TERMINAL SIRE BREED AND EWE GENOTYPE EFFECTS ON PRODUCTION OF HEAVYWEIGHT LAMB CARCASSES

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SUMMARY

Lambs from Columbia (C), New Zealand Dorset (D) and Suffolk (S) sires and born to either whiteface (WF) ewes or blackface (BF) ewes containing at least half Hampshire genes were slaughtered to produce carcasses averaging 29 kg. S-sired lambs were the lowest and D-sired lambs were the highest for all measures of carcass fatness. Lambs from BF dams were likewise leaner than lambs from WF dams for all fatness measures. These genetic paternal and maternal effects on carcass fatness were reflected in significant differences in weight of trimmed cuts produced by carcasses at the same weight.

INTRODUCTION

U.S. lamb producers are facing the dilemma of processor demands for heavier slaughter lambs but consumer demands for leaner meat. Unfortunately, as lambs approach maturity their weight gains are increasingly made up of fat (Butterfield, 1988). Tatum et al. (1988), in a U.S. national survey of lamb carcass cutability, found that over half of all carcasses exceeded the maximum fatness (6 mm of fat over the longissimus dorsi) considered acceptable. The average weight of carcasses measured was 27 kg and a strong positive relationship was seen between carcass weight and fatness.

Clearly, there is need to reduce average carcass fatness. This trial was conducted to examine the potential roles of terminal sire breeds, dam genotypes, and post-weaning management regimens in production of acceptably lean lamb carcasses of heavy weight. Ewe genotypes were chosen to represent a cross section of commercial ewes commonly raised in the Pacific Northwest region of the U.S.

MATERIALS AND METHODS

Lambs were produced from Columbia (C), New Zealand Dorset (D), and Suffolk (S) rams mated to ewes of seven breeds or crosses: Coopworth (Cp), Polypay (P), Cp x P, Hampshire (H), H x Cp, H x P, and H x (CpxP). Each sire breed was represented by three rams mated in single-sire groups. Ewes were randomized within each genotype to sire breed and ram within breed. All ewes were two years old at lambing and, apart from separation for single-sire mating, had been managed together as a single group since their birth.

Lambs were born indoors in late winter (February). Within 24 hours of birth, lambs were individually identified, elastrator rings were applied to dock all lambs and castrate males, and litters of three or more lambs were reduced to two. Lambs went to pasture with their dams at an average age of ten days and remained there until weaning at an average age of 90 days. From about 300 lambs available in early June, a group of 210 was selected based on uniformity of weight and balanced for sire breed, sire within breed, dam genotype, and gender. Lambs were then randomized within these criteria to three nutritional management regimens - ad libitum concentrate feeding (pelleted 14% protein diet) to slaughter, conserved pasture silage fed for six weeks followed by the concentrate diet until slaughter, or irrigated pasture for 10 weeks followed by the concentrate diet until slaughter. Lambs were sent to slaughter in four groups of approximately equal size at an average liveweight of 57 kg.

Lambs were slaughtered and graded by standard commercial procedures. Kidney/pelvic fat was removed, weighed and recorded prior to carcasses entering the chiller. Chilled carcasses were weighed and numerous linear measures were recorded (Table 1). Carcasses were fabricated by plant personnel into trimmed, tray-ready retail cuts and the weight of each cut was recorded. The weights of the three minor cuts (shank, riblets and neck) were combined for analysis and reported as a single measure.

Data were analyzed using General Linear Models (GLM) procedures of the Statistical Analysis System software package (SAS Institute, 1985). Initial models indicated little importance of two-way interactions, and dam genotype effects were largely explained by the presence or absence of blackface (H) breeding in the ewes. Accordingly, dam genotype was designated as whiteface (WF) or blackface (BF) on the basis of absence or presence of H breeding in the dam. Data were then analyzed with a final model fitting sire breed, dam genotype (WF vs BF), lamb gender, and nutritional treatment as main effects with cold carcass weight fitted as a covariate. Treatment effects were of minor importance and will not be reported in this paper.

RESULTS

Both sire breed and dam genotype affected the majority of carcass measurements as shown in Table 1. As a consequence of slaughtering lambs when an adequate number reached the target slaughter weight, lambs of the three sire breeds did not differ significantly in carcass weight although carcasses from S-sired lambs were slightly heavier. Since facilities were not available to weigh lambs pre-slaughter, it was not possible to determine dressing percentages.

Lambs from S sires had larger ribeye area ($P<.05$) and a higher leg score ($P<.001$) than lambs from the other two breeds, suggesting they were more muscular. They also had the lowest values for body wall thickness, all linear fat measurements, weight of kidney fat, and USDA yield grade scores while D-sired lambs were highest for all of these traits (all $P<.05$).

Sire breed differences in fatness were reflected in the total weight of trimmed cuts with S-sired lambs producing 4% more saleable product then D-sired lambs adjusted to the same cold carcass weight ($P<.01$). Relative to the other two sire breeds, S-sired lamb carcasses produced the heaviest trimmed legs, sirloins, and shoulders but the lightest racks (all $P<.01$). C-sired lambs produced heavier legs and shoulders than D-sired lambs (both $P<.01$).

The pattern of greater muscling but leaner carcasses in lambs from blackface (Suffolk) vs whiteface (Columbia and Dorset) sires was repeated in progeny of BF vs WF dams. Lambs from BF ewes exhibited greater ribeye area and leg score (both $P<.001$) but were leaner with lower values for yield grade and all four linear fat measures (all $P<.05$). The sire breed pattern also extended to weight of cuts produced with progeny of BF dams producing heavier legs, sirloins, shoulders, and total salable cuts (all $P<.05$) than lambs from WF dams.

All measures of carcass fatness except thickness of sacral fat indicated that male lambs were leaner than females. Male lambs produced heavier legs and shoulders while females produced heavier sirloins and racks (all $P<.01$). Total weight of cuts was greater for male lambs ($P<.01$).

DISCUSSION

Overall, only 54% of carcasses in this trial were acceptably lean as defined by having 6 mm or less fat over the longissimus dorsi. The respective proportions by genetic and gender group were: .54, .25, and .84 for C, D and S-sired lambs; .51 and .57 for lambs from WF vs BF dams; and .65 for males vs .43 for female lambs. The effect of gender on proportion of acceptable carcasses was largest for D-sired lambs (10% of females vs 40% or males) and least for S-sired lambs (79% of females vs 88% of males).

While lambs from Suffolk sires were the leanest in this trial, results from previous comparisons of Suffolks with other sire breeds have not been consistent. This may be due to previous comparisons generally being made at substantially lighter carcass weights (eg. Wolf et al. (1980), 16 kg; Kempster et al. (1987), 18.5 kg) or to the larger mature size of U.S. Suffolks relative to the breed in other countries (Leymaster and Jenkins, 1993).

Among previous North American comparisons of crossbred lambs from the Suffolk and Columbia breeds, Vesley and Peters (1972) and Hohenboken (1977) both reported Suffolk-derived animals producing leaner carcasses while Leymaster and Smith (1981) reported Columbia-sired carcasses being leaner. In all three previous trials carcass weights were at least 5 kg lighter than in this trial which may explain the apparent discrepancy between our results and those of Leymaster and Smith (1981).

Results of this trial indicate that the recently-imported New Zealand Dorset breed is not suitable as a terminal sire for producing lean carcasses of the weights desired by the U.S. market.

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Table 1. Least squares means and average standard errors ($\bar{SE}$) for carcass measures and weight of individual cuts from carcasses of lambs from Columbia (C), Dorset (D), and Suffolk (S) sires and whiteface (WF) or blackface (BF) dams.

	Sire					Dam				Sex			
	C	D	S	$\bar{SE}$	Sig.	WF	BF	$\bar{SE}$	Sig.	F	M	$\bar{SE}$	Sig.
Number	62	66	67	-	-	100	95	-	-	100	95	-	-
Carcass weight, kg	28.9	28.9	29.3	0.3	NS	28.8	29.3	0.2	*	28.5	29.3	0.2	*
Carcass length, cm	65.2	64.1	65.2	0.2	***	64.9	64.7	0.2	NS	64.6	65.0	0.2	+
Ribeye area, cm	15.2	15.0	15.8	0.2	*	14.6	16.0	0.2	***	15.2	15.5	0.02	NS
Yield grade	2.5	3.21	1.99	0.07	***	2.66	2.48	0.06	*	2.80	2.34	0.06	***
Body wall, cm	2.65	2.98	2.32	0.04	***	2.77	2.52	0.04	***	2.77	2.52	0.04	***
Leg score[a]	12.3	12.4	12.7	0.1	***	12.1	12.8	0.1	***	12.4	12.5	0.1	+
Kidney fat, kg	1.12	1.01	0.90	0.04	**	1.04	0.98	0.03	NS	1.05	0.97	0.03	NS
Fat thickness, cm													
12th rib	0.65	0.85	0.48	0.02	***	0.78	0.62	0.02	**	0.72	0.58	0.02	***
Lower rib	1.84	2.21	1.57	0.04	***	1.97	1.77	0.04	**	1.96	1.78	0.04	***
Sacral	1.74	2.14	1.48	0.05	***	1.86	1.71	0.04	+	1.79	1.78	0.04	NS
Retail cuts, kg													
Leg	5.66	5.47	5.88	0.02	***	5.60	5.73	0.02	***	5.59	5.74	0.02	***
Sirloin	1.38	1.39	1.43	0.01	***	1.38	1.42	0.01	***	1.42	1.37	0.01	***
Loin	2.29	2.27	2.29	0.02	NS	2.27	2.30	0.02	NS	2.27	2.30	0.02	NS
Rack	2.40	2.42	2.26	0.03	***	2.35	2.36	0.02	NS	2.40	2.31	0.02	**
Shoulder	5.18	5.04	5.27	0.03	***	5.13	5.20	0.02	*	5.05	5.27	0.02	***
Minor Cuts	2.75	2.64	2.82	0.02	***	2.72	2.75	0.01	***	2.71	2.77	0.01	**
Total	19.65	19.23	19.94	0.05	***	19.45	19.76	0.04	***	19.44	19.76	0.04	***

[a]11 = Choice, 12 = Choice +, 13 = Prime-.

***(P<.001, **(P<.01), *(P<.05), +(P<.10), NS(P>.01).