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On-farm ewe lamb mating outcomes from feeding practices before mating and during pregnancy

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ABSTRACT

Farmers in southern New Zealand identified areas where knowledge was needed to improve the outcomes from mating ewe lambs at seven months of age. Anecdotal evidence suggested that ewe lambs growing rapidly at mating were less likely to become pregnant. Farmers recorded ewe lamb live weight in March and late May, and pregnancy diagnosis data. Data analysis showed no relationship between liveweight gain and number of ewe lambs pregnant. Farmers retained their original views that liveweight gain before and during mating should be below 100 g/d. Feeding levels in late pregnancy were considered to influence ease of lambing and lamb survival. The amount of feed offered to ewe lambs in late pregnancy on eight farms was compared to tailing percentage and lamb mortality. Feed offered to single bearing ewe lambs in late pregnancy ranged from 0.75 to 1.6 kg dry matter/d. Late pregnancy feed allowance and lamb mortality were unrelated. Analysis of winter liveweight gain data from both on-farm studies and survey results over two years showed that winter liveweight gains of 10 to 14 kg, including conceptus weight, minimised lamb losses ($P < 0.05$). Farmers changed management practices to improve winter liveweight gain, and improve the accuracy of late pregnancy feed allocation.

Keywords: case study; farmer; lamb mating; lamb mortality; nutrition.

INTRODUCTION

Mating ewe lambs has been a topic of potential for improved production on New Zealand sheep farms for a long time (McMillan, 1983; Keane, 1976; Kenyon *et al.*, 2004). Recently ewe lamb mating has become more popular as farmers investigate the opportunity that it may present through increasing the productivity of sheep that are over-wintered (Gavigan & Rattray, 2002). Mating ewe lambs at seven to nine months of age instead of 19 months of age, provides the opportunity to increase the number of lambs born without increasing the over-wintering stock numbers on most New Zealand farms.

While increasing total lamb numbers, there are several features of ewe lamb mating that alter the farm system. These include an altered feed requirement of pregnant ewe lambs, an extended lambing period as ewe lambs give birth a month later than the conventional ewe flock, and the problem of having to finish lambs that are born late (Hight, 1982; Gavigan & Rattray, 2002). Other perceived concerns include the lifetime performance of ewes that lambed as a yearling, ensuring lambing yearlings meet appropriate live weights at the following mating and the longevity of ewes that lambed as a yearling (Keane, 1976; Gavigan & Rattray, 2002).

A total of between 0.7 and 1.6 million lambs from yearling ewes have contributed to the national lamb supply per annum over the past 10 years. These are estimated to come from 1.5 to 3.1 million ewe lambs put to the ram each year (Bascand, 2010) giving an average lambing percentage of 49%. This is between 15 and 34% of the 8 to 9 million hoggets overwintered. Some farmers have developed successful ewe lamb mating and lambing practices, but these are not well documented or researched. The single greatest factor preventing farmers from mating ewe lambs was having not done it before (Kenyon *et al.*, 2004), reinforcing the issues with lack of experience in the wider farming community.

A group of farmers in southern New Zealand raised concerns about the inconsistency of ewe lamb mating. This included variable numbers being scanned in-lamb and high variability in the amount of shepherding required and lamb losses. These inconsistent results of ewe lamb mating have resulted in a relatively low uptake of this technology. These farmers identified two distinct areas for investigation to help increase the success of ewe lamb mating. The first was to define the level of nutrition of yearlings to prevent lambing difficulties, especially dystocia in single bearing yearlings. Farmers thought that "tight feeding" may reduce the problems but could not accurately quantify this. The second area was maximising conception rate. Anecdotal evidence suggested that lambs growing rapidly just prior to and during mating were less likely to become pregnant.

This study attempted to quantify the impacts of winter feeding on lamb mortality to better understand the importance of feeding during the last 45 days of pregnancy. The effect of rapid ewe lamb growth rate on the variation in conception rate was also investigated.

MATERIALS AND METHODS

A Discussion Group of fifteen farmers interested in learning more about yearling lambing was formed in 1999. These farmers were from South and West Otago, and Eastern and Central Southland. Information was collected from some of the farms through farmer surveys and farm monitoring of records for 1998, 1999 and 2000. This resulted in some restrictions in the data that could be collected. The information was also collected over a range of sheep breeds and crosses between breeds. Data that directly related to the questions of the impacts of pre-tupping live weight and live weight gain, and late pregnancy feeding were collected.

Standard practices were recommended for the mating and winter periods to ensure that results were comparable. These included the use of teasers 21 days before mating, and the use of rising two-year-old or older rams at a ratio of 50 to 1 for 21 days to ensure that lambing was over a short controlled period, for farmer convenience. The mating period in most cases was 15 to 21 days.

Monitoring included ewe lamb live weights at the end of March, at mating, post mating, pregnancy diagnosis, and pre-lamb three to five weeks before lambing. Pregnancy ultrasound diagnosis, cause of lamb death based on a farmer diagnosis, number of dead lambs, tailing percentages, and predicted intakes from pre and post grazing feed measurements during late pregnancy were all recorded.

Seven farms monitored 11 mobs to provide information with which to assess the effects of feed intake in late pregnancy on lamb mortality and their cause in spring 1999. Data was collected on pasture and brassica crop yield, area offered, mob size and herbage quality. In four cases farmers provided information on the cause of death in single and twin born lambs.

Ewe lamb liveweight gain in winter from mating to pre-lamb, was calculated from the data provided by the farmers in both 1998 and 1999. This information was compared to lamb loss estimates in both years to determine if any relationship was evident. The effect of liveweight gain before mating on conception was tested in the 2000 mating season, when records from nine farms were collected.

Data were analysed using the general linear model (GenStat, 2005). The effects of pregnancy nutrition on lamb mortality was analysed in two ways; firstly by adding the estimated late pregnancy feed intake and secondly the winter liveweight gain as the variable effects with flock and pregnancy status as fixed effects. The effect of nutrition on conception success was analysed using live weight gain over the mating period as the variable effect and flock as the fixed effect. Regression analysis was used to provide descriptive statistics for the effect of mating liveweight on conception success in two mobs only.

FIGURE 1: A comparison of feed allowance in the four weeks before lambing and the lamb losses from pregnancy diagnosis to tailing.

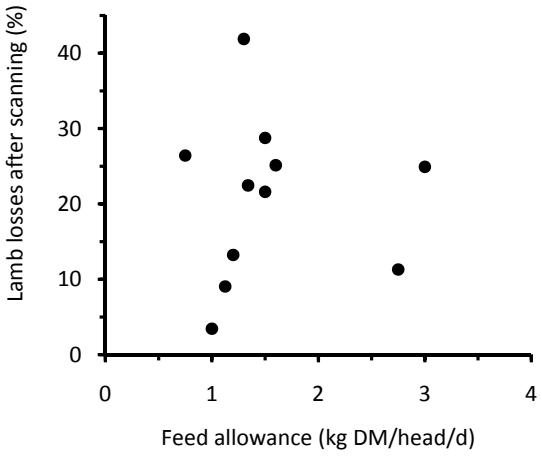
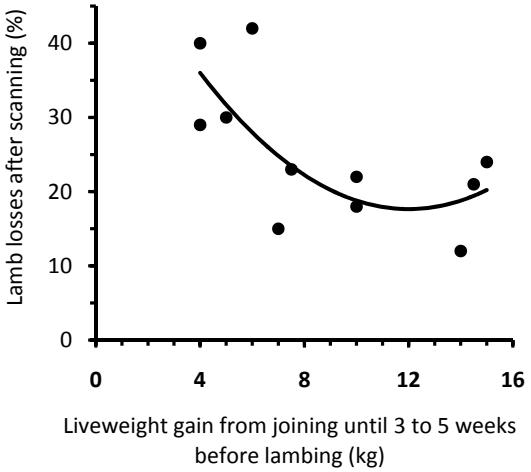


FIGURE 2: Lamb losses decline as ewe lamb liveweight gain from joining until 3 to 5 weeks before lambing increases.



RESULTS

Late pregnancy feed allowance was not related to lamb mortality between pregnancy scanning and tailing ($P > 0.05$; Figure 1). Pasture quality measurements using near infrared spectroscopy techniques indicated an average energy concentration of 12.2 MJ metabolisable energy (ME)/kg dry matter (DM) and a protein concentration of 270 g/kg DM.

The overall lamb mortality (Table 1) varied from 3 to 42%, excluding abortion diseases. Higher death rates were recorded in twins than singles, The farmer diagnosis of death in singles saw an average 53% of lamb deaths due to dystocia and 10% to

TABLE 1: Late pregnancy feed allocation and lamb losses of yearling ewes lambing in southern New Zealand in 1999 listed in order of decreasing allowance within each lambing status classification. DM = Dry matter; NA = Not available.

Farm	Lambing status	Allowance (kg DM/d)	Losses			
			Total (%)	% of total losses		
				Dystocia	Starvation	Other
3	Singles	1.6	25	73	24	3
1	Singles	1.1	9	56	19	25
2	Singles	1.0	3	33	0	67
4	Singles	0.8	26	43	5	52
1	Twins	3.0	25	5	54	41
4	Twins	2.8	11	10	10	80
3	Twins	1.3	22	20	61	19
2	Twins	1.2	13	5	40	55
5	All	1.3	42	NA	NA	NA
6	All	1.1	25	NA	NA	NA
7	All 1998	1.5	29	NA	NA	NA
7	All 1999	1.5	22	NA	NA	NA

starvation/exposure. In twin born lambs dystocia was 12% and starvation/exposure 41% by farmer diagnosis.

Figure 2 shows the relationship between ewe lamb liveweight gain in winter, including conceptus weight, and lamb mortality. As liveweight gain increased lamb mortality declined. An optimum live weight gain of yearlings from tupping until four weeks before lambing was 10 to 14 kg in this study ($P < 0.05$; $R^2 = 0.52$).

Data from two farms in 1999 suggests that pre-mating weight of the ewe lamb influenced conception success (Figure 3). This effect was estimated to increase conception by approximately 1% for every extra kg of live weight at mating.

There was no significant relationship between pre-mating liveweight gain and conception rate (Figure 4) in the data collected from nine farms in the 2000 mating season.

DISCUSSION

Placental size in yearlings has been shown to be manipulated by altering yearling growth during early and mid pregnancy (Wallace *et al.*, 2000) using a concentrate diet. Altering lamb birth weight by late pregnancy nutrition may therefore be relatively difficult to achieve. Lower lamb birth weights have more often been associated with a high plane of nutrition throughout pregnancy than with a low plane of nutrition during late pregnancy (Wallace, 2000). A comparison of yearlings gaining weight at 100 g/d or 200 g/d throughout pregnancy found that both lamb birth weight and yearling live weight were increased at lambing with the higher weight gain during pregnancy with no impact on lamb mortality (Kenyon *et al.*, 2008) although each nutrition group was only represented by approximately 55 lambing yearlings per group.

Analysis of the actual late pregnancy feed intake of the yearlings showed that farmers all had different perceptions of "tight" feeding. The amount eaten by yearlings bearing a single lamb varied from 0.75 to 1.6 kg DM/d. While this range may not be extreme it does suggest that late pregnancy feeding levels that are currently achieved on-farm do not influence lamb mortality outcomes. Kenyon *et al.* (2008) recommended that high levels of feeding to achieve 200 g/d throughout pregnancy may provide some advantages including higher lamb growth rates during lactation. Feeding to a pre-determined feed budget may be the most effective way to ensure a consistent result during late pregnancy.

The relationship between yearling liveweight gain during pregnancy and lamb mortality indicates that yearlings should be well fed during pregnancy. Research in New Zealand (Morris *et al.*, 2005; Kenyon *et al.*, 2008) has shown that liveweight gains during pregnancy of between 15 and 22 kg had no impact on lamb mortality. Research by Wallace *et al.* (1996) showed that weight gains of approximately 75 g/d during this period produced lower lamb mortality than higher live weight gains of 234 g/d. This was supported by Mulvaney *et al.* (2008). However, investigation of the effects of the relatively low liveweight gains that are found in yearlings on some New Zealand farms has not been done.

Farmer visual diagnosis of lamb losses indicated that although dystocia was of concern and may create a high labour requirement, it was not the major cause of lamb losses. These figures were similar to those reported by McMillan (1983). He found that while the average birth weight of lambs born to yearlings was in the then recommended desired range of 3.3 to 4.1 kg many lambs fell outside this range resulting in lamb losses of 32% on two commercial farms. Farmer diagnosis by visual inspection may be unreliable, especially in twin born lambs, as another study (D.R. Stevens, Unpublished data) found a significant number of light twin lambs diagnosed as starvation/exposure by visual inspection had symptoms of dystocia at

FIGURE 3: Conception success of ewe lambs mated for one cycle as live weight at joining changes within two flocks.

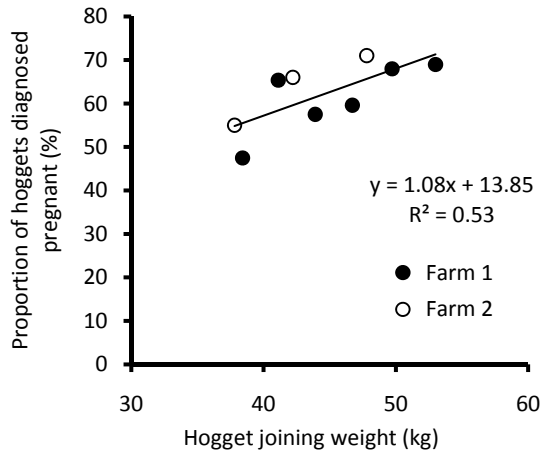
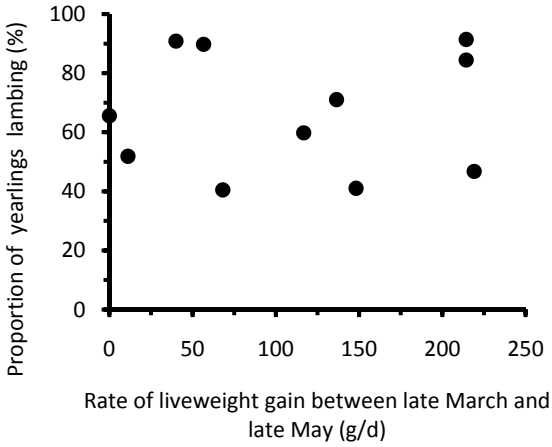


FIGURE 4: A comparison of the rate of liveweight gain of ewe lambs between late March and late May, and the proportion of yearling ewes lambing, as predicted by ultrasound pregnancy diagnosis.



autopsy, presumably from a difficult twin birth. Farmer feedback indicated that both lambing difficulties and time spent assisting births decreased as weight gain in winter increased.

There is, however, a significant cost to increasing the live weight of the yearling during pregnancy. A non-pregnant yearling growing at 40 g/d requires approximately 11 MJ ME/d, while a pregnant yearling growing at 140 g/d will require 16 to 17 MJ ME/d. This extra feed is required during the winter when feed is at a premium which is why hogget liveweight gain in winter is often minimal. The extra 5 to 6 MJ ME/d is approximately half of the requirement of an adult ewe at maintenance, so the lambing percentage of the yearling must be evaluated against the potential lambing percentage that may be gained from increasing the number of ewes to eat the same amount of feed.

Increasing live weight at mating provided an increase in conception success. This is also reflected in a nationwide survey (Kenyon *et al.*, 2004) that found a strong correlation between weight at mating and lambing percentage. That data indicated an increase in lambing percentage of approximately 2% per kg increase in mating live weight. It is important to note that these results are from mating over a single cycle, as is common practice in many southern flocks. As such, a pregnancy rate of up to 70% reflects well on the management practices in place.

The hypothesis that high liveweight gain during mating has a detrimental effect on conception success remains untested from this on-farm study, but is still a major point of concern with farmers. The conditions for testing this hypothesis need to be much more closely controlled, and possibly need to include different breeds to ensure a robust result. Several studies have tested the impact of high liveweight gains of >200 g/d on conception success in pasture fed lambs with mixed results. A reduction in conception success with increasing nutrition (McMillan & McDonald, 1983; Wallace *et al.*, 1996; Mulvaney *et al.*, 2008) and no effect of nutrition (Wallace *et al.*, 1999; Morris *et al.*, 2005; Kenyon *et al.*, 2008) have been reported. Results from Kenyon *et al.* (2008), who tested post-mating feeding to achieve 100 g/d compared with *ad libitum* feeding, found that more yearlings on *ad libitum* feeding returned to service. While they concluded that the overall conception success was unaffected, this presumed that the rams were out for two cycles. Given current farmer practices where the ram is left out for approximately one cycle, then high liveweight gain will have a significant impact on conception success on-farm, as per farmer experience. Using data from Kenyon *et al.* (2008), the conception success rates would be 78% and 55% pregnant on the moderate and *ad libitum* feeding respectively if the ram was left out for a single cycle.

This data collected from farming situations has provided some insights to the responses of pregnant yearlings to the feeding conditions that prevail on farm. Subsequent research has provided an insight into the observations made by farmers. High liveweight gains are required in pregnant yearlings to ensure that lambing difficulties and lamb losses are minimized. These liveweight gains come at a significant cost as extra feed is required during winter when feed is at a premium. Farmers need to examine these costs when entering into yearling lambing.

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