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A comparison of the reproductive performance of ewe lambs and mature ewes

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ABSTRACT

This work compared the reproductive performance of ewe lambs and mature ewes and the growth of their lambs from birth to weaning under conditions in which they had been managed as a single group. Two studies were conducted; the first study, conducted in 2007, included 307 multiparous mature ewes and 297 primiparous ewe lambs and the second study, conducted in 2009, included 399 multiparous mature ewes and 400 primiparous ewe lambs. Physical measures of ewes and lambs were recorded as was their behaviour within 12 h of birth in study one. Ewe lambs were lighter ($P < 0.05$) than mature ewes throughout pregnancy and lactation. However, the total live weight gained during pregnancy was similar ($P > 0.05$). Lambs born to ewe lambs were smaller ($P < 0.05$) and lighter ($P < 0.05$) than their birth rank contemporaries born to mature ewes. However, single lambs born to ewe lambs and twin lambs born to mature ewes had similar birth weights and growth to weaning. Lamb survival rates were lowest ($P < 0.05$) for lambs born to ewe lambs although in study two, singleton lambs born to ewe lambs had similar survival rates to both singleton and twin lambs born to mature ewes. This study identified that the limitations to ewe lamb breeding were that they produced smaller, lighter lambs with lower survival rates to weaning and maternal behaviour indicating a lack of experience compared to mature ewes. Therefore future research should be directed at alleviating these constraints.

1. Introduction

The breeding of ewe lambs (7–9 months of age) is a potential means of increasing the number of lambs born on farm each year, lifetime productivity and farm profitability (Kenyon et al., 2004b, 2011; Morel et al., 2010; Young et al., 2011). However despite this, in New Zealand in 2011, only 30% of ewe lambs were presented for breeding which accounted for only 10% of all ewes presented for breeding and ewe lambs produced only 3.5% of total lambs weaned (Statistics New Zealand, 2012). Thus while there is the potential for gains to be made through ewe lamb breeding, many farmers are not choosing to utilise this management option. Farmers have stated poor and varied reproductive performance as a limiting factor for breeding ewe lambs (Kenyon et al., 2004b). In comparison to mature ewes, ewe lambs have been reported to display lower rates of ovulation, conception and lower embryonic survival, and give birth to fewer lambs which have lower birth weights and survival to weaning (Dyrmundsson, 1981; Davies and Beck, 1993; Beck et al., 1996; Annett and Carson, 2006). A lower number of lambs weaned per ewe lamb results from some components of overall reproductive output being

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compromised (Donald et al., 1968; Annett and Carson, 2006; Munoz et al., 2009). However, most of these studies are somewhat limited because either (i) mature ewes and ewe lambs were not bred with the same rams at the same time, or (ii) the two classes of ewes where not managed together during pregnancy and lactation.

Therefore the aim of this research was to compare the performance of naturally mated ewe lambs and mature ewes and their offspring from birth to weaning in two studies under the conditions in which both ewe classes were bred together and managed as a single cohort until weaning. This design allows for more accurate determination of where the major discrepancies in reproductive performance occur from breeding to weaning and direct further research.

2. Materials and methods

Two studies were conducted to compare the reproductive performance of Romney ewe lambs (8-months of age) and Romney multiparous mixed-age ewes (7–9 months of age) when breed and managed as a single flock. Study one was conducted in 2007 with 297 ewe lambs and 307 mixed age ewes and study two in 2009 with 400 ewe lambs and 399 mixed age ewes. Study one was conducted at Massey University's Tuapaka Farm (latitude: −40.331759, longitude: 175.734043) and Riverside Farm (latitude: −40.842905, longitude: 175.627785) in the lower North Island of New Zealand where the winter solstice is on the 21st June.

The breeding period began with the introduction of the ram in early May (study one on the 3rd May 2007 and study two on the 1st May 2009). In study one, for twelve days prior to the introduction of the ram all ewes were treated with a progesterone treated controlled internal drug release device (CIDR type G, Livestock Improvement Corporation, Hamilton, New Zealand) inserted vaginally. The CIDRs were removed and fifty 8-month old Romney rams (ram to ewe ratio of approximately 1:12) fitted with mating harnesses were introduced to the flock for 26 days. In study two, eight vasectomised teaser rams were introduced to the flock for 17 days prior to breeding (P-17) at a ratio of 1:100 ewes. At the end of this period the vasectomised rams were removed and entire Romney rams were introduced at a ram to ewe ratio of 1:40 for 34 days.

Pregnancy was diagnosed and the number of foetuses present was determined using trans-abdominal ultrasound scanning (P79 in study one and P81 in study two). Following ultrasound scanning, on P99 for study one and P81 for study two, non-pregnant ewes (study one $n = 178$ ewe lambs and $n = 40$ mixed-age ewes and study two $n = 108$ ewe lambs and $n = 12$ mixed-age ewes) were removed from the remainder of the study. Additional ewes removed at this stage were 16 and 28 ewe lambs and ewes, respectively in study one and 48 ewes in study two due to low numbers of ewe lambs bearing twin foetuses (study one) or ewes with triplet (study one and two) or quadruplet foetuses (study one).

Prior to lambing (study one at P143 and study two at P126) ewes were randomly allocated to lambing paddocks with minimum herbage masses of 1200 kg DM/ha at a ratio of 15 ewes/ha. Each paddock contained both ewe lambs and mature ewes. During study one, ewes that were bred in the first six days post CIDR removal were placed in different lambing paddocks from those bred later in the breeding period to assist in management during lambing. Ewes remained on their lambing paddocks until 34 and 92 days after the mid-point of the lambing (L34 and L92) period for study one and two, respectively. After this time all ewes in study one were managed as a single mob until weaning (L75) whereas in study two, ewes remained in their lambing paddocks until weaning (L92).

2.1. Measurements taken

All ewes were weighed un-fasted at various intervals throughout pregnancy and lactation (study one at P1, P23, P50, P79, P99, P140 and L38, L59 and L75 and study two at P1, P35, P81, P126, and L32 and L92). In addition, ewe body condition scores (BCS) were recorded on a scale from 1 to 5 (1 = emaciated and 5 = grossly fat; Jefferies, 1961) during study one (at P1, P140, and L75) and study two (at P1, P35, P81 and L92).

During the lambing period (study one between 22nd September and 20 October and study two between 21st September and 27 October) ewes were inspected twice daily. New lambs, if more than 3 h of age, were ear tagged and identified to their dam. At tagging, the sex of the lamb, birth weight and body dimensions of the lamb were recorded. Body dimensions recorded in study one included crown to rump length (CRL, distance from the crown of the head to the base of the tail), thoracic girth (circumference of the chest immediately posterior to the fore limb), fore limb length (FL, distance from the shoulder joint to the tip of the hoof of the left leg) and hind limb length (HL, distance from the hip joint to the tip of the hoof of the left leg). During study two only lamb CRL and thoracic girth were recorded. During the lactation period, additional lamb live weights were recorded for study one at L38, L59 and L75 and study two at L32 and L92.

Ewe maternal behaviour during study one was observed for ewes and lambs whilst her lamb(s) was being handled during ear-tagging. The behaviour of only those twin bearing ewes where both lambs were alive at the time of tagging was recorded. Maternal behaviour scores (MBS) were ranked on a scale from 1 (the ewe fled when the shepherd approached lamb and did not return) to 5 (ewe remained close to the lamb and made contact with either the lamb or shepherd; O'Connor et al., 1985). The behaviour of the ewe and lamb was recorded for 5 min after the completion of the tagging of the lamb. The number of ewe bleats, both the high-pitched or "protest" bleat and the low-pitched or "care-giver" bleat (Dwyer et al., 1998) and the number of lamb bleats were recorded. The latency for lambs to stand, bleat, reunite with dam, follow dam (if she moved more than 5 m from the tagging site) and successfully suckle was recorded. The manner in which the ewe and lamb were reunited, either the ewe moved to the lamb or the lamb moved to the ewe, was also recorded. Behavioural observations were not made during study two.

2.2. Statistical analyses

Complete ewe and lamb data was collected in study one from 66 singleton bearing ewe lambs and 78 and 96 mature ewes that gave birth to singletons or twins, respectively. In study two, data was only collected at birth from ewes in which the number of lambs identified at tagging matched the number of foetuses identified at pregnancy scanning. Therefore, data from 88 single (ewe lamb single) and 38 twin-bearing ewe lambs (ewe lamb twin) and their lambs and 22 single- (mature ewe single) and 150 twin-bearing mature ewes (mature ewe twin) and their lambs were included in the analyses, respectively. In study one, the analyses contained the fixed effect of ewe type (ewe lamb single, ewe single or ewe twin) due to the exclusion of the small number of twin-bearing ewe lambs. However, in study two, there were sufficient twin-bearing ewe lambs to include ewe type (ewe lamb and ewe) and birth rank (single and twin) and their interaction (ewe lamb single, ewe lamb twin, ewe single and ewe twin).

Dam live weight during pregnancy was analysed with a repeated measures ANOVA using the Mixed procedure (SAS, 2011). The model also contained the repeated effect of day and included ewe nested within treatment. Dam live weight during lactation was also analysed with a repeated measures ANOVA and the model included the additional fixed effects rearing rank. Therefore in study one the fixed effects included: ewe lambs that gave birth to, and reared to docking, a singleton lamb (ewe lamb single–single), mature ewes that either gave birth to, and reared, a single lamb (ewe single–single), or gave birth to twin lambs and reared a single (ewe twin–single) or gave birth to, and reared, twin lambs (ewe twin–twin). In study two, there were the additional classes of ewe lambs that gave birth to twins and reared a single (ewe lamb twin–single) and ewe lambs that gave birth to, and reared, twins (ewe lamb twin–twin). Ewes which did not give birth to live lambs were removed from the lactation analysis.

Ewe body condition scores were analysed using the Genmod procedure in SAS. A Poisson regression analysis using a log-linear model was used. The models used for pregnancy and lactation had the same fixed effects as described for the live weight models. Least squares means and their standard errors were reported as transformed values with the back-transformed mean presented in parentheses.

Lamb live weights and body dimensions were analysed using the Mixed procedure in SAS. The models of study one the model contained the fixed effects of ewe type (ewe lamb single, ewe single and ewe twin) and sex of the lamb (ewe or ram). Study two contained both ewe type (ewe lamb and ewe) and birth rank (single and twin) and sex of the lamb. All models of lamb live weight, except birth weight, included date of birth as a covariate. Lamb survival to weaning was analysed using the Genmod procedure in SAS. A binomial regression analysis was conducted using a log-linear model with the fixed effects of ewe type. Mean survival