# BRIEF COMMUNICATION: Effects of birth rank and yearling lambing on long-term ewe reproductive performance

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## INTRODUCTION

It has long being recognised that mating ewes at 7 to 9 months of age could potentially improve their life-time monetary return, as an extra litter is produced (Dýrmundsson, 1973). Baker et al. (1981) showed that joining young sheep to lamb at one year of age was not detrimental to their life time productivity. At that time wool sales were very significant contributors to sheep farm incomes and fears of reduced wool weights and quality were reasons reducing the uptake of the practice. Today, despite potential effect on wool returns being of far less significance, the percentage of yearlings joined is still only 33% (Anon, 2005), mainly because sheep farmers believe that mating young actively growing sheep will have a negative effect on their future reproductive performances (Kenyon *et al*., 2004). Since the early work on yearling lambing, the National lambing percentage have increase to 125.6% (MWNZ, 2009). Recently, Kenyon et al. (2008) reported that two-year-old ewes that lambed as yearlings had less multiple births than those which were not exposed to the ram as lambs (50 % vs. 60%). However, little is known about the effect of mating yearlings in modern sheep genotype on the reproductive performance past two years of age. The data analysis reported here investigates the effect of birth rank (1Y) and age of first lambing, either as a one-year old or two-years old (2Y), on litter-size over the first four parities as well as the total of number of lambs produced at four-years of age.

## MATERIALS AND METHODS

The reproductive data for lambs born between 1999 and 2009 from a mix-breed ewe-flock (n = 50 ewes) located on a property in Horowhenua (New Zealand, 40º46 S latitude; 175º52 E longitude) were investigated in this study. Replacement ewes (10 to 15 per annum) were selected within the flock, but not those born to yearling dams. Each year all selected ewe-lambs were joined to the ram for three cycles. At lambing, litter size for each ewe was recorded and all ewe-lambs were tagged. Data for 249 litters born to 99 ewes were included in the analysis. Litter size at birth and the total number of lambs born through to four years of age were analysed with a mixed linear model with birth rank (BR) (1, 2, 3, 4) and first lambing (1Y or 2Y) as fixed effects and lambing year as a random effect. The litter-size data were analysed both according to parity number and ewe age. The effects of birth rank and lambing year on the percentage of ewes lambing at one year of age were analysed after logit transformation (Proc Mix, Proc Genmod, SAS 2008).

## RESULTS

Overall, 77 % of the ewes lambed at one-year old and this percentage was not significantly influenced by their BR (Table 1). At four years of age, the percentage of ewes remaining in the flock was the same for 1Y and 2Y (53 % vs. 56 %). Each year, ewes were culled according to conformation and past reproductive performance. Between 1999 and 2009, the percentages of lambs born as singles, twins and triplets/quads were 26%, 49%, and 25% respectively, and the corresponding percentage mortalities to docking were 8.2%, 9.3% and 18%. Sixteen percent of the lambs were born to 1-year-old ewes and 84% to older ewes. The mortality to docking was twice as high for lambs born to 1-year-old ewes as to older ewes (19.4% vs 9.7%, respectively).

**TABLE 1:** Logit-transformed values and back-transformed percentages (%) of ewe lambs born as singles, twins, triplets or quadruplets that lambed at one year of age.

| Parameter | Birth rank | | | |
|---|---|---|---|---|
| | Single | Twin | Triplets | Quads |
| Number of ewes | 19 | 47 | 22 | 11 |
| Lambing as one year old | 1.03[1] ± 0.52 (73.7[2]) | 1.58 ± 0.39 (83.0) | 0.56 ± 0.44 (63.6) | 1.50 ± 0.78 (82.0) |

[1]Logit-transformed ± standard error
[2]Back-transformed (%)

**TABLE 2:** Least-square means (± standard error) for litter sizes in the first three parities and at two, three or four years of age for single-, twin-, triplet- or quadruplet-born ewes having their first lambs as a one-year-old (1Y) or as a two-year-old (2Y) as well as the total number of lamb produced by four year of age (NL4).

| Effect | Age at first parity | | Birth rank | | | | P values | |
|---|---|---|---|---|---|---|---|---|
| | 1Y | 2Y | Single | Twin | Triplets | Quads | Age first parity | Birth rank |
| Parity | | | | | | | | |
| P1 | 1.41 (0.09) | 1.75 (0.15) | 1.24[a] (0.17) | 1.56[a] (0.12) | 1.41[a] (0.15) | 2.11[b] (0.22) | 0.054 | 0.015 |
| P2 | 1.66 0.13) | 1.69 (0.23) | 1.17[a] (0.22) | 1.62[b] (0.18) | 1.82[b] (0.20) | 2.09[b] (0.29) | 0.870 | 0.030 |
| P3 | 1.94 (0.23) | 2.12 (0.35) | 2.07 (0.33) | 2.07 (0.29) | 1.81 (0.31) | 2.16 (0.37) | 0.550 | 0.760 |
| Age | | | | | | | | |
| 2 years | 1.62 (0.12) | 1.70 (0.19) | 1.12[a] (0.21) | 1.66[b] (0.15) | 1.74[b] (0.20) | 2.12[b] (0.27) | 0.710 | 0.021 |
| 3 years | 1.90 (0.17) | 1.71 (0.28) | 1.71 (0.29) | 1.86 (0.23) | 1.87 (0.27) | 1.77 (0.36) | 0.530 | 0.960 |
| 4 years | 2.14 (0.21) | 2.11 (0.30) | 2.05 (0.31) | 2.24 (0.28) | 2.00 (0.27) | 2.21 (0.39) | 0.920 | 0.850 |
| NL4 | 5.84 (0.56) | 4.20 (0.83) | 4.23 (0.84) | 4.71 (0.73) | 5.05 (0.83) | 6.09 (1.09) | 0.051 | 0.510 |

Means across a row that are labelled with different subscripts are significantly different (P <0.05) from each other.

The litter sizes according to parity number or ewe age for ewes having their first lambs as a one year old (1Y) or as a two-year-old (2Y) are presented in Table 2. Within parity, litter size tended to be smaller for the 1Y compared to 2Y. In the first two parities ewes born as quadruplets produced significantly more lambs than ewes born as s single.

Within age, no difference (P >0.05) in litter size were observed between the 1Y and 2Y groups. At two years of age, single-born ewes born produced less lambs than those born as a twin, triplet or quadruplet (P <0.05). No difference in litter size between birth rank were observed in older ewes.

The total number of lambs born over a four-year period per ewe exposed to the ram was greater for 1Y than 2Y (5.84 vs 4.20; P = 0.05), and this number tended to increase with ewe's birth rank.

## DISCUSSION

At two, three and four years of age, there was no difference in litter size between ewes which did or did not lamb as a yearling. Kenyon *et al*. (2008) found that at two years of age there was no difference in the percentage multiple lambs born between ewes which were exposed to the ram at seven months of age and did or did not have a litter at one year of age (50.1% vs 50.0%, respectively), Similarly, Moore *et al*. (1983) found no significant difference in the percentage of multiple lambs born between two-year-old ewes which had (27%) or had not (17.5) lambed as yearlings after being tupped by fertile rams. Baker *et al*. (1981) found no negative effect of lambing as a yearling on ewe prolificacy between two and four years of age.

On a same parity basis, no difference in litter size was observed between 1Y and 2Y for Parity 2 and Parity 3. However two-year-old, Parity 1 ewes, which did not lamb as yearlings had a larger litter size than those which had had their first lambs as yearlings (1.75 vs 1.41). This difference in litter size can be explained by the fact that fecundity increase as sheep get older up to three to four years of age. Generally, ovulation rate is low soon after puberty and progressively increases in the following years.

Over their first four years, ewes that lambed as a yearling have given birth to 1.64 more lambs than those which did not lamb as a yearling (5.84 vs 4.20, respectively). After adjusting for lamb mortality, which was 20% in our study for the yearling dams, an extra 1.2 lambs at four years of age could be expected with yearling lambing.

In this study, birth rank of ewes was related to the number of lambs only for the first two parities with single-born ewes producing fewer lambs than multiple-born ewes. Litter size in sheep generally has a low to moderate heritability, so it might be expected that multiple-born ewes will have genotypes promoting larger litters. Combining the heritability values for litter size reported in different breeds in Sweden (Pelt, Svea, Landrace: Gates & Urioste, 1995), Netherlands (Swifter, Zwarbles,

Merino; de Vries *et al.,* 1998) and Switzerland (White Alpine, Brown Head, Black Brown, Valiser Black Nose; Hagger, 2002 ) show that as parity number increased, the heritability values decrease; Parity 1: Mean = 0.17 (Range = 0.02 to 0.40); Parity 2: 0.16 (0.02 to 0.33); Parity 3: 0.13 (0.01 to 0.26). This suggests that environmental effects are becoming more important with age. This could explain the lack of BR effect on litter size for Parity 3 and also after two years of age.

The results from this small data set suggest that the long-term reproduction performances of ewes that lamb as hogget were not compromised. However, it should be noted that higher level of management is required, when ewes have their first lamb as a one-year old compared to being two-years old.

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