PE1.71 The influence of feeding regimes on lamb performance, carcass and meat quality traits under grazing conditions in Uruguay 440.00

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Abstract-The inclusion of grain supplementation could improve individual lamb performance, production per unit of area, and carcass and meat quality. The objective of this study was to evaluate the effects of the restricted use of grain supplementation on specialized pastures for improving lamb production, carcass and meat quality. Seventy five castrated male Uruguayan Corriedale purebred or Merino Dohne crossbred lambs were finished into 3 different feeding systems, with different proportions of pasture (P) (mainly dominated by a mixture of Plantago lanceolata cv. Tonic and Lotus corniculatus cv. INIA Draco) and entire sorghum supplementation (C), where: T1, P (4% of live weight, LW); T2, P (2% LW) plus C (0.8% LW); and T3, P (2% LW) plus C (1.6 % LW). T1 lambs had significantly higher liveweight gain (LWG), hot carcass weight (HCW), boneless leg weight (BLW) than T2 and T3 lambs (P<0.05). However, there were no effects of treatments on final liveweight (FLW), rib eye area (REA), fat cover (PC) at REA, carcass tissue depth at GR point (GR), frenched rack weight (FRW), meat colour (a* and b*, with the exception of L* in favour of T1), tenderness, and pH. Restricted use of grain supplementation under grazing condition improved lamb performance and productivity per unit of area, but had minor influence on lamb carcass and meat quality.

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Index Terms-Plantago Lanceolata, supplementation, grazing, lamb, carcass and meat quality.

I. INTRODUCTION

LAMB meat production and exportation has increased substantially in Uruguay since the establishment of the Heavy Lamb Program (HLP; 1996) [1]. The main markets for this product are Brazil and the European Union. The Uruguayan sheep production systems are mainly operated by small to medium scale livestock producers under extensive grazing, without the use of hormone promoters, feedloting, or feeding ruminants with animal protein, etc [1]. However, the global increase in crop prices had an important impact on land use, price, rent and in farming practices in South America. In this new scenario, livestock land has been taken for cropping, lead by soybean farming. Meat and wool farming has principally moved to the marginal soils of the country [2]. Under this competitive commercial context, lamb production systems have to increase production levels and efficiency. The use of improved pastures and grain supplementation under intensive grazing conditions could increase lamb meat production levels per hectare as well as product quality and profitability in the semi-extensive regions of Uruguay. Under grazing conditions, grain supplementation has demonstrated to be profitable when high stocking rates and restricted amount of supplements are used [3]. Recently research studies have demonstrated additional benefits in carcass and meat quality [3], sensory attributes [4] and consumer acceptance [5]. This approach could be applied to the strategic use of grain supplementation for lamb fattening on improved pastures developed on medium and deep soils in the extensive Basaltic region of Uruguay, where most of the sheep farming is concentrated on. This experiment was designed to evaluate the effects of the restricted use of grain supplementation on specialized pastures for improving lamb production and carcass and meat quality.

II. MATERIALS AND METHODS

A. Animals and treatments

This experiment was conducted at the Experimental Unit 'Glencoe', belonging to the INIA Tacuarembó Experimental Station. The experiment lasted 108 days (24th July-9th November 2008). Seventy five castrated male Uruguayan Corriedale purebred or Merino Dohne crossbred lambs were finished into 3 feeding treatments, with different proportions of pasture (P) (mainly dominated by a mixture of Plantago lanceolata cv. Tonic and Lotus corniculatus cv. INIA Draco) and entire sorghum supplementation (C), where: T1, P (4% of liveweight, LW); T2, P (2% LW) plus C (0.8% LW); and T3, P (2% LW) plus C (1.6 % LW). Animals were distributed in a balanced manner between treatments according to the lamb initial liveweight (ILW) and body condition score (IBCS), genotype, and sires (6) within each genotype evaluated. The lambs used were part of the crossbreeding genetic project between Corriedale and Merino Dohne breeds [6] . At the beginning, animal live weight (ILW) was 35.5 ± 4.72 kg. and body condition score (BCS) was 2.93 ± 0.35 units (scale 1-5) [7].

B. Traits measured

The variables measured in vivo were: LWG, FLW, rib eye area (REA), and fat cover (PC) at REA by ultrasound scanning. The following carcass and meat quality parameters were measured: HCW, GR, FR and BLW, meat colour, tenderness, and meat temperature (T24) 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 centre of the exposed Longissimus dorsi (LD) 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 CIELAB colour space system. A portion of LD 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 70oC was reached. The internal temperature was monitored using type E thermocouples placed in the approximate geometric centre of the sample. Six cores (2.54 cm in diameter) parallel to the muscle fibre 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, carcass and meat measurements are described by Montossi [8].

C. Statistical analysis

It was applied a completely random experimental design. The analysis of variance was done with Proc GLM (SAS Institute Version 9.1, 2008) with treatment as a fixed effect. Means were compared by the LSMEAS procedure (SAS, 2008)($P<0.05$). 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

In Table 1 is presented the effect of treatments on lamb performance, in vivo carcass measurements and carcass quality traits. Treatments had a significant effect on LWG. Animals at T1 and T3 showed higher values than those animals of T2. This result could be explained by the lower intake and nutritive value of the diet achieved by T2 lambs compared with those lambs of T1 and T3 (Montossi et al., unpublished). The energy and crude protein concentrations of Plantago lanceolata and/or Lotus corniculatus during winter-spring are normally higher than that of sorghum grain (Montossi et al., unpublished). Similar tendency was also reflected in FLW, HCW and BLW. The other carcass traits (in vivo and pos mortem) were not affected by treatment (REA, PC, GR and FR). Despite of the differences found in LWG in favour of T1, T2 and T3 produced more LW per unit of area than T1 during the 108 days of fattening (165, 275 and 302 kg. LW/hectare for T1, T2 and T3, respectively). These results showed the key role of grain supplementation in increasing lamb carrying capacity and the subsequent positive effects on production per unit of area. Table 2 shows the influence of treatments on meat quality parameters. The values of pH found in this study are desirable to reduce the losses of proteins and to inhibit bacterial growth [9]. Consumer preferences are strongly affected by meat tenderness, which is considered as the most important characteristic of meat quality, determining the repetition of purchasing [9]. Lamb meat texture results, obtained by SF analysis, fell into the recommended threshold mentioned [8]. Lamb meat tenderness standardized by the meat industries of the United States and New Zealand suggests that meat SF have to be up 5 kgF. This is a goal to maintain or access to new markets. The small differences on tenderness found between treatments could also be influenced by the 10 days ageing period. This process allows the tenderization of the muscle, reducing differences in initial meat tenderness values or differences caused by some processes applied pre, during or post slaughtering [9]. The range of values found in this study coincide with those reported by Brito [9] and Montossi [8] for lamb meat of animals between 8 and 12 months old, reared with different nutritional regimes under grazing conditions, with different gender and genotypes. Grain supplementation (T2 and T3) improved L* values. Similar results have been mentioned in others studies [8].

IV. CONCLUSION

In the semi-extensive regions of Uruguay, the results of this study shows that the restricted use of grain supplementation in 8-12 months old lambs under grazing conditions, could improve animal performance and productivity per unit of area, but not necessary has major effects on lamb carcass and meat quality.

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Table 1. Mean values of animal performance characteristics and carcass quality traits.

Variable	T1	T2	T3	P
LWG (g/d)	163 a	134 b	148 ab	**
FLW (kg) [1]	53.0 a	49.8 b	51.5 ab	*
REA (cm^2) [2]	11.5	11.3	11.3	ns
PC (mm) [2]	4.1	4.0	4.2	ns
HCW (kg)	22.9 a	21.7 b	22.7a b	**
GR (mm) [3]	9.8	8.7	10.0	ns
Frenched Rack (kg)[3]	0.514	0.497	0.502	ns
Boneless Leg (kg)[3]	2.265 a	2.151 b	2.202a b	**

References:
ns: not significant (*; P<0.05, **; P<0.01).
FLW: Final fasted live weight.
[a, b]: means with different letters among columns are significant different (P<0.05).
[1]: adjusted by initial FLW.
[2]: adjusted by FLW.
[3]: adjusted by HCW.

Table 2. Mean values of meat quality traits.

Variable	TF	T1	T2	T3	P
SF (kgF) 10 days	-	2.5	2.6	2.6	ns
pH 24 hs	-	5.7	5.7	5.7	ns
L* 10 days	?3	34.2 b	35.7 a	35.6 a	*
a* 10 days	?3	17.2	17.4	17.2	ns
b* 10 days	?3	7.6	6.9	7.3	ns

References:
ns: not significant (P>0.05).
[a, b]: means with different letters among columns are significant different (P<0.05).
TF = Transformation factor.