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The effect of ewe prelamb body condition on triplet lamb performance in a commercial flock

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Abstract

Triplet-bearing ewes ($n = 999$) were identified at pregnancy scanning (PS) and randomly assigned to two pasture feeding treatments through to lamb weaning, FeedPlus (FP) and Control (C). FeedPlus ewes were fed according to theoretical requirements based on live weight and a fetal number of three while C ewes were fed as for twinning ewes. Ewe body condition score (BCS) was similar for FP and C ewes at PS (BCS 3). FP ewes had higher BCS than C ewes at set-stocking one month before the mean lambing date (PL, BCS 2.9 ± 0.1 versus 2.6 ± 0.1 , $P < 0.001$). Every unit increase in BCS at PS improved litter survival to weaning by 0.33 ± 0.17 of a lamb. An increase of BCS at set-stocking improved litter survival to weaning by 0.45 ± 0.18 of a lamb ($P < 0.05$). Litter weight increased with increasing BCS PL ($\beta = 1.2 \pm 0.5$ kg/unit BCS, $P < 0.05$). Low BCS ewes ($BCS \leq 2.5$) at PS weaned 3.5 kg less lamb than medium BCS ewes at PS ($BCS \geq 3$) (82.4 ± 1.1 kg versus 85.9 ± 1.4 kg, $P < 0.05$) when rearing triplets. Pre-lamb BCS had a positive effect on lamb weaning weight ($\beta = 1.3 \pm 0.6$ kg/unit BCS, $P < 0.05$) and on lamb growth rates from birth to weaning ($\beta = 13.5 \pm 6.0$ g/day per unit increase in PL BCS, $P < 0.05$). The study highlighted the importance of ewe body condition score at PS and PL on triplet ewe performance.

Keywords: triplet; body condition score

Introduction

Improved lambing percentage is the biggest contributor to higher profits on New Zealand sheep farms. Many sheep breeders have selected and bred ewes for increased fecundity over the last four decades. Genetic progress for number of lambs born per ewe mated has increased 1% annually according to the SIL-ACE across flock genetic evaluation for the New Zealand sheep industry (Sheep Improvement Ltd. 2012). Lamb survival is an important issue in highly fecund sheep flocks. The national mean lambing percentage from 2010-12 was 126%, which was greater than the 100% recorded twenty years ago (1990-1993) (Beef + Lamb New Zealand 2012). Davis et al. (1983) reported that as mean litter size increases above 1.7 the decline in single-bearing ewes is offset by an increase in triplet bearing ewes. The increased proportion of ewes having triplets is of concern to farmers and to industry as lamb mortality is highest in triplets (Kerslake et al. 2005; Everett-Hincks et al. 2005, 2007).

Researchers and farmers are aware of the effect of maternal nutrition on lamb survival. The majority of studies suggest that maternal under-nutrition reduces lamb survival through its effect on lamb birth weight (Moore et al. 1986; Scales et al. 1986; Dwyer et al. 2003; Kenyon et al. 2004; Shreurs et al. 2010). However, few studies in recent times have investigated the effect of ewe management on improving triplet-bearing ewe performance. Kenyon et al. (2011) reported that early pregnancy nutrition can be controlled to not reduce offspring performance from birth to weaning. However, they did highlight the importance of nutrition in mid to late pregnancy to ensure ewe liveweight increases to account for the

weight of the gravid uterus with three fetuses. Everett-Hincks et al. (2005) showed that ewe nutrition in late pregnancy affected triplet behaviour, regardless of birth weight. Triplet lamb survival was similar to twin lamb survival when pasture allowance was not restricted in late pregnancy (Everett-Hincks et al. 2005). To date 'optimal' pasture feeding levels for ewes with triplets has not been adequately defined as research into ewe energy requirements in late pregnancy has focused on ewes with singles and twins (Geenty & Rattray 1987).

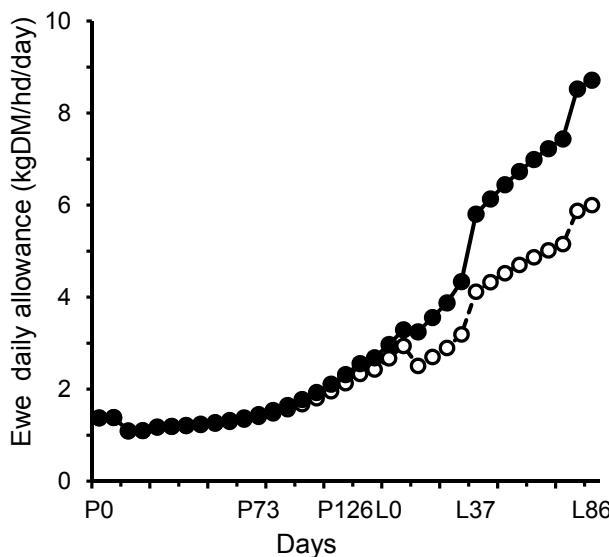
This paper reports the results from a study on a commercial farm in the Te Anau basin with 19,000 sheep stock units. The proportion of their ewe flock having triplets had increased and was expected to increase further, based on the breeding objective of their source of genetics. A study was implemented to increase performance from triplet-bearing ewes. Feed allocations were calculated and the hypotheses that poor body condition ewes will have lower lamb survival rates and produce less weight of lamb weaned while an increase in feeding in late pregnancy will improve ewe production, was explored.

Materials and methods

Animals and measurements at lambing

Animal ethics approval was not required for this study as the study followed standard farming practices on a commercial farm. On 11 May 2010, 19,000 commercial ewes were mated at Landcorp, Mararoa Station, Te Anau, New Zealand. At pregnancy scanning, on Day 73 of gestation, 1,000 first cycle mixed age triplet-bearing ewes were identified, tagged and live weight (LW) and body condition score (BCS) were recorded. BCS was recorded on a scale of 1 to 5

Figure 1 Ewe daily feed allowance for Feedplus ewes (●) and Control ewes (○) from mating (P0) to lamb weaning (L86) (from AFRC, 1993). P0 = Mating start date; P73 = Day 73 of gestation (Pregnancy scanning); P126 = Day 126 of gestation (Day of set-stocking); L0 = Day 147 of gestation (Lambing start date); L37 = Lambs 37 days of age (Lamb tailing); L86 = Lambs 86 days of age (Lamb weaning). DM = Dry matter.



as described by Jeffries (1961) and modified to include half scores (Mathias-Davis et al. 2011), with 1 being Emaciated and 5 being Obese.

The ewes were randomly assigned to two treatments, FeedPlus and Control. The feed requirements for FeedPlus ewes were calculated as the theoretical requirements based on live weight and a fetal number of three, while the feed requirements for Control ewes were calculated as the requirements for twin-bearing ewes as calculated from an officially authorised advisory manual from the AFRC Technical Committee that implements the recommendations on the energy and protein requirements of cattle, sheep and goats (AFRC 1993) (Figure 1). The Control strategy is a common farm practice where triplet bearing ewes are not identified and the ewes are fed as twin-bearing ewes. Ewes were randomly assigned to lambing paddocks and set stocked prior to lambing (PL) on 14 September 2010, approximately four weeks before the planned start of lambing. BCS and LW were recorded. Ewe fate codes were recorded from set-stocking pre-lambing.

Lambing started on 5 October 2010, following a snow storm 10 days prior to lambing. At lambing 300 lambs were individually identified from each of the FeedPlus and Control treatments, being 600 lambs from 200 identified ewes. Tagged lambs were identified to their dam, date of birth, birth weight (BWT) and their sex were recorded. Lamb deaths were recorded daily from each paddock throughout lambing and through to weaning, on 14 January 2011, at 86 days of age. Lambs were tailed on 11 November 2010.

At lamb weaning, LWT and BCS were recorded for all ewes. All surviving tagged lambs were weighed and lamb growth rate calculated (g/d) from birth to weaning (GRBW) and from tailing to weaning (GRTW). Litter and lamb survival rates were calculated for tagged lambs over this period and recorded as a proportion.

Animal management

FeedPlus and Control Ewes were only fed pasture throughout the trial. From scanning to pre-lambing FeedPlus and Control ewes were allocated feed on a one to two day basis from the feed budget and rotationally grazed (Figure 1). At set stocking pre-lambing FeedPlus and Control ewes were randomly assigned to lambing paddocks approximately four weeks prior to mean lambing date at 6.5 ewes per hectare for the FeedPlus and 8.5 ewes per hectare for the Control treatments. Pasture cover was 1,550 kg dry matter (DM)/ha and 1,320 kg DM/ha for the FeedPlus and Control groups respectively. Pasture covers were recorded every 7 to 10 days. Ewes remained in their randomly assigned paddocks for the duration of the study. All mob shifts, dates, pre and post-grazing covers were recorded throughout the study from pregnancy scanning to lamb weaning. Pasture cages were used to assess pasture quality (MJME/kg DM) and growth (kg DM/ha) from set-stocking until weaning. The feed budget was monitored to ensure treatment feeding levels were followed. Surplus feed was harvested by cows and calves on a put-and-take system during lambing.

Statistical analyses

This paper reports the performance for animals that were individually recorded. Animals included in the analysis were all tagged triplet born lambs and their ewes.

Differences in ewe and lamb performance between scanning and lamb weaning for the FeedPlus and Control treatments were analysed using the MIXED procedure (SAS 2010). A univariate mixed effects model was fitted to test for the effects of Treatment (FeedPlus and Control), paddock, ewe age, date of birth, ewe live weight at pregnancy scanning (LWPS), ewe live weight at set stocking (LWPL), lamb weight at tailing (LWT) and lamb weight at weaning (LWW), body condition score of the ewe at pregnancy scanning (BCSPS), body condition score of the ewe at set stocking (BCSPL), body condition score of the ewe at lamb tailing (BCST) and body condition score of the ewe at lamb weaning (BCSW). To decide the pathways involved in the differences in ewe and lamb performance, higher order interactions and covariates were tested and retained in the model if statistically significant at $P < 0.05$. Results are given as least square means and their standard errors. β is the regression coefficient of the trait on the covariate tested. Ewe performance was adjusted for the random effect of paddock and lamb performance was adjusted for the random effect of ewe and paddock.

Table 1 Least squares means \pm standard error of mean for ewe performance of ewes with triplet born litters when offered either a FeedPlus or a Control level of feeding from scanning to lamb weaning. FeedPlus ewes were fed according to actual theoretical requirements based on live weight and fetal number of three. Control ewes were fed according to the farm's standard management protocol for twinning ewes. P values in bold type indicates significance at $P < 0.05$. P values in italic type indicates significance between $P = 0.05$ and $P = 0.10$.

Trait	Time measured	Feeding level		P value
		FeedPlus	Control	
Number of ewes	Pregnancy scanning	102	99	
Ewe body condition score	Pregnancy scanning	3.00 ± 0.04	3.04 ± 0.04	0.37
	Prelambing	2.87 ± 0.04	2.59 ± 0.04	<0.001
	Lamb tailing	3.05 ± 0.07	2.95 ± 0.07	0.27
	Lamb weaning	3.03 ± 0.07	2.98 ± 0.07	0.62
Ewe live weight (kg)	Pregnancy scanning	67.8 ± 0.7	67.5 ± 0.7	0.64
	Prelambing	87.5 ± 0.7	85.9 ± 0.4	<i>0.08</i>
	Lamb tailing	82.7 ± 1.2	82.2 ± 1.2	0.81
	Lamb weaning	79.8 ± 1.1	80.1 ± 1.1	0.94
Litter weight (kg)	Lamb tagging	13.0 ± 0.3	13.2 ± 0.3	0.74
	Lamb tailing	27.7 ± 0.5	27.2 ± 0.6	0.86
	Lamb weaning	58.7 ± 0.8	58.0 ± 0.9	0.82
Litter size	Lamb tagging	2.57 ± 0.05	2.64 ± 0.06	0.61
	Lamb tailing	2.10 ± 0.10	2.11 ± 0.09	0.82
	Lamb weaning	2.06 ± 0.09	2.11 ± 0.09	0.58

Table 2 Least squares means \pm standard error of mean for triplet born lamb performance when their dams were offered either a FeedPlus or a Control level of feeding from scanning to lamb weaning. FeedPlus ewes were fed according to actual theoretical requirements based on live weight and fetal number of three. Control ewes were fed according to the farm's standard management protocol for twinning ewes.

Trait	Time measured	Feeding level		P value
		FeedPlus	Control	
Number of lambs	Birth	306	297	
Lamb live weight (kg)	Lamb tagging	4.31 ± 0.06	4.35 ± 0.06	0.69
	Lamb tailing	14.1 ± 0.2	14.0 ± 0.2	0.29
	Lamb weaning	29.9 ± 0.4	29.8 ± 0.4	0.21
Lamb growth rate (g/day)	Birth to tailing	318 ± 6	319 ± 6	0.46
	Tailing to weaning	270 ± 4	271 ± 4	0.20
Lamb survival	Birth to tailing	0.93 ± 0.02	0.93 ± 0.02	0.65
	Tailing to weaning	0.65 ± 0.03	0.66 ± 0.03	0.40

Results

There was no difference in the incidence of ewe fates between the FeedPlus and Control treatment ewes. Of the 999 ewes recorded in the trial at pregnancy scanning, 5% died, 3% had bearings, 2% had assisted births and 13% of the ewes were cast at least once. Udder problems were observed in 2% of the ewes with half of these subjectively diagnosed as gangrenous mastitis or 'black udder'.

There was no significant difference in ewe and lamb performance between FeedPlus and Control treatments (Table 1 and 2). However there were some significant associations between BCS and ewe and lamb performance.

Lamb rearing rank had a significant effect on lamb growth rate ($P < 0.001$). Lambs reared as a triplet from birth to weaning had a GRBW of 248 ± 2.9 g/day, lambs reared as a twin had a GRBW of 263 ± 3.6 g/day and lambs reared as a single had a GRBW of 302 ± 6.5 g/day. Lamb rearing rank to weaning had a significant effect on ewe BCSW ($P < 0.001$). Ewes that failed to rear any lambs had a BCS of 4.1 ± 0.2 , ewes that reared one lamb had a BCS of 3.3 ± 0.1 , and ewes that reared two lambs had a BCS of 3.0 ± 0.1 . Whereas ewes that reared three lambs had a BCS at weaning of 2.7 ± 0.1 .

FeedPlus ewes had a higher BCSPL than Control ewes (Table 1). Control ewes lost 0.4 BCS units between pregnancy scanning and prelambing whereas

FeedPlus ewes lost 0.1 BCS units. The effect of BCS on ewe performance was important for triplet-bearing ewes. Every unit increase in BCSPS improved litter survival by 0.33 ± 0.17 of a lamb and an increase of BCSPL improved litter survival by 0.45 ± 0.18 of a lamb ($P < 0.05$).

An increase in BCS at pregnancy scanning translated into an additional 1.2 ± 0.5 kg in triplet litter weight at birth ($P < 0.05$) or an extra 0.3 ± 0.1 kg of individual lamb birth weight ($P < 0.05$). Another interesting relationship was that ewes rearing triplets that had a low BCSPS (BCS ≤ 2.5) weaned 3.5 kg less lamb weight at weaning than ewes of medium BCSPS (BCS ≥ 3) (82.4 ± 1.2 kg versus 85.9 ± 1.4 kg, $P < 0.05$).

Pre-lamb BCS had a positive effect on lamb tailing weight and lamb weaning weight ($\beta = 0.7 \pm 0.4$ kg and $\beta = 1.3 \pm 0.6$ kg respectively, $P < 0.05$) for additional unit increase in BCS. BCSPL had a significant effect on GRBT and GRBW ($\beta = 23 \pm 10$ g/day and $\beta = 13.5 \pm 6.0$ g/day respectively, $P < 0.05$) per unit increase in BCSPL.

Discussion

The objective of the study was to investigate triplet-bearing ewe performance when ewes were identified as carrying triplets from mid pregnancy at time of ultrasound pregnancy diagnosis, and allocated adequate feed (FeedPlus), compared to those that are treated as twin-bearing ewes and allocated insufficient feed (Control).

This study showed that FeedPlus ewes maintained BCS from scanning to pre-lambing when, compared with Control ewes at the feed allocated according to AFRC (1993) shown in Figure 1. Pregnancy scanning is a useful and important tool to identify flock ewes with three fetuses, in contrast to identifying ewes carrying 'multiples'. Triplet-bearing ewes can be allocated enough feed to meet their energy requirements. This objective was met, and ewes allocated sufficient feed increased their intakes to maintain body condition score from mid to late pregnancy. However, some differences between the groups may have been lost due to the early set-stocking date being a month before lambing.

When variation across treatments was investigated, ewes that maintained a BCS ≥ 3 had heavier litter and lamb weaning weights. This association was in line with that reported by Mathias et al. (2011) where ewes having triplets at birth with a ewe BCS of 3–3.5 or >3.5 BCS at mating, outperformed ewes with a BCS of < 3 with respect to total weight of lamb weaned.

In this study lamb growth rates increased as ewe BCS pre lamb increased. Similar positive associations have been reported in twin lambs when ewe BCS was recorded at mating (Kenyon et al., 2004). Gibb and Treacher (1980) reported that fat ewes with a BCS of 3.2, tended to produce more milk and their lambs grew

faster and attained a higher live weight at eight weeks of age than thin ewes with a BCS of 2.4.

This brings the discussion to our perception of 'fat' and 'thin' ewes, in relation to BCS. Animal welfare code dictates that ewes with a BCS ≤ 1.5 should be remedied immediately. Body condition scores of ewes on commercial properties often fluctuates between BCS 1.5 and 3 (Stevens et al. 2011). This potentially has significant implications on welfare and farm profit. A general perception held by farmers is that higher BCS ewes, or 'fat' ewes, will be too heavy or unfit and have increased animal health problems (Watson 2011). In this study ewe health problems did not increase in the FeedPlus when compared with the Control ewes.

Many research studies investigating the performance of highly fecund ewes have limited their study to ewes with BCS ≤ 3 and in many cases have failed to demonstrate a positive association between BCS and ewe performance (Kenyon et al. 2004, Shreurs et al. 2010). Whereas this study recommends that prelamb BCS should exceed a score of 3 for triplet-bearing ewes to ensure improved lamb weights and growth rates to weaning. This finding on a commercial farm is in agreement with Mathias et al. (2011, 2013) who studied performance recorded flocks. The ewe and lamb performance in the study, on a large scale commercial farm, was of similar magnitude as performance recorded flocks (Everett-Hincks & Cullen 2009; Everett-Hincks & Dodds 2007; Mathias et al. 2013).

This study showed a production benefit from increasing BCS above a score of 3 in late pregnancy in triplet-bearing ewes. Further research was carried out in 2012 to compare the performance of triplet-bearing ewes with BCS of 4 prelambing compared with those with a BCS of 3 to 3.5. Economic analysis will be performed to determine whether improved ewe production and associated revenue will outweigh the extra costs associated with increasing feed allocations to lift BCS in late pregnancy.

With this information farmers can then determine, within the constraints of their farm system, whether it is worthwhile allocating more feed to enable their ewes to attain a high ewe BCS at lambing.

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