Nutrition effects on live weight and reproduction of Cashmere doe hoggets

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ABSTRACT

Effects of autumn-winter feeding level on live weight and the timing and success of hogget mating were studied in 180 cashmere doe hoggets bred from ferals in each of 2 years. They were fed pasture allowances of 0.8 (L nutrition) or 3 kg DM/hd/d (H nutrition) from 10 March to 30 June in 1986 and from 1 May to 10 July in 1987. Start live weights were 13 and 13.3 kg in 1986 and 1987, respectively. In both years H and L hoggets entered a period of weight stasis. H and L group live weight increased to 15.2 and 13.9 kg respectively by 2 May 1986 and then remained almost static. In 1987 H live weight increased to 14.8 kg by 29 May before stasis. L live weights declined slightly. Entire bucks were joined from 1 May to 12 June each year. Teasers were present outside of these times. Peak incidence of puberty occurred between 14 and 29 May in both years and for both H and L treatments. More H hoggets showed oestrus than L hoggets (74 *v* 37% in 1986 and 62 *v* 42% in 1987). This reflected in a greater percent of H hoggets diagnosed as pregnant when scanned ultrasonically in July (HP/HJ) of 45% *v* 18% in 1986 and 50% *v* 34% in 1987. High nutrition appeared to improve hogget puberty rate over and above its effect on live weight in 1986 but not in 1987. Low levels of cashmere down production were recorded (57 g) and these were not influenced by differences in nutrition.

Keywords Doe hogget; cashmere; nutrition; liveweight stasis; puberty; pregnancy; reproduction; pasture allowance

INTRODUCTION

Breeding from young animals as soon as they reach puberty maximises rate of population gain during the establishment of a livestock industry. This has been a major reason for interest in breeding from young does in the New Zealand goat fibre industry. In the case of Angoras this interest has extended to multiple ovulation and embryo transfer of doe hoggets (McMillan pers. comm.).

However, even with *status quo* populations, breeding from doe hoggets may need to become a routine practice to maximise fibre returns. In Cashmere, Cashgora and Angora goat types fibre fineness and yield decrease sharply with age (Shelton, 1981; Bigham M.L. pers. comm.). This markedly reduces fibre returns from animals over 3 years old.

Hogget mating may be necessary to provide enough replacements to allow culling of does and wethers at 3.5 years of age to achieve high levels of fibre production from the flock.

To maximise reproduction rates, knowledge is required of factors affecting growth and reproductive development of young goats. This paper shows how autumn-winter feeding affects live weight and the success of hogget mating in Cashmere does. Timing of hogget mating and Cashmere production do not appear to be influenced by nutrition.

MATERIALS AND METHODS

The trial was conducted in 2 years, with 180 doe hoggets in year 1 (1986) and 190 in year 2 (1987). In 1986, 57 of the hoggets were G4 (first cross Angora x New Zealand feral). All other hoggets were Cashmere producing, bred from New Zealand feral does. Hoggets were fed pasture allowances of 0.8 (low nutrition, L) or 3 kg DM/head/day (high nutrition, H) in weekly breaks, from 10 March to 30 June in 1986 and from 1 May to 10 July in 1987. The later start in 1987 was due to an initial shortage of suitable feed for high nutrition owing to a summer

drought.

Pre and post grazing pasture mass were estimated by double sampling using pasture cuts and visual assessment (Haydock and Shaw, 1975). Samples were hand plucked at each assessment for determining pasture composition by dissection into green grass, legume, weed and dead fractions. Apparent pasture intakes were calculated using pre and post graze pasture assessment data.

All hoggets had been born in spring prior to the respective trial. Mean birthdays were 3 October and 10 October for 1986 and 1987 hoggets, respectively. Start live weights were 13 kg on 10 March 1986 and 13.3 kg on 1 May 1987.

Adult entire bucks were joined from 1 May to 12 June each year. Teasers were present outside of these times. All bucks were fitted with mating harnesses. Mating marks were recorded fortnightly in 1986 and either fortnightly or weekly in 1987. Crayon colours were changed each fortnight. A small number of hoggets which were pregnant but had no tup record were included in total puberty rates.

Hoggets were shorn at the completion of each trial, and in 1986 Cashmere fleeces were analysed for down yield and weight.

Pregnancy was determined by real time ultrasonic scanning at the end of July each year. Subsequent scannings were done on 20 August and 16 September in 1987 to confirm hoggets were still carrying foetuses.

Breed, 1986, and nutrition treatment were fitted in all statistical models. Start live weight was fitted as a covariate in live weight and down weight analyses.

Logit models were fitted to reproduction data and birthday was fitted as a covariate for these analyses. Reproduction data were also analysed with 30 May live weight used as an explanatory covariate. Significant nutrition treatment effects on reproduction after fitting this covariate were interpreted as being due to nutrition, independent of nutrition effects on live weight.

RESULTS

Pastures

Mean pasture mass, allowance and intake are shown for each treatment in Table 1. Apparent pasture intake and post grazing residual both declined with pasture allowance.

TABLE 1 Pasture mass (kg DM/ha), allowance and intake (kg DM/hogget/day).

	1986		1987	
Feeding level	High	Low	High	Low
Pre-graze mass	2195	2100	2620	1725
Post-graze mass	1825	1215	2160	1200
Allowance	2.9	0.82	3.0	0.85
Intake	0.48	0.30	0.52	0.27

Mean pre-grazing composition of the pastures were 59% green (grass plus legume) 11% weeds and 30% dead in 1986, and 63%, 8% and 29%, respectively in 1987. Percentage green post-grazing was highest for the high nutrition treatment in 1986, 54% v 41%. In 1987 high and

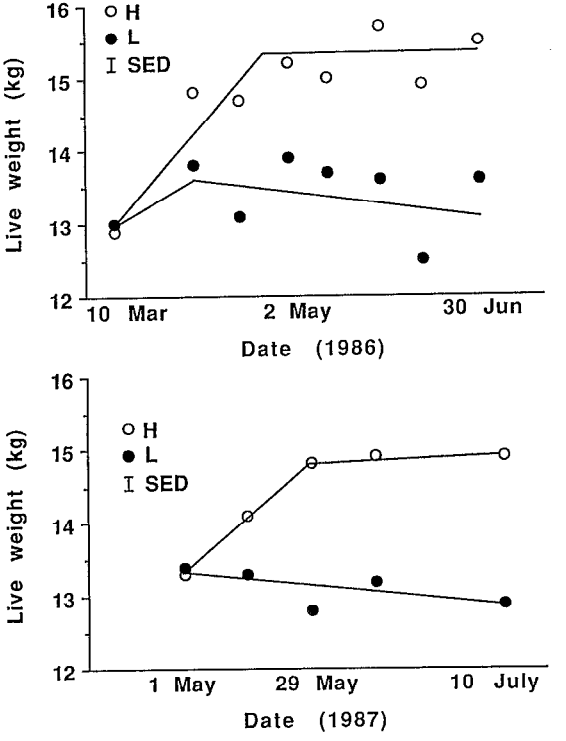

FIG. 1 Nutrition effects on doe hogget liveweight gain in 1986 (1a) and 1987 (1b).

low nutrition treatments were 55% and 58% green post-grazing, respectively.

Live Weight and Down Weight

In both years H and L hoggets entered a period of weight statis. High and low group live weights increased to 15.2 and 13.9 kg respectively by 2 May 1986 and then both essentially remained static (Fig. 1a).

Cashmere hoggets were 0.8 kg heavier than G4s ($P<0.01$) at the start of the 1986 trial and remained heavier throughout. Breeds did not differ in any analysis that included start live weight as covariate in the model and there were no interactions involving breed.

Down weight was unaffected by feeding level. Mean down weights were 59 and 54g for high and low treatments, respectively, in 1986; SED = 7.3.

Reproduction

The timing of puberty (first behavioural oestrus) was very similar between years with peak incidence occurring between 14 and 29 May for both H and L hoggets (Table 2). Birthday affected the probability of a hogget reaching puberty before 14 May in 1986 ($P<0.01$) and before 22 May in 1987 ($P<0.05$) with older hoggets having a higher probability of reaching puberty by these times. After these dates birthday had no effect on the probability of reaching puberty.

Mean day of puberty was 24 May in each year and was unaffected by nutrition treatment. More H hoggets showed oestrus than L hoggets (Table 2).

Hoggets on low nutrition reached puberty at a lower live weight than those on high nutrition (Table 2). Mean live weight of hoggets reaching puberty were greater than treatment mean live weights through late May and June.

Increased pregnancy rates resulted from the H nutrition treatment. These were aided by an apparent higher mean conception rate in H than L hoggets (Table 2).

In 1986, 39% of G4 hoggets achieved puberty compared to 64% of Cashmere. This resulted in just 15% G4 hogget pregnancies compared to 40% in Cashmeres ($P<0.01$).

High nutrition improved hogget puberty rate ($P<0.001$) and pregnancy rate ($P<0.01$) over and above its effect on 30 May live weight in 1986, but not in 1987.

DISCUSSION

Growth of Cashmere and G4 doe hoggets was characterised by a period of stasis, or very slow growth through early winter. This has also been reported in doe hoggets fed pelleted diets in Australia (Norton, 1985). It appears to be associated with decreased efficiency of feed use for liveweight gain, and to a lesser extent, reduced intake (Norton, 1985). Depressed pasture intake

TABLE 2 The timing and success of hogget mating in Cashmere does at two levels of nutrition.

		Period of first tup[1]					Puberty rate	Mean LW (kg) at	Pregnant rate	Mean conception
		-2/5	-15/5	-22/5	-29/5	-12/6	HT/HJ	puberty	HP/HJ	rate (HP/Σ tups)
1986	High	4	3		59	7	75	16.5	45	50
	Low	8	3		18***	7	36***	14.9***	18***	37
	SED	3.7	2.1		6.5	3.7	6.8	0.2	6.4	
1987	High		4	30	12	5	62	15.7	50	74
	Low		8	19	5	4	40**	13.8***	34*	62
	SED		7.7	6.2	4.0	2.8	7.4	0.1	7.4	

[1] Percentage first tupped in period ended.
HT/HJ = % hoggets tupped/hoggets joined.
HP/HJ = % hoggets pregnant/hoggets joined.
HP/Σ tups = number hoggets pregnant/total number tups recorded.

was not apparent in this study, although there are difficulties in detecting small changes in intake using pre-post graze assessments.

Reasons for winter weight stasis in doe hoggets are not clear. Internal parasitism was controlled in both this and Norton's study and in Norton's study diet quality was constant. The phenomena is probably triggered by photoperiod. Red deer stags show cyclic trends in growth similar to those above (Fennessey, *et al.* 1981). Photoperiod effects on growth efficiency and intake may be more pronounced in animals of recent feral origin.

The decline in feed use efficiency appeared greatest under high feeding levels. Average liveweight gain of H and L hoggets were similar over winter despite large differences in apparent intake. This suggests that a change in partitioning of surplus feed energy into increased body fat may have been responsible for decreased efficiency of feed use in early winter. Ad lib fed Cashmere doe hoggets contain 24.2% carcass fat at 11.1 kg carcass weight compared to 18.1% fat at the same weight in restricted hoggets (Norton and Ash, 1985). The greater reproductive development of H than L does may also support this idea. There is evidence that minimum body fat levels are associated with puberty in other mammals (Moore *et al.* 1985).

Onset of weight stasis in H hoggets occurred earlier in 1986 (start of May) than 1987 (end of May). Greater maturity of 1986 hoggets on 1 May could be a reason for this since in both years live weight remained static at about 15 kg.

Incidence, but not timing of puberty was affected by autumn-winter nutrition. The indication that nutrition influences puberty rate over and above its effect on live weight, suggests high feeding should be maintained through early winter where hoggets are to be mated.

Peak onset of first oestrus occurred in the last fortnight of May in both years. The pattern of onset is similar to that of adult does where bucks are joined all year round (Restall, 1983). Under these conditions adult does commence cycling in January-February. The buck effect, a synchronised oestrus 3 to 5 days after buck introduction, which occurs in adult does with February to May joinings (Restall, 1983), was not evident in hoggets with 1 May joining. Buck effect is therefore unlikely to be a suitable technique for advancing puberty in hoggets. Limitations of physiological maturity are likely to predominate breeding from doe hoggets.

Cashmere down production was unaffected by nutrition during the peak of the down growth cycle. This confirms Norton and Ashs' (1985) conclusions with low producing animals. Cashmere animals need to produce about 150g down per year before down production is responsive to feeding (McGregor 1987).

Around 50% of H hoggets became pregnant to a 6 week joining. The slightly lower rate in 1986 was due to lower pregnancy rates in G4s than in Cashmeres. The 50% pregnancy rate in Cashmeres was achieved with moderate live weights, 15kg, and high intakes over mating, 0.5kg DM/h/d. Higher live weights would appear to be necessary to successfully breed G4 hoggets.

In 1987 repeated scanning indicated that all but 1 doe carried her foetus at least until 3 weeks from term. Assuming 40% kids weaned per hogget mated, adult weaning percents need to be 120 to allow a 20% culling of hoggets and still produce enough replacements to turn over the flock at 3.5 years of age.

Under natural mating systems hoggets' progeny will be later born than adult progeny. Kidding will commence on about 10 October. Problems with the hogget mating system could arise if the later born hoggets' progeny can not be grown to 15kg by May, hence reducing pregnancy rates in hoggets out of hogget dams. Reduced weaning rates in hoggets out of hogget dams has been reported in a large scale hogget lambing system with sheep (McCall and Hight, 1981).

Effects of hogget kidding on adult kidding performance are not known. In sheep, hogget lambing does not impair subsequent reproductive performance provided lambed and unlambed hoggets achieve similar two tooth mating weights (Moore *et al.*, 1983).

CONCLUSIONS

Hogget pregnancy rates of 50% can readily be achieved in Cashmere doe hoggets fed to reach 15kg by early May and with high pasture intakes

through hogget mating, 0.5kg DM/h/d. G4 hoggets need to be at greater live weights.

Under the above conditions hogget should generate sufficient additional female replacements to replace the doe flock at 3.5 years of age.

Issues which remain are weaning rates from hoggets, the hogget mating performance of late born hoggets out of hogget dams and effects of hogget kidding on adult reproduction.

Nutrition appears to have no influence on the timing of hogget mating, nor on doe hogget liveweight gain in early winter.

Compared to sheep, high pre-grazing pasture masses and high residuals are required to maximise goat intake.

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