
THE PROCEEDINGS OF THE
NEW ZEALAND SOCIETY
OF
ANIMAL PRODUCTION
VOLUME 62 2002

ISSN 0370-2731/99 Proceedings of the New Zealand Society of Animal Production **59**: 104-107

Effects of herbage mass and ewe condition score at lambing on lamb survival and liveweight gain

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ABSTRACT

Scanned, twin-bearing mixed aged ewes (n=1276) were set-stocked (7.5 ± 0.1 ewes ha^{-1}) over the lactation period at either high or low condition score (CS) (2.51 vs 1.52) and high or low herbage mass (HM) (1160 vs 880 kg DM ha^{-1}) in an experiment replicated on 5 farms in Wairarapa. Three farms lambed early (27 August to 4 September 1997) and were summer-dry and two lambed later (22 to 27 September 1997) and were summer-wet. High ewe CS may have improved lamb survival (167 vs 150%, P=0.13) through reduction in estimated lamb mortality (17 vs 25%, P<0.01) on late lambing farms where weather conditions were adverse at lambing, but had no effect on early lambing farms where lambing conditions were more favourable. Ewe CS had no effect on either lamb or ewe LWG. High HM may have reduced lamb mortality on early lambing farms (10 vs 14%, P<0.05) where ewes were under greater nutritional stress than on late farms. Additional HM at set-stocking increased lamb LWG up to docking by 11 g d^{-1} per 100 kg DM ha^{-1} increase (P<0.03) on early farms but had no effect on late farms. Lamb LWG from docking to weaning was unaffected by set-stocking HM. The overall effect of an increase in set-stocking HM by 100 kg DM ha^{-1} was to increase lamb weaning weight by 2 kg on early farms. Additional HM at set stocking increased ewe LWG from birth to docking by 33 g d^{-1} per 100 kg DM ha^{-1} increase (P<0.001) but decreased LWG from docking to weaning by 18 g d^{-1} per 100 kg DM ha^{-1} increase. This response was similar on early and late lambing farms. On early farms there was a net increase in ewe liveweight at weaning of 1.6 kg for each 100 kg DM ha^{-1} increase in lambing HM.

Keywords: ewe; lamb, condition score; herbage mass; growth rate.

INTRODUCTION

Under contemporary agricultural cost structures, high liveweight gain of lambs from birth to weaning and increased docking percentage are key components in improving sheep farm profitability. Improving lamb survival, a problem particularly in twinning ewes, leads to improved docking percentages. Currently, it is widely believed by farmers that lamb survival is enhanced by increasing ewe condition at lambing in twin-pregnant ewes. Supporting evidence was seen when the growth rate of lambs suckling ewes of high condition score at lambing were greater than those suckling ewes of low condition score (Gibb & Treacher 1980). Conversely, in studies conducted over a number of years, ewe condition at lambing was shown to have little effect on lamb survival and lamb weaning weight (Smeaton and Rattray, 1984). High ewe condition at lambing is normally achieved at the expense of herbage mass at that time. Increased herbage allowance on ryegrass/white clover pastures during lactation improves ewe and lamb growth rates, particularly in twinning ewes (Coop *et al.,* 1972, Gibb *et al.,* 1981, Rattray *et al.*, 1982). However, high herbage masses at lambing may not be as beneficial on set stocked, poorer quality pastures (Thomson *et al.* 1986). Information on the relative benefits of improved ewe condition and herbage mass at set stocking in contemporary twinning ewes is required so feed allocation decisions can be made during the winter grazing rotation. The objective of this experiment was to determine the effect of herbage mass (HM) and ewe condition score (CS) at lambing on lamb survival and liveweight in twinning ewes grazed on commercial Wairarapa hill country farms.

MATERIALS AND METHODS

Experimental animals

A sample (n = 1700) of mixed-aged ewes, diagnosed as twin-pregnant at scanning in mid-pregnancy, was condition scored (1-5 scale) by a single operator within two weeks of the 1997 lambing, on 5 Wairarapa hill-country farms. Lambing commenced "early" (27 August to 4 September) on three historically summer-dry farms, and "late" (22 to 27 September) on two historically summer-wet farms. The early lambing farms were located to the south east of Masterton, the late lambing farms north of Pahiatua. Experimental ewes (n = 1276, 180-330 per farm) were selected from the larger sample, and allocated to two condition score (CS) groups with average scores of 1.52 ± 0.01 and 2.51 ± 0.01. Effectively these groups represented the fatter and thinner ewes in the larger group, the ewes of intermediate condition being discarded.

Treatments

On each farm, four paddocks of similar fertility, topography, and aspect were selected. Each of the paddocks was allocated to one treatment in a factorial design of 2 herbage masses and 2 ewe condition scores. Two low herbage mass (HM) paddocks were grazed within 2 weeks of set-stocking for lambing (average HM 880 kg DM ha^{-1} at set-stocking), the other 2 high HM paddocks (average HM 1160 kg DM ha^{-1} at set-stocking) remained ungrazed. Ewes were randomly allocated within CS to HM paddocks, and set-stocked at 7.5 ± 0.1 ewes ha^{-1} within one week of expected onset of lambing. Experimental sheep remained in the same paddock until weaning and received the same animal health remedies as their non-experimental companions. Additional grazing-stock were added to individual paddocks irrespective of initial treatment when HM increased above 1600 kg DM ha^{-1}. All paddocks received a single dressing of nitrogenous fertiliser (13-28 kg N ha^{-1}) during the period from August to early October.

Measurements

The ewes were counted, condition scored and weighed at set-stocking, docking (6.3 ± 0.1 weeks after mean lambing date) and weaning (13.6 ± 0.6 weeks after mean lambing date). Lambs were counted and weighed at docking and weighed at weaning. Herbage mass was measured using a rising plate meter at set-stocking, docking and weaning. A similar route was taken through each paddock for each measurement and about 100 readings were taken in each paddock. Plate reading was converted to dry matter using a standard equation (kg DM ha^{-1} = 200 + 158 * plate reading).

Calculations

After discussion with the farmers, mean lambing date was assumed to be 10 days after the planned start of lambing as determined by the joining date, and average lamb birth weight was taken as 3.5 kg for calculation of lamb liveweight gain from birth to docking (Geenty, 1997). Ewe liveweight after lambing was assumed to be liveweight 2 weeks prior to set-stocking minus 10 kg (Geenty and Rattray, 1987). Docking percentages were calculated from numbers of lambs and ewes present at docking.

Statistical analysis

Paddock means were used in a general linear analysis of variance using herbage mass and ewe condition as classes and farms as replicates in one analysis. In a second analysis paddock mean values were analysed using general linear regression models with actual herbage mass and condition scores fitted as the independent variable with farm and type (early and late) as classes (SAS, 1990). Non significant (P>0.10) main effects and interactions were dropped from the models until only significant factors remained. These equations are presented. The effect of treatment on lamb mortality (calculated from scanned potential number of lambs less the number of lambs present at docking over the scanned potential number of lambs present) was determined using chi square analysis.

RESULTS

Herbage Mass

High HM at lambing did not increase (P>0.10) docking percentage, which was 180 vs 172% and 156 vs 161% for high compared to low HM paddocks on early farms and late farms respectively (Table 1). However on early lambing farms lamb mortality was lower on high HM treatments (10 vs 14%, P<0.05).

Lamb liveweight gain (LWG) from birth to docking tended to respond differently to HM on early and late lambing farms (lambing date * HM, P<0.09). On early farms an extra 100 kg DM ha^{-1} at set-stocking increased LWG by 11 g d^{-1} and docking weight by 4.7 kg (Table 2). On late lambing farms lamb LWG from birth to docking had a similar trend as on early lambing farms but it did not achieve significance (Tables 1, 2). Lamb LWG from docking to weaning was not influenced by set-stocking HM on either early or late lambing farms (Table 2). However, the higher rate of LWG before docking meant that lambs were 2 kg heavier at weaning on the high HM treatment on early farms at weaning (Table 1).

TABLE 1: The effect of ewe condition score (CS) and herbage mass (HM) at set-stocking on lamb survival and liveweight on early and late lambing Wairarapa farms at docking and weaning.

	HERBAGE MASS						CONDITION SCORE					
	Early Lamb			Late Lamb			Early Lamb			Late Lamb		
	High	Low	P<	High	Low	P<	High	Low	P<	High	Low	P<
Set-stocking												
HM (kg DM ha^{-1})	1058	874	0.07	1257	885	0.01	991	940	0.58	1075	1067	0.93
Ewe CS	2.03	2.02	0.73	2.01	2.00	0.86	2.50	1.54	0.01	2.50	1.50	0.01
Ewe weight (kg)	63.6	63.6	0.96	61.9	61.9	0.94	65.4	61.8	0.01	64.4	59.5	0.01
Docking												
HM (kg DM ha^{-1})	1228	881	0.24	1253	1123	0.60	1118	991	0.65	1086	1292	0.46
Ewe weight (kg)	55.4	48.1	0.01	57.6	53.6	0.21	53.7	49.9	0.03	57.9	53.3	0.16
Ewe CS	1.94	1.81	0.05	2.30	2.10	0.20	2.00	1.67	0.01	2.40	2.03	0.08
Ewe LWG^{bd} (g d^{-1})	85	-61	0.01	140	62	0.24	12.3	12.3	1.00	97	105	0.23
Lamb weight (kg)	12.9	11.8	0.01	14.0	13.7	0.63	12.2	12.5	0.51	13.8	13.9	0.96
Lamb LWG^{bd} (g d^{-1})	296	261	0.01	292	272	0.62	275	282	0.54	278	288	0.62
Docking (%)	180	172	0.20	156	161	0.66	176	176	1.00	167	150	0.13
Weaning												
HM (kg DM ha^{-1})	1163	899	0.13	1407	1521	0.73	991	1072	0.61	1365	1563	0.56
Ewe weight (kg)	59.3	54.3	0.01	59.0	59.9	0.75	58.0	55.6	0.24	61.4	57.6	0.04
Ewe CS	2.60	2.20	0.01	2.59	2.71	0.20	2.46	2.27	0.08	2.79	2.51	0.02
Ewe LWG^{dw} (g d^{-1})	107	153	0.03	22.5	93.0	0.05	113	146	0.10	49	67	0.06
Lamb weight (kg)	23.1	21.0	0.01	26.2	26.2	0.90	22.2	22.0	0.65	26.2	26.0	0.65
Lamb LWG^{dw} (g d^{-1})	232	210	0.15	210	215	0.65	228	214	0.41	216	210	0.62

^{bd} birth to docking; ^{dw} docking to weaning

Ewes on high HM at set-stocking increased LW at docking by 7.3 kg and 4.0 kg for early and late lambing ewes respectively, and early lambing ewes on low HM paddocks lost weight over that period (Table 1). An additional 100 kg of set-stocking HM increased (P<0.01) ewe LWG by 33 g d^{-1} (footnote in Table 2) between lambing and docking and this relationship was similar for early (37 g d^{-1}) and late (25 g d^{-1}) lambing ewes (Table 2).

After docking, ewe LWG was negatively related to set-stocking HM and regression relationships (Table 2) were not significantly different (P>0.10) between farm types. Overall, ewe LWG from docking to weaning decreased by 18 g d^{-1} for each 100 kg DM ha^{-1} increase in set-stocking HM (footnote in Table 2). At weaning early ewes were still substantially (5 kg) heavier in high compared to low HM

TABLE 2: Regression equations describing the relationship between herbage mass at set-stocking and liveweight and liveweight gain in ewes and lambs.

	EARLY					LATE				
	Intercept	se	Slope	se	P<	Intercept	se	Slope	se	P<
DOCKING										
Ewe weight (kg)	30	7	0.022	0.008	0.02	51	9	0.004	0.008	0.60
Ewe LWG^{bd} (g d^{-1})	-347	124	0.37	0.01	0.01	-171	97	0.25	0.09	0.02
Lamb weight (kg)	8	2	0.005	0.002	0.02	15	1	0.002	0.49	0.49
Lamb LWG^{bd} (g d^{-1})	164	5	0.12	0.03	0.01	332	3	-0.046	0.62	0.62
Docking (%)	154	18	0.022	0.02	0.25	150	25	0.008	0.02	0.74
WEANING										
Ewe weight (kg)	42	6	0.016	0.007	0.03	65	6	-0.006	0.005	0.23
Ewe LWG^{dw} (g d^{-1})	214	11	-0.087	0.01	0.44	240	51	-0.17	0.05	0.01
Lamb weight (kg)	19	3	0.003	0.004	0.42	28	2	-0.002	0.002	0.44
Lamb LWG^{dw} (g d^{-1})	185	51	0.04	0.05	0.49	201	22	0.01	0.02	0.58

^{bd} birth to docking; ^{dw} docking to weaning

Common relationships across farm types:

Ewe LWG^{bd} = -292 ± 79 + 0.33 ± 0.08P=0.01

Ewe LWG^{dw} = 278 ± 65 - 0.18 ± 0.06P=0.01

treatments while the differences in LW at docking in the late lambing ewes had disappeared by weaning (Table 1).

Ewe condition score

At set-stocking, low CS sheep had 1 unit less CS than high CS sheep (P<0.01) and were on average 4.3 kg lighter (Table 1). The docking percentage of high and low condition ewes was the same on early farms (both 176%, Table 1). On late lambing farms high ewe CS may have improved docking percentage (167 vs 150%, P=0.13) through reduction in estimated lamb mortality (17 vs 25%, P<0.01). Lamb mortality for high CS ewes on late lambing farms (17%) was 25% lower (P<0.01) than for low CS ewes.

Differences between CS treatments diminished with time, high CS ewes having 0.35 and 0.24 higher CS and being 4.3 and 3.1 kg heavier (P<0.01) than low CS ewes at docking and weaning respectively (Table 1). However, ewe CS treatment did not affect lamb weight at either docking or weaning (Table 1).

DISCUSSION

Overall, ewe condition score did not affect lamb docking percentage but lamb mortality was lower on late lambing farms in good conditioned ewes. The failure to achieve statistical significance (P = 0.13) in docking percentage on the late lambing farms, despite the 17 % difference between CS treatments was possibly due to the relatively low statistical power of the design (only 4 high and 4 low CS cells) and the large individual paddock variation in docking percentage. According to Geenty (1997) low CS ewes have an slower onset of milk secretion and produce lambs with less fat reserves and a less pronounced suckling drive, all of which interact to adversely affect lamb survival. There was a week of inclement weather during peak lambing on the late farms, in contrast to relatively mild conditions on the early farms and ewe CS may be more important during such adverse conditions. Lamb mortality was lower in the high HM compared with the low HM treatment on early lambing but not on late lambing farms. This supports practical experience suggesting mis-mothering and lamb deaths are greater where HM is less than 1000 kg DM ha^{-1} and pasture growth rate fails to meet animal demands (Geenty 1997). But this result conflicts with that of Smeaton and Rattray (1984) who found that nutrition during pregnancy and lactation did not affect lamb survival.

High HM at lambing increased ewe LWG up to docking on all farms, and increased lamb LWG to docking on the early lambing farms. This agrees with previous work (Coop *et al.* 1972, Parker & McCutcheon 1992, Chestnutt 1992, Morris *et al.* 1994). On the early lambing Wairarapa farms in this study an additional 200 kg DM ha^{-1} herbage mass at set-stocking resulted in an additional 10.9 kg of lamb weight and 19.0 kg of ewe weight ha^{-1} at docking in twinning ewes. The lack of a response in lamb LWG to set-stocking HM on late lambing farms may have been because pasture growth more quickly exceeded animal requirements and the 2 treatments tended to converge more rapidly following set-stocking than on the early lambing farms (Table 1). This may have been because pasture growth rates more closely matched animal demands on the later lambing properties. In interpreting the responses measured in this trial, it needs to be borne in mind that the HM treatments were imposed at set-stocking, and subsequently converged i.e., they were not deliberately maintained throughout the trial period. It is interesting to note that the effects of HM on lamb mortality and lamb LWG both occurred on the early lambing farms but not the late lambing farms. This suggests that the early lambing ewes experienced greater levels of nutritional stress, and this possibility is borne out by the tendency for greater LWG in response to high HM on the early lambing compared with late lambing farms (Table 1).

The reduction of ewe LWG after docking associated with high set-stocking HM may have resulted from the lower maintenance requirements of the lighter ewes on the low HM treatment, possibly coupled with greater feed intakes on the low compared to the high HM treatment. Also, feed quality may have declined as a result of greater reproductive stem development and accumulation of dead material (Butler and Chu, 1988) following lower grazing pressure in the high HM treatment. High herbage allowances give sheep the opportunity to select for more digestible herbage, however Thomson *et al.*, (1986) showed that ewe and lamb performance was positively correlated with the green percentage of the pasture and this was reduced by high herbage mass on commercial farms. Many of the studies which advocate high herbage allowances during lactation were conducted on rotationally grazed ryegrass/white clover swards in the Waikato (Rattray *et al.*, 1982; Smeaton and Rattray, 1984). Other studies have found that when herbage mass increased over the later part of lactation, herbage mass had either no effect (McEwan *et al.*, 1983) or a negative effect (Rattray 1977) on lamb growth. This decrease in lamb growth was attributable to the decline in pasture quality that occurs in pastures in late spring.

In this experiment, LWG of twin lambs was non-responsive to ewe condition, as for Smeaton and Rattray (1984) where large increases in prelambing liveweight had little effect on lamb weaning weights. This is in contrast to Gibb & Treacher (1980) who found that growth rate of twin lambs suckling “fat” (CS 3.2) ewes was greater than that of lambs on “thin” ewes (CS 2.4), between weeks 1-8 of lactation. In our trial, CS differences were not deliberately generated. Rather, the way in which the ewes were chosen reflected a situation where a farmer might separate low and high condition ewes at lambing for differential treatment. Hence effects of CS *per se* may have been confounded with those of environment and genetics.

Several issues that are relevant to commercial sheep farmers require resolution under more tightly controlled experimental conditions, and using sheep of “modern” genetic origin. These include the influence of ewe CS and of set-stocking HM on lamb survival; the effect of ewe condition score at lambing on suckling lamb growth rate; and management of the interaction between HM and herbage quality in the period between docking and weaning.

This work suggests that under commercial sheep-farming conditions where ewes are lambed in moderate condition e.g., CS 2.5, feed after lambing is potentially more valuable than feed before lambing, as suggested by Smeaton *et al.* (1983). Carrying feed forward as close as possible to lambing (or even after lambing), at the expense of greater ewe condition, could lead to higher lamb weaning weights in many situations.

ACKNOWLEDGEMENTS

The provision of field resources by the 5 Wairarapa farmers, and their willingness to be involved in this trial is greatly appreciated, as is the statistical assistance rendered by Robert Fletcher and Terry Knight. This project was funded by Technology for Business Growth (Project Number WSF501).

REFERENCES

Butler B.M.; Chu A.C.P. (1988). The influence of spring grazing management on pasture quality. *New Zealand Grasslands Association.* **49:** 131-134.

Chestnutt, D.M.B. (1992). Effect of sward surface height on the performance of ewes and lambs continuously grazed on grass/clover and nitrogen-fertilised grass swards. *Grass and Forage Science* **47:** 70-80.

Coop, I.E.; Clark, V.R.; Claro, D. (1972). Nutrition of the ewe in early lactataion 1. Lamb growth rate. *New Zealand Journal of Agricultural Research* **15:** 203-208.

Geenty K.G.; Rattray P.V., (1987). The energy requirements of grazing sheep and cattle. Feeding Livestock on Pasture. *New Zealand Society of Animal Production* Occasional Publication pp 39-53.

Geenty, K.G. (1997). A Guide to Improved Lambing Percentage for Farmers and Advisors.128 pp.

Gibb, M.J.; Treacher, T.T.; Shanmugalingham, V.S. (1981). Herbage intake of grazing ewes and of their lambs when weaned at 6, 8, 10, or 14 weeks of age. *Animal Production* **33:** 223-232.

Gibb, M.J.; Treacher, T.T. (1980). The effect of ewe body condition at lambing on the performance of ewes and their lambs at pasture. *Journal of Agricultural Science* **95:** 631-640.

McEwan J.C.; Mathieson C.; Hawer, H. (1983). Date of lambing and sheep production in Southland. *Proceedings of the New Zealand Society of Animal Production* **43:** 45-48.

Morris, S.T.; McCutcheon, S.N.; Parker, W.J.; Blair, H.T. (1994). Effect of sward surface height on herbage intake and performance of lactating ewes lambed in winter and continuously stocked on pasture. *Journal of Agricultural Science, Cambridge* **122:** 471-482.

Parker, W.J.; McCutcheon, S.N. (1992). Effect of sward height on herbage intake and production of ewes of different rearing rank during lactation. *Journal of Agricultural Science, Cambridge* **118:** 383-395.

Rattray P.V. (1977). Effect of lambing date on production from breeding ewes and on pasture allowance and intake. *Proceedings of the New Zealand Grassland Association* **39:** 98-107.

Rattray P.V.; Jagusch K.T.; Duganzich D.M.; McLean K.S.; Lynch R.J. (1982). Influence of feeding post-lambing on ew and lamb performance at grazing. *Proceedings of the New Zealand Society of Animal Production* **42:** 179-182.

SAS Institute Inc (1990): SAS* Procedure Guide. Version 6, Third Edition. Cary, N.C: SAS Institute Inc.

Smeaton, D.C.; Rattray, P.V.; Mackisack, B.; Heath, S. (1983). Nutrition and management of ewes before and after lambing. *Proceedings of the New Zealand Society of Animal Production* **43:** 37-40.

Thomson, N.A.; Mace M.J.; Wright, L.A.; Bishell S.M. (1986). Preliminary investigation into factors affecting lamb growth from birth to weaning on Taranaki hill country. *Proceedings of the New Zealand Society of Animal Production* **46:** 139-144.