LIVEWEIGHT FERTILITY RELATIONSHIPS IN MERINO AND HALF-BRED EWES IN A HIGH COUNTRY ENVIRONMENT

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INTRODUCTION

The positive relationship between liveweight, fertility and fecundity in sheep is well known. In analysis of the breeding performance of some 11 000 ewes Coop (1962) showed barrenness to be relatively independent of liveweight above 40 to 45 kg but below this weight to increase rapidly. Twinning was shown to increase linearly with increasing liveweight at a rate of about 6% per 4.5 kg. These relationships have been confirmed many times in ewes of differing age and breed (*e.g.*, Drew *et al.*, 1973; Hight and Jury, 1973). Reports concerning Romney, Border Leicester × Romney and Corriedale ewes indicate that the lower reproductive performance of two-tooth ewes in comparison with older ewes can be explained primarily on the basis of their lower liveweight at mating.

Critical information concerning liveweight and fertility in Merino and half-bred ewes in the high country is scarce. In flocks of 2- and 4-tooth ewes whose mean liveweight at first mating varied from 34 to 40 kg, Coop and Clark (1966) reported a 3 to 4% decrease in barrenness for every 4.5 kg increase in pre-mating liveweight. Most Australian work with Merinos shows that barrenness is at a maximum and twinning at a minimum in ewes lambing at two years of age.

METHODS

Two trials, 1971 and 1972, were carried out at Tara Hills (Trials 1 and 2). Equal numbers of 2-tooth and mixed-age (4-tooth and older) ewes were run together with groups of three rams at ram/ewe ratios of 3/100 and 3/300 to provide information on several aspects of reproduction. Observations on Merino productivity at Tara Hills (Trial 3) provide information on liveweight, twinning and barrenness for ewes lambing between 1967 and 1971 in a trial outlined by Lewis *et al.* (1971). Fertility data from 2-tooth Merino half-bred and three-quarter bred ewes from Mt Dasher and Ribbonwood stations

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used in hogget rearing investigations in the high country (Thompson, 1972) give pregnancy rates in relation to liveweight prior to mating.

RESULTS

(1) Mating Behaviour—Trials 1 and 2

In Trials 1 and 2 differences in season and feed supply resulted in mean pre-mating liveweights of 2-tooths of 35.0 kg and 41.5 kg, respectively. The percentages of ewes mated in the first 17 days are shown in Table 1. Differences in the per-

TABLE 1: TRIALS 1 AND 2—% OF EWES MATED DURING FIRST 17 DAYS OF MATING PERIOD

Trial	*Age of Ewes*	*Mean Liveweight (kg)*	*% Mated at Ram/Ewe Ratio* 3/100	3/300
1	2-tooths	35.0	94.0	49.7
	Mixed-age[1]	45.0	99.0	80.3
2	2-tooths	41.5	93.0	83.7
	Mixed-age[1]	45.0	100.0	97.7

[1] Ewes older than 2-tooths.

centage mated between the two ram/ewe ratios were much more evident in Trial 1 when the 2-tooth ewes were small and poorly developed. In this trial, pre-mating liveweight was important in the young ewes mated with three rams/300 ewes. Only 37.3% of 2-tooths below 34 kg were mated in the first 17 days in comparison with 58.6% of animals above this weight (47/126 v 102/174; $\chi^2 = 12.4$; $P < 0.001$). This was the only group in which there was any relationship between pre-mating liveweight and the proportions mated in the first 17-day cycle. In those ewes which were mated there was no relationship between premating weight and whether a ewe was mated by one, two or three rams. A similar situation existed in all mating groups in both years.

At a ram/ewe ratio of 3/100 the incidence of both 2-tooth and mixed-age ewes mating in the first 17-day cycle was very high in both years. This established that almost all ewes had in fact been coming into heat and that differences observed between groups were due to insufficient rams or to rams concentrating on the older ewes. This resulted in a lower proportion of 2-tooths being mated in the 3/300 groups. At the end of a 51-day mating period in Trial 1, 14.7% of 2-tooth ewes (44/300) in these groups had never been mated, these animals

contributing approximately 60% of all barren 2-tooths. In Trial 2 only 3.3% (10/300) 2-tooth ewes were not mated during the mating period.

(2) Pregnancy Rates—Ribbonwood and Mt Dasher Stations

Pregnancy rates in 2-tooth ewes mated with 2% of rams on two high country runs are given in Table 2. Prior to mating in these flocks, approximately 30% of animals had been culled on the basis of low liveweight. Ewes were mated on an improved tussock block of 20 ha at Ribbonwood Station but at Mt Dasher mating was on two rough, unimproved hill blocks of 105 and 130 ha. Pregnancy was determined using an ultrasonic pregnancy detector between 100 and 120 days of gestation when diagnostic accuracy is close to 100% (Allison, 1971).

Two-tooths at Ribbonwood were heavier and had slightly higher pregnancy rates than at Mt Dasher. Within flocks there was a slight decrease in barrenness as pre-mating liveweight increased but the effect was not as pronounced as previously reported (Coop and Clark, 1966).

TABLE 2: INFLUENCE OF PRE-MATING LIVEWEIGHT (kg) ON % OF 2-TOOTH EWES PREGNANT 120 DAYS AFTER THE START OF MATING (Numbers of records in parentheses)

	Pre-mating Liveweight (kg)		
Mt Dasher	< 37.5	37.5-42.5	> 42.5
1971	89.5 (143)	93.8 (276)	92.0 (87)
1972	82.3 (164)	85.0 (267)	83.8 (74)
Ribbonwood	< 50.0	50.0-55.0	> 55.0
1972	93.3 (375)	95.0 (417)	97.8 (184)

(3) Twinning and Barrenness

Figure 1 presents twinning and barrenness information for Trials 1, 2 and 3. In these trials twinning was low in 2-tooth ewes, between 2% and 6%, and was not related to pre-mating liveweight. Increasing levels of twinning with increasing liveweight were evident in ewes 4-tooth and older, in agreement with other reports (Coop, 1962; Hight and Jury, 1973).

Barrenness was higher in 2-tooth ewes than in older animals in all trials but there was no consistent relationship with pre-mating liveweight. In Trial 1 there was a decline in barrenness of 2-tooth ewes as pre-mating liveweight increased,

whereas in Trial 3 there was a slight rise. A constant level of barrenness was recorded within the three liveweight groupings in Trial 2. In ewes older than 2-tooths, pre-mating liveweight did not appear to be an important factor in determining levels of barrenness.

When 2-tooth ewes were small and poorly developed as in Trial 1, barrenness was 19.0%, whereas in Trial 2, when 2-tooth

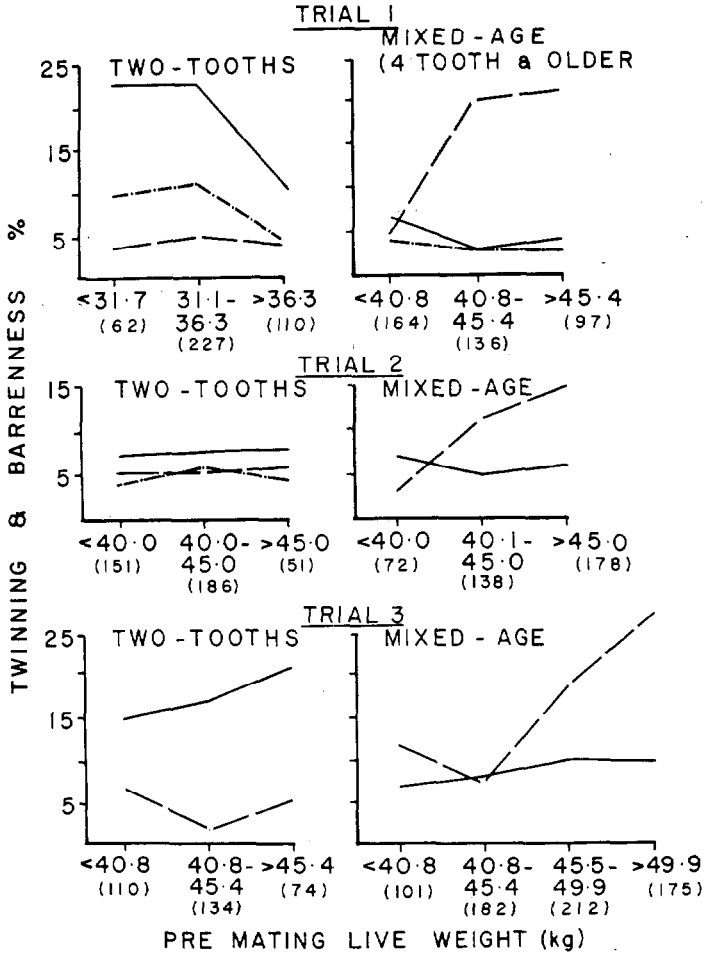

FIG. 1: *Influence of pre-mating liveweight on percentage of ewes barren. All ewes ——; Eliminating ewes never mated — . — . —. (Trials 1 and 2 only); Percentage of ewes lambing twins — — — —. Numbers of records in parentheses.*

ewes were heavier but mated in similar areas, barrenness was only 7.4%. However, when ewes unmated in a mating period of 51 days are removed from the data the mean percentages of 2-tooth ewes barren become 8.5 and 4.7, respectively. Thus a large part of the difference between the two trials can be explained on the basis of differences in mating behaviour of the 2-tooth ewes which differed widely in pre-mating liveweight between the two years.

DISCUSSION

The decline in barrenness in 2-tooth ewes with increasing pre-mating liveweight presented here for Trial 1 is similar to that recorded by Coop and Clark (1966) whose level of 3 to 4% decline for every 4.5 kg increase in pre-mating liveweight was also derived from ewes of low liveweight. However, observations in Trials 2 and 3, when weights of 2-tooths were heavier, do not add support in this respect. Also, the data from the two tussock runs show only a very slight effect of pre-mating liveweight on the percentages of ewes pregnant 100 to 120 days after the start of mating. Coop and Clark (1966) measured barrenness only on the basis of udder examination at tailing and could not differentiate between ewes mated or not mated. Trial 1 has established the importance of mating behaviour in determining levels of barrenness, particularly in 2-tooth ewes of low liveweight prior to mating. These effects were probably primarily responsible for the effects measured by Coop and Clark (1966).

When those ewes not mated at all are eliminated from the data (Fig. 1), the relationship between pre-mating liveweight and barrenness is more tenuous. Provided lightweight 2-tooth ewes are actually mated, the proportion actually lambing can be expected to be very close to that observed in older ewes or in better-developed ewes of the same age. Lightweight 2-tooth ewes are less likely to be mated, particularly when the number of rams or paddock size becomes limiting. Thus mating management must be manipulated to ensure all animals have the opportunity to come into contact with a ram or rams. In practice this means that 2-tooths should be run with more rams and in more confined areas than older ewes.

It is probable that high levels of barrenness in 2-tooth ewes recognized to be a problem in New Zealand are due in part to a certain proportion of ewes failing to mate. Certainly Inkster (1957) recorded big differences in mating behaviour between 2-tooth and older ewes resulting in very high barrenness values for the former.

Ram/ewe ratio has had little effect on barrenness in ewes older than 2-tooths in trials at Tara Hills.

A strong positive relationship between pre-mating liveweight and twinning in Corriedale, Romney and Border-Leicester × Romney 2-tooths is generally accepted (Drew *et al.*, 1973; Hight and Jury, 1973). However, in the present work twinning in 2-tooths was at a constant low level and bore no relationship to liveweight prior to mating. Thus increasing the liveweight of Merino ewe hoggets with the aim of better subsequent reproductive performance can be expected to have no effect on twinning at the 2-tooth lambing. Also, pregnancy rates observed in two commercial flocks varied little between liveweight groupings.

In an environment where there is little potential for growth subsequent to mating as a 2-tooth, good hogget rearing may still be important in relation to levels of twinning in subsequent lambings.

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