Could supplement type affect lamb performance, carcass and meat quality traits under grazing conditions?

F. Montossi*; C. Silveira; S. Luzardo; G. Brito; I. De Barbieri; and R. San Julián

Meat and Wool Production National Research Program, National Institute of Agricultural Research (INIA).

INIA Tacuarembó, Ruta 5 Km 386, Tacuarembó, Uruguay.

*Corresponding author (phone: +598-63-22407; fax: +598-63-23969; e-mail: fmontossi@tb.inia.org.uy).

Abstract— **The objective of this research was to evaluate the influence of different supplement types on animal performance and carcass and meat quality traits. Ninety six Corriedale x Merino Dohne lambs were used with an initial live weight (LW) and body condition (BC) of 25.8 ± 2.7 kg and 2.47 ± 0.17 units, respectively. For 111 days (from 9th June to 29th September 2010) lambs grazed a mixed improved pasture of *Cichorium intybus* and *Trifolium pratense spp*. Lambs were distributed into 8 treatments (T), product of the combinations of two stocking rates (SR)(12 and 18 lambs/hectare) and three types of supplements (TS; RB-rice bran; S-sorghum; M-maize) and non supplemented animals (NSA). Supplements were offered daily at 1% of LW. SR affected significantly LW gain, Final LW, ultrasound ribeye area (REA), hot (HCW) and (CCW) cold carcass weight as well as frenched rack weight (FR) and boneless leg weight (BL) (P<0.01), being higher for the low SR. There was no effect of SR on BC and carcass fatness (GR) and meat quality traits (intramuscular fat, pH, meat color and tenderness). TS had an important influence on LW gain, Final LW, REA, HCW, CCW and intramuscular fat, in general, the tendency followed the pattern of RB=S>M=NSA (P<0.05). However, TS did not influence BC, FD, FR, BL and for all the meat quality traits measured (P>0.05). In the majority of the traits evaluated, there were no interactions between SR and TS. Considering the different prizes and market availability of the supplements taken for this study, RB supplement appears as an interesting option to increase animal performance and productivity in lamb finishing systems in the extensive areas of Uruguay, achieving also the standards for carcass and meat quality traits required by plant packers and their international clients**.

***Keywords*—supplement type, grazing, lamb performance, carcass and meat quality.**

I. INTRODUCTION

The high wool and lamb meat prices are encouraging sheep farmers to increase animal performance, productivity and carcass/meat quality. There are also requirements from plant packers to lamb producers to accomplish certain carcass quality standards, which are encouraging via price to produce higher carcass weights with adequate level of carcass fatness. In this positive business environment, the use supplements for lamb finishing systems under grazing conditions are clear technology and economical options to lamb producers. There is an active interest in using different sources of supplements, where the most common used by farmers are sorghum and corn grains, as well as other alternatives like supplement blocks and concentrates. Rice bran, given its price advantage, adequate nutritional composition, and extensive availability in many of the sheep producing regions, appears an interesting option to be used in lamb finishing systems. However, there is a lack of technology information about the influence of rice bran supplement on lamb performance, carcass and meat quality. This study is focused into study the impact of different alternatives of grain supplements under contrasting grazing conditions to increase lamb productivity and quality.

II. MATERIAL AND METHODS

This experiment was carried out at the Basaltic region of Uruguay, using *Trifolium repens* cv. LE 116 and *Cichorium intybus* cv. INIA Lacerta, grazed by 96 Corriedale x Merino Dohne lambs (3-4 months of age), to evaluate the effect of stocking rate (SR; 12 and 18 lambs/ha) and type of supplement (TS; RB-rice bran; S-sorghum; M-maize) and non supplemented animals (NSA). Supplements were offered daily at 1% of liveweight (LW). S and M were offered entire and RB in the natural way (well mixed). At the beginning of the experiment, the average LW and body condition score (BCS) were 25.8 ± 2.7 and 2.47 ± 0.17 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), carcass fat cover (GR), frenched rack weight (FR) and boneless leg weight (BLS), meat parameters colour, tenderness, and meat temperature (T24) and pH (pH 24) at 24 hours *psmortem*, 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 ^{o}C 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^{o}C 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 2x4 factorial structure, where the main plot was SR (12 and 18 lambs/ha) and the split plot was TS (NSA, RB, S, and M). 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.

III. RESULTS AND DISCUSSION

Table 1 shows animal performance and carcass quality traits results. SR affected significantly LW gain, Final LW, ultrasound ribeye area (REA), hot (HCW) and (CCW) cold carcass weight as well as frenched rack weight (FR) and boneless leg weight (BL) (P<0.01), being higher for the low SR, where animals at the lower SR obtained higher values than animals at higher SR There was no effect of SR on carcass fatness (GR).

These results can be explained by pasture results, which are not presented here, where lambs at the lower SR had potentially higher herbage intakes and nutritive value in the diet than those of managed at the high SR. This information is aligned with those obtained in a series of experiment performed and summarized by Montossi *et al*. (2003). The other carcass quality traits were not affected by SR (Table 2), with the exception of IMF, where it was higher for lambs at the low SR. Under extreme conditions under grazing, SR could have important effects on meat quality traits (Montossi *et al*., 2003). The TS affected LWG, FLW, HCW, CCW, FR, and BLS traits, with the exception of FR and REA, where RB and S produced higher values than NSA, being M in a intermediate position. When FR and BLS were adjusted by HCW (co-variate) the differences between TS disappeared. In most of the cases, there were no significant interactions between SR and TS for all variables, or these were of scarce significance, showing that grazing conditions were not extreme to perceive the positive effect of supplementation to increase animal production and product quality, as it has been shown by Montossi *et al.* (2003). As it is shown in Table 2, most of the meat quality variables analyzed were located into the recommended ranges for the Uruguayan heavy lamb market. With the exception of IMF, the TS did not affect meat quality traits. Consumer preferences are strongly affected by meat tenderness, being considered as the most important characteristic of meat quality and determinant of the repetition of purchasing (Brito *et al.*, 2002a). The high tenderness values obtained in this experiment could be related to the high fat content of the animals under high energy diets and given the aging period of 10 day applied (Montossi *et al.*, 2003). Bickerstaffe (1996), cited by Brito (2002b), 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 findings on T24 and pH24 are similar to those reported by Brito *et al.* (2002a) for lamb carcasses of different gender and genotypes and less than 12 months old, reared with different nutritional regimes under grazing conditions.

IV. CONCLUSIONS

In general, the results of this experiment showed that the use of high productive pastures, proper supplements and adequate SR could encourage productivity and carcass/meat quality in intensive lamb finishing systems in the extensive regions of Uruguay. Given the advantages in price and availability to farmers, RB supplement appears to be an interesting excellent tool for lamb producers, which have not been used in the pass. This requires further information related to its effect on fatty acid profile and therefore on human health

ACKNOWLEDGMENT

F. Montossi wishes to thank INIA for the financial support of this study.

REFERENCES

1. Brito, G., San Julián, R., Montossi, F., Castro, l., Robaina, R. 2002a. Caracterización de la terneza, pH, temperatura y el color pos mortem en corderos pesados machos y hembras: resultados preliminares. In: Investigación aplicada a la cadena agroindustrial cárnica: avances obtenidos: carne ovina de calidad (1998-2001). Montossi, F., ed. INIA Tacuarembó. p. 131-139. (Serie Técnica 126).
2. Brito, G. 2002b. Factores que afectan el rendimiento y la calidad de canales. In: Investigación aplicada a la cadena agroindustrial cárnica: avances obtenidos: carne ovina de calidad (1998-2001). Montossi, F., ed. INIA Tacuarembó. p. 51-57. (Serie Técnica 126).
3. Montossi, F., San Julián, R., Brito, G., de los Campos, G., Ganzábal, A., Dighiero, A., De Barbieri, I., Castro, L., Robaina, R., Pigurina, G., de Mattos, D. y Nolla, M. 2003. Producción de carne ovina de calidad con la raza Corriedale: recientes avances y desafíos de la innovación tecnológica en el contexto de la Cadena Cárnica Ovina del Uruguay. Resúmenes del 12° Congreso Mundial de Corriedale. Montevideo, Uruguay. pp. 74-90.

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

Variable	Stocking rate (SR)			Type of Supplements (TS)				
	12	18	P	RB	M	S	NSA	P
LWG (g/d)	192a	176b	**	187a	182ab	198a	169b	**
FLW (kg)	47.1a	45.5b	**	47.1a	45.9bc	47.8a	44.4c	**
REA (cm^2)	10.6a	10.1b	*	10.6	10.4	10.4	10.0	ns
HCW (kg)	22.2a	21.1b	**	22.2a	21.4ab	22.4a	20.5b	*
CCW (kg)	21.9a	20.7b	**	21.6a	21.0ab	22.0a	20.3b	**
GR (mm)	13.4	12.1	ns	14.7a	12.9ab	12.3b	11.2b	*
FR (g)	529a	496b	*	529	505	520	494	ns
BLS (g)	2168a	2048b	*	2174	2117	2139	2011	*

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 TS on tenderness, temperature and pH and muscle colour parameters.

Variable	Stocking rate (SR)			Type of Supplements (TS)				P
	12	18	P	RB	M	S	NSA	
IMF (%)	6.4a	6.0b	*	6.5ab	5.9b	6.8a	5.7b	*
SF[1] (kg F)	2.2	2.1	ns	2.1	2.2	2.1	2.2	ns
T 24 (°C)	3.5	3.5	ns	3.4	3.5	3.7	3.4	ns
pH 24	5.8	5.78	ns	5.78	5.79	5.78	5.82	ns
L*m	35.2	35.5	ns	35.1	35.0	35.7	35.7	ns
a*m	18.0	18.1	ns	18.0	18.3	17.9	17.9	ns
b*m	3.9	3.7	ns	3.8	3.8	3.8	3.7	ns

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