Yearling lambing performance and primary cause of lamb death

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ABSTRACT

As a result of increasing on-farm costs, farmers are aiming to increase the number of saleable lambs by lambing yearling ewes. This study investigated lamb survival rates in lambs born to yearlings from birth to three days of age. Data were collected from six recorded flocks in 2007 and 2008, involving 880 yearling ewes giving birth to 557 single and 756 twin lambs. All lambs were weighed at birth and at weaning. Lambs that died within the first three days of life were subject to post-mortem to determine the primary cause of death. Mean lamb survival to three days of age was 80% and survival to weaning was 72%. There were significantly less twin lambs born alive, than single lambs (90%, CI 88% - 92%, cf. 95%, CI 93% - 96%, P <0.05). Twin lambs had a higher death rate due to starvation/exposure, (6.3%, CI 5.3% - 7.4% cf. 2.8%, CI 2% - 3.8%, P <0.05) than single lambs. Dystocia did not differ significantly between single and twin lambs (6% cf. 10% respectively; P >0.05). Mortality in the first few days after birth is higher in yearlings than in flock ewes and higher in twins than singles.

Keywords: yearling lambing; lamb survival.

INTRODUCTION

Lambing as a yearling, rather than as a two – year-old, is an option for farmers to maximise farm returns through increasing number of lambs born (Gavigan & Rattray, 2002; Hight, 1982; Tyrrell, 1976). One limitation of ewes lambing as a yearling is the higher lamb death rate at approximately 30% from birth to weaning (McMillan & Kitney, 1983) which is nearly 15% higher than that of mixed age ewes,(McMillan & Kitney, 1983). Previous studies (Dýrmundsson, 1973; McMillan, 1983) have suggested that the higher mortality rate found in lambs born to yearling dams may be due to lambs having lighter birth weights. Previous research found the average birth weight of lambs born to yearling dams to be 3.55 kg and concluded that the optimum birth weight for lambs born to yearlings to maximise their survival was between 3.3 and 4.1 kg McMillan (1983). This is considerably lighter, than lambs born to mixed aged ewes where the optimum birth weight was 5.5kg (Everett-Hincks & Dodds, 2007).

Dystocia has been reported as a major factor contributing to yearling lamb deaths with reports of dystocia death incidence being as high as 12.3% (McMillan, 1983). This is almost three times as much as has been found in similar studies carried out on mixed age ewes with dystocia rates accounting for 4% of total lamb deaths to three days of age (Everett-Hincks & Dodds, 2007). Starvation/exposure death risk has also been reported to be much higher in lambs born to yearlings with a rate of 2.7% (McMillan, 1983), compared with a rate of 1% in mixed aged ewes (Everett-Hincks & Dodds, 2007).

The aim of this study was to investigate causes of death between birth and three days of age in lambs born to yearlings and to make recommendations to improve yearling lambing performance.

MATERIALS AND METHODS

Data were collected for the survival of lambs born to yearling ewes in six Sheep Improvement Limited (SIL) recorded flocks from the North and South Island (Table 1) that had volunteered to be part of the Ovita lamb survival project in 2007 and 2008. It included data for a total of 880 yearling dams and their 557 single and 756 twin lambs. Breeds included in the study consisted predominantly of Perendale, Romney and crossbreds with Texel and Suffolk and breed composites such as TEFRom and GrowBulk. All lambs were weighed (BWT) and tagged within 24 hours of birth. Lambs that died at birth or within the first three days of life were collected and subjected to post-mortem by either a trained farmer or alternatively frozen and transported to Invermay for post-mortem by trained technicians. The post-mortem was carried out to firstly identify if the lamb was viable at birth (LVB) and then to assign a primary cause of death. Lambs were classified as viable at birth if they had taken a breath. The primary cause of death was classified as; dystocia (LDD), or starvation/exposure (LDSE), following the standardised protocol of Everett-Hincks and Duncan (2008). All records of lambs born to yearling ewes were obtained from SIL and the AgResearch lamb survival database. Lamb survival traits recorded included lamb survival to three days

TABLE 1: Farm participants, sheep breeds and number of breeding yearlings included in the study.

Region	Farm/ Flock	Breed	Number of lambs	Number of yearling dams
Manawatu	A	Romney	285	214
Otago	B1	Perendale	27	23
	B2	Perendale	81	63
Southland	C1	Composite & Romney	752	518
	C2	Composite & Crossbred	96	82
	D	Composite	72	62
Total			1,313	962

TABLE 2: Lambing performance of yearling dams including lamb viability at birth, lamb death risk from dystocia and starvation/exposure, survival from birth to three days of age and survival from birth to weaning with data quoted as proportion and confidence interval. Also included are birth and weaning weight, and growth rate with data quoted as least square mean ± standard error.

Trait	Birth rank		Significance
	Single	Twin	
Lamb viability at birth	0.95 (0.93, 0.96)	0.90 (0.88, 0.92)	*
Lamb death from dystocia	0.06 (0.05, 0.08)	0.10 (0.09, 0.13)	NS
Lamb death from starvation/exposure	0.03 (0.02, 0.04)	0.06 (0.05, 0.07)	*
Survival from birth to three days of age	0.87 (0.85, 0.89)	0.76 (0.74, 0.77)	***
Survival from birth to weaning	0.79 (0.77, 0.81)	0.67 (0.65, 0.69)	NS
Birth weight (kg)	4.6 ± 0.1	3.6 ± 0.1	***
Lamb growth rate (g/d)	267 ± 3	254 ± 3	***
Wean weight (kg)	30.6 ± 0.3	29.1 ± 0.3	***

of age (SurvJ3) and survival to weaning at 12 to 14 weeks of age (SurvW). Lambs were weighed at weaning at 12 to 14 weeks of age (WWT) and mean growth rate to weaning (Growth) calculated by subtracting the birth weight from the weaning weight and then dividing it by the lamb's age in days. Data was transferred into a purpose built database, data checks performed and the data analysed. Records of lambs that had been fostered, hand reared, assisted at birth, aborted or were rotten at birth were removed from the dataset.

Statistical analyses were performed using GenStat v.11 (VSN International Ltd., Hemel Hempstead, Hertfordshire, UK). Birth weights, Growth and weaning weight were analysed using the linear mixed model procedure. The effects of birth rank, sex, birth date and breed were fitted as fixed effects, with both WWT and Growth models adjusted by BWT, and dams fitted as a random effect to account for dam differences within flock. Lamb death risks and the survival descriptors of LVB, LDD, LDSE, SurvJ3 and SurvW, were modelled using the generalized linear mixed models procedure with logit link and dispersion parameter fixed at 1. The effects of birth rank, sex, birth date and BWT, with both a linear and a quadratic term, were fitted as fixed effects and dam as a random effect. All the possible two-way interactions for the models were tested. Those that did not show significant effects were not included in the final models.

RESULTS

Table 2 shows the effect of the birth rank on the traits analysed. When comparing single and twin born lambs from yearling dams, twins had a 5% lower viability at birth. Twins also had a 3% higher death risk to starvation exposure. There was no significant difference in singles and twins for death risk to dystocia or survival to weaning. Overall singles had a 12% higher survival rate to three days of age compared to twins. There were significant BWT differences between singles and twins, where singles were 1 kg heavier. Growth and WWT were significantly higher in singles compared to twins by 13 g/d and 1.5 kg, respectively.

There was a significant ($P < 0.001$) quadratic relationship between lamb viability at birth and birth weight in singles and twins with an optimum birth weight of approximately 4 kg. Viability decreased below and above a birth weight of 4 kg. (Figure 1; Table 2).

The quadratic relationship ($P < 0.001$) for lamb survival to three days of age and birth weight demonstrated a decrease in survival for birth weights below or over the 4 kg birth weight region (Figure 2; Table 2). The optimum birth weight for reduced death risk to dystocia as apparent in a significant quadratic relationship ($P < 0.001$) was approximately 4 kg where lamb birth weights below or above this had an increased death risk (Figure 3; Table 2). However death risk to starvation/exposure had no optimum weight within the range analysed ($P < 0.195$) (Figure 4; Table 2).

FIGURE 1: Regression of lamb viability at birth (LVB, proportion) on lamb birth weight (BWT) (kg) for single and twin lambs born to yearling ewes.
Single lamb LVB = 0.531 + 0.275 BWT - 0.040 BWT^2
Twin lamb LVB = 0.308+ 0.394 BWT - 0.056 BWT^2

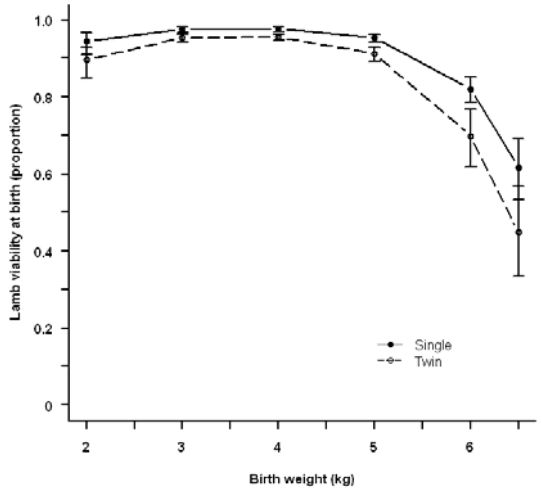
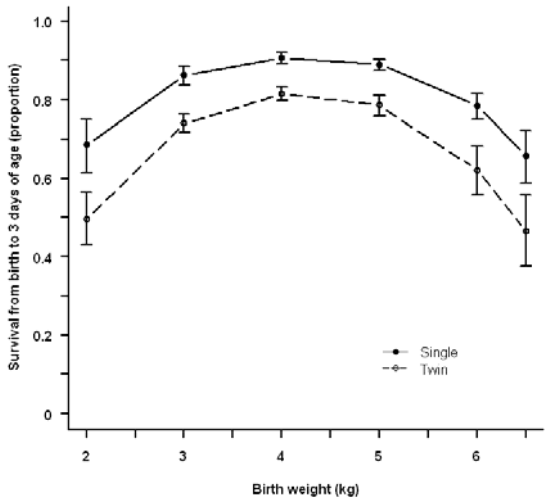


FIGURE 2: Regression of survival from birth to three days of age (SurvJ3) (proportion) on lamb birth weight (BWT) (kg) for single and twin lambs born to yearling ewes.
Single lamb SurvJ3 = 0.074+ 0.404 BWT - 0.048 BWT^2
Twin lamb SurvJ3 = - 0.368 + 0.570 BWT - 0.068 BWT^2



In summary, all traits other than starvation/exposure had an optimum survival rate within the region of 4 kg for both singles and twins. Single lambs when compared with twin lambs, had increased birth and weaning weights and lower mortality rates for LDSE and SurvJ3.

DISCUSSION

More than half of all lamb deaths to weaning occurred within the first three days from birth. In this study of lambs born to yearling dams, lamb death rates from birth to three days of age were 20% compared to an overall of 28% to weaning. This rate was higher than that found for mixed age ewes from SIL recorded flocks, in a study performed by Everett-Hincks and Dodds (2007) where lamb mortality rates within the first three days from birth were 9% compared with a total of 16% from birth to weaning.

The major death risk for lambs born to yearling dams was dystocia at 7%, which was higher than reported in mixed age ewes at 4% (Everett-Hincks & Dodds, 2007). Dystocia rates in maiden two-year-old ewes have been found to be no different than that of older ewes, with four-year-old ewes having the highest dystocia rates and three-year-old ewes having the lowest (Everett-Hincks & Dodds, 2007). The higher dystocia rates in lambs born to yearlings may be as a result of prolonged parturition in yearling dams (McMillan, 1983) due to a size disproportion between the ewe and the lamb (Sargison, 1997).

Starvation/exposure death risk rates were also elevated in lambs born to yearling dams at 5% compared with only 1% in mixed age ewes (Everett-Hincks & Dodds, 2007). However this may be due to lambs born to yearling ewes having lighter lamb birth weights compared with single and multiple born lambs from mixed age ewes (Everett-Hincks & Dodds, 2007).

Lamb viability at birth was lower in lambs born to yearling dams at only 94% compared with 98% reported in mixed age ewes (Everett-Hincks & Dodds, 2007). This may be due to yearlings having more difficulties with labour than mixed age ewes as farmers generally assist yearlings with parturition problems more than in two-year-old and older ewes.

This study highlighted the significant difference in survival rates between single and twin lambs born to yearlings with single lambs having a much higher viability at birth, lower starvation/exposure risk and higher survival rate from birth to three days of age than twin lambs. The decreased survival in twins may in part be due to twins having significantly lower birth weights which this study has found to be a crucial factor for lamb survival. Previous studies have found the optimum birth weight for lambs born to mixed age ewes was 5.5 kg (Everett-Hincks & Dodds, 2007). This study found the optimum birth weight for lambs born to yearlings was within the region of 4 kg. At the optimum birth weight of approximately 4 kg there was an overall increase in survival to three days of age and decreased death risk to dystocia for both single and twin born lambs. The optimum weight for lamb viability at birth was slightly lower at between 3 and 4 kg.

Twin born lambs had slower growth rates from birth to weaning and lower weaning weights than single lambs, even when adjusted for BWT.

FIGURE 3: Regression of lamb death risk from dystocia (LDD) (proportion) on lamb birth weight (BWT) (kg) for single and twin lambs born to yearling ewes.
Single lamb LDD = 0.478 - 0.298 BWT + 0.044 BWT^2
Twin lamb LDD = 0.613 - 0.377 BWT + 0.057 BWT^2

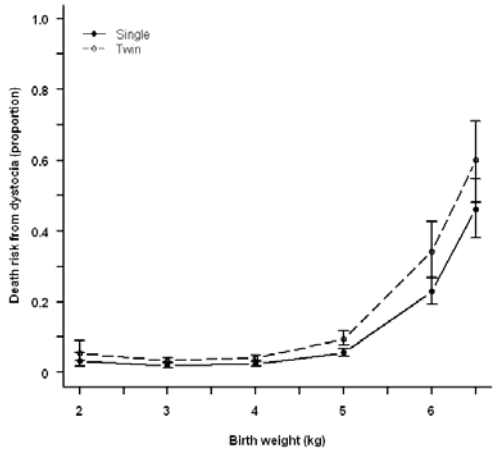
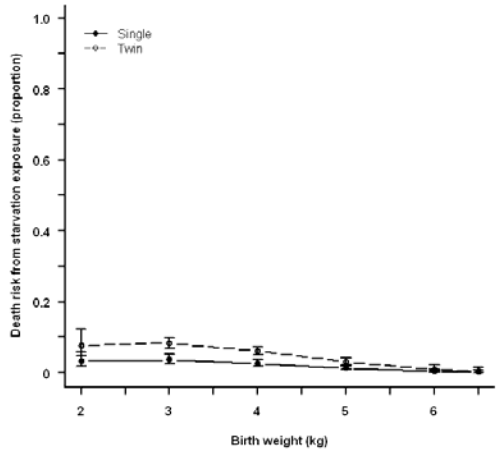


FIGURE 4: Regression of lamb death risk from starvation/exposure (LDSE, proportion) on birth weight (BWT, kg) for single and twin lambs born to yearling ewes.
Single lamb LDSE = 0.039 + 0.001 BWT - 0.001 BWT^2
Twin lamb LDSE = 0.086 + 0.004 BWT - 0.003 BWT^2



Therefore the reduced growth rate in twin lambs is likely to be a result of other factors that we did not measure such as reduced milking ability in yearling dams.

In summary lambs born to yearling dams have high lamb mortality rates and therefore may require more shepherding than lambs born to older ewes. Twin bearing yearlings may also need to be managed separately from single bearing yearlings to increase survival and lamb growth rates. Therefore it may be beneficial to pregnancy scan yearlings to identify and preferentially feed those carrying twins to increase lamb birth weight to within the range of a 4 kg optimum and hence increase survival. However, monitoring birth weight is necessary if lambing yearlings as increasing birth weight may have a detrimental effect on survival as observed in increased dystocia rates. Lamb birth weight can be influenced through genetics, as birth weight is moderately heritable (Safari *et al*., 2005). Twin bearing yearlings should also be set stocked in more favourable sheltered lambing paddocks in an attempt to decrease risk to starvation/exposure (Alexander *et al*., 1980). Increasing twin lamb birth weights will also decrease starvation/exposure death rates as reported by Everett-Hincks and Dodds (2007). It would be advantageous to preferentially feed twin born lambs after birth to increase growth and weaning weights, this would ensure lambs reach their target weights at the same time as single born lambs.

This study reported performance of yearling dams in commercial flocks whereas the majority of recent studies have been on research farms and focussed on investigating live weight and body condition of ewe lambs at joining (Kenyon *et al*, 2009), controlling live weight throughout pregnancy and the effect it has had on lambing performance (Kenyon *et al.*, 2005). Further research is required to investigate the growth of pregnant yearling ewes and the effect on lamb birth weight, survival and lamb growth.

CONCLUSION

Lamb survival to three days of age was 10% lower in lambs born to yearling dams than that of a similar study carried out on mixed age ewes by Everett-Hincks and Dodds (2007). Single born lambs had higher survival rates than twins, along with improved weaning weights and growth rates. A target birth weight in the range of 4 kg was the optimum weight for survival in lambs born to yearling dams in this study.

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REFERENCES

Alexander, G.; Lynch, J.J.; Mottershead, B.E.; Donnelly, J.B. 1980: *Proceedings of the Australian Society of Animal Production* **13**: 329-331.

Dýrmundsson, Ó.R. 1973: Puberty and early reproductive performance in sheep. I. Ewe lambs. *Animal Breeding Abstracts* **41**: 273-289.

Everett-Hincks, J.M.; Dodds, K.G. 2008: Management of maternal-offspring behaviour to improve lamb survival in easy care sheep systems. *Journal of Animal Science* **86**: E259-E270.

Everett-Hincks, J.M.; Duncan S.J. 2008: Lamb post-mortem protocol for use on farm to diagnose primary cause of lamb death from birth to 3 days of age. *The Open Veterinary Science Journal* **2**: 55-62.

Gavigan, R.; Rattray, P.V. 2002: A guide to hogget mating. Meat and Wool Innovation, Wellington, New Zealand. 72 pp.

Hight, G.K. 1982: Improving the efficiency of breeding schemes. *In*:Sheep Production. Volume I. Breeding and Reproduction. Wickham, G.A.; McDonald, M.F. eds. Ray Richards Publishers, Wellington, New Zealand. p. 169-198.

Kenyon, P.R.; Morris S.T.; Mulvaney, F.J.; Burnham, D.L.; West D.M. 2005: Management of lambing hoggets. *Proceedings of the Society of Sheep and Beef Cattle Veterinarians of the New Zealand Veterinary Associaton*. Annual Seminar. p. 65-71.

Kenyon, P.R.; Smith S.L.; Morel P.C.H.; Morris S. T., West D.M. 2009: The effect of the maturity and prior breeding activity of rams and body condition score of ewe hoggets on the reproductive performance of ewe hoggets. *New Zealand Veterinary Journal* **57**: 290-294.

McMillan, W.H. 1983: Hogget lamb mortality. *Proceedings of the New Zealand Society of Animal Production* **43**: 33-36.

McMillan, W.H.; Kitney, I.W. 1983: Hogget reproductive performance studies in commercial flocks. Agricultural Research in the New Zealand Ministry of Agriculture and Fisheries. Annual Report 1982/83. New Zealand Ministry of Agriculture and Fisheries, Agricultural Research Division, Wellington, New Zealand. p. 141-142.

Safari, E.; Fogarty, N.M.; Gilmour A.R. 2005: A review of genetic parameter estimates for wool, meat and reproduction traits in sheep. *Livestock Production Science* **92**: 271-289.

Sargison, N.D. 1997: Lamb mortality – Conception to weaning. *Proceedings of the Society of Sheep and Beef Cattle Veterinarians of the New Zealand Veterinary Associaton*. Annual Seminar. p. 77-89.

Tyrrell, R.N. 1976: Some effects of pregnancy in eight month old Merino ewes. *Australian Journal of Experimental Agriculture and Animal Husbandry* **16**: 458-461.