108 Corriedale lambs (3-4 months of age), to evaluate the effect of stocking rate (SR; 9 and 18 lambs/ha) and supplementation (S; 0, 0.75 and 1.5 % live weight) on lamb performance and carcass and meat quality. The concentrate was a grounded mix of corn (72%) and soybean (28%). At the beginning of the experiment, the average live weight (LW) and body condition score (BCS) were 20.4 ± 1.78 (fasted) and 3.42 ± 0.31 units, respectively. The variables measured *in vivo* were: live weigh gain (LWG), final live weight (FLW), rib eye area (REA) by ultrasound scanning. The following carcass and meat quality parameters were measured: hot and cold carcass weight (HCW and CCW), fat cover (GR), frenched rack weight (FR) and boneless leg weight (BLS), meat parameters colour, tenderness, and meat temperature (T 24) and pH (pH 24) at 24 hours *pos mortem*, between 12th and 13th rib (*Longissimus dorsi* muscle). The muscle pH was measured using a hand-held pH meter (Orion A 230) with a probe type electrode (BC 200, Hanna Instruments), standardized against two pH buffers (4 and 7). The temperature was determined by a thermometer (Barnant 115) with stainless steel thermocouple (type E). Muscle color measurements were made using a Minolta Colorimeter (model C-10). They were recorded in triplicate from the approximate geometric center of the exposed *Longissimus dorsi* muscle at the 13th rib, after 24 hours *pos mortem*, taking the readings of L*, a* and b* parameters on the muscle, according to the Hunter system. A portion of *Longissimus dorsi* was removed from the left side of carcasses, labelled, vacuum-packaged and aged for 10 days at 2-4 ºC before the shear force analysis was done. The samples were cooked by immersion within a plastic bag in a water bath until an internal temperature in the muscle of 70 ºC was reached.. The internal temperature was monitored using type E thermocouples placed in the approximate geometric center of the sample. Six cores (2.54 cm in diameter) parallel to the muscle fiber orientation were removed from each sample. Tenderness was obtained for each core using a WBSF machine (G-R Electric Manufacturing Co, Manhattan, KS). Individual shear force (SF) values were averaged to assign a mean peak WBSF value to each sample. Further procedures for animal and carcass measurements are described by Montossi *et al*. (2003). The animal information was performed using the statistical package GLM procedure of SAS, based on Split-Plot design using 2 blocks, being the main plot arranged in a 2x3 factorial structure, where the main plot was SR (9 and 18 lambs/ha) and the split plot was S (0, 0.75 and 1.5 % LW). All data were initially tested for normality and homogeneity of variance and some variables were normalized previously to be analyzed. Also, some variables were adjusted by co-variates.

Results and Discussion

Table 1 shows animal performance and carcass quality traits results. The SR affected LWG (which influenced FLW and HCW), where animals at the lower SR obtained higher values than animals at higher SR. The other carcass quality traits were not affected by SR. The S affected LWG and FLW, and carcass quality traits with the exception of FR and REA, where increasing S levels tended to produced higher values. There were no significant interactions between SR and S for all variables, but for HCW. Table 2 describes meat quality parameters. Most of the variables measured are located into the recommended ranges. The highest SR had significant influences on T 24, pH 24 and b*m, but SR did not affect the rest of the traits. It is desirable to decrease muscle temperature after the animal is slaughtered to reduce the losses of proteins and to inhibit bacterial growth, but this reduction has to be slow to prevent cold shortening (Brito, 2002). Consumer preferences are very affected by meat tenderness, being considered as the most important characteristic of meat quality and determinant of the repetition of purchasing (Brito *et al.*, 2002). Tenderness results, obtained by SF measurements were affected by S treatments. These results could be related to the high fat content of the animals under high energy diets (Montossi *et al.*, 2003). Bickerstaffe (1996), cited by Brito *et al.* (2002), suggested that the values of lamb meat tenderness standardized by the meat industry of the United States and New Zealand, to maintain or access to new markets, have to be up to 5 kgF of SF. According to the tenderness results obtained in the present experiment, these animals would be accepted by those important markets. The small differences on tenderness found between treatments, are strongly influenced by the 10 days of meat ageing. This process allows the tenderization of the muscle, reducing differences caused by initial meat tenderness or some processes applied pre, during or post slaughtering (Brito *et al.*, 2002). The findings on T 24 and pH 24 are similar to those reported by Brito *et al.* (2002) for lamb carcasses of different gender and genotypes and less than 12 months old, reared with different nutritional regimes under grazing conditions.

Table 1: Effect of SR and S on animal performance and carcass quality traits.

Variable	Stocking rate (SR)			Supplementation (S)				SR x S
	9	18	P	0	0.75	1.5	P	
LWG (g/d)	123a	106b	**	93c	116b	135a	**	ns
FLW (kg)	36.6a	34.5b	**	33.1c	35.8b	37.9a	**	ns
REA (cm^2)	12.5	12.3	ns	12.3	12.4	12.4	ns	ns
HCW (kg)	14.5a	13.7b	*	12.4b	14.5a	15.4a	**	*
CCW (kg)	14.0	13.4	ns	11.7c	14.1b	15.2a	**	ns
GR (mm)	6.7	5.7	ns	4.6b	6.4a	7.6a	**	ns
FR (g)	344	340	ns	342	338	346	ns	ns
BLS (kg)	1.360	1.330	ns	1.300b	1.340b	1.400a	*	ns

References: ns: not significant (P>0.05), *: P<0.05 and **: P<0.01.
a, b, c: means with different letters within each variable are statistically different.

Table 2: Effect of SR and S on tenderness, temperature and pH and muscle colour parameters.

Variable	CF	Stocking rate (SR)			Supplementation (S)				SRxS
		9	18	P	0	0.75	1.5	P	
SF (kgF)	Nl	2.32	2.25	ns	2.63b	2.05a	2.20a	**	**
T 24 (°C)	1/Nl	4.4a	4.2b	*	4.4	4.3	4.3	ns	ns
pH 24	1/Nl	5.6b	5.7a	*	5.7	5.7	5.7	ns	ns
L*m	Nl	37.7	38.1	ns	38.1	37.7	37.7	ns	ns
a*m	R^3	17.7	17.9	ns	17.9	17.9	17.7	ns	ns
b*m	R^3	8.8a	9.4b	*	9.1	9.2	9.0	ns	ns

References: ns: not significant (P>0.05), *: P<0.05 and **: P<0.01. CF = Correction factor.
a, b: means with different letters within each variable are statistically different.

Conclusions

For the conditions imposed in this study, in general, under grazing conditions with adequate feeding levels, lambs meat quality attributes were not substantially affected by SR and S, particularly when it is considered plant processor requirements (pH and T) and/or consumer preferences (meat tenderness and colour). This study and those provided by Montossi *et al*. (2003) in a national sheep meat quality audit may suggest that the meat produced by these Uruguayan Corriedale lambs would be accepted by the most important external markets.

References

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