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# The effect of litter size and sward height on ewe and lamb performance

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**Abstract** This study compared ewe and lamb performance in twin- and triplet-bearing/rearing ewes offered varying sward heights from day 64 (P64) of pregnancy until weaning at day 87 (L87) of lactation. Ninety-six twin- and 90 triplet-bearing Romney ewes were randomly assigned on P64 to four replicated sward height treatments (2, 4, 6, and 8 cm sward height). Within 24–36 h of parturition (L1) the ewes were reassigned to two (4 and 8 cm) replicated sward heights until weaning at L87. Ewes grazing the 2 cm sward height during pregnancy were significantly ($P < 0.01$) lighter at P99 and P132 and at L1 than ewes grazing 4, 6 or 8 cm swards. These ewes also had significantly ($P < 0.01$) lower dry matter intakes, condition scores, and ultrasonic backfat depths. Litter size had no effect on ewe intake, ewe liveweight or condition score throughout pregnancy and lactation. Ewes grazing the 2 cm sward height had significantly ($P < 0.05$) lower dry matter intakes during pregnancy than ewes on the 4, 6, and 8 cm treatments. Estimated herbage dry matter intakes measured using n-alkanes were similar to calculated energy requirements. Lambs born to ewes grazing the 2 cm swards during pregnancy were lightest at birth ($P < 0.01$), but sward height during pregnancy or lactation had no effect on lamb weaning weight or lamb survival rate to weaning. Triplet-born lambs were 0.9 kg lighter ($P < 0.05$) than twins at birth, with the difference increasing in those lambs reared as a full triplet set to 4.7 kg at L87. Lamb losses were 14% in twin-born lambs and 32% in triplet-born lambs. There was no sward height by litter size interaction for ewe liveweight, intake or lamb birth and weaning weight or survival, therefore the results suggest ewes rearing either twins or triplets should be fed sward height allowances of 4 cm or better during pregnancy. However, there is no need to feed above 4 cm in pregnancy or lactation to optimise lamb weaning weight, lamb survival or ewe liveweight and condition score gain.

**Keywords** sheep; triplet lambs; feed intake; sward height; lamb growth; triplet-bearing ewes

## INTRODUCTION

Currently lambing percentages in New Zealand are at the highest level ever recorded (Meat and Wool Innovation Economic Service (MWIES) 2002) and associated with these increases is a higher proportion of triplet-born lambs (Amer et al. 1999). The nutritional requirements for both singleton- and twin-bearing ewes are well established (Geenty & Rattray 1987) and sward surface height guidelines have been developed for New Zealand conditions (Parker & McCutcheon 1992; Morris et al. 1993b, 1994). Morris et al. (1993b, 1994) identified 4 cm as the optimal sward height for single- and twin-bearing/rearing ewes. However, the feeding requirements of triplet bearing/rearing ewes under pastoral grazing conditions have not been researched in New Zealand. The approach often used by farmers is to offer ad-lib feeding to triplet-bearing/rearing ewes without knowledge of its effects. Triplet-born lambs have been associated with low birth weights and high mortality (Scales et al. 1986; Kenyon et al. 2002). It is possible that a contributing factor to these high mortality rates is sub-optimal nutrition of the ewe in both pregnancy and lactation, as nutrition during both pregnancy and lactation are known to affect birthweight of lambs and ewe lactational performance (Davis et al. 1980; Rattray et al.

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1982a,b; Robinson 1983; Treacher 1983; Mellor & Murray 1985; Smeaton et al. 1985; Robinson 1990). The aim of this study was to compare ewe and lamb performance in twin- and triplet-bearing/rearing ewes offered varying sward height allowances during both mid to late pregnancy and lactation and to identify appropriate sward height regimens for continuously grazed twin- and triplet-bearing/rearing ewes.

## MATERIALS AND METHODS

One hundred and eighty-six Romney ewes (96 twin- and 90 triplet-bearing, evenly split between two-tooth and mixed-age ewes) that had been successfully mated in a 17-day period (9–26 April 2003) to Romney rams were selected on the basis of pregnancy diagnosis by ultrasound 62 days after the midpoint of mating (P62). The trial period was from April to December 2002. At P64 the twin- and triplet-bearing ewes were stratified by age and weight and then randomly allocated to four replicated mid-pregnancy to parturition sward height regimes (2, 4, 6 or 8 cm). Within 24–36 h of parturition (L1) the ewes and their lambs (balanced for twin- and triplet-rearing ewes) were randomly allocated to two replicated lactation period sward height regimes (4 or 8 cm). The experimental design was therefore a 2 × 4 × 2 replicated factorial design, incorporating two litter sizes (twin and triplet), four sward heights between P64 and L1 (2, 4, 6, and 8 cm) and two sward heights between L1 and L87 (4 and 8 cm). Thus, eight sward height treatments were established (2–4, 2–8, 4–4, 4–8, 6–4, 6–8, 8–4, 8–8).

Ewes were removed from the study if they gave birth to four lambs or died (1 and 8 ewes, respectively). Thus, data from 177 ewes and their lambs were used in this study.

### Pasture management

Four-year-old pastures containing predominantly ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*) pasture were used for grazing the ewes and their lambs throughout the study period. Sward surface heights were measured using a sward stick (Jenquip, New Zealand, 50 readings per paddock) at 2-weekly intervals. The ewes grazed their assigned paddocks throughout the trial except for those on the 6 and 8 cm sward heights, which if the sward was found to be below the nominal treatment height, were moved to an additional paddock (2 ha) to ensure the correct nominal sward height was offered. These spare paddocks were kept at either 6 or 8 cm sward height during pregnancy and 8 cm during the lactation period, by on-off grazing. Average herbage masses were measured using a rising plate meter (Ashgrove Pastoral Products, New Zealand, 50 readings per paddock) at days P85, P111, P132, L30, L60, and L80. The treatment paddocks averaged 1.5 ha, resulting in an average stocking rate of 12 ewes ha$^{-1}$.

### Animal measurements

Liveweights of ewes were recorded within 1 h of their removal from pasture on days P69, P97, P119, P132, L1, L39 and at weaning (L87). Ewe condition score (Jefferies 1961, scale 0–5 including half units) was determined on days P69, P97, P132, L39, and L87. Ewe ultrasonic backfat depth measurements (Delphi A-mode ultrasound, Auckland; Purchas & Beach 1981) on the left-hand side above the loin area (of the last rib) were measured on days P77, P132, L39, and L87.

A subsample of ewes (*n* = 120) was dosed with an intra-rumenal Alkane™ slow release capsule (Captec NZ Ltd) on days P66, P107, L22, and L50, respectively. Herbage intake was estimated using the n-alkane method described by Dove & Mayes (1991) where the capsules release a combination of even-chain alkanes, dotriacontane (C32) and hexatriacontane (C36), at a rate of 48.3 mg day$^{-1}$ (Captec NZ Ltd). Faecal sampling commenced mid morning 7–10 and 13–16 days after each capsule insertion. Faecal samples were oven dried at 60°C for up to 72 h (to constant weight) then bulked within ewes over each 4-day sampling period on an equal weight basis (0.5 g DM day$^{-1}$) and ground to pass through a 1 mm sieve prior to n-alkane extraction and analysis.

Herbage samples were taken daily during the faecal sampling periods by hand plucking at least 20 herbage samples to a height similar to that grazed by the sheep. Intake was then calculated using the procedures of Mayes et al. (1986) and Dove & Mayes (1996).

One hundred and twenty-two ewes were blood sampled (10 ml) via jugular venepuncture (SST gel and clot activator, Becton Dickinson Vacutainer Systems, USA) on days P107, P119, and P132. At L1, 103 of the previously blood sampled ewes were re-sampled. All blood samples were centrifuged at 3500 rpm for 15 min within 2 h of collection. The serum samples were then frozen until analysis. Serum concentrations of β-hydroxybutyrate and non-esterified fatty acids (NEFA) were analysed using enzymatic assays (Sigma, Illinois, USA and Wako Pure Chemical Industries Ltd, Osaka, Japan, respectively). Glucose serum concentrations were analysed using a hexokinase assay (Roche Diagnostics Ltd, Switzerland). Serum concentrations of calcium and magnesium were analysed using dye-binding assays (Roche Diagnostics Ltd, Switzerland).

All newborn lambs were identified to their dam, tagged, sexed and weighed, girth and crown rump length measurements taken and their birthrank recorded within 12 h of birth (L0). Lambs were weighed at days L37 and L87. Male lambs were castrated by the rubber ring method at day L37.

### Statistical analysis

Ewe liveweight, condition score, backfat thickness, and herbage intake were analysed by a repeated measures analysis of variance using the statistical analysis package SAS (1985). Pre-lambing ewe liveweights were calculated on numbers of lambs born. Any ewes that gave birth to twin or triplet lambs but only reared one lamb (or lost all lambs) were discarded from the ewe liveweight data at L87. Ewes that gave birth to triplets but reared twins were included as twin-rearing ewes at the L87 liveweight analysis. All interactions between main effects for ewe liveweight, condition score, and ultrasonic backfat depth were non-significant and hence the model was refitted without these interactions. Sex of lamb, ewe age (two-tooth or mixed age) and replicate were used as fixed effects in the ewe and lamb liveweight models and date of birth as a covariate.

Ewe metabolite and mineral concentrations were subject to a repeat measure analysis model with sward surface height, pregnancy rank, replicate and time of blood sampling and animal effects as well as significant interactions fitted to the data.

The lamb liveweight model was a repeat measures analysis but as there was only one each of crown rump length and girth measurements, they were analysed using univariate analysis of variance. The proportion of lambs surviving to weaning was analysed as a binomial trait using the SAS procedure for categorical data modelling (CATMOD). There were no significant interactions between birth-rank and sward height for lamb weight at birth, L37 and L87. Hence, models were refitted without these interactions. Lambs that were born as twins or triplets and reared as singles, or born as triplets and reared as twins were included in the lamb survival model, but only lambs born and reared as twins or triplets were included in lamb liveweight data at days L37 and L87.

## RESULTS

The mean (± SD) sward heights measured on the nominal 2.0, 4.0, 6.0, and 8.0 cm sward height treatments from day P64 to L1 were 1.7 ± 0.4, 3.7 ± 0.8, 5.6 ± 1.3, 6.8 ± 1.0 cm. These sward heights corresponded to average herbage masses of 750 ± 35, 1180 ± 40, 1591 ± 63, and 1954 ± 67 kg DM ha$^{-1}$, respectively. During lactation the mean sward heights were 4.5 ± 0.5 and 7.6 ± 0.4 cm with average herbage masses of 1174 ± 67 and 2074 ± 77 kg DM ha$^{-1}$, respectively. There were no interactions between sward height and litter size for ewe liveweight, condition score, ewe intake, lamb weight at birth or at L37 and L87 or lamb survival rate, so results are presented as main (sward height and litter size) effects for these factors only.

### Ewe liveweight and condition

There were no significant differences in liveweight, condition score or ultrasonic backfat depth between twin and triplet ewes at any of the measurement days during pregnancy (Table 1). Ewes grazing the 2 cm sward height treatments were significantly ($P < 0.01$) lighter at P97, P119, P132, and L1 than ewes grazing 4, 6 or 8 cm sward height treatments (Table 1). Ewes grazing the 2 cm sward also had significantly ($P < 0.01$) lower condition scores at days P97 and P132 than ewes grazing the 4, 6 or 8 cm swards. There was also a significant ($P < 0.01$) difference in condition score between ewes grazing the 4 and 8 cm sward height treatments at P132. Ewe backfat depth was influenced by sward height only on day P132 where ewes grazing the 2 cm sward had significantly ($P < 0.01$) lower measurements than ewes on the 4, 6, and 8 cm sward heights. Additionally, ewes grazing the 4 cm treatment had significantly ($P < 0.01$) lower backfat depth at P132 than the 6 cm treatment ewes.

Ewe rearing rank had no effect on liveweight or condition score, but those ewes that reared twin lambs had significantly ($P < 0.05$) greater ultrasonic backfat depths at days L39 and L87 than ewes that reared triplets or those ewes that gave birth to triplets but only reared two lambs (Table 2).

Ewes that grazed 2 cm swards during pregnancy were significantly ($P < 0.01$) lighter at day L39 than ewes grazed at 4, 6 or 8 cm swards in pregnancy regardless of whether they grazed 4 or 8 cm swards during lactation. Ewes that had grazed the 2 cm swards throughout pregnancy and then 4 cm swards during lactation (i.e., 2–4) were also lighter ($P < 0.01$) at day L87 than ewes on the 4–4, 4–8, 6–4, 6–

**Table 1** Effect of pregnancy rank and sward height (cm) treatment on ewe liveweight (kg), condition score (scale 0–5), and ultrasonic backfat depth (mm) at the periods indicated during pregnancy (P69 = day 69 of pregnancy) and on day 1 of lactation (L1) (mean ± SEM). Means within pregnancy rank and sward height and columns with letters in common or no superscripts are not significantly different ($P > 0.05$).

| | | Liveweights | | | | | Condition score | | | Backfat depth | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | P69 | P97 | P119 | P132 | L1 | P69 | P97 | P132 | P77 | P132 |
| Pregnancy rank | | | | | | | | | | | |
| 2 | 95 | 52.3 ± 1.1 | 59.4 ± 1.2 | 64.5 ± 1.3 | 67.6 ± 1.3 | 58.2 ± 1.7 | 2.2 ± 0.1 | 3.0 ± 0.1 | 2.5 ± 0.1 | 4.7 ± 0.5 | 3.8 ± 0.4 |
| 3 | 82 | 51.2 ± 1.1 | 60.4 ± 1.2 | 66.1 ± 1.3 | 69.6 ± 1.4 | 58.4 ± 1.7 | 1.9 ± 0.1 | 3.1 ± 0.1 | 2.4 ± 0.1 | 4.3 ± 0.5 | 3.7 ± 0.4 |
| Sward height | | | | | | | | | | | |
| 2 | 45 | 52.2 ± 0.8 | 55.0 ± 0.8$^{a}$ | 56.7 ± 0.9$^{a}$ | 59.5 ± 1.0$^{a}$ | 49.1 ± 1.2$^{a}$ | 2.1 ± 0.1 | 2.2 ± 0.1$^{a}$ | 1.6 ± 0.1$^{a}$ | 4.3 ± 0.3 | 2.0 ± 0.3$^{a}$ |
| 4 | 44 | 51.6 ± 0.8 | 61.1 ± 0.8$^{b}$ | 69.1 ± 0.9$^{b}$ | 70.8 ± 1.0$^{b}$ | 61.7 ± 1.1$^{b}$ | 2.1 ± 0.1 | 3.1 ± 0.1$^{b}$ | 2.6 ± 0.1$^{b}$ | 4.6 ± 0.3 | 3.9 ± 0.3$^{b}$ |
| 6 | 45 | 51.2 ± 0.8 | 61.3 ± 0.8$^{b}$ | 68.4 ± 0.9$^{b}$ | 72.6 ± 1.0$^{b}$ | 61.7 ± 1.1$^{b}$ | 2.0 ± 0.1 | 3.4 ± 0.1$^{b}$ | 2.7 ± 0.1$^{bc}$ | 4.5 ± 0.3 | 4.9 ± 0.3$^{c}$ |
| 8 | 43 | 52.0 ± 0.8 | 62.3 ± 0.8$^{b}$ | 66.9 ± 0.9$^{b}$ | 71.3 ± 0.9$^{b}$ | 60.9 ± 1.1$^{b}$ | 2.1 ± 0.1 | 3.3 ± 0.1$^{b}$ | 3.0 ± 0.1$^{c}$ | 4.7 ± 0.3 | 4.2 ± 0.3$^{bc}$ |

**Table 2** Effect of pregnancy and rearing rank and sward height (cm) treatment during pregnancy and lactation on liveweight (kg), condition score (scale 0–5), and ultrasonic backfat depth (mm) at days 39 and 87 of lactation (mean ± SEM). Means within pregnancy/rearing rank and sward height and columns with letters in common or no superscripts are not significantly different ($P > 0.05$).

| | | Liveweight | | Condition score | | Backfat depth | |
|---|---|---|---|---|---|---|---|
| | *n* | L39 | L87 | L39 | L87 | L39 | L87 |
| Pregnancy/ rearing rank | | | | | | | |
| 2/2[1] | 69 | 58.5 ± 1.0 | 62.2 ± 1.0 | 1.9 ± 0.1 | 2.2 ± 0.1 | 2.7 ± 0.2$^{b}$ | 3.2 ± 0.3$^{b}$ |
| 3/2 | 33 | 58.6 ± 1.3 | 62.8 ± 1.2 | 1.7 ± 0.1 | 2.1 ± 0.1 | 1.9 ± 0.3$^{a}$ | 2.5 ± 0.3$^{a}$ |
| 3/3 | 26 | 59.1 ± 1.4 | 63.2 ± 1.4 | 1.7 ± 0.1 | 2.0 ± 0.1 | 1.9 ± 0.3$^{a}$ | 2.5 ± 0.4$^{a}$ |
| Sward height | | | | | | | |
| 2–4[2] | 14 | 52.6 ± 1.8$^{a}$ | 57.7 ± 1.8$^{a}$ | 1.5 ± 0.2$^{ab}$ | 1.8 ± 0.1$^{a}$ | 1.3 ± 0.4$^{a}$ | 2.0 ± 0.5$^{a}$ |
| 2–8 | 15 | 54.6 ± 1.7$^{a}$ | 60.5 ± 1.7$^{ab}$ | 1.3 ± 0.1$^{a}$ | 2.0 ± 0.1$^{a}$ | 1.0 ± 0.4$^{a}$ | 1.9 ± 0.5$^{a}$ |
| 4–4 | 16 | 59.0 ± 1.5$^{b}$ | 64.3 ± 1.6$^{bc}$ | 1.8 ± 0.1$^{bc}$ | 1.8 ± 0.1$^{a}$ | 1.9 ± 0.3$^{ab}$ | 2.3 ± 0.4$^{a}$ |
| 4–8 | 19 | 60.3 ± 1.6$^{bc}$ | 63.7 ± 1.6$^{bc}$ | 2.0 ± 0.1$^{c}$ | 2.3 ± 0.1$^{bc}$ | 2.7 ± 0.4$^{bc}$ | 3.4 ± 0.4$^{b}$ |
| 6–4 | 17 | 60.7 ± 1.6$^{bc}$ | 63.7 ± 1.6$^{bc}$ | 1.8 ± 0.1$^{bc}$ | 2.1 ± 0.1$^{ab}$ | 2.6 ± 0.3$^{bc}$ | 3.0 ± 0.4$^{ab}$ |
| 6–8 | 15 | 63.2 ± 1.6$^{c}$ | 64.6 ± 1.6$^{bc}$ | 2.0 ± 0.1$^{bc}$ | 2.3 ± 0.1$^{bc}$ | 3.1 ± 0.3$^{c}$ | 3.4 ± 0.5$^{b}$ |
| 8–4 | 16 | 57.7 ± 1.6$^{b}$ | 60.6 ± 1.6$^{ab}$ | 1.7 ± 0.1$^{bc}$ | 2.0 ± 0.1$^{a}$ | 2.4 ± 0.4$^{bc}$ | 2.5 ± 0.5$^{ab}$ |
| 8–8 | 16 | 61.7 ± 1.7$^{bc}$ | 66.6 ± 1.6$^{c}$ | 2.0 ± 0.1$^{c}$ | 2.5 ± 0.1$^{c}$ | 2.6 ± 0.3$^{bc}$ | 3.5 ± 0.5$^{b}$ |

[1] The first number denotes number of lambs born per ewe; the second denotes number of lambs reared per ewe.

[2] The first number denotes sward height from P64–L1; the second denotes sward height from L1–87.

**Table 3** Effect of pregnancy and rearing rank and sward height (cm) treatment on ewe dry matter intake (kg DM ewe$^{-1}$ day$^{-1}$) (mean ± SE). Means within pregnancy/rearing rank and sward height and columns with letters in common or no superscripts are not significantly different ($P > 0.05$).

| | Dry matter intake | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | P73–76 | P79–82 | P114–117 | P120–123 | *n* | L29–32 | L35–38 | L57–60 | L63–66 |
| Pregnancy/rearing rank | | | | | | | | | | |
| 2/2[1] | 66 | 1.9 ± 0.1 | 1.8 ± 0.1 | 1.9 ± 0.1 | 1.6 ± 0.1 | 70 | 2.5 ± 0.1 | 2.7 ± 0.1 | 2.6 ± 0.1 | 2.7 ± 0.1 |
| 3/2 | | – | – | – | – | 33 | 2.2 ± 0.1 | 2.5 ± 0.1 | 2.4 ± 0.1 | 2.7 ± 0.1 |
| 3/3 | 54 | 1.9 ± 0.1 | 1.9 ± 0.1 | 2.0 ± 0.1 | 1.6 ± 0.1 | 31 | 2.5 ± 0.1 | 2.8 ± 0.1 | 2.7 ± 0.1 | 2.6 ± 0.1 |
| Sward height | | | | | | | | | | |
| 2–4[2] | 29 | 1.2 ± 0.1$^{a}$ | 1.3 ± 0.1$^{a}$ | 1.2 ± 0.1$^{a}$ | 1.0 ± 0.1$^{a}$ | 14 | 2.8 ± 0.1$^{b}$ | 2.7 ± 0.2$^{ab}$ | 2.8 ± 0.1$^{b}$ | 2.7 ± 0.2 |
| 2–8 | | | | | | 15 | 2.1 ± 0.1$^{a}$ | 2.4 ± 0.2$^{ab}$ | 2.3 ± 0.1$^{a}$ | 2.9 ± 0.2 |
| 4–4 | 30 | 2.2 ± 0.1$^{b}$ | 2.2 ± 0.1$^{b}$ | 2.6 ± 0.1$^{c}$ | 1.9 ± 0.1$^{b}$ | 17 | 2.6 ± 0.1$^{b}$ | 2.8 ± 0.2$^{ab}$ | 2.7 ± 0.1$^{b}$ | 2.8 ± 0.2 |
| 4–8 | | | | | | 19 | 2.2 ± 0.1$^{a}$ | 2.7 ± 0.2$^{ab}$ | 2.5 ± 0.1$^{ab}$ | 2.9 ± 0.2 |
| 6–4 | 31 | 2.1 ± 0.1$^{b}$ | 2.2 ± 0.1$^{b}$ | 2.2 ± 0.1$^{b}$ | 1.7 ± 0.1$^{b}$ | 17 | 2.6 ± 0.1$^{b}$ | 3.0 ± 0.2$^{b}$ | 2.8 ± 0.1$^{b}$ | 2.5 ± 0.2 |
| 6–8 | | | | | | 17 | 2.0 ± 0.1$^{a}$ | 2.4 ± 0.2$^{a}$ | 2.2 ± 0.1$^{a}$ | 2.7 ± 0.2 |
| 8–4 | 30 | 2.2 ± 0.1$^{b}$ | 2.0 ± 0.1$^{b}$ | 1.9 ± 0.1$^{b}$ | 1.8 ± 0.1$^{b}$ | 17 | 2.9 ± 0.1$^{b}$ | 3.1 ± 0.2$^{b}$ | 3.0 ± 0.1$^{b}$ | 2.6 ± 0.2 |
| 8–8 | | | | | | 15 | 2.0 ± 0.1$^{a}$ | 2.3 ± 0.2$^{a}$ | 2.2 ± 0.1$^{a}$ | 2.4 ± 0.2 |

[1] The first number denotes number of lambs born per ewe; the second denotes number of lambs reared per ewe.
[2] The first number denotes sward height from P64–L1; the second denotes sward height from L1–87.

8, and 8–8 treatments. Those ewes grazing 2 cm pasture during pregnancy and the 8 cm swards in lactation (2–8) were significantly ($P < 0.01$) lighter in lactation than ewes that had grazed 8 cm swards during both pregnancy and lactation (8–8) (Table 2).

Within each of the pregnancy sward-height treatments there was no advantage in ewe liveweight at days L39 or L87 when ewes were offered either 4 or 8 cm swards during lactation, except for those ewes that had grazed the 8 cm swards during pregnancy and were offered 8 cm in lactation which were significantly ($P < 0.05$) heavier at L87 than those offered 4 cm (8–4). The effect of sward height during lactation on both ewe condition score and backfat was not as prominent as on liveweight, although there was a tendency for ewes that grazed 4 cm swards and above during pregnancy to have higher ultrasonic backfat depths (Table 2).

## Ewe intake

Ewes grazing the 2 cm sward-height treatment during pregnancy had significantly ($P < 0.05$) lower dry matter intakes than ewes on the 4, 6, and 8 cm sward-height treatments (Table 3). From days P114–P117 ewes on the 4 cm swards had the highest ($P < 0.01$) intakes, however on all other pregnancy measurement occasions there were no differences in dry matter intake between ewes grazing 4, 6 or 8 cm swards.

During lactation, ewes grazing the 4 cm sward-height treatment had significantly ($P < 0.05$) higher intakes than ewes on the 8 cm swards during days L29–L32 and L57–L60 with the exception of ewes grazing the 4–8 treatment on L57–L60. This significant difference in intake was also observed during days L35–L38 in ewes that had grazed 6 and 8 cm swards during pregnancy (i.e., 6–4, 6–8, 8–4, 8–8). There was no difference in ewe intake during days L35–L38 between ewes grazing the 4 and 8 cm during lactation when they had previously grazed 2 and 4 cm swards during pregnancy (i.e., 2–4, 2–8, 4–4, 4–8 treatments). Sward height had no effect on ewe intake from days L63–L66.

Ewe pregnancy and rearing rank did not affect ewe intake at any of the measurement periods during pregnancy or lactation.

**Table 4** Effect of sward height (cm) and pregnancy rank on glucose (mmol/l) concentrations in the ewe at P107, P119, and P132 and at L1 (mean ± SEM). Means within pregnancy rank and sward height with letters in common or no superscripts are not significantly different ($P > 0.05$).

| | | Glucose concentration | | | | |
|---|---|---|---|---|---|---|
| | *n* | P107 | P119 | P132 | *n* | L1 |
| Pregnancy rank | | | | | | |
| 2 | 66 | 3.44 ± 0.08 | 3.84 ± 0.09 | 3.87 ± 0.08 | 59 | 3.47 ± 0.09 |
| 3 | 56 | 3.35 ± 0.09 | 3.76 ± 0.09 | 3.89 ± 0.08 | 44 | 3.32 ± 0.11 |
| Sward height | | | | | | |
| 2 | 29 | $3.26^{b}$ ± 0.13 | $3.59^{a}$ ± 0.13 | $3.76^{a}$ ± 0.13 | 23 | 3.32 ± 0.15 |
| 4 | 31 | $2.87^{a}$ ± 0.12 | $3.71^{b}$ ± 0.12 | $3.64^{a}$ ± 0.12 | 23 | 3.56 ± 0.15 |
| 6 | 32 | $3.71^{c}$ ± 0.12 | $3.72^{b}$ ± 0.12 | $4.24^{b}$ ± 0.12 | 30 | 3.30 ± 0.13 |
| 8 | 30 | $3.74^{c}$ ± 0.12 | $4.18^{c}$ ± 0.13 | $3.90^{a}$ ± 0.13 | 27 | 3.41 ± 0.13 |

**Table 5** Effect of sward height (cm) and pregnancy/rearing rank on non-esterified fatty acids (mmol/l) concentration in the ewe at P107, P119, and P132 and at L1 (mean ± SEM). Means within pregnancy/rearing rank with letters in common or no superscripts are not significantly different ($P > 0.05$).

| | Non-esterified fatty acid concentration | | | | | |
|---|---|---|---|---|---|---|
| | *n* | P107 | P119 | P132 | *n* | L1 |
| Pregnancy/ rearing rank | | | | | | |
| 2–2[1] | 15 | $0.82^{abc}$ ± 0.07 | $0.96^{cd}$ ± 0.07 | $0.82^{ab}$ ± 0.07 | 12 | $1.16^{cd}$ ± 0.08 |
| 2–4 | 16 | $0.80^{ab}$ ± 0.07 | $0.64^{ab}$ ± 0.07 | $0.99^{b}$ ± 0.07 | 14 | $0.70^{a}$ ± 0.07 |
| 2–6 | 19 | $0.76^{ab}$ ± 0.06 | $0.69^{ab}$ ± 0.06 | $0.99^{b}$ ± 0.06 | 18 | $0.63^{a}$ ± 0.06 |
| 2–8 | 16 | $0.64^{a}$ ± 0.07 | $0.70^{ab}$ ± 0.07 | $1.01^{b}$ ± 0.07 | 15 | $0.70^{a}$ ± 0.07 |
| 3–2 | 14 | $1.01^{c}$ ± 0.07 | $1.13^{d}$ ± 0.07 | $0.90^{ab}$ ± 0.08 | 11 | $1.21^{d}$ ± 0.08 |
| 3–4 | 15 | $0.93^{bc}$ ± 0.07 | $0.81^{bc}$ ± 0.07 | $1.11^{bc}$ ± 0.07 | 9 | $0.94^{bc}$ ± 0.10 |
| 3–6 | 13 | $0.67^{a}$ ± 0.08 | $0.61^{a}$ ± 0.08 | $0.75^{a}$ ± 0.08 | 12 | $0.60^{a}$ ± 0.08 |
| 3–8 | 14 | $0.75^{ab}$ ± 0.07 | $0.81^{bc}$ ± 0.07 | $1.26^{c}$ ± 0.08 | 12 | $0.78^{ab}$ ± 0.08 |

[1] The first number denotes pregnancy rank; the second denotes sward height from P64–L1.

**Table 6** Effect of sward height (cm) and pregnancy rank on β-hydroxybutyrate (mmol/l) concentrations in the ewe at P107, P119, and P132 and at L1 (mean ± SEM). Means within pregnancy rank and sward height with letters in common or no superscripts are not significantly different ($P > 0.05$).

| | | β-hydroxybutyrate concentrations | | | | |
|---|---|---|---|---|---|---|
| | *n* | P107 | P119 | P132 | *n* | L1 |
| Pregnancy rank | | | | | | |
| 2 | 66 | $0.65^{a}$ ± 0.02 | $0.70^{a}$ ± 0.02 | $0.75^{a}$ ± 0.02 | 59 | 0.58 ± 0.02 |
| 3 | 56 | $0.80^{b}$ ± 0.02 | $0.83^{b}$ ± 0.02 | $0.88^{b}$ ± 0.02 | 44 | 0.63 ± 0.02 |
| Sward height | | | | | | |
| 2 | 29 | $0.89^{c}$ ± 0.03 | $0.99^{c}$ ± 0.03 | $0.95^{c}$ ± 0.03 | 23 | $0.74^{b}$ ± 0.04 |
| 4 | 31 | $0.79^{b}$ ± 0.03 | $0.79^{b}$ ± 0.03 | $0.84^{b}$ ± 0.03 | 23 | $0.58^{a}$ ± 0.04 |
| 6 | 32 | $0.64^{a}$ ± 0.03 | $0.66^{a}$ ± 0.03 | $0.67^{a}$ ± 0.03 | 30 | $0.52^{a}$ ± 0.03 |
| 8 | 30 | $0.58^{a}$ ± 0.03 | $0.63^{a}$ ± 0.03 | $0.79^{b}$ ± 0.03 | 27 | $0.58^{a}$ ± 0.04 |

## Blood metabolites

There was a significant ($P < 0.05$) sward height by time interaction for glucose. On day P107, glucose concentrations of ewes grazed on the 4 cm sward height treatments were significantly ($P < 0.05$) lower than all other ewe groups, while those on the 2 cm swards had significantly ($P < 0.05$) lower concentrations than those on 6 and 8 cm sward heights (Table 4). At day P119, ewes on the 2 cm sward heights had significantly ($P < 0.05$) lower glucose concentrations than all other groups, and at the same time ewes grazing the 4 and 6 cm sward height treatments had significantly ($P < 0.05$) lower concentrations than those on 8 cm swards. On day P132 ewes on 2, 4, and 8 cm sward treatment heights had significantly ($P < 0.05$) lower glucose concentrations than those on 6 cm swards.

There were significant ($P < 0.05$) sward height by pregnancy rank and sward height by time interactions for NEFA concentrations (Table 5). At both days P107 and P132, within the twin-bearing ewes sward height had no effect on NEFA concentrations. However at P119 and L1, twin-bearing ewes grazed on 2 cm sward heights had significantly ($P < 0.05$) higher NEFA concentrations than all other twin-bearing ewe groups. At P107 within the triplet-bearing ewes grazed, those at 2 cm had significantly ($P < 0.05$) lower concentrations than those ewes on 6 and 8 cm treatments. At P119 and L1 those ewes on the 2 cm sward heights had significantly ($P < 0.05$) higher NEFA concentrations than all other groups. At day P132 those triplet-bearing ewes grazing the 8 cm sward height treatments had significantly ($P < 0.05$) higher NEFA concentrations than those ewes grazed on either the 2 or 6 cm sward heights and those ewes on 4 cm swards had significantly ($P < 0.05$) higher concentration than those ewes on the 6 cm sward height treatments. At day L1, triplet-bearing ewes on the 4 cm sward treatment had significantly ($P > 0.01$) higher concentrations than those on the 6 cm swards.

Concentrations of β-hydroxybutyrate were significantly ($P < 0.05$) higher in triplet- than twin-bearing ewes on days P107, 119, and 132 (Table 6). There was a significant sward height by time interaction such that at all measurement times, ewes grazed on 2 cm sward height treatments had significantly ($P < 0.05$) higher β-hydroxybutyrate concentrations than all other ewe groups, while only on days P107 and P119 did those ewes grazing the 4 cm sward height treatments have significantly ($P < 0.05$) higher β-hydroxybutyrate concentrations than those on 6 and 8 cm sward height treatment. On day P132 those ewes which grazed the 4 and 8 cm sward heights had significantly ($P < 0.05$) higher β-hydroxybutyrate concentrations than those ewes grazed on the 6 cm sward height treatment.

There was a significant ($P < 0.05$) sward height by time interaction for magnesium whereby on day P132 those ewes grazing 2 cm swards had a significantly ($P < 0.05$) lower magnesium concentration than those on the 4, 6 or 8 cm sward height treatments, however, such a relationship was not present on day L1 (Table 7).

**Table 7** Effect of sward height (cm) and pregnancy rank on magnesium (mmol/l) concentrations in the ewe on P132 and L1 (mean ± SEM). Means within pregnancy rank and sward height with letters in common or no superscripts are not significantly different ($P > 0.05$).

| | Magnesium concentration | | | |
|---|---|---|---|---|
| | *n* | P132 | *n* | L1 |
| Pregnancy rank | | | | |
| 2 | 66 | 0.91 ± 0.01 | 59 | 0.86 ± 0.01 |
| 3 | 56 | 0.90 ± 0.01 | 44 | 0.85 ± 0.01 |
| Sward height | | | | |
| 2 | 29 | $0.85^{a}$ ± 0.01 | 23 | 0.85 ± 0.02 |
| 4 | 31 | $0.91^{b}$ ± 0.01 | 23 | 0.85 ± 0.02 |
| 6 | 32 | $0.91^{b}$ ± 0.01 | 30 | 0.85 ± 0.01 |
| 8 | 30 | $0.94^{b}$ ± 0.01 | 27 | 0.84 ± 0.01 |

**Table 8** Effect of sward height (cm) and pregnancy rank on calcium (mmol/l) concentrations in the ewe on P132 and L1 (mean ± SEM). Means within pregnancy rank and sward height with letters in common or no superscripts are not significantly different ($P > 0.05$).

| | Calcium concentration | | | |
|---|---|---|---|---|
| | *n* | P132 | *n* | L1 |
| Pregnancy rank | | | | |
| 2 | 66 | $2.31 \pm 0.02$ | 59 | $2.39 \pm 0.02$ |
| 3 | 56 | $2.25 \pm 0.02$ | 44 | $2.37 \pm 0.02$ |
| Sward height | | | | |
| 2 | 29 | $2.19^{a} \pm 0.03$ | 23 | $2.29^{a} \pm 0.04$ |
| 4 | 31 | $2.32^{b} \pm 0.03$ | 23 | $2.42^{b} \pm 0.04$ |
| 6 | 32 | $2.34^{b} \pm 0.03$ | 30 | $2.42^{b} \pm 0.03$ |
| 8 | 30 | $2.25^{a} \pm 0.03$ | 27 | $2.41^{b} \pm 0.03$ |

**Table 9** Effect of lamb birth and rearing rank and sward height (cm) during pregnancy or lactation on lamb liveweights (kg) on L0, L37, and L87 and on the proportion of lambs surviving (%) to weaning (mean ± SEM). Means within treatments with letters in common or no superscripts are not significantly different ($P > 0.05$).

| | Liveweights | | | | | | |
|---|---|---|---|---|---|---|---|
| | *n* | L0 | *n*[6] | L37 | L87 | Proportion surviving | |
| Birth/rearing rank | | | | | | | |
| 2/2[1] | 190 | $4.6 \pm 0.1^{b}$ | 140[2] | $14.3 \pm 0.5^{c}$ | $27.4 \pm 0.4^{c}$ | $1.85 \pm 0.21^{b}$[4] | (86)[5] |
| 3/2 | 237 | $3.7 \pm 0.1^{a}$ | 66[2] | $13.0 \pm 0.3^{b}$ | $25.3 \pm 0.5^{b}$ | $0.77 \pm 0.14^{a}$ | (68) |
| 3/3 | | | 78 | $11.5 \pm 0.3^{a}$ | $22.7 \pm 0.5^{a}$ | | |
| Sward height | | | | | | | |
| 2–4[3] | 105 | $3.8 \pm 0.1^{a}$ | 28 | $11.6 \pm 0.5^{a}$ | $23.2 \pm 0.8$ | $1.28 \pm 0.39$ | (78) |
| 2–8 | | | 34 | $12.3 \pm 0.4^{ab}$ | $24.2 \pm 0.7$ | $2.92 \pm 0.73$ | (94) |
| 4–4 | 108 | $4.2 \pm 0.1^{b}$ | 38 | $13.4 \pm 0.4^{bc}$ | $25.6 \pm 0.7$ | $1.90 \pm 0.44$ | (87) |
| 4–8 | | | 42 | $12.9 \pm 0.4^{b}$ | $25.3 \pm 0.6$ | $2.15 \pm 0.47$ | (90) |
| 6–4 | 102 | $4.1 \pm 0.1^{b}$ | 35 | $13.5 \pm 0.4^{bc}$ | $26.2 \pm 0.7$ | $1.90 \pm 0.44$ | (87) |
| 6–8 | | | 36 | $14.0 \pm 0.4^{c}$ | $26.4 \pm 0.7$ | $1.97 \pm 0.47$ | (88) |
| 8–4 | 112 | $4.3 \pm 0.1^{b}$ | 37 | $13.4 \pm 0.4^{bc}$ | $25.4 \pm 0.7$ | $1.77 \pm 0.41$ | (75) |
| 8–8 | | | 36 | $12.6 \pm 0.4^{ab}$ | $24.8 \pm 0.7$ | $2.25 \pm 0.53$ | (90) |

[1] The first number denotes birth rank; second number denotes rearing rank.

[2] Lambs born as twins or triplets and reared as single were excluded from liveweight data at L37 and L87 of lactation.

[3] The first number denotes sward height P64–L1; the second letter denotes sward height from L1–L87.

[4] Logit-transformed value.

[5] Back-transformed (%).

[6] Only those present at L37 and L87.

On P132, ewes grazing 4 and 6 cm sward height treatments had significantly ($P < 0.05$) higher concentrations of calcium than those on either 2 or 8 cm treatments (Table 8). At L1, ewes grazing the 2 cm sward height treatments had significantly ($P < 0.05$) lower calcium concentrations than all other groups.

## Lamb production

Triplet-born lambs were 0.9 kg lighter ($P < 0.05$) than twin-born lambs, and this difference increased in those lambs reared as triplets to 2.8 and 4.7 kg at days L37 and L87, respectively (Table 9). Lambs born as triplets but reared as twins were also lighter ($P < 0.05$) than those born and reared as twin lambs by 1.3 and 2.1 kg at days L37 and L87.

Lambs born to ewes grazing the lowest sward height treatment (2 cm) were lighter at birth ($P < 0.01$). Sward height treatment during pregnancy or lactation had no effect on lamb weaning weight at day 87 (Table 9), although lambs born to ewes

**Table 10** Effect of litter size, fate of lambs (born alive or dead) and sward height (cm) during pregnancy on lamb crown rump length (cm) and girth size (cm) (mean ± SEM). Means within treatments with letters in common or no superscripts are not significantly different ($P >$ 0.05).

| | $n$ | Crown rump length | Girth |
|---|---|---|---|
| Litter size | | | |
| 2 | 190 | $46.0 \pm 0.6^b$ | $47.2 \pm 0.6^b$ |
| 3 | 237 | $44.3 \pm 0.5^a$ | $43.3 \pm 0.5^a$ |
| Fate | | | |
| Alive | 389 | $47.2 \pm 0.3^b$ | $46.8 \pm 0.3^b$ |
| Dead | 38 | $43.1 \pm 1.0^a$ | $43.7 \pm 0.9^a$ |
| Sward height | | | |
| 2 | 105 | 44.7 ± 0.7 | $42.7 \pm 0.6^a$ |
| 4 | 108 | 45.1 ± 0.7 | $46.6 \pm 0.6^b$ |
| 6 | 102 | 45.4 ± 0.7 | $45.4 \pm 0.7^b$ |
| 8 | 112 | 45.3 ± 0.7 | $46.2 \pm 0.7^b$ |

grazing the 2 cm swards during pregnancy tended to be lighter at L37 than lambs born to ewes grazing the other sward height treatments. Sward height and litter size had no significant effect on the proportion of lambs surviving through to weaning (Table 9).

Triplet-born lambs had significantly ($P < 0.05$) shorter crown rump lengths and girth measurements than twin born lambs (Table 10). Likewise, lambs that were born dead or died within their first 3 days of life had shorter crown rump lengths and girths.

Sward height treatment during pregnancy had no effect on crown rump length, but ewes grazing 2 cm swards from day P64 to L1 had lambs with significantly ($P < 0.05$) smaller girths than lambs born to ewes grazing 4, 6 or 8 cm swards from P64–L1.

## DISCUSSION

The objective of this experiment was to compare the effect on ewe and lamb performance of twin- and triplet-bearing/rearing ewes on a range of sward surface heights from mid pregnancy to weaning for continuously stocked September-lambing ewes.

Paddocks were initially prepared to nominal sward heights of 2, 4, 6, and 8 cm for the mid to late pregnancy period and 4 and 8 cm for the lactation period. The actual mean sward heights of 1.7, 3.7, 5.6, and 6.8 cm during pregnancy and 4.5 and 7.6 cm during lactation were all relatively constant and were, with the exception of the 8 cm sward, all within 0.5 cm of the nominal sward heights, indicating that the stocking rate chosen through feed budgeting matched previously recorded herbage growth rates (Hawkins et al. 1989) and the management of swards by the use of addition of land in the case of 6 and 8 cm swards were successful. There were no interactions between sward height and litter size either during pregnancy or in lactation for ewe liveweight, condition score, ewe intake or lamb weight at birth, L37 and L87 weight or lamb survival rate. Discussion therefore is centred around the effects of sward height across both litter sizes.

The relationship between ewe intake and sward surface height was most noticeable during pregnancy where ewes grazing the 2 cm sward had lower dry matter intakes than all other treatments and this corresponded with lighter body weights, condition scores, and backfat thickness from P97 of pregnancy through to parturition. This group of ewes also tended to have the highest β-hydroxybutyrate and NEFA concentrations and lowest mineral concentrations in late pregnancy.

Conversely, during lactation ewes grazing the 4 cm swards had higher intakes during the periods L29–L32 and L57–L60 than those ewes grazing the 8 cm swards. Interestingly, ewe liveweight, condition score, and backfat level did not follow this trend, with those ewes grazing the 8 cm swards in lactation tending to be heavier, and of better condition and with a higher backfat level.

Litter size had no effect on ewe intake, liveweight, and condition score throughout pregnancy and lactation. There was, however, a difference in backfat thickness during lactation, with twin-rearing ewes having greater fat depths than triplet-rearing ewes. It is probable that ultrasonic measurements are more sensitive to changes in ewe condition than the subjective condition scoring system. The maximum ewe intakes reached during pregnancy (2.0 kg dry matter ewe$^{-1}$ day$^{-1}$) occurred during the period of P114–P117 which represents a dry matter intake of around 3% of ewe liveweight. This is slightly lower than the 2.4 kg DM ewe$^{-1}$ day$^{-1}$ recorded by Morris et al. (1993a) for single- and twin-bearing ewes. Triplet-bearing ewes intakes declined to 2.4% of ewe liveweight in the present study in the late pregnancy period (P120–P123). Similarly, Morris et al. (1993a) noted that intakes declined in late pregnancy. The range of dry matter intakes measured over the pregnancy period of 1.0–2.6 kg DM ewe$^{-1}$ day$^{-1}$ are similar to those measured by Morris et al. (1993a), and Rattray & Jagusch (1978) for single- and twin-rearing ewes of a similar liveweight and grazed at comparable pasture allowances.

The dry matter intakes over late pregnancy, of 1.2 and 1.0 kg DM ewe$^{-1}$ day$^{-1}$ for ewes on the 2 cm swards are somewhat lower than the organic matter intakes recorded in ewes grazing 2 cm swards at a similar stage of pregnancy by Morris et al. (1993a). In that study, intakes were determined using the chromium capsule technique. It is not known if the n-alkane technique is more or less accurate than the chromium marker technique for estimating intake when sheep are offered restricted allowance and have to graze at lower sward levels.

The calculated energy intakes at P120–P123 for both the triplet- and twin-rearing ewes in this trial of 17.6 MJ ME ewe$^{-1}$ day$^{-1}$, are comparable to the 16.2 and 18.8 MJ ME ewe$^{-1}$ day$^{-1}$ recommended by Geenty & Rattray (1987) for twin- and triplet-bearing ewes of similar liveweight and stage of pregnancy. The theoretical extra nutrient requirement of triplets was probably being met from tissue mobilisation of body tissues. This is supported by the significantly higher β-hydroxybutyrate concentrations in triplet-bearing ewes than twin-bearing ewes and the tendency for higher NEFA concentrations in triplet-bearing ewes. Additionally, in both twin- and triplet-bearing ewes condition scores and backfat levels were lower at P136 than they had been earlier in pregnancy. It is probable that the triplet-bearing ewe is unable to meet theoretical feed requirements as the size of the gravid uterus would be reducing rumen size.

The dry matter intakes measured during lactation ranged from 2.1 to 3.1 kg DM ewe$^{-1}$ day$^{-1}$ and are equivalent to the organic matter intakes measured by Morris et al. (1994) for single- and twin-rearing ewes (i.e., 1.8–3.1 kg DM ewe$^{-1}$ day$^{-1}$). Intakes of twin- and triplet-rearing ewes did not differ. Ewe intakes were relatively constant from L29 through to L66, however ewes grazing the 4 cm swards had greater dry matter intakes than those ewes grazing the 8 cm swards on all occasions except days L63–66. These results support those of Morris et al. (1994) who suggested that ewe and lamb production are maximised at a sward surface height of 4 cm from birth to day 60 of lactation. Morris et al. (1994) did not report any significant change in ewe intake from birth to weaning in ewes grazing either 4.4 or 7.8 cm swards. Parker & McCutcheon (1992) found that ewe intakes were maximised at a sward height of 5 cm. Other researchers have noted that ewe intake is maximised at sward surface height of 6 cm (Penning & Hooper 1985; Penning et al. 1991; Chestnutt 1992). The findings agree with the recommendations of Hodgson (1990) for ewes grazing at pasture under continuous stocking management. This study is the first to the authors knowledge that has examined the effects of sward surface height on triplet-bearing/rearing ewes continuously stocked on pasture. The present results indicate that the triplet-bearing ewe cannot meet her requirement when grazing 2 cm swards during pregnancy, while at sward-height levels above 4 cm the ewe can not utilise the extra herbage possibly due to rumen restriction. Conversely, during lactation in spring, maximum ewe intakes can be met by the 4 cm sward height.

The calculated energy intakes measured from L35–L38 of 29.1 and 30.8 MJ ME ewe$^{-1}$ day$^{-1}$ for twin- and triplet-rearing ewes in this study are slightly less than 30.0 and 32.0 MJ ME ewe$^{-1}$ day$^{-1}$ recommended by Geenty & Rattray (1987). From a ewe nutritional point of view there is no advantage in separating twin- and triplet-bearing/rearing ewes as intakes were not found to differ under pastoral grazing conditions.

Average magnesium and calcium levels in both twin- and triplet-bearing ewes at all sward heights both in late pregnancy and soon after parturition were not at a level that would cause mineral deficiency problems.

Lamb birthweights were significantly lower on the 2 cm sward heights, a result that is not consistent with the findings of Morris et al. (1993a). This difference may be related to early pregnancy feeding where ewe liveweights in early pregnancy were lower in the present trial compared with the trial of Morris et al. (1993a). Cooper et al. (1998) and Clarke et al. (1998) have shown that poor nutrition throughout early and mid pregnancy restricts placental size. Placental weight peaks at approximately day 100 of gestation and a small placenta may have altered fetal growth in late gestation. Sward height during lactation had no effect on lamb weaning weights, although there was suggestion of a carryover effect from pregnancy feeding level such that lambs born to ewes fed 2 cm swards during pregnancy were lighter in early lactation.

Triplet-born lambs were lighter at birth than twin-born lambs, which supports previous research (Kenyon et al. 2002). Additionally, weaning weights were lower in triplet lambs reared as a triplet compared with twin-born and -reared lambs. It is well established that as the number of lambs born increases the milk production of a ewe does not increase proportionally (Geenty 1979; Geenty et al. 1985). Interestingly, triplets reared as twins were lighter than twin-born and -reared lambs. This lighter weaning weight is likely to be due to a lighter birthweight and the effect this has on the ability of the lamb to initiate extra milk production (Cloete 1993; Dwyer et al. 2001, 2003).

Lamb losses to weaning were 14% in twin-born lambs and 32% in triplet-born lambs. These mortality rates are similar to those recorded by Scales et al. (1986) (14.7 and 33.0% for twin- and triplet-born lambs, respectively), but much higher than the 18.1% observed in triplet-born lambs by Rohloff et al. (1982). Kenyon et al. (2002), using sheep from the same flock as reported in this paper, observed mortality rates of 19.7 and 40.7% in twin- and triplet-born lambs.

The results suggest ewes rearing twins and triplets should be grazed on swards of 4 cm height or better during pregnancy, to achieve optimal lamb birthweight, however there is no further advantage in feeding above 4 cm in pregnancy or lactation in terms of lamb liveweights and survival. These are similar to the targets suggested by Parker & McCutcheon (1992) and Morris et al. (1993a, 1994) for twin-rearing/bearing ewes. It should be noted that these sward heights were achieved on predominantly ryegrass white clover pastures under lowland conditions, and results might differ under hill country conditions where unimproved grasses may dominate the sward. These results support the suggestion that farmers need not separate and differently graze, twin- and triplet-bearing ewes before lambing to achieve optimum lamb production.

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