Postweaning growth and carcass leanness of lambs that differed in preweaning growth rate

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ABSTRACT

The influence of preweaning growth rate on postweaning growth and carcass grading characteristics was investigated in two experiments with lambs at pasture. Differences in preweaning growth rate due to within mob variation, feed allowance treatments or rearing rank had small or no effects on postweaning growth when lambs were offered the same pasture allowance per unit of liveweight or per head after weaning. Therefore lambs with slower preweaning growth rates had lighter carcasses at a common age ($P<0.01$) or were older at a common weight ($P<0.05$). Carcass GR measurements were not significantly influenced by preweaning growth rates when compared at the same carcass weight and slaughter date. An increase in weight-adjusted GR measurements was observed over autumn.

Keywords Lamb growth; carcass; leanness; pasture allowance; rearing rank.

INTRODUCTION

Breed, sex and castration are known to have substantial influences on lamb growth rates and leanness (Carter and Kirton, 1975; Rhodes, 1969; Seideman *et al.*, 1982; Wolf and Smith, 1983) so they should be considered when selecting lambs for production of heavyweight carcasses. There are, however, no proven guidelines for the selection of fast growing, lean lambs from within single breed, sex and castration types. Many lamb producers have only male lambs of one breed and one castration type from which to select. In this situation lamb size is often used as a selection criteria. This paper reports results of two experiments to determine the effect of preweaning growth rate - a major component of lamb size at weaning - on carcass production.

MATERIALS AND METHODS

Experiment 1

Growth rates from birth to weaning were calculated for 420 Coopworth x Romney lambs from a single breeding flock that were reared together until weaning. After removal of unthrifty lambs, those with the slowest (n = 180) and fastest (n = 180) rates were selected for the experiment. They were allocated to 12 mobs in two replicates of a 3 x 2 factorial design with 3 preweaning growth rate treatments (Slow, Fast, Mixed) at each of two pasture allowances (Low, High).

Each treatment group contained 18 ewes, 6 wethers and 6 rams, 20 of which were single and 10 twin lambs. Mixed treatment groups contained 15 lambs from each of the preweaning Slow and Fast categories.

Treatment groups grazed pasture as separate mobs from weaning at 80 days of age to slaughter at 183 days. All lambs were slaughtered on the same day. The Low and High pasture allowances averaged 86 and 434g DM/kg liveweight/d, respectively. Mobs of lambs were shifted to new plots of pasture each week. The area required for each plot was calculated from the pre-grazing herbage mass, total liveweight of the mob and pasture allowance.

Birth dates and weights were recorded. Subsequent liveweights were recorded after an overnight fast. Carcass weights and GR measurements (tissue depth at 12th rib, 11cm from spinous process) were recorded on hot carcasses after slaughter at a commercial meat works. Dressing percentages were calculated from hot carcass weights and unfasted liveweights recorded 3 days before slaughter.

The Mixed groups were included to determine

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TABLE 1 Preweaning growth rate effects on lamb growth and carcass characteristics at two post weaning feeding levels; experiment 1.

Treatments			Liveweight Gain (kg)		Carcass Measurements		
Postweaning pasture allowance	Preweaning growth rate	Postweaning management	Birth to weaning	Weaning to slaughter	Dressing (%)	Weight (kg)	GR[1] (mm)
Low	Slow	Alone	11.8	7.5	38.1	10.1	3.1
		Mixed[2]	12.1	7.2	40.3	10.4	3.1
	Fast	Alone	15.7	8.0	38.7	12.4	4.8
		Mixed[2]	15.8	7.8	40.4	12.5	4.2
High	Slow	Alone	11.8	15.5	41.7	14.6	9.5
		Mixed	11.8	15.8	43.2	14.9	8.5
	Fast	Alone	15.5	15.5	42.2	16.8	11.0
		Mixed	15.1	16.2	43.5	17.0	12.0
LSD (5%)[3]			0.9	2.0	2.3	0.8	1.7

[1] adjusted to the mean carcass weight at each allowance level by analysis of covariance

[2] Slow Mixed = Slow lambs in groups containing Slow and Fast lambs. Similarly for Fast Mixed.

[3] LSD values are based on analyses of 2 replicates of 8 treatment means. Quoted values apply to comparisons of Alone groups. For comparisons of Mixed groups multiply by $\sqrt{2}$ and for comparisons of Alone and Mixed groups multiply by $\sqrt{1.5}$

effects of competition between smaller Slow and larger Fast lambs. These effects were calculated as the difference between the mean values for Slow (or Fast) lambs in Mixed groups and mean values for groups containing only Slow (or Fast) lambs.

Experiment 2

Twelve groups of 22 Coopworth ewes with 22 single or 44 twin lambs were deployed in a 2 (ewe tooth conditions) x 3 (pasture allowance levels) x 2 (lamb rearing ranks) experimental design from an average lamb age of 12 days to weaning at an average age of 82 days. Low, Medium and High pasture allowances for groups with single lambs were 3.5, 6 and 8kg DM/ewe/d and for groups with twin lambs 5, 7.5 and 10kg DM/ewe/d. Each treatment group contained male (induced cryptorchid) and female lambs in the ratio 1:1.2.

After weaning all lambs grazed pasture in one mob until slaughter. On six occasions between February 2 and May 25, lambs expected to produce 15kg carcases were slaughtered. The target liveweight for ewes was 35kg and for cryptorchids 36kg. Procedures were the same as in Experiment 1.

The effects of ewe tooth condition on lamb growth after weaning and carcass leanness were not significant and will not be discussed.

RESULTS

Experiment 1

Lambs in the preweaning Fast category gained liveweight 51g/d faster (197 v. 149g/d) from birth to weaning and were 3.8kg heavier (15.5 v. 11.9kg) at weaning than Slow lambs ($P<0.01$). This difference was maintained till slaughter at both pasture allowance levels. Although there was a trend for lighter lambs to grow faster after weaning, particularly in Mixed groups and at the High allowance level, postweaning growth rates did not differ significantly between preweaning treatments when fed the same pasture allowance per

TABLE 2 Growth and carcass characteristics of single and twin lambs at two postweaning feeding levels; experiment 1.

Treatment	Liveweight Gain (kg)	Carcass Measurements				
Postweaning pasture allowance	Rearing rank	Birth to Weaning	weaning to slaughter	Dressing (%)	Weight (kg)	GR[1] (mm)
Low	Single	14.1	7.4	39.5	11.6	3.8
	Twin	11.9	8.4	38.9	10.6	4.2
	LSD (5%)[2]	0.7	0.7	0.6	0.5	0.6
High	Single	14.1	15.1	42.6	16.0	10.4
	Twin	12.0	16.2	42.2	15.1	10.0
	LSD (5%)[2]	0.6	0.9	0.6	0.6	0.9

[1]adjusted to the mean carcass weight at each allowance level by analysis of covariance

[2]LSD values are based on analyses in which individual lambs were used as replicates.

TABLE 3 Main effects of preweaning nutritional treatments and rearing ranks on growth and carcass characteristics, experiment 2.

	Liveweight Gain (kg)		Carcass Measurements			Age At Slaughter[1] (Days)
	Birth to Weaning	Weaning to first slaughter	Dressing (%)	Weight (kg)	GR[2] (mm)	
Preweaning pasture allowance						
Low	14.8	8.4	40.7	15.3	8.4	182
Medium	15.9	7.8	41.3	15.5	8.5	179
High	17.4	7.8	40.9	15.4	8.2	172
LSD (5%)[3]	0.5	0.6	0.7	0.3	0.6	7
Rearing Rank						
Single	16.6	7.7	40.8	15.3	7.1	165
Twin	15.5	8.3	41.1	15.5	8.5	191
LSD (5%)[3]	0.5	0.5	0.6	0.2	0.6	6

[1] adjusted to 15kg carcass weight by assuming a carcass weight gain of 60g/d

[2] adjusted to 15kg carcass weight using analysis of covariance

[3] LSD values are based on an analysis of 24 = 2 x 3 x 2 treatments (x 2 sexes) group means with the error term derived using individual lambs as replicates.

unit liveweight (Table 1). Lambs fed the Low postweaning allowance grew at 77 g/d between weaning and slaughter while those fed the High allowance grew at 159g/d ($P<0.01$).

Competition between preweaning Slow and Fast lambs in Mixed groups had no significant effect on growth rates after weaning, at Low or High pasture allowance levels.

Carcasses of the preweaning Fast lambs were 2.2kg heavier than those of Slow lambs at 6 months of age($P<0.01$). Significant ($P<0.05$) treatment effects on carcass dressing percentage and GR measurement in Table 1 were removed when values were adjusted for differences in carcass weight.

None of the treatment interactions were significant for growth or carcass parameters.

Ram lambs had heavier carcasses than wether or ewe lambs ($P<0.05$) principally because they grew faster after weaning ($P<0.01$). Compared with single lambs, twin lambs were 2.2kg lighter at weaning ($P<0.01$) and although they grew 1.1kg more after weaning ($P<0.05$) their carcasses were 1.0kg lighter ($P<0.01$) when slaughtered at 6 months of age (Table 2). When GR measurements were adjusted for differences in carcass weight, mean values for twin lambs were not significantly different from those for single lambs.

Experiment 2

Preweaning liveweight gains increased with increased preweaning pasture allowance ($P<0.01$; Table 3); High allowance lambs were 2.6kg liveweight heavier than Low allowance lambs at weaning. When grazed together for 61 days from weaning to first slaughter, lambs offered the Low allowance before weaning gained 0.6kg more than preweaning High allowance lambs ($P<0.10$). Over the same period twins gained 0.5kg more than single lambs ($P<0.05$). For each 1kg decrease in weaning weight, postweaning growth increased by 2g/d.

Despite these greater gains after weaning, lambs that were lighter at weaning were older when they reached 15kg carcass weight. Those in Low preweaning pasture allowance groups were 10 days older than lambs in High allowance groups ($P<0.05$), and twin lambs were 26 days older than single lambs ($P<0.01$). Cryptorchid lambs were heavier at birth and the difference between them and ewe lambs increased with time. They were 18 days younger on average when they reached 15kg carcass weight.

GR measurements adjusted to the mean carcass weight were not significantly influenced by preweaning pasture allowance level but the mean value for twin lambs was 1.4mm greater than that for single lambs ($P<0.01$). Figure 1 shows that, in addition to sex and rearing rank effects, GR measurements increased with slaughter date at the rate of 1mm per month from February 2 to May 25. There was no obvious correlation of GR measurements with lamb growth rates over this period. After adjustment to the mean slaughter date and mean carcass weight, GR measurements of twin and single lambs were not significantly different.

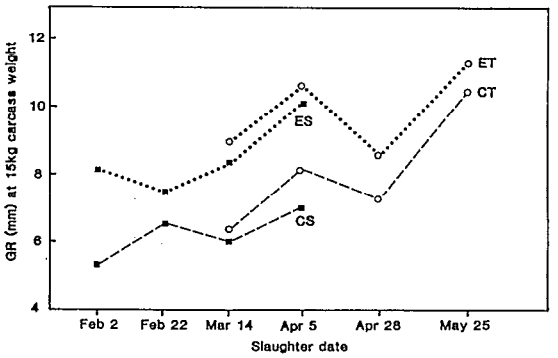

FIG 1 Effect of slaughter date on GR measurements at constant carcass weight in sex and rearing rank subclasses. C = cryptorchid, E = ewe, S = single, T = twin. Each point is the mean of 2-55 values.

DISCUSSION

There was a trend in both experiments for faster postweaning growth in lambs that were lighter at weaning, as noted by McEwan *et al.* (1988). The differences in liveweight at weaning due to variations in preweaning growth rate within a mob, to preweaning pasture allowance or to rearing rank were not, however, great enough for the effects on postweaning growth to be statistically significant. This outcome was obtained at two levels of postweaning nutrition and was not altered by competition between preweaning Slow and Fast lambs (experiment 1). It was obtained when postweaning pasture allowances were allocated per unit of liveweight (experiment 1) and per head (experiment 2). It is in agreement with the results of Kirton (1970), Munro and Geenty (1983) and O'Toole (1985) who offered lambs a common level of pasture feeding per head after weaning.

With larger differences in liveweight at weaning greater effects on postweaning growth rate would be

expected. Also, given sufficient time and nutrition, compensatory growth would be expected to result in all groups achieving similar liveweights (Doney *et al.*, 1988). Notwithstanding these possibilities, responses in postweaning growth within the limits of the current experiments were small. Similarly, effects on carcass GR measurements were not significant after adjustment for differences in carcass weight and slaughter date.

The increase in weight-adjusted GR measurements with slaughter date is difficult to explain since it is not possible to separate effects of lamb growth rate, lamb age and seasonal influences. Published evidence does not support an effect of the observed range of growth rates or lamb ages on leanness of lambs at pasture (Black, 1983). Changes in leanness of lambs approaching puberty should not be ruled out. A seasonal influence on carcass fat levels is another possibility since Bray and Taylor (1987) and others have reported a reduction over winter.

Implications of these results for production of lean, heavy lamb carcasses are, firstly, that light healthy lambs have at least as great a potential as heavier lambs from the same breeding flock but will be older when they reach target weights. This applies whether the differences in size are due to rearing rank, within mob variation or plane of nutrition. Secondly, separation of lambs into groups that differ in mean liveweight by only a few kilograms will not affect subsequent growth rates. Thirdly, an increase in GR measurement over autumn will increase the difficulty of producing lean, heavy carcasses in late autumn.

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