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Some Effects of Liveweight and Breed of Ewe on Fertility and Fecundity

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Summary

The relationships between premating livestock and fertility and fecundity in ewes are reviewed. Between flock estimates of the liveweight fecundity relationship vary from 6 to 16% increase in twinning per 4.5 kg increase. A substantial proportion of the increased productivity performance of Border Leicester crosses compared with Romneys can be attributed to increased liveweight. Comparative data from Romney, Coopworth and Perendale flocks is presented to support this contention. Marked increases in reproductive performance can be achieved through using high fecundity sires selected with a breed.

The use of the highly fecund Booroola Merino and Finnish Landrace breeds as crossing sires with traditional breeds is also discussed. Substantial increases in fertility and litter size have been shown in the progeny. It is concluded that the use of ¼ Booroola or ¼ Finnish Landrace ewes will probably be the most logical use of these breeds within industry, resulting in animals which produce more lambs at a moderate liveweight.

Introduction

The number of lambs born and surviving to sale is a major determinant of profitability in sheep farming. This is affected by ewe deaths, the number of barren ewes, the number of lambs born per ewe lambing (litter size LB/EL), mothering ability of ewes and lamb survival. Liveweight of ewes, strains within breed, and breed are the main factors affecting fertility and fecundity although mating management can have dramatic effects on barrenness (Allison & Davis 1976). The relationship between premating liveweight and twinning in 2-tooth and older ewes as defined by Coop (1962) has been the basis of sheep management advice since the time of publication. Cross breeding using Border Leicester or Cheviot sires over Romney ewes and subsequent interbreeding has been a popular means of increasing lamb drop giving rise to the Coopworth and Perendale breeds. However, the recent increase in performance recording of flocks, together with the advent of large scale breeding schemes, is giving rise to productively superior strains within breeds which are now being more widely disseminated within industry. The use of these genotypes or the high fecundity breeds such as the Booroola Merino, currently available, and the Finnish Landrace at present in quarantine provides exciting possibilities for cross-breeding for increased reproductive efficiency in the future.

The following discussion is concerned mainly with barrenness, ovulation rate and litter size, both in ewe hoggets and mature ewes (i.e. 2-tooth and older) and concentrates on data available in New Zealand.

Reproductive Performance of Ewe Hoggets

Ewe hoggets growing at faster rates will exhibit oestrus and conceive at a younger age and heavier bodyweights than animals growing at slower rates (see review by Dyrmundsson 1973). More simply stated "for successful joining of ewe hoggets, the heavier the better". Some effects of breed on the incidence of oestrus and on lambing performance are shown in Tables 1 and 2 which summarise experiments at Invermay. These Romney, Coopworth and Perendale animals were run together from weaning and were joined for two cycles from mid-May. Although mean liveweights of the breeds did not differ markedly there were substantial differences in the percentage mated, these differences being reflected in the percentage lambing. Mated hoggets were 2½-3½ kg heavier at the time of joining, but 4-6 kg lighter at the time of 2-tooth joining. Hight, Lang & Jury (1973) reported similar liveweight differences between hoggets exhibiting oestrus and those which did not. This liveweight difference has, however, not resulted in impaired reproductive performance and is substantially reduced by the time of 4-tooth joining.

High fecundity breeds are sexually precocious and cross bred progeny also show a higher incidence of oestrus and conception rates than their indigenous dams (see Jakubec 1977). Thus a higher percentage of ½ Booroola (B) ½ Romney hoggets exhibit oestrus than Romneys bred from similar base ewes Data are in Table 2. In addition ¼ B ¾ Romney hoggets showed a higher incidence of oestrus and ovulation rate compared with Romneys despite a 4 kgm liveweight disadvantage. Crosses with the Finnish Landrace can be expected to give similar results.

Of approximately 14 million ewe hoggets reared each year in New Zealand only a small percentage are joined with rams. Although there are many animals not of sufficient liveweight to exhibit oestrus in their first breeding season there is certainly a tremendous unutilised potential for lamb production from hoggets within industry. It is well established that breeding of hoggets at 7-9 months of age has little effect on subsequent reproductive performance providing adequate nutrition is available. The ewe hoggets in industry which are joined, are usually very well grown and animals of 30-33 kg as in the Invermay trials would usually be considered too small to mate. Probably the practice of joining hoggets suffers from the stigma of resulting in poorly grown 2-tooths which themselves may have a lower reproductive performance than heavier ewes. At Invermay Lewis (unpublished data) recorded a depression in twinning of approximately 20% at the 2-tooth lambing in ewes which had reared lambs as hoggets, but no difference thereafter between ewes and animals not lambing as hoggets. As previously stated the more recent and continuing studies are showing little difference at all between the parous and non parous hoggets.

Liveweight Fertility and Fecundity Relationships in Mature Ewes

As a basis for discussion it is appropriate to refer to the extensive liveweight barrenness and twinning information based mainly on Corriedale records (Figure 1). Barrenness was relatively constant above 40 kg, but increased rapidly below this weight. Twinning increased linearly with increasing liveweight at about 6% per 4.5 kg (10 lbs) both in 2-tooth and older ewes. This relationship is calculated from mean values of different flocks of ewes (as are the regressions in Figure 2). Variation between mobs of ewes is usually caused by feeding and management differences, but also genetic variation between breeds and between flocks within breeds. Age of ewe differences may also contribute to between flock variation and Coop (1973) has shown that increasing liveweight with increasing age of ewes may account for a substantial part of the increasing lamb drop associated with age. Within flock liveweight fecundity relationships calculated after dividing ewes into various liveweight groupings usually result in a reduced regression slope compared with between flock estimates. Thus Coop and Hayman (1962) showed that the regression of the percentage of twins on liveweight gave values equivalent to an 8.2% increase between flocks and a 4.6% within flocks for an increase in liveweight from 45.5 to 50.0 kg. Hight & Jury (1973) calculated that within flocks the percentage of ewes lambing multiples increased between 1 and 2% per kg of increased liveweight. These authors also showed that within groups in any particular season ewes bearing twins were approximately 3 kg heavier than those bearing singles which in turn were 1 kg heavier than animals failing to lamb. Culling ewes on the basis of liveweight can however be expected to give only very slow or nil progress in selection for fertility. These authors also drew attention to the fact that between years flocks of ewes at the same liveweight had quite widely varying levels of twinning, i.e. relatively little of the between year differences in flock fertility and fecundity could be explained on the basis of liveweight alone. Carryover effects of the lactational stress of rearing twins will often result in a ewe having only a single lamb the next year this contributing to reduced within flock regressions in comparison with between flock estimates. This fact is in accord with a recent review on predicting ovulation rate from liveweight by Morley *et al* (1978) who concluded that the ovulation response of ewes to the current plane of nutrition to be less than to the body reserve status of the ewe. It must, however, be emphasised that other things being equal higher liveweights resulting from increased levels of nutrition will invariably result in higher twinning.

Increasing lambdrop with increasing premating liveweight has been observed in many breeds of ewe in New Zealand. Figure 2 shows four litter size relationships, which have been calculated from

(i) Whatawhata selection flock data from 1969-76 omitting the Romney High Fertility flock and the breeds comparison flocks from 1972-76, omitting the High Fertility Perendales Data were available from the Ministry of Agriculture and Fisheries Research Division Annual Reports. Values for each flock in each year were used to calculate the regression.

(ii) Data from an Invermay survey involving 21 farms (1976 and 1977, Kelly *et al* 1978) in South Canterbury, Central Otago, South Otago and Southland and flocks of Romney, Coopworth, Perendale, Drysdale and Border Corriedale ewes.

(iii) The Ruakura stocking rate trial (Joyce *et al* 1976) where Romney, Coopworth and Perendale ewes were run at three stocking rates. Data are from the 1974 and 1975 lambings.

(iv) A 6% per 4.5 kg relationship (Coop 1962) included for comparative purposes.

Data from i and iii above have combined all ages of ewes and ii is derived from data from 4-tooth ewes only. The incidence of triplet births in all flocks used for these calculations was very low and thus the estimates can essentially be considered as liveweight twinning relationships. However, litter size has been used on the vertical axis of Figure 2 because of the greater incidence of triplets in the Booroola and Finnish Landrace crosses.

The liveweight twinning estimates from i, ii and iii represent an increase of approximately 8%, 13% and 16% twinning per 4.5 kg (i.e. 10lb) increase in premating liveweight respectively. In the relationships from ii and iii no mobs of ewes were below a mean weight of 45 kg although the 40-45 kg weight range was represented by many flocks from i. It is likely therefore that the between mob liveweight twinning relationship which could be expected in industry will be substantially stronger than the accepted 6% per 4.5 kg (Coop 1962) particularly at liveweights higher than 50 kg. The liveweight twinning relationships described have been derived from the breeds in most common use in New Zealand. The only apparent exception to this relationship is in Merino 2-tooth ewes where twinning is at a low level irrespective of premating liveweight (Allison and Davis 1976). Similar within flock analyses with 4-tooth and older Merino ewes showed increasing twinning with increasing liveweight. Whether or not the relationship is still linear at very high liveweights is subject to some debate. There is evidence for a 'tail off' in the relationship above 60 kg in Perendale ewes at Ruakura (Rattray *et al* 1978) and above 70 kg in Corriedale ewes (Coop 1962). From an industry viewpoint this is pretty academic as commercial flocks are rarely in the liveweight range where any reduction in liveweight twinning responses would be expected.

Coop and Clark (1966) showed that barrenness in Merino flocks decreased on average 3-4% for every 4.5 kg increase in premating weight. However in low liveweight ewes (i.e. less than 40 kg) inadequate mating management may be implicated in the high barrenness levels often recorded. This is evident in Merino 2-tooths where less than 10% barrenness in 35 kg ewes can be achieved providing they are joined with 3 rams/100 ewes on small paddocks. When a ratio of one ram/100 ewes was used on large hill blocks barrenness levels were much higher, particularly in the smaller animals (Allison and Davis 1976). Approximately 60% of the barren ewes were nonetheless not mated at all (i.e. animals in the lower weight range were mated in the higher ram percentage small paddock treatment) and when these ewes are removed from the analysis the liveweight barrenness relationship largely disappears. This is in fact true with other observations (Hight personal communication) and further emphasises the importance of mating management in determining levels of barrenness particularly in poorly developed 2-tooth ewes.

Cross Breeding

The Border Leicester (BL) has been extensively used for crossing with Romney ewes with the F_2 and subsequent generations being recognised as Coopworths. More recently there has been an upsurge of interest in the BL x Corriedale or Borderdale Trials at Lincoln College have shown that BL cross Romney or Corriedale F_1 ewes are approximately 7 kg heavier and wean approximately 25% more lambs. Mean litter sizes for Romney (Coop and Clark 1964) and Corriedale (Coop 1957) ewes and their respective BL F_1's are seen in Figure 2. These points appear to fit the steeper liveweight twinning lines calculated from the Ruakura and Invermay data. Part of the increased reproductive performance of the BL cross F_1's is due to hybrid vigour and this may be lost in F_2 and subsequent generations of interbreeding.

At Whatawhata (Hight & Jury 1970) BL x Romney F_1 ewes have also shown a marked superiority in twinning over Romney ewes (see Figure 2). In this experiment all ewe offspring were retained and by the F_3 generation reproductive performance was similar to the Romney ewes. Of particular interest, however was the fact that the liveweight of the BL x Romney F_3 ewes had also declined almost to that of the Romney controls. From the data in Figure 2 it would seem therefore that a substantial part of the hybrid vigour in BL crosses may be explained in terms of increased liveweight. Rigorous selection for performance within the F_1 ewes and subsequent interbreds can of course result in much of the productive superiority evident in the F_1 ewes being retained just as selection within any breed can result in increased productive performance. Selection within breeds (i.e. pure breeds or cross breed ewes) is thus the most important *long term* way of increasing twinning genotypes. The use of BL or Cheviot rams to produce F_1 ewes and interbreeding to Coopworths or Perendales is no guarantee of increasing productive performance. Dalton (1976) showed little difference between these crosses and the Romney in a trial using flocks of 250 ewes on North Island east coast hill country. Unfortunately no liveweight data were available from this comparison, but it does illustrate the genotype of the ewes themselves rather than the breed is critical in determining the level of performance of the F_1's and interbreds.

The most comprehensive comparative data on Romneys, Coopworths and Perendales comes from two breeds x stocking rate trials at Invermay and at Ruakura and a breeds comparison trial at Whatawhata.

The data from Ruakura and Invermay are summarised in Table 3.

The Ruakura Romney flock comprised ewes from the control flock previously described by Wallace (1958, 1964) which has been closed since 1948. Consequently this flock may not be considered representative of the Romney breed as a whole. The other five flocks were all initiated from a number of sources in an effort to obtain a representative cross section of the breeds. Barrenness was higher in the Romney ewes, but there was little difference between Coopworths and Perendales. Litter size was higher in Coopworth and Perendales than in Romneys although differences were much smaller at Invermay which is perhaps a more valid comparison of the breeds. In the more difficult hill country environment at Whatawhata Coopworth and Perendale ewes have proved markedly superior to Romney ewes. In the seven years from 1969-77 the percentages barren were 30, 17 and 13 in Romneys, Coopworths and Perendales respectively. Mean premating liveweights and the percentages of ewes with multiple births were Romney 42 kg, 11, Coopworth 46 kg, 22, Perendale 46 kg, 19 (Dalton *et al* 1978). Litter sizes therefore appear to be slightly higher in Coopworth and Perendale ewes than in Romney ewes at similar liveweights. At higher liveweights, however, Coopworths which have a large mature bodysize and appetite may respond better than Perendales which may also have increasing dystocia problems at weights higher than 60 kg (Rattray *et al* 1978). Major differences in barrenness and in lamb survival have been evident in most comparative trials with Romneys being inferior to Coopworths and Perendales (Dalton *et al* 1978)

The Use of High Fecundity Strains within Breeds

When considering the productive merits of one particular breed against another it should be understood that there is considerable between flock variation in fertility and fecundity within each breed which could and should be exploited within industry. The regression lines in Figure 2 represent only the mean situation for the data available in each case and some flocks are substantially above or below the line. Before discussing the use of high fecundity breeds to produce more productive crosses it is opportune to consider the use of fecundity strains within breeds. This approach overcomes all of the prejudice against using different breeds which although of very high fecundity may be widely different from existing ewe flocks in wool type and weight, body size, or in other productive characteristics. There are few available data which assess the productive advantage in the progeny of high fecundity sires from superior flocks when used over "average" commercial ewes. The subject has recently been reviewed by Clarke (1978). Unless such information is available it is all to easy to point to the actual performance as the only criterion of productive merit which could be due to either

(a) good management and the resulting high liveweight.
(b) higher genetic merit, and which may also be affected by inbreeding.

Following a series of comprehensive surveys Quinlivan and Martin (1971 a, b, c,) have shown that lamb tailing percentages are 13-17% higher in stud flocks than in commercial flocks. Of course the commercial flocks on average provide a progeny test of the average genetic merit of the rams produced from the stud flocks. It is likely therefore that a major part of this difference between commercial and stud flocks is due to better nutritional management in the stud flocks resulting in higher liveweights.

Only when progeny of supposedly high performance sires are compared with progeny from "average" commercial sires can any objective assessment of merit be made.

Two sources of data point to the efficacy of using high fertility strains within breeds. From a flock of 1000 ewes Wallace (1958) selected a High Fertility Line (HF), a low Fertility Line (LF) and a control (C) in 1948. From that time the flocks have been closed with selection in the HF and LF lines being based on the dam's number of lambs born. Selection in the C line was made without reference to the dams fertility, the best looking 2-tooths being chosen, a course of action taken in many commercial and stud flocks. Progress in selection has been discussed by Wallace (1958, 1964) and Clarke (1972) and is summarised in Table 4.

In an outcrossing experiment started in 1968 Clarke and Dobbie (1976) have compared the projeny of HF rams and rams from commercial stud flocks joined with similar flocks of ewes. From 1970-74 the HF sired progeny had a litter size of 1.57 and a lamb tailing percentage of 121% in comparison with with 1.36 and 107% in the progeny from commercial sires.

The Lands and Survey Department Rotorua operate a breeding scheme where very large numbers of ewes are screened into a selection flock for the purpose of breeding rams for their own use. The development of the selection flocks at Waihora and levels of performance in more than 7000 recorded ewes have been described by Hight *et al* (1975). As no randomly bred flock has been maintained it has not been possible to measure genetic progress. However, from 1971 groups of ewes from another property have been joined with "average" Waihora bred rams or rams taken at random from those purchased from private breeders. Levels of twinning in the 2-tooth Waihora and Commercial progeny were 27.4% and 10.0%, and 15.8% and 9.9% in 1973 and 1974 respectively. In the 4-tooth ewes in 1974 comparable data were 19.2% and 8.9%. Further minor differences in barrenness and lamb survival resulted in tailing percentages being 21.9% and 10.4% higher than in the Waihora 2-tooths in 1973 and 1974 and 12.1% higher in the 4-tooth ewes. The advantages in using sires for high fecundity flocks are thus ably demonstrated. The increases are possible in a very short time by screening and selection rather than the long term selection and then outcrossing as in Wallaces high fecundity flock.

Booroola Merino and Finish Landrace Crosses

Booroola Merino (B) rams first imported in 1972 have been used over Merino ewes at Tara Hills since 1973 and over Romney ewes at Invermay since 1975. Similarly Finnish Landrace (F) rams have been joined with Romney ewes in quarantine since 1974. The litter size produced in these first cross animals has been substantially higher than the base ewe flocks to which they have been joined and points have been included in Figure 2 to illustrate that the high litter sizes are achieved at moderate liveweights. The productivity of crosses based on prolific breeds of sheep has been reviewed by Jakubec (1976) and New Zealand data of B and F crosses by Allison *et al* (1977, 1978) and Meyer *et al* (1977) which are summarised in Table 5. Ovulation rates and litter sizes of the B and F cross animals were considerably higher than the Merino and Romney ewes respectively. These differences result in substantially higher tailing percentages in the high fecundity crosses. Lamb mortalities in twin and triplet born lambs have been high in some years in the B crosses, but in the twin lambs not significantly different from the Merino or Romney controls (Allison *et al* 1978). Barrenness has been lower in the higher fecundity crosses.

With high percentages of twins and also up to 15% of triplets in ½ B or ½ F ewes the use of ½ B or ½ F rams over commercial ewes to produce ¼ high fecundity ¾ 'local' breed ewes may be a more attractive proposition in industry. Table 6 outlines one years data with ¼ B ewes on three properties where ½ B rams have previously been used. On two properties where premating liveweights of the 2-tooth were low the ovulation rate of the ¼ B ewes was only slightly higher than in Merino ewes, but 12-17% more ewes had ovulated at the time of laparoscopy (end of one cycle of mating). These differences were reflected in substantially lower barrenness in ¼ B animals and thus higher tailing percentages. On the third property the ovulation rate was 0.48 higher in the ¼ B ewes. Further observations in 1978 on five properties have shown ovulation rate differences of between 0.11 and 0.51 between the ¼ B ewes and Merino or Romney ewes respectively. The differences in barrenness between the ¼ B and Merino ewes require further confirmation, but suggest that some degree of B influence will certainly be beneficial to reproductive efficiency.

Liveweight fecundity relationships in the B crosses appear to be of particular interest. Early indications are that within groups the ½ B ewes seems to have similar fecundity irrespective of premating liveweight. Data from the 1976 lambing are summarised in Table 7 where ewes have been divided into various liveweight groupings and the number of lambs born compared. The data in Figure 2 however, show higher litter size in both 4-tooth ½ B ½ Merino ewes and ½ F ½ Romney ewes than in the respective 2-tooth ewes which were of slightly lower liveweight. A great deal of work has still to be done with these crosses, but the possibility of using a type of animal whose nutritional requirements about mating time are not as critical as in other breeds of sheep, is an exciting one.

Nutrition of the Breeding Ewe and Conclusions

With liveweight at mating so important in maximising lamb production in the national flock, improved nutrition through grazing management has been an area attracting a considerable amount of farm advisory effort. Recently the concept of feed budgeting has been used as an aid to achieve "target" weights and further refinements in terms of 'feed allowance' or the amount of dry matter which needs to be offered in order to achieve desired rates of gain may be of benefit in the future. However, perhaps we delude ourselves as we strive to further refine management techniques whether they be grazing management, crossbreeding or whatever, in our aims for higher lamb production. A more logical aim for efficient lamb production would be to have ewes of moderate liveweight (i.e. 45 to 50 kg) which have a high lamb drop and survival each year. Having only a moderate liveweight implies a mediocre level of nutrition and or management which is essentially what we have got in industry particularly in hill country, where we are told, the main areas for potential increased production lie. At present it does not seem that the existing breeds of sheep in New Zealand can adequately meet this aim unless the highest fertility sires available are used extensively. There is little doubt that sheep of sufficient genetic merit exist within industry both in stud and commercial flocks. The main problem is to identify them, multiply the numbers quickly and then widely disseminate the sires throughout the industry. It is possible that large scale breeding schemes iniated throughout New Zealand could produce 'superior' sires for the whole industry within a short time, such rams each being used over higher numbers of ewes than is the current practice. Organisational difficulties involving widespread between farmer co-operation suggest that this stratgegy will result in only a slow rate of progress in our national flocks. Thus the use of ½ Booroola or ½ Finnish Landrace (should they finally emerge) sires may well prove an attractive means of producing ewes which have a higher lambing performance per unit of liveweight than is the case at present.

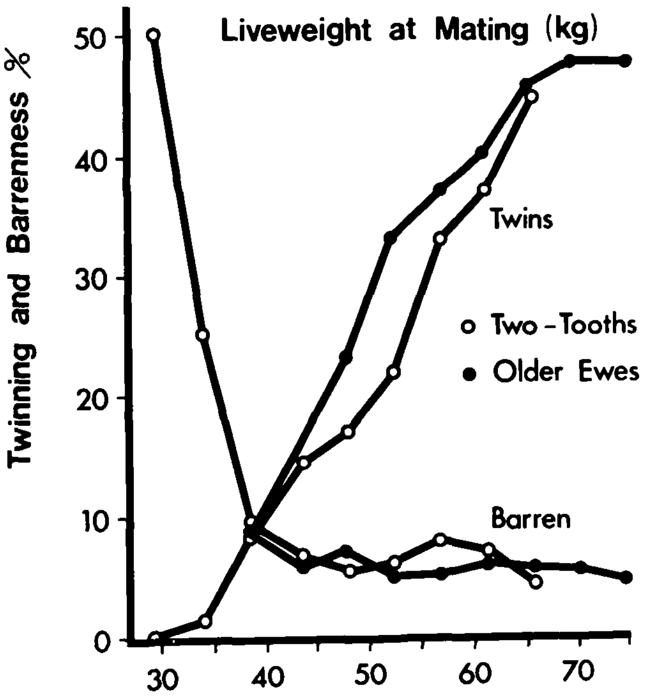

Figure 1. *Liveweight barrenness and twinning relationships in 2-tooth and older ewes (from Coop 1962).*

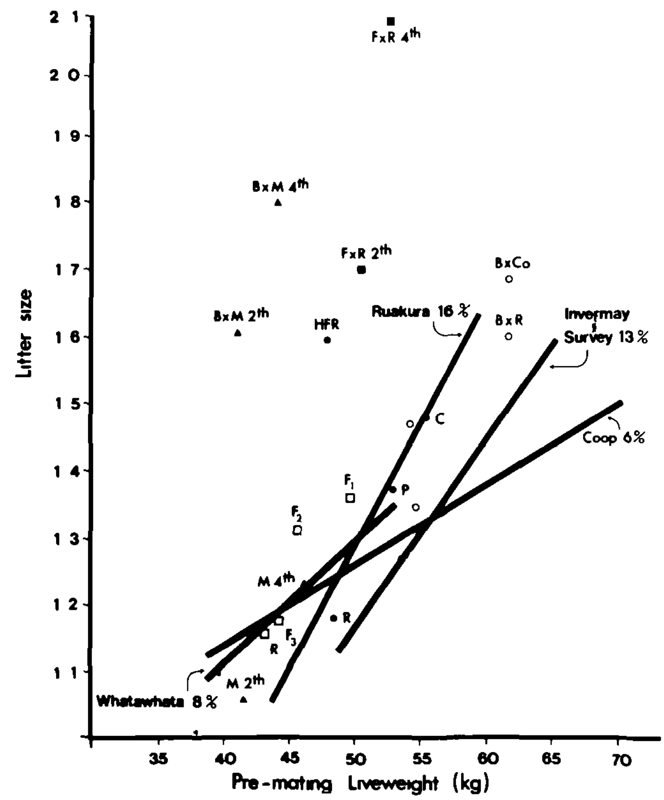

Figure 2. *The relationship between premating liveweight of ewes and litter size — between flock basis*

Bo x M	½ Booroola ½ Merino 2-tooth and 4-tooth ewes	from Allison *et al* 1978
M	Merino 2-tooth and 4-tooth	
R	Romney control	
F1	Border Leicester x Romney	from Hight & Jury 1970
F2	Border Leicester x Romney	
F3	Border Leicester x Romney	
R	Romney	
C	Coopworth	from Joyce *et al* 1976
P	Perendale	
HFR	High Fertility Romney	
Co	Corriedale	from Coop 1957
B x Co	Border Leicester x Corriedale	
R	Romney	from Coop & Clark 1965
B x R	Border Leicester x Romney	
F x R	Finnish Landrace x Romney 2-tooth and 4-tooth ewes	from Meyer *et al* unpublished

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Table 1. Mean liveweight and reproductive performance of Romney, Coopworth and Perendale hoggets. (Approximately 300 animals/group 1974-76.)

Breed	**% displaying oestrus**	**Eight month oestrous**	**weight (kg) non oestrous**	**% lambing of ewes present**
Romney	51 7	30 7	28 2	32 7
Coopworth	72 4	33 1	30 1	50 3
Perendale	85 1	32 2	28 6	63 6

Table 2. Mean liveweight, incidence of oestrus or ovulation, and ovulation rate in ½ B or ¼ B hoggets in comparison with Romneys.

Breed	**Mean 8 month liveweight**	**% in oestrus**	**Number of ovulations per ewe ovulating**
½ B ½ Romney	29 5	68 2	1 38
Romney	29 8	47 2	1 02
¼ B ¾ Romney	29 7	75 0*	1 27
Romney	33 7	55 0	1 09

* % ovulating, as no incidence of oestrus recorded

Table 3. Liveweight (kg), barrenness and litter size in Romney, Coopworth and Perendale ewes. (Ruakura data from Joyce et al 1976.)

	Ruakura 1973-1977			**Invermay 1974-1977**		
Breed of Ewe	**Mean Live-weight***	**% Barren**	**Litter Size**	**Mating Weight**	**% Barren**	**Litter Size**
Romney	53	19	1 19	57	9*	1 38
Coopworth	59	14	1 53	59	6	1.47
Perendale	56	12	1.42	58	7*	1 51

* 1975 values excluded due to vibrionic abortion outbreak

Table 4. Reproductive performance in HF, LF and Control lines of Romney Ewes 1968/72. (Clarke and Dobbie 1976.)

Flock	**% Barren**	**Lambs Born/ Ewe Lambing**	**% Lamb Deaths**	**Tailing Percentage**
High fertility	7	1 63	23	116
Control	11	1 17	18	85
Low Fertility	21	1 11	13	77

Table 5. *Mean liveweight and reproductive performance of Merino and Romney ewes and F_1 Booroola (B, 92-366 ewes per group) and Finnish Landrace (F, 49-115 ewes per group) crosses.*

Age of ewes	Years of record	Breed	Liveweight kg	Ovulation rate	Litter size	% barren
2-tooth	1975, 76	½B ½ Merino	41 6	2 02	1 61	22 3
	1975, 76, 77	Merino	42 1	1 12	1 06	30 4
4-tooth	1976, 77	½B ½ Merino	44 3	2 05	1 80	9 6
		Merino	46 7	1 35	1 22	22 7
2-tooth	1977	½B ½ Romney	39 6	2 00	1 77	12 0
		Romney	43 9	1 16	1 12	17 2
2-tooth*	1976, 77	½F ½ Romney			1 71	4 2
		Romney			1 14	14 2
4-tooth*	1977	½F ½ Romney			2 09	6 1
		Romney			1 21	7 00

* Data from H H Meyer and J N Clarke personal communication

Table 6. *Mean liveweight and reproductive performance of 2-tooth Merino and Romney ewes and crosses with ½ Booroola (B) rams (35-270 ewes per group from Allison et al. 1978).*

Breed	Liveweight kg	% of ewes ovulating	Ovulation rate/ewe ovulating	% barren	% lambs weaned/EP
¼B ¾ Merino	36 2	100	1 09	9 5	86
Merino	33 5	88	1 02	42 2	57
¼B ¾ Merino	33 4	97	1 12	13 5	
Merino	30 3	80	1 00	42 8	-
¼B ¼ Merino ½ Romney	41 0	98	1 54*	0 0	129
Romney	43 9	96	1 06	10 0	92

Table 7. *Premating liveweight and number of lambs born in ½ Booroola ½ Merino ewes.*

	2-tooths		4-tooths	
Premating liveweight	No. of ewes	LB/EL	No. of ewes	LB/EL
38 kg	47	1 43	9	2 11
38-41 kg	64	1 55	26	2 04
42-45 kg	33	1 48	55	1 85
45 kg	5	1 20	38	1 68