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## Nutritional effects, in early pregnancy, on lamb production of Finnish Landrace x Romney ewes

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### ABSTRACT

This study tested the hypothesis that in high fertility ewes, low nutrition in early to mid pregnancy could affect placental development in turn affecting foetal development, lamb birth weight and lamb survival.

In 1997, 600 Finn x Romney ewes were randomised to 1 of 5 herbage allowance treatments applied over day 20 to 70 of pregnancy. Over the treatment period, mean herbage intake ranged from 0.69 to 2.04 kg DM/ewe/day resulting in ewe live weight changes of -36 to +60 g/ewe/day respectively ( $p < 0.001$ ). The result was a consistent but non-significant trend in birth weight with the lowest allowance ewes having single and twin lamb birth weights of 5.2 and 4.3 (SED 0.2) kg respectively. Corresponding birth weights for lambs from the highest allowance ewes were 5.3 and 4.4 kg. Lambing rate and lamb survival were not affected.

In 1998, 4 nutrition treatments were applied from day 7 to 70 of pregnancy to 650 ewes randomised from either of 2 previously generated mating weight groups. These treatments gave live weight changes of -84 to +35 g/ewe/day ( $p < 0.001$ ) from average herbage intakes of 0.70 to 1.96 kg DM/ewe/day. Birth weight of the single lambs (trial average 5.0 kg; SED 0.1) was not affected. However, twin lambs born from ewes from the lowest herbage allowance treatment were 0.35 kg lighter than those from the other treatments ( $p < 0.01$ ). Similarly, lambs born per ewes mated and lambs weaned per ewes present at lambing were also affected ( $p < 0.05$ ). We conclude that, in fecund ewes, nutrition in early pregnancy can affect twin lamb birth weight and lambing rate but only where the ewes are losing weight at more than 40 g/ewe/day or lose more than 4 kg from mating to mid-pregnancy.

**Keywords:** nutrition; pregnancy; ewe; lamb.

### INTRODUCTION

Farmers in North Island hill country have in recent years sought to take advantage of new breeds of sheep to increase lambing percentage. Substantial increases have occurred for example by running Finnish Landrace (Finn) x Romney ewes. Early work by Rattray *et al.*, (1987) using the lower fertility ewes typically in use at that time indicated that nutrition in early to mid-pregnancy had little effect on lamb birth weight and therefore on lamb survival (Dalton *et al.*, 1980). However, Rohloff (1984) speculated that placental development in high fertility sheep was quite clearly affected by nutrition in early pregnancy. In turn, this would affect both foetal development and lamb birth weight. Farm survey data collected by Tarbotton & Webby (1999) has shown wide variation in apparent foetal survival in high fertility ewes between farms and mobs within farms. The implications were that nutrition in early to mid-pregnancy may have affected foetal development, lamb birth and survival in high fertility ewes. Hence, the recommendation of Smeaton (1983) to feed ewes at maintenance levels only, from mating up to late pregnancy might not apply in high fertility sheep. Clearly, this would have implications for feed flow in the winter and early spring periods. The following study evaluated the effects of different pasture feeding levels in early pregnancy on lamb output in high fertility sheep.

### MATERIALS AND METHODS

In each of two years at Whatawhata Research Centre, approximately equal numbers of half Finn and quarter

Finn x Romney ewes were run on pasture at 1 of 5 (1997) or 4 (1998) levels of nutrition from day 20 (1997) or day 7 (1998) until day 70 of pregnancy. After this, the ewes (580 in total) were managed similarly until weaning. In both years all ewes were treated against facial eczema.

The nutrition treatments described in Table 1 were set using measured herbage mass (Smeaton *et al.*, 1983) to achieve weight loss and gain (Table 1 also) over the treatment period. Each treatment was replicated twice in 1997. In 1998 the treatments were not replicated but were applied separately to previously generated heavy or light ewes. Progesterone synchronised mating, using a CIDR<sup>TM</sup> intra vaginal device, commenced in the first week of April in each year. The ewes were joined with Dorset rams and ovulation rate from this oestrous was determined by laparoscopy 5 to 10 days later. To determine foetal loss, if any, the ewes were scanned by ultrasonography on days 40 to 45 of pregnancy and every 15 to 20 days thereafter until day 90. The ewes were weighed at approximately 2 weekly intervals. Ewes lambing, lamb numbers, survival and birth weights were all recorded along with weights at weaning in early December of each year. A balanced half of the ewes were shorn in mid-June in both years and then all ewes shorn again after weaning. The mid-June shearing treatment is reported elsewhere (Smeaton in press).

The data were analysed by analysis of variance using the statistical package of Rothamsted Experimental Station (Genstat 5 Committee, 1993). All animal data presented are fitted estimates. Contrasts tested included breed ( $\frac{1}{4}$  vs  $\frac{1}{2}$  Finn), mating cycle, replicate (in year 1), treatment, shearing treatment (not reported here) and all inter-

actions. Where appropriate, mating weight was tested and used as a covariate (within pre-mating liveweight group in 1998 only). Unless described otherwise, all interactions tested were non-significant.

**RESULTS**

**1997 Trial**

Significant ( $p < 0.001$ ) differences in ewe liveweight change between groups were achieved by the herbage feeding levels described in Table 1. Average pre-grazing herbage mass was recorded at 2200 kg dry matter (DM)/ha with a green content of 79%. A range of both liveweight loss and gain occurred (Table 1). Ewe liveweight at the start on day 20 of pregnancy was 51.7 kg.

**TABLE 1:** Descriptive pasture data and ewe weight change (LWG) recorded over the period day 20 to 70 of pregnancy (1997)

Treatment	1(low)	2	3	4	5(high)	Signif <sup>1</sup>	SED
Pasture mass (kg DM/ha)	870	1010	1120	1335	1525		
-post graze							
Pasture allowance (kg DM/ewe/day)	1.14	1.58	2.28	5.09	6.84		
Estimated intake (kg DM/ewe/day)	0.69	0.87	1.14	1.87	2.04		
Ewe LWG (g/ewe/day)	-36	+8	+30	+60	+60	***	6

<sup>1</sup> \*\*\*  $p < 0.001$

Table 2 shows the impact of liveweight change on lamb output. Absence of significance shows that the nutrition treatments had no impact on lamb output and survival, although treatment 1 recorded the lowest multiple lambing rate.

**TABLE 2:** Effects of treatments on lamb output (1997)

Treatment	1(low)	2	3	4	5(high)	Signif <sup>3</sup>	SED
Ovulation rate (eggs/ewe)	2.00	1.97	1.93	1.98	1.99	n.s.	0.09
Ultra-sound scan (foetuses/ewe present) -3 July <sup>1</sup>	1.45	1.51	1.56	1.43	1.44	n.s.	0.08
EL/EPL <sup>2</sup>	0.97	0.95	0.96	0.92	0.93	n.s.	0.02
ELM/EL	0.43	0.60	0.57	0.53	0.58	n.s.	0.05
LS/LB	0.95	0.90	0.90	0.92	0.90	n.s.	0.02

<sup>1</sup> Other scans on 29 May and 16 June showed similar (n.s.) results

<sup>2</sup> EL etc = ewes lambing, ewes present at lambing, ewes lambing multiples, lamb survival, lambs born

<sup>3</sup> n.s. = non-significant

The treatments had no impact on lamb weights (Table 3).

**TABLE 3:** Effects of treatments on lamb liveweights and ewe fleece weight (kg) 1997

Treatment	1(low)	2	3	4	5(high)	Signif <sup>1</sup>	SED
Birth weight (kg)							
singles	5.2	5.3	5.2	5.3	5.4	n.s.	0.2
twins	4.3	4.3	4.4	4.4	4.4	n.s.	0.1
Wean weight (kg)							
singles	28.6	28.5	28.5	29.9	29.1	n.s.	0.9
twins	22.0	21.7	22.3	22.1	22.5	n.s.	0.7

<sup>1</sup> n.s. = non-significant, \*\*  $p < 0.01$

**1998 Trial**

The pasture nutrition treatments described in Table 4 again significantly affected ewe liveweight change ( $p < 0.001$ ). Average pre-graze herbage mass across all treatments was 2300 kg DM/ha and green content of this material was 70% (compared to 79% in 1997).

**TABLE 4** Descriptive pasture data and ewe weight change (LWG) data recorded over the period day 7 to 70 of pregnancy (1998)

	Pre-mating weight group		Signif <sup>1</sup>	SED	Pregnancy treatment				Signif <sup>1</sup>	SED
	Low	High			low		high			
Pasture mass (kg DM/ha)	775	710			585	700	790	920		
-post graze										
Pasture allowance (kg DM/ewe/day)	1.67	1.68			0.98	1.32	1.86	2.66		
Estimated Intake (kg DM/ewe/day)	1.06	1.12			0.71	0.91	1.25	1.56		
Ewe LWG (g/ewe/d)	-10	-50	***	3	-84	-57	-12	35	***	5

<sup>1</sup> \*\*\*  $p < 0.001$

Pasture allowances were set lower than in 1997 and the object of achieving greater ewe liveweight loss at the lower allowance end was successful. A liveweight change in these ewes of -84 g/ewe/day was achieved compared to -36 g/ewe/day in 1997. Average ewe liveweight at the start was 48.3 and 53.9 kg for the low and high pre-mating treatments respectively ( $p < 0.001$ ).

Table 5 shows that the pre-mating weight treatments had a consistent and usually significant effect on lamb output variates demonstrating the benefits of higher mating weights in these ewes.

**TABLE 5:** Effects of treatments applied in 1998 on lamb output variates

	Pre-mating weight group		Signif <sup>2</sup>	SED	Pregnancy treatment				Signif <sup>2</sup>	SED
	Low	High			low		high			
Ovulation rate (eggs/ewe)	1.73	2.06	***	0.06	1.90	1.89	1.87	1.92	n.s.	0.08
Ultra-sound scan (foetuses/ewe present)										
-26 June <sup>1</sup>	1.32	1.51	***	0.05	1.36	1.40	1.41	1.50	n.s.	0.07
EL/EPL	0.95	0.93	n.s.	0.08	0.93	0.94	0.95	0.95	n.s.	0.09
ELM/EL	0.35	0.43	**	0.03	0.36	0.39	0.38	0.43	n.s.	0.04
LS/LB	0.97	0.97	n.s.	0.03	0.96	0.98	0.97	0.96	n.s.	0.02

<sup>1</sup> earlier scans on 13 May, 27 May and 8 June showed similar results

<sup>2</sup> n.s. = non-significant, \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Nutrition treatment during pregnancy showed a trend of reduced multiple lamb output in the lowest allowance treatment but this was non-significant. However, lambs weaned per ewes present at lambing (not shown) was 15% units lower in this bottom group compared to the others ( $p < 0.05$ ).

Ewe live weight at mating (Table 6) did not affect lamb weights. Nutrition during pregnancy did not affect single lamb weights but did significantly affect the twins. These lambs, from the treatment 1 ewes, were lighter than the others which were similar.

**TABLE 6:** Effects of treatments applied in 1998 on lamb liveweights and ewe total fleece weight (kg)

	Pre-mating weight group				Pregnancy treatment					
	Low	High	Signif <sup>1</sup>	SED	1	2	3	4	Signif <sup>1</sup>	SED
					low			high		
Birth weight										
-singles	4.9	5.0	n.s.	0.07	5.0	4.8	4.9	5.0	n.s.	0.10
-twins	4.2	4.2	n.s.	0.09	4.0	4.3	4.2	4.3	**	0.13
Wean weight										
-singles	26.1	26.7	n.s.	0.5	26.4	26.3	26.2	26.7	n.s.	0.7
-twins	20.5	21.3	n.s.	0.5	19.8	21.5	20.7	21.3	**	0.7

<sup>1</sup>n.s. = non-significant, \*\* p<0.01

## DISCUSSION

The data showed that ewe liveweight was affected by ewe nutrition in early pregnancy. Lamb output and lamb survival were not, except when severe underfeeding occurred. Ewe mating weight affected lamb output.

The ewe liveweight responses were as expected and similar to those described in the review by Rattray *et al.*, (1987). Our 1997 results, where ewe liveweight loss in the poorest fed group was -36 g/day, showed that there may have been an influence of this on lamb output (ELM/EL) but statistically, the effect was not significant. This hint of a response was the rationale behind the more severe treatments adopted in 1998. Here a consistent although non-significant response did occur in the scanning data and a significant response occurred in lamb output (LW/EPL) and particularly in twin lamb birth and weaning weights. These results are in line with the observations of Edey (1976), Manktelow (1996), Geenty (1997) but not Cooper *et al.*, (1998). The latter stated that foetal development can be influenced by ewe nutrition when they are over- rather than underfed. None of our high allowance ewes showed evidence of this response. Geenty (1997) wrote that placental development between days 30 and 90 of pregnancy is linked to lamb birth weight. By implication, this would therefore affect lamb survival (Dalton *et al.*, 1980). Geenty also commented that loss of ewe liveweight (5 kg or greater) during early to mid-pregnancy will reduce lamb birth weight causing poorer survival of multiples. The lowest allowance treatment ewes in our trial in 1998 lost 84 g/day for 63 days; equivalent to 4 kg. In 1997 the loss was 36 g/day for 50 days or 1.8 kg in total. Our data therefore confirm the comments of Geenty (1997). However, he further cited unpublished evidence that showed placental weight increased linearly with nutrition over early pregnancy up to day 100. We think the response is more likely to be curvilinear or alternatively if it is linear, the impact of placental size becomes unimportant once a threshold placental size is reached. Our estimate is that this occurs at a ewe weight loss figure of about 40 g/ewe/day. From a practical point of view, this is the result of fairly severe undernutrition or less than any of:

- pasture allowance 1.0 to 1.2 kg DM/ewe/day depending on green content
- feed intake of 0.8 kg DM/ewe/day
- residual herbage mass of 800 to 1000 kg DM/ha depending on pasture quality and density.

The above circumstances are unlikely to apply in most practicable farming situations. Hence, our recommendation is that even high fertility ewes can be run on a maintenance diet after say at least 3 weeks from the start of mating. We would recommend that any feed which is surplus to these requirements be used either prior to this period to promote ewe liveweight or be transferred through the winter via a long rotation into the late pregnancy or post-lambing period. The only time when nutrition in early pregnancy could be a threat to multiple lamb production would be in periods of severe feed stress such as in a prolonged summer-autumn drought.

## ACKNOWLEDGEMENTS

We acknowledge the assistance of Chris Boom, Bill Carlson, Peter Moore, Shane Hill, Darren McDonald and other farm staff at Whatawhata Research Station, Linda Trolove for pasture analyses and related work, John Smith and John Parr for laparoscopy work and Catherine Cameron for carrying out the statistical analyses. Funding for the project was kindly provided by Meat New Zealand and Wool Pro.

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