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Effect of sire genotype on lamb growth and carcass productivity

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ABSTRACT

The growth and carcass traits of 774 lambs out of Romney ewes and sired by Suffolk (S), Landcorp Lamb Supreme (LS), Texel (T) and Romney (R) rams were compared when slaughtered on five occasions (groups 1 to 5): November 1995, February, March, May and July 1996. Forty carcasses per slaughter group were dissected into commercial cuts of saleable meat, fat trim and bone. S- and LS-sired lambs had heavier pre-slaughter liveweights than T-sired lambs (38.4 ± 0.27, 38.5 ± 0.26, vs 36.3 ± 0.27 kg respectively; P<0.001), which in turn were heavier than R-sired lambs (35.0 ± 0.29 kg; P<0.001). S-sired lambs had heavier hot carcass weights than both LS- and T-sired lambs in slaughter groups 4 and 5 (+0.9 to +1.9 kg; P<0.01); R-sired lambs were significantly lightest in all slaughter groups (-0.7 to -3.9 kg; P<0.05). S- and R-sired lambs had greater adjusted GR tissue depths than LS-sired lambs in later slaughter groups. T-sired lambs were generally intermediate between LS- and R-sired lambs. R-sired lambs produced less weight of saleable meat than S-, LS- and T-sired lambs (by 1.4 to 1.7 kg; P<0.01). Lambs sired by Landcorp's terminal sire breeds out-produced those sired by the company's maternal R sire breed. S-sired lambs exhibited rapid growth early in the season, but increased fat levels later in the season compared with LS-and T-sired lambs.

Keywords: lamb; sire genotype; growth; carcass; saleable meat.

INTRODUCTION

Landcorp Farming Limited's slaughter lamb enterprise is comprised of predominantly straightbred Romney (R) lambs surplus to breeding flock requirements, and crossbred lambs sired by the Suffolk (S), Landcorp Lamb Supreme (LS) and Texel (T) terminal sire breeds. The purpose of this study was to compare the growth and carcass performance of these four genotypes of lambs when slaughtered at various stages throughout the season, to better coordinate the supply flow in the company's slaughter lamb production system. It was expected that the S-sired lambs would display rapid early growth, but increased fatness levels at later stages compared with LS- or T-sired lambs. It was further expected that lambs sired by Landcorp's terminal sire breeds would out-perform those sired by its maternal R breed.

MATERIALS AND METHODS

Approximately five sires from each breed were selected as being representative of those produced in Landcorp's sire breeding programmes involving the Suffolk (S), Landcorp Lamb Supreme (LS), Texel (T) and Romney (R) breeds. The LS is a composite terminal sire breed (Nicoll *et al*., 1992). Each team of sires (ie, sires of the same breed) was joined with around 520 Landcorp ewes of mixed ages for 21 days (22 March to 11 April 1995). Ewes marked during this period were identified according to the sire breed they were joined with; an average conception date of 1 April was assumed. Ultrasonic pregnancy diagnosis was conducted on 13 June, with pregnant ewes being drafted into single- and twin-bearing management ("birth rank") groups. In late August/early September the ewes were further drafted into their original mating groups for lambing (ie, 4 mating groups x 2 "birth rank" groups = 8 mobs). Lambs were individually identified at docking (18-19 October), and recorded for sire breed, sex (ewe and short-scrotum ram), and "birth rank". Ewes and lambs were mobbed within "birth rank" groups to weaning (23 November), at which time all lambs were weighed, allocated to one of five slaughter groups (balanced for sire breed, sex, "birth rank" and weaning weight), and subsequently managed in one mob. Using these same allocation criteria, 40 lambs in each slaughter group were also identified for post-slaughter carcass dissection.

Lamb liveweights were recorded some 2 to 5 days preceeding each of the five slaughter dates (Table 1). Following slaughter, hot carcass weight, GR depth and weight of kidney fat were recorded for each lamb. Carcass dissection was conducted on the selected carcasses after chilling overnight, and involved dissection of the half-carcass into commercial boneless cuts, with the weights of saleable meat, fat trim and bone recorded.

All liveweight and carcass data were analysed by GENSTAT (1995), fitting the fixed effects of sire breed, slaughter group, sex, "birth rank", and the first order interactions among sire breed, slaughter group and sex.

RESULTS

The number of lambs recorded and the dates of slaughter are shown in Table 1. The sire breed x slaughter group interaction for lamb pre-slaughter liveweight was not sig-

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TABLE 1: Number of lambs recorded and dates of slaughter.

Slaughter group	Date of slaughter	Assumed lamb age (d)	Number of lambs per sire breed[1]				
			S	LS	T	R	Total
1	28 Nov 1995	90	49	51	51	41	192
2	1 Feb 1996	158	56	53	52	43	204
3	19 Mar 1996	203	25	28	26	23	102
4	14 May 1996	259	23	24	24	23	94
5	9 Jul 1996	315	49	48	42	43	182
			202	204	195	173	774

[1] In this and subsequent tables, S = Suffolk, LS = Landcorp Lamb Supreme, T = Texel, R = Romney

TABLE 2: Mean (± SEM) hot carcass weight (kg) for lambs by different sire breeds and slaughtered at varying stages[1].

Sire breed	Slaughter group[2] 1	2	3	4	5
S	10.7 (0.28)a	15.8 (0.26)a	19.4 (0.39)a	22.4 (0.42)a	24.5 (0.28)a
LS	11.2 (0.27)a	15.5 (0.27)ab	19.1 (0.37)a	20.5 (0.41)b	23.6 (0.28)b
T	10.9 (0.27)a	15.0 (0.26)b	19.0 (0.38)a	20.9 (0.40)b	23.2 (0.30)b
R	10.0 (0.30)b	13.3 (0.30)c	16.8 (0.42)b	18.5 (0.41)c	21.8 (0.30)c

[1] Within slaughter group, values with different superscripts differ significantly (P<0.05).
[2] See Table 1 for definitions of slaughter groups.

nificant. Sire breed means were 38.4 ± 0.27, 38.5 ± 0.26, 36.3 ± 0.27 and 35.0 ± 0.29 kg for S, LS, T and R respectively. S- and LS-sired lambs had heavier pre-slaughter liveweights than T-sired lambs (P<0.05), which in turn were significantly heavier than R-sired lambs. As expected, pre-slaughter liveweights increased with slaughter group (P<0.001): 24.2 ± 0.27, 35.5 ± 0.26, 39.1 ± 0.37, 44.2 ±0.39 and 48.0 ± 0.28 kg for slaughter groups 1 to 5 respectively.

There was a significant sire breed x slaughter group interaction for hot carcass weight (Table 2; P<0.01). S-sired lambs had significantly heavier carcass weights than LS-sired lambs in slaughter groups 4 and 5 and T-sired lambs in slaughter groups 2, 4 and 5. LS- and T-sired lambs did not differ at any stage, and R-sired lambs had lighter carcass weights than all other breed groups in all slaughter groups (P<0.05).

Changes in sire breed rankings between pre-slaughter liveweight and hot carcass weight indicated variation between genotypes in carcass dressing percentage. T-sired lambs had the highest dressing percentage in virtually all slaughter groups (range = 43.3 to 49.8%), being greater than those for LS-sired lambs (range = 41.7 to 47.7%; P<0.001) and R-sired lambs (range = 40.7 to 47.5; P<0.001). The dressing percentage of S-sired lambs (range = 42.3 to 49.9%) was similar to LS-sired lambs in slaughter groups 1 and 2 (P>0.05), and thereafter did not differ significantly from those of T-sired lambs.

The sire genotype x slaughter group interaction was significant when GR tissue depths were adjusted for mean hot carcass weight within slaughter group (P<0.001). Differences between the sire genotypes were small in slaughter groups 1 and 2 (Table 3). However, S- and R-sired lambs had significantly greater adjusted GR depths than LS-sired lambs in slaughter groups 3 through 5. T-sired lambs were generally intermediate between the R- and LS-

TABLE 3: Mean (± SEM) GR depth (mm) adjusted for hot carcass weight within slaughter group, for lambs sired by different sire breeds and slaughtered at varying stages[1].

Sire breed	Slaughter group[2] 1	2	3	4	5
S	3.6 (0.34)[ab]	6.4 (0.32)[a]	12.5 (0.47)[a]	13.9 (0.51)[a]	17.3 (0.34)[a]
LS	3.2 (0.33)[b]	5.8 (0.32)[ab]	10.8 (0.45)[b]	12.2 (0.49)[b]	13.4 (0.34)[b]
T	3.2 (0.33)[b]	5.7 (0.32)[b]	11.4 (0.46)[bc]	13.1 (0.48)[ab]	14.4 (0.36)[c]
R	4.1 (0.37)[a]	6.3 (0.37)[ab]	11.9 (0.51)[ac]	13.6 (0.50)[a]	15.6 (0.37)[d]

[1] Within slaughter group, values with different superscripts differ significantly (P<0.05).
[2] See Table 1 for definitions of slaughter groups.

sired lambs. Adjusted GR depths differed significantly amongst all sire genotypes in slaughter group 5.

Weight of kidney fat (adjusted for hot carcass weight within slaughter group), showed similar variation across the sire genotypes and slaughter groups as GR depth. In general, R-sired lambs (range = 114.8 ± 14.8 to 480.8 ±15.4 g) had greater kidney fat weights (P<0.05) than T-sired lambs (range = 77.3 ± 13.0 to 432.4 ± 14.5 g). S- (range = 85.3 ± 13.2 to 506.1 ± 13.8 g), and LS-sired lambs (range = 91.9 ± 13.1 to 423.9 ± 13.4 g), tended to be intermediate between these two sire genotypes.

The sire genotype x slaughter group interaction did not influence weight of saleable meat dissected from the selected carcasses (P>0.05). Weight of saleable meat did not differ between S-, LS- and T-sired lambs (12.5 ± 0.20, 12.6 ± 0.21 and 12.3 ± 0.20 kg, respectively; P>0.05). However, R-sired lambs had lighter saleable meat weights than the other three sire genotypes (10.9 ± 0.20 kg; P<0.001). The same sire genotype differences were observed for saleable meat weights in the loin, shoulder and hind leg regions of the carcass.

When adjusted for cold carcass weight within slaughter group, the saleable meat weight of T-sired lambs (12.2 ± 0.06 kg) was heavier than that of either LS-sired lambs (12.0 ± 0.06 kg; P<0.01) or R-sired lambs (12.0 ± 0.07 kg; P<0.001). S-sired lambs were intermediate between the T- and LS-sired lambs (12.1 ± 0.06 kg; P>0.05), but had a greater meat weight than the R-sired lambs (P<0.05). The greater adjusted weight of saleable meat of the T-sired lambs was reflected in the adjusted weights of meat in the shoulder and hind leg regions of the carcass, compared with the other three sire genotypes (P<0.05), but not in the loin region.

Sire genotype was not a significant source of variation in either absolute weight of fat trim, or weight of fat trim adjusted for cold carcass weight within slaughter group.

Slaughter group effects were significant for all saleable meat and fat trim weights, whether or not these weights were adjusted for mean cold carcass weight within slaughter group. For example, absolute (unadjusted) weight of saleable meat increased from 7.4 ± 0.22 kg in slaughter group1 to 16.0 ± 0.23 kg in slaughter group 5 (P<0.001). The corresponding values for weight of fat trim were 6.2 ± 59.4 to 888.2 ± 62.0 g (P<0.001).

DISCUSSION

Since the present study effectively slaughtered animals at constant ages, sire genotype effects could be expected to be observed in weight-related traits. Of the terminal sire breeds used, the S- and LS-sired lambs had distinctly heavier pre-slaughter liveweights than the T-sired lambs. However, T-sired lamb carcass weights were generally similar to either or both of the S- and LS-sired lambs throughout the study, reflecting greater dressing out percentages for the T-sired animals. Leymaster and Jenkins (1993) reported heavier pre-slaughter liveweights and carcass weights for S-sired lambs compared with T-sired lambs when slaughtered at different ages. Ellis *et al*. (1997) found that S-sired lambs were heavier than T- and Charollais-sired lambs but that carcass weights and dressing out percentages were similar, when the lambs were slaughtered at the same estimated level of carcass fat cover. When S- and T-sired lambs were slaughtered at the same liveweights (40, 44 and 48 kg), Wylie *et al*. (1997) reported T-sired lambs to have significantly higher dressing out percentages, but sire genotype differences were not observed for either average daily gain or carcass weight.

Sire genotype rankings were generally consistent for carcass fat indicators in the present study. S-sired lambs had significantly greater GR tissue depths and heavier carcass kidney fat weights than the other three sire genotypes, particularly in the later slaughter groups. It is noted that biological variations in fatness may not have been detected by commercial preparation of boneless saleable meat cuts compared with laboratory dissection procedures. Indeed, sire genotype effects were not significant for weight of fat trimmed when cutting into commercial boneless cuts. Nevertheless, S-sired lambs had more fat trim (477.8 ± 54.5 g) than either R-(312 ± 54.4 g; P<0.01), or T-sired lambs (386.7 ± 54.3 g; P<0.10), but not LS-sired lambs (400.7 ± 54.9 g; P>0.10).

When adjusted to the mean carcass weight within slaughter group, the magnitude of sire genotype effects in the present study were reduced, but remained important. In the later slaughter groups S- and R-sired lambs had greater GR depths, more kidney fat, and a tendency for more fat trim than T- and LS-sired lambs. These results contradict the suggestions of Leymaster and Jenkins (1993) and Ellis *et al*. (1997) that T-sired lambs deposited proportionately more of their fat subcutaneously, and less intermuscularly than S-sired lambs. Our results tend to follow those of Cruickshank *et al*. (1996), where the GR depths of T-sired lambs were less than those of S- and Oxford Down-sired lambs at the same carcass weight.

S-, LS- and T-sired lambs produced a greater weight of saleable meat than R-sired lambs; differences between the S-, LS- and T-sired lambs were small. These results suggest that weight of saleable meat was related to carcass weight. When adjusted for carcass weight however, T-sired lambs produced more saleable meat than S- (P<0.10), LS- (P<0.01) or R-sired lambs (P<0.001). The greater meat composition characteristic of T-sired lambs compared with other terminal sire breeds has been commonly reported (eg, Cameron and Drury, 1985; Cruickshank *et al*., 1996; Ellis *et al*., 1997).

Our results clearly demonstrate the greater growth and carcass productivity of crossbred terminal-sired lambs out of maternal breed dams, compared with straightbred maternal breed lambs. Results also indicate that Landcorp Farming Ltd’s slaughter lamb enterprise can exploit different terminal sire breeds to suit different production circumstances and(or) market requirements. The company’s prime lamb enterprise is vertically integrated so that increased production of saleable meat is of direct benefit to the company; the enterprise also has the scale to produce slaughter lambs virtually year round. With spring lambing predominating in Landcorp’s lamb production flocks (and assuming a spread of lambing dates to suit geographical and local climate/pasture production variations), choice of terminal sire breed is a contributing factor to the consistent supply of lambs for slaughter.

Our study supports the hypothesis that S-sired lambs have rapid growth but increased levels of fatness at later stages of the season relative to LS- and T-sired lambs. Within Landcorp, the production of S-sired lambs would be best suited to satisfying lamb supply requirements early in the season. In contrast, T-sired lambs displayed supriority in saleable meat productivity at a given carcass weight, indicating that T-sired lambs would provide carcasses of consistently high saleable meat content at carcass weights specified by market requirements. LS-sired lambs tended to display rapid growth, comparable weight of saleable meat to S- and T-sired lambs at the same age, and low carcass fat compared with these sire genotypes at the same carcass weight. These age-constant weight advantages, and weight-constant leanness advantages, imply that LS-sired lambs could reach target carcass weights at similar times to S-sired lambs but without overfatness problems later in the season, while producing comparable weights of saleable meat as T-sired lambs.

Landcorp Farming Ltd can exploit the differences observed among the terminal sire breeds used in this experiment. Their role in the company's slaughter lamb enterprise is determined by considering the particular breed's characteristics in combination with planned production and marketing circumstances.

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