MANAGEMENT FOR INCREASED LAMBING PERCENTAGES IN THE WAIRARAPA HILL-COUNTRY

A thesis presented in partial fulfilment
of the requirements for the degree of
Master of Agricultural Science in
Farm Management at Massey University

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ABSTRACT

This thesis reports on a survey conducted in the hill-country of the Wairarapa in May-June 1972. The object of the survey was to provide information on the management practices that farmers were using in relation to the aim of the Ministry of Agriculture and Fisheries of increasing lambing percentages in the area.

In Chapter Four, an extensive review of literature is presented on factors affecting lambing percentages. This review is divided into two sections, the first relating to the management of the flock throughout the year, and the second relating to breeding management, in particular, selection, culling and crossbreeding.

Data collected in the survey is presented in Chapters Five and Six. Chapter Five presents physical data on the survey farms, and Chapter Six presents data on management policies and practices employed on the survey farms.

In Chapter Seven, some analysis is attempted of the relationships between the data presented in Chapters Five and Six, and lambing percentages. The small numbers of survey farms (20) and the wide range of factors affecting lambing percentage, precludes any precise statistical analysis, but trends are observed and discussed.

Chapter Eight presents an in-depth study of two case farms, based on two of the survey farms. Physical data, present production and present management practices of these two farms are presented, followed by recommendations for management changes which could increase lambing percentages. These recommendations are made on the basis of the literature review, the results achieved on other survey farms, and the resources available on the case farms. The effects of an increased lambing percentage are also discussed.

In Chapter Nine, general recommendations are made for the improvement of lambing percentages in the area, and conclusions drawn as to the effectiveness of the study. Possible areas of further research are also indicated.

1. INTRODUCTION

1.1 Study motivation

Although lambing percentages in the Wairarapa area are not the lowest in New Zealand, they cannot be considered satisfactory (see Appendix A). This study is an attempt to isolate some of the causes of low lambing percentages and to show how existing management practices could be changed in order to alter this situation. The problem of low lambing percentages has been overcome on many farms, but average lambing percentages remain low.

Table 1.1 presents MAF[1] estimates of average lambing percentage in the Wairarapa Counties for 1968[2].

Table 1.1

Estimates of average lambing percentages in Wairarapa Counties, 1968.

Eketahuna	90.9%
Masterton	90.9%
Wairarapa South	93.3%
Featherston	90.4%
Average	91.2%

In 1970, Advisory Officers of the MAF (Wairarapa district) set themselves the task of improving lambing percentages in their advisory area. However, it was recognised that there was a lack of documented information on management practices, related to ewe breeding performance, used by farmers in the district.

The survey carried out, and reported in this thesis, is an attempt to provide some of this information.

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1. Ministry of Agriculture and Fisheries (known as the Department of Agriculture until 1971).
2. 'Wairarapa District Situation'
   Farm Advisory Division, MAF, Masterton, 1970.

This study corresponds to the first two stages in the Farm Advisory Model developed by Squires and Hughes (1973). These two stages are, the analysis of the present farming situation, and an analysis of the production possibilities. This study is not concerned with the question of farm advice priorities, as discussed by Squires and Hughes, but rather with farm management analysis related to a specific advisory goal.

The Ministry of Agriculture and Fisheries provided a research grant to the author to help finance this study.

1.2 Definitions

Lambing percentage is defined, in this study, as the number of lambs alive at docking, expressed as a percentage of the number of ewes mated. Other measures of flock prolificacy are also used, based on the number of lambs born, or the number of lambs surviving to sale. These are less commonly used, and when referred to in the text are defined as 'Percentage lambs dropped' and 'Survival to Sale percentage' respectively. The reason for using the number of lambs alive at docking is that this is the measure most easily derived by farmers, and hence is the most commonly used. Some farmers persist in deriving lambing percentages using the number of ewes wintered or lambing, but this will often lead to over-estimation of the true fertility level of the flock, especially where there are many dry ewes.

> The fertility of a ewe is defined as the ability of the ewe to conceive, to carry the foetus(es) to full term, and bear a live lamb.
>
> The fertility of a flock is defined as the collective fertility of the ewes in that flock.
>
> Fecundity is a measure of the prolificacy of a ewe or flock, and is dependent on the number of multiple births.
>
> A dry ewe is one that fails to rear a lamb. There are basically two types of dry ewe:

Dry/dry ewes are ewes which fail to conceive, or lose the embryo early in pregnancy.

Wet/dry ewes are ewes which conceive, but lose the lamb, either in late pregnancy, at birth, or shortly after birth.

1.3 The topic

The topic of this study is 'Management for increased lambing percentages in the Wairarapa hill-country'.

Lambing percentage is influenced by a large number of variables, and any quantitative study of the effect of any specific management practice, on the farm level, is virtually impossible. As a consequence, this study, although attempting to isolate those management practices which may lead to a higher lambing percentage, does not attempt, in any detail, to quantify the effects of such practices.

A review of literature relating to the problem of increasing lambing percentages is presented, followed by chapters describing the survey farms, and the management practices used on these farms. Included are two case farm studies, where an attempt is made to evaluate the applicability of changing management to increase lambing percentages, and where the effects of an increase in lambing percentage are evaluated. Finally, there is a chapter of conclusions and recommendations, applicable to the survey area as a whole.

2 THE SURVEY

2.1 Uses of surveys

G F Warren (1914) developed the idea of farm surveys to collect information on agricultural organisation and practices in areas where such information was not available. Later, other workers saw in the survey, a method of obtaining information to help in the solving of specific problems. The use of surveys in this way is now an accepted method of collecting information on farm management problems.

Farm Surveys can thus be either general in approach or specifically directed toward some problem.

The general-purpose survey is usually conducted along the lines of a census, using fixed questionnaires and an impersonal approach. They are often mail surveys, or surveys which extract data from existing data collected for some other purpose.

The special-purpose survey is designed to collect information on a particular topic, and a 'survey schedule' is often used, rather than a fixed questionnaire. The difference is that while the questionnaire is inflexible in its wording, in the survey schedule only headings or items are listed in the data sheet, and questions are framed according to the situation on the farm.

These different types of survey have been called Enumerative and Interview surveys (Schapper, 1957).

The Enumerative survey often involves the 'farm standards' approach as described by Candler and Sargent (1962) which can lead to misleading conclusions being drawn if the data is applied to specific problems and cases. Differences among farms in the levels of resources available, and subjective aspects such as farmer attitudes cannot be incorporated into such a survey. The main use for Enumerative surveys in farm management research is to provide simple descriptive data, and to point out areas of possible, future, more intensive research using interview surveys.

Interview surveys are often a means of testing hypotheses, though in some cases it may not be possible to define a specific hypothesis, but only an area of concern. A specific hypothesis may develop during the survey, or as a result of the data collected, or alternatively, the original hypothesis may have to be changed on the basis of the data collected. In the Interview survey, both subjective and objective data is collected, rather than just objective data, and the information is usually collected by means of a personal interview, rather than the more impersonal approach of the

Enumerative survey. The data collected in the Interview survey can be considered along with other subjective information, and a greater understanding of differences in production, or reasons for decisions, obtained. This understanding allows much more useful recommendations to be made on specific problems. The gaps between optimal and actual use of farm resources can be seen, and the reasons for them determined, in both economic and non-economic terms. There is some danger of interview bias and some difficulty in getting reliable confidential data, and assessing subjective attitudes, and this is where the skill and experience of the interviewer is very important.

All sample surveys rely to some extent on individual farm records, and the lack of these can be a problem. Variability in different types of records is also a problem, especially in the case of farm accounts. Some standardisation of these could be very useful to people conducting surveys.

Small sample surveys are particularly appropriate for dealing with problems involving the introduction of new techniques or practices at the farm level. Where the sample size is small, the interviewer can keep the farm and farmer in mind, both when he is collecting his data, and later when he is analysing it. This intensive interview procedure allows for a greater appreciation of the peculiar problems of a particular situation. In a small sample, the opportunity can be taken to look over the farm at the time of the interview, and this can bring out points which would otherwise have been missed or not fully understood. With this system of conducting surveys there is the opportunity of making adjustments to data to allow for individual farm situations. Warren's philosophy was to get over the problem of individual farm situations by using larger samples, but this is very time consuming, and does not help the understanding of the problem at the individual farm level.

Small sample surveys can result in an element of bias being introduced into the data, since farmers selected to contribute information are often those with records and information

readily available, rather than those without. These farmers will usually tend to be above average in managerial ability, This effect has to be taken into account, and such surveys cannot be considered to give, or result in, conclusions representative of all farms in the same area or practising the same system of farming.

2.2 The survey area

After some discussion with local Advisory Officers it was decided to limit the area of study to the hill-country areas of the Wairarapa, where farmers were running predominantly breeding flocks, and not selling all wether lambs fat. It was felt that the majority of farmers with lambing percentage problems were in this area. This is supported by Farm Improvement Club figures for the 1969-1970 season[1]. Table 2.1 presents lambing percentages for different farming types represented in the Club.

Table 2.1

Lambing percentage in relation to farming type

Farm type	Lambing percentage	
	Average	Range
Store	85.0	76.0-98.5
Semi-fattening	96.2	72.4-127.0
Fattening	98.0	87.0-111.0
Cropping	100.0	97.8-104.0

These farms cannot be regarded as a random sample, and figures are probably higher than the Wairarapa average, but they do show the trend.

With the price schedule operating at the commencement of this study, many hill-country farmers were in some financial difficulty, which was aggravated by low lambing percentages. Subsequent events have placed these farmers in a much sounder financial position, but performance can still be improved.

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1. Wairarapa District Situation.
Farm Advisory Division, MAF, Masterton 1970.

It was decided to take a cross-section of farms in the Wairarapa hill-country, including a range of sizes, breeds of sheep, and lambing percentages. The location of the survey area is shown in Figure 2.1 and the distribution of the farms selected is shown in Figure 2.2.

A wide distribution of farms was thought desirable to give an appreciation of the effect of different climate, soils, and other conditions, while remaining within one class of farming. It was realised that this would make the analysis of survey results very difficult, but it was felt that it was more important to gain this wider appreciation of farming problems, than to attempt detailed analysis of a limited range of farms.

2.3 Survey design

The survey was designed to examine, at the farm level, those management practices which appear to be related to lambing percentage, and to determine the practicability of employing these and other practices on other farms in the area. Physical data on farm resources, stocking, and production was also to be collected, so that this could be related to the management practices used. Such data could also be used as a basis for case-farm studies where the feasibility or productivity of different management systems could be evaluated.

In order to collect such information it was considered that some form of interview procedure, involving a relatively small sample of farms, would be most successful. Time was a limiting factor. Allowing a day for each interview, twenty interviews would take a month. Trying to conduct more than one interview a day was impractical, as it would not allow time to evaluate each farm before moving on to the next.

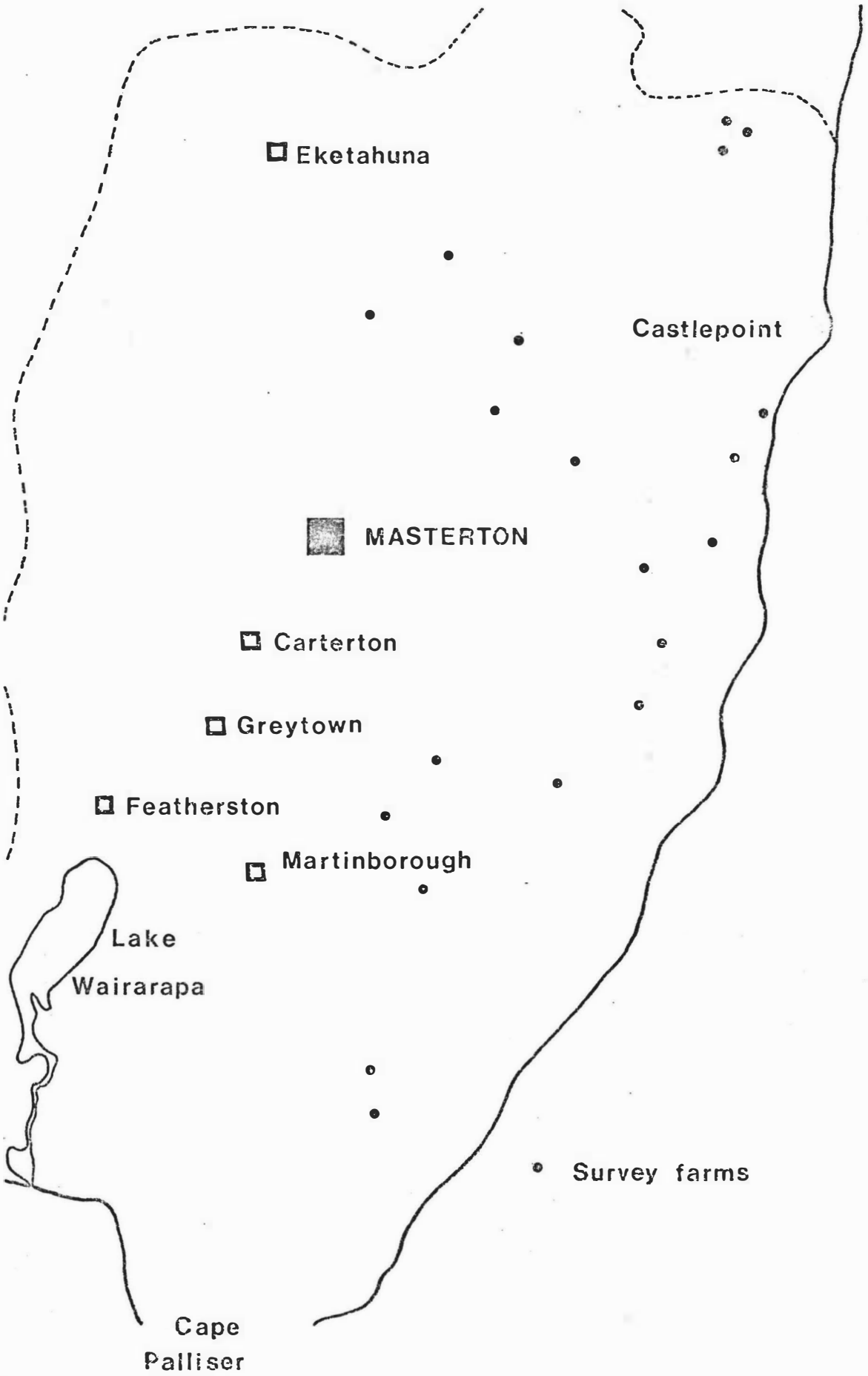
If it had been decided to identify a few important factors from the review of literature, and to examine these factors in detail on the survey farms, then a much larger sample could have been possible. With the decision to examine all

Figure 2.1

Location of the Survey Area.

Figure 2.2

Location of Farms in the Survey Area



the management policies and practices which seemed potentially important in affecting lambing percentages, the examination of fewer farms, in greater depth, was thought to provide better utilisation of the limited resources available.

2.4 Period for which data collected

The survey was carried out during May-June, 1972. Data on stocking and stock performance was collected relating to the 1969, 1970 and 1971 lambings. It was hoped that three years figures would be sufficient to present a true picture of the production achieved on the farms. Any shorter period might represent an artificial situation, due to short term development, an artificial years trading, or some other unusual situation. Information on major management changes, such as in grazing systems or breeding programmes, was recorded for a period of five years prior to the survey, since these can have delayed effects and results can be more evident two or three years after they are introduced. This is particularly true of breeding programmes.

2.5 Selection of farms

A list of forty farmers was prepared with the help of local advisory officers, and from this list, twenty farmers plus five extras were selected. Farmers who would be likely to cooperate, provide useful information, and who were using management systems judged to be of interest, in relation to the objectives of the study, were selected with the help of MAF Advisory Officers. Consequently, practically all of the farmers visited were known by MAF Advisory Officers to some degree, since they were the major sources of information. The farmers visited were in no way a random sample of farmers in the area. They consisted of farmers who, had high percentages, had overcome lambing percentage problems, or had problems that they were trying to overcome. Several farmers with stud enterprises, in addition to their basic farming system, were included, but it was thought that the effects of this could be isolated so that valid comparisons could be made.

Approaches to the farmers were made, first by letter[2], and then by telephone, to arrange suitable dates for visits. Of the farmers approached, five declined to proceed any further for reasons of pressure of work or change of ownership. The extra five were then approached, and twenty farms finally visited. Those farmers who agreed to help were contacted again the night before the visit, to confirm the interview for the following day.

2.6 Questionnaire design

A draft questionnaire, divided into two main sections was prepared. The first section was concerned only with the farmer's records, stock carried, stock sales, purchases, prices, etc., and the physical details of the farm. The second section concerned the management of the farm through the year, the practices used, why they were used, how successful they were, and any proposed changes. This trial questionnaire was tested on a separate farm, and a number of changes made. A condensed version of the final questionnaire used is presented in Appendix C.

2.7 Interview procedure

The usual procedure was to arrive at the farm at 8.30-9.00 am and to obtain the physical details first. Once these had been obtained, the subsequent procedure varied somewhat from farm to farm. On some farms, especially where the weather was unfavourable, the management section of the questionnaire was also completed at the homestead, and then a look over the farm was suggested, during which, details previously missed, were noted. On other farms, the second half of the questionnaire was completed while looking around the farm, or after a trip around the farm. All approaches worked well, and the approach used was varied according to the wishes of the farmer, and the weather on the day. A useful approach was to record most of the information in the morning and then discuss management aspects in greater detail during an inspection of the farm in the afternoon.

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2. A copy of the introductory letter is in Appendix B.

An approach was made to all farmers for some form of financial information, preferably in the form of farm accounts. In most cases, these were made freely available, or at least some summarised version of them, such as these prepared by a Farm Improvement Club. Most agreed to lend accounts for further study, and these were returned, as soon as possible, by mail. Some farmers were quite prepared to give current working account figures but were reluctant to give figures on liabilities. Their right to such privacy was respected.

The interviews varied in length from three to six hours, including the examination of the farm concerned. The length of time was largely determined by the accessability of information and the length of the farm inspection.

After each visit, an attempt was made to go through the questionnaire to fill in any gaps left during the interview, to add comments, and to try and reconcile some of the figures given. Accounts were also examined at this time, to get some idea of income and expenditure patterns, and financial position.

3 THE SURVEY AREA

3.1 Topography[1]

Figure 3.1 shows the distribution of land above 300 and 900 metres, and so gives an idea of the topography of the area. The area depicted is about 60 kilometres wide and about 100 kilometres long, and comprises approximately 600,000 hectare, or about three percent of New Zealand's total land area. In the West, the area is bounded by the Tararua and Rimutaka ranges which are bush clad, and rise to a maximum height of 1500 metres. Parallel to these ranges is a wide valley which has been filled by alluvial deposition in the Ruamahanga, Waingawa, Waiohine, and Tauherenikau Rivers to form a wide plain. The Eastern hill country is broken, and composed of upfolds of sedimentary rocks, mainly sandstones, mudstones, argillites, and limestones.

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1. from: 'Farming in the Wairarapa'. NZ Department of Agriculture Bulletin.

The highest point in the Aorangi Range, which runs North from Cape Palliser, is Mount Ross (960 metres).

From Figure 3.1 it can be seen that all the survey farms are in the Eastern hill-country.

3.2 Climate[1,2]

The climate of the Wairarapa is greatly influenced by the topography and the local winds. Westerly winds tend to blow as Nor'westers to the East of the Tararuas, and as Sou'westers closer to Cook Strait. Southerly or Easterly winds bring most of the rain to areas sheltered from the West by the Ranges. The Nor'westerly winds are usually dry, and sufficiently strong to affect plant growth, through the depletion of soil moisture. This effect is usually less pronounced closer to the Coast, although some areas around Castlepoint are very prone to these winds. Winds from the East and South are less frequent, but have a great impact on coastal areas in that they bring most of the rain to these areas.

The average annual rainfall pattern is shown in Figure 3.2. The effect of the ranges on rainfall can be readily seen. East of the Tararuas the rainfall drops very rapidly, to a minimum of about 750 mm at Martinborough. The dryness of the Martinborough area is also aggravated by shelter to the Southwest, provided by the Aorangi Range. The driest coastal area appears to be around Castlepoint. The average monthly rainfall for the six points marked on Figure 3.2 is shown in Figure 3.3. As a general rule, the driest month appears to be March. This has rather serious implications for farmers, who are trying to feed their ewes well at this time. The difficulty of the situation is even more evident when the reliability of the rainfall is examined, as in Figure 3.4. By means of 'rainfall percentiles' it can

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1. from: 'Farming in the Wairarapa'. NZ Department of Agriculture Bulletin
2. from: NZ Meteorological Service, Technical Information Circular No 133. NOTES ON THE CLIMATE OF THE WAIRARAPA.

Figure 3.1

Contour Map of the Wairarapa Survey Area

Figure 3.2

Yearly rainfall distribution in the survey area (mm)

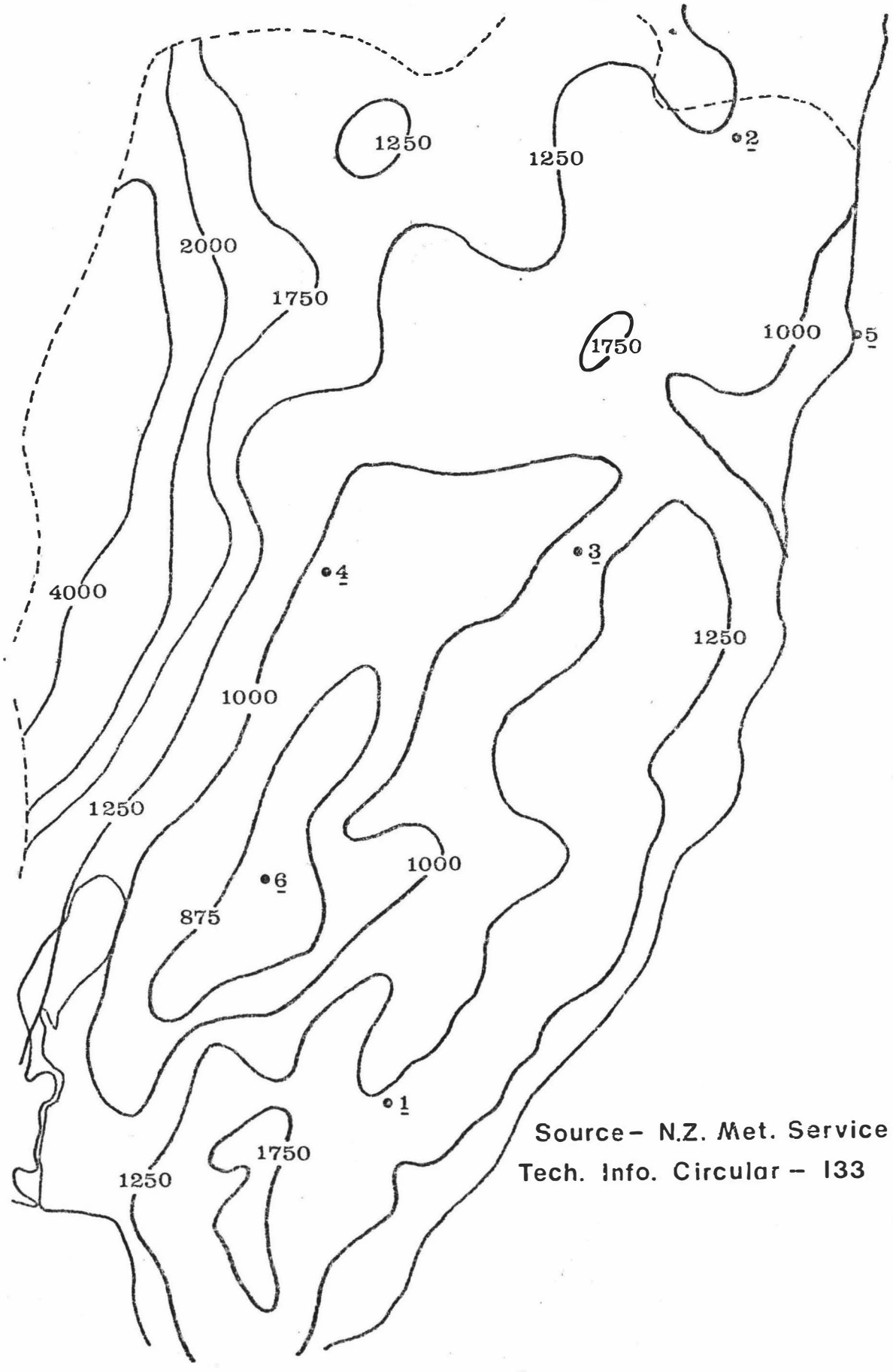


Figure 3.3

Average monthly rainfall at marked stations in the survey area.
Source - NZ Meteorological Service climatological data.

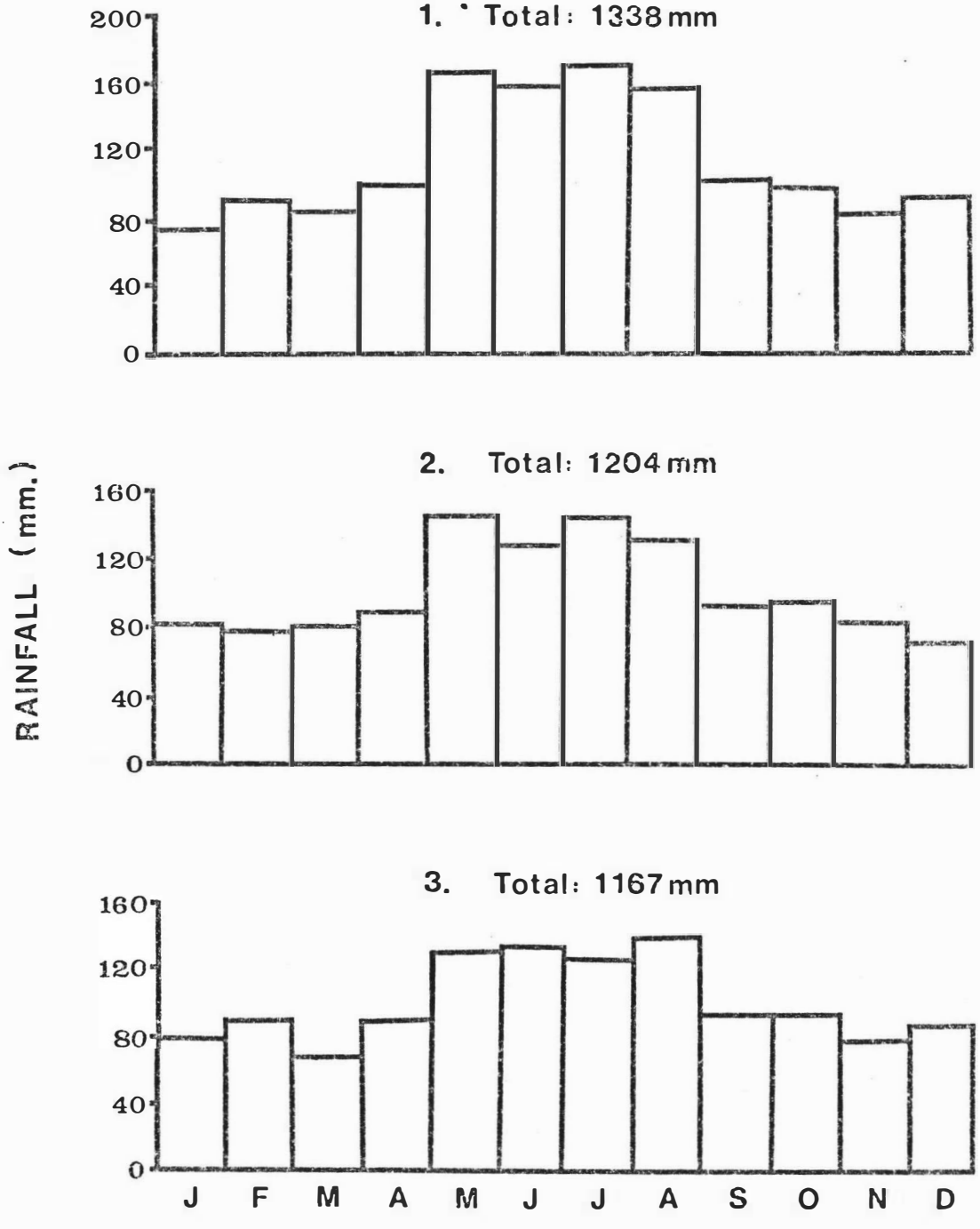


Figure 3.3 (Contd.)

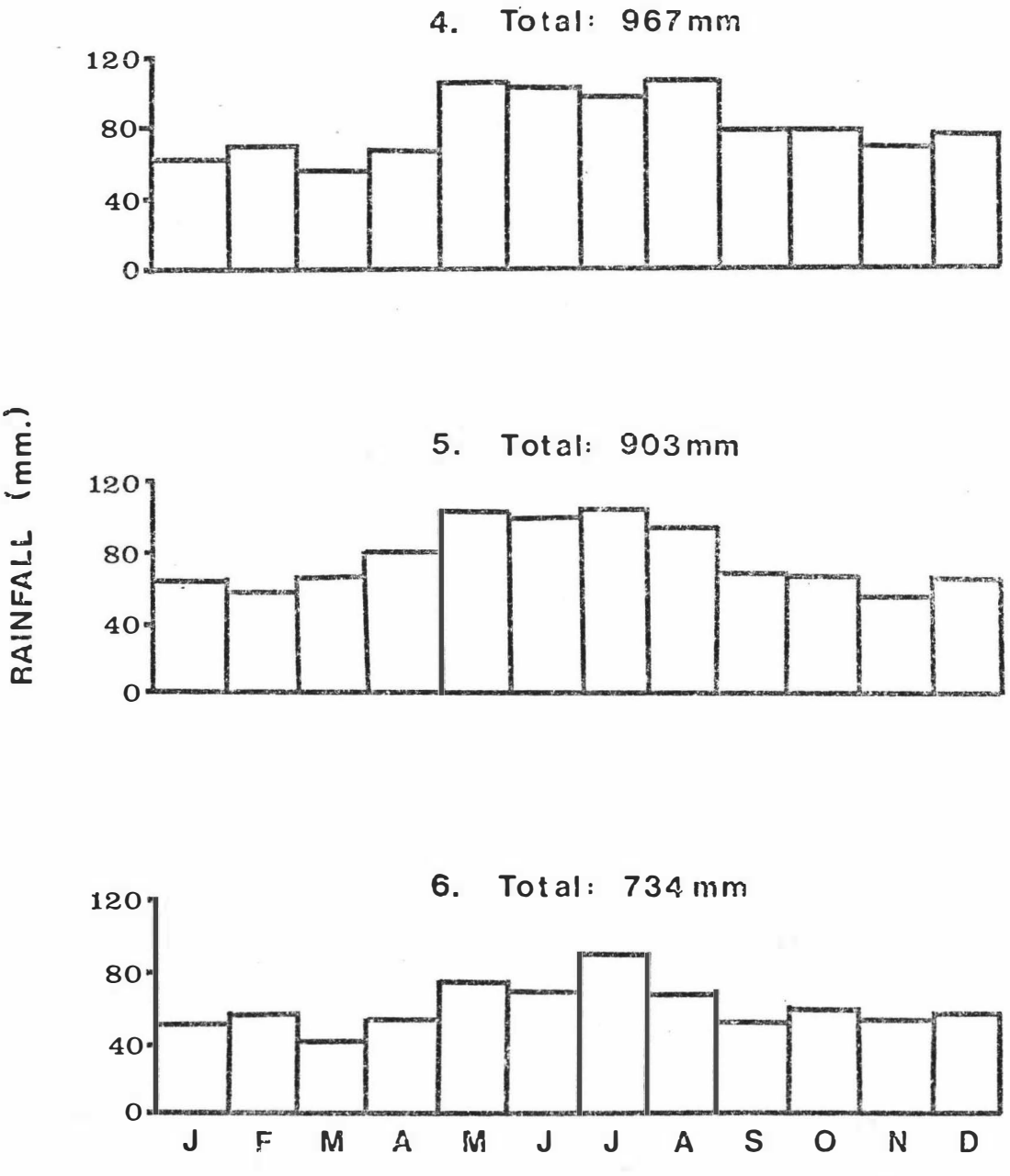
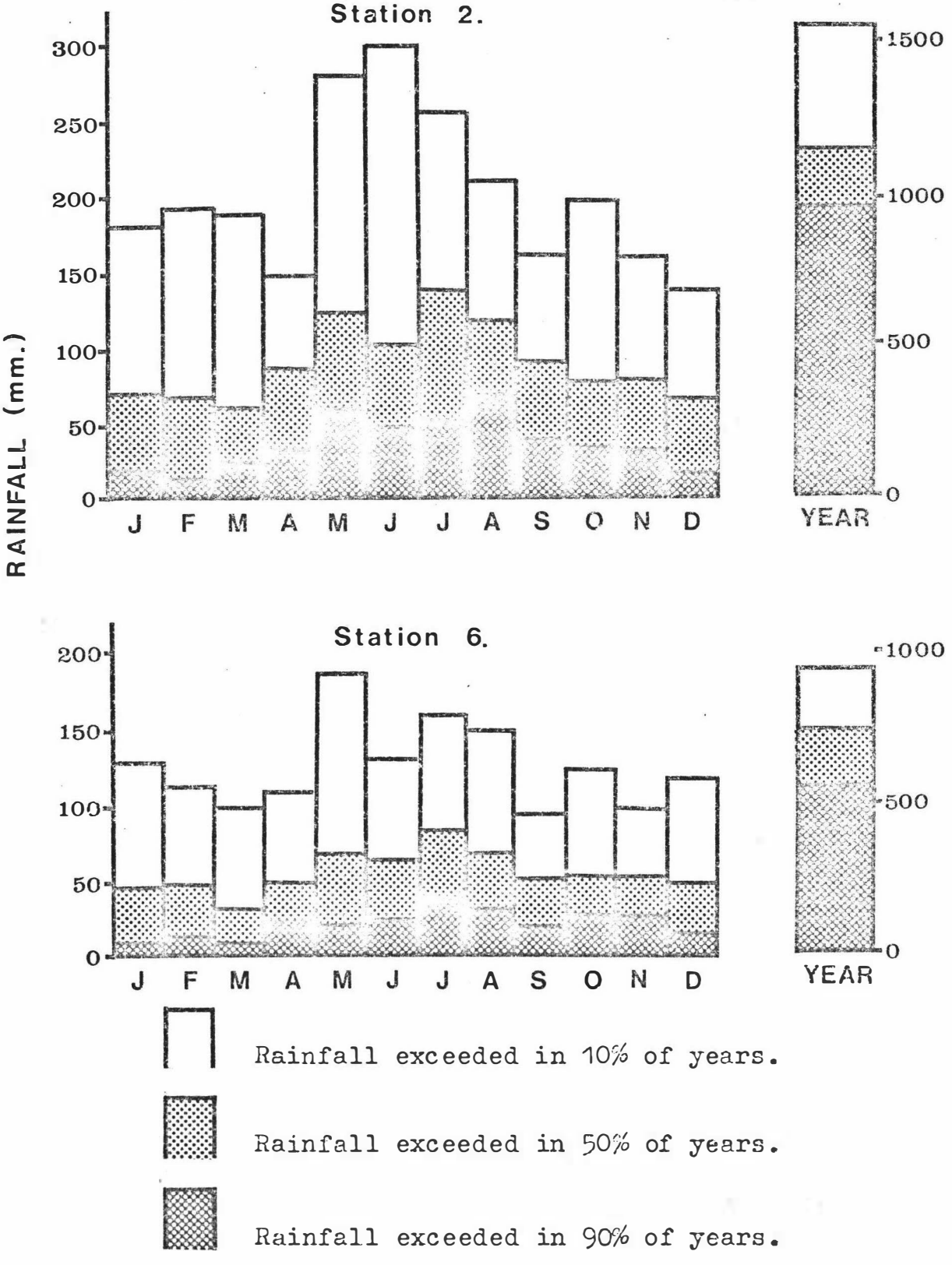


Figure 3.4

Reliability of rainfall for two of the marked stations.



Source - NZ Meteorological Service climatological data.

be seen that there is great variability between years in the monthly distribution of rainfall. This effect overshadows the variation in total rainfall between years. In a high proportion of years, summer growth would be severely limited by the low rainfall.

3.3 Soils[3]

The major soil classifications of the area are shown in Figure 3.5 and are discussed in more detail below.

There are two main soil groups, The Central Yellow-brown Earths, and the Central Yellow-grey Earths. Also present are intergrades between these two, and steepland soils related to each. Recent alluvial soils occupy much of the plains area.

The Central Yellow-brown Earths

These soils have been formed under forest, on land with an average rainfall of above 1100 mm. Drainage is free, and there is a constant loss of nutrients under the moderately high rainfall. Most of these soils have low natural fertility, but respond well to fertilizers because of their good physical condition. Under cultivation the soil aggregates break down rapidly, and the soils are thus not suitable for regular cropping. Soils within this group vary somewhat with climate, parent material, and native vegetation.

The Steepland Soils related to the Yellow-brown Earths

These soils are generally shallow, friable, and freedraining. Nutrient content is very dependent on the parent material. Nutrients are high in soils from siltstones and mudstones, moderate in soils from argillites and greywacke, and low in soils from sandstones. All of these steepland soils are subject to soil erosion. The more fertile areas are suitable for pastoral production, but the less fertile are better used for forestry or soil conservation.

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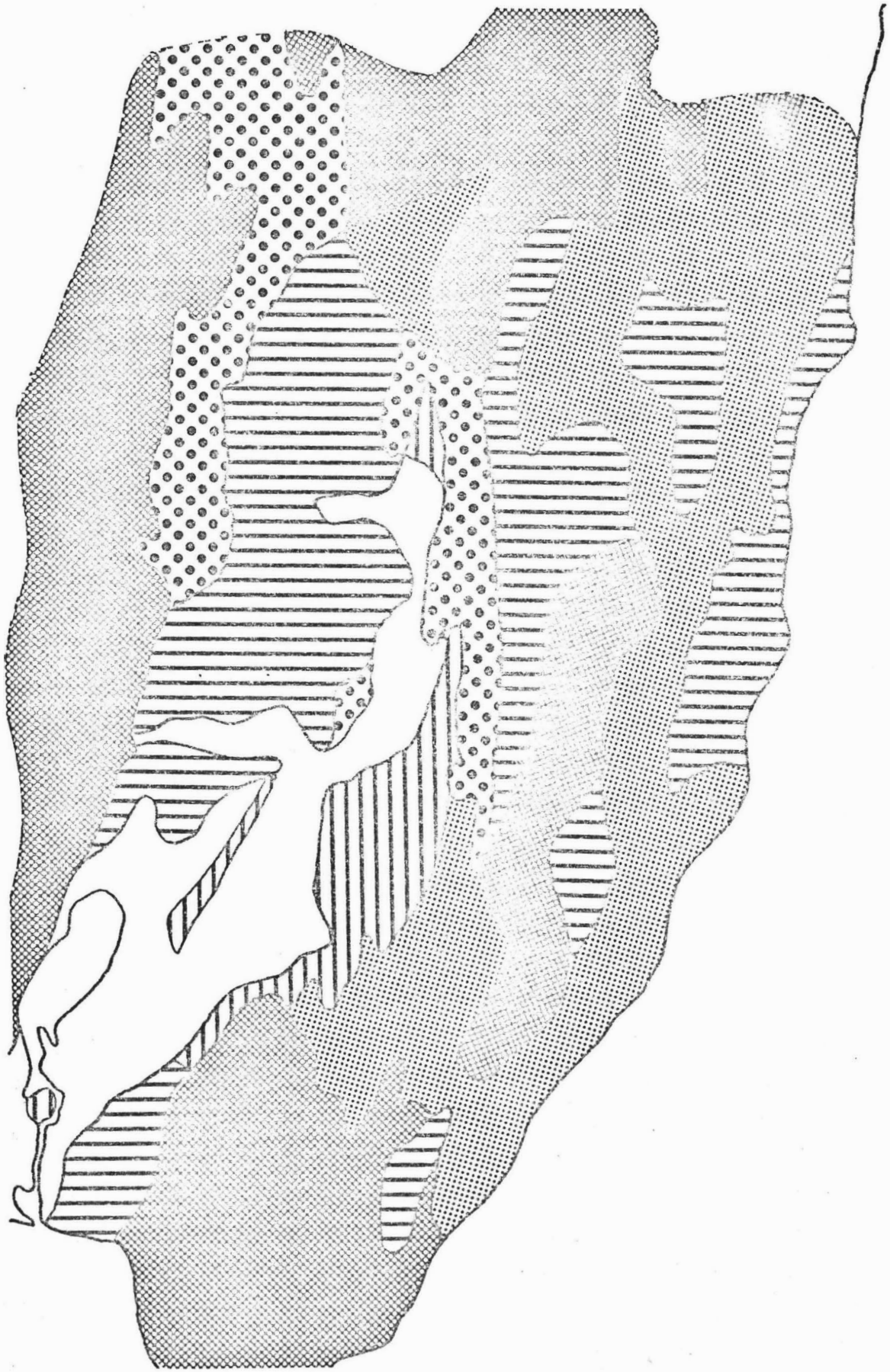
3. NZ Soil Bureau, Bulletin 26(1), 1968. 'Soils of New Zealand', Part 1.

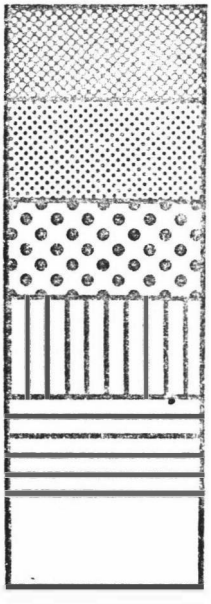
Figure 3.5

Soil classification of the survey area



Source NZ Soil Bureau Bulletin , 26(1)
'Soils of NZ.' Part 1.

Key to soil classification map.



Steepland soils related to the Central Yellow-Brown earths.

Steepland soils related to the Central Yellow-Grey Earths.

Central Yellow-Brown Earths.

Central Yellow-Grey Earths.

Central Yellow-Grey Earths intergrades to Central Yellow-Brown Earths.

Recent Alluvial Soils.

The Central Yellow-grey Earths

These soils have developed in areas with a well defined dry season, and with annual rainfall less than 1100 mm. A characteristic often present is a compacted fragipan. This is less noticeable in intergrades tending towards the Yellow-brown Earths. In this group of soils, available phosphorus is generally low. The soils are suitable for grazing or cropping, but with impeded drainage, the winter carrying of high stock numbers can be a problem.

Soil Intergrades between the Yellow-grey Earths and the Yellow-brown Earths

These soils occupy extensive areas in the Wairarapa. The soils are more leached than the Yellow-grey Earths, and have a less developed fragipan. Plants are less susceptible to drought. The range of soils in the intergrade is wide.

Wanstead soils	- sticky clays, highly fertile but unstable.
Atua soils	- silt loams over clay loams, developed from siltstones. Generally require only light fertilizer to maintain good pastures.
Maraetotara soils	- sandy loams of low natural fertility, respond well to fertilizer, but prone to slip erosion.
Tinui soils	- silt loams on stony silt loams derived from argillite, prone to serious gully, slump and sheet erosion.

Steepland soils associated with the Yellow-grey Earths and Intergrades

These are shallow, fertile soils that drain freely, and are prone to drought conditions. Slopes are apt to slip because of water entering shrinkage cracks formed in dry spells.

Divisions within this grade are made on the basis of parent material.

Taihape steepland soils	- on siltstones
Tangoio steepland soils	- on sandstones
Whareama steepland soils	- on mudstones
Mataikona steepland soils	- on argillites.

Recent alluvial soils

These are generally of high fertility, and suitable for intensive cropping or livestock enterprises.

The soils of the area have also been subdivided by the NZ Soil Bureau[3] into classes showing 'Potential for Pastoral Use'. The land is classified into six classes on the basis of suitability for pastoral production. Figure 3.6 shows this classification of the area, and the characteristics of each class are listed below.

Class 1 Soils of flat or rolling land, with slight limitations to pastoral production, caused by lack of nutrients.

Class 2 Soils of flat or rolling land with moderate limitations to pastoral production, caused by poor drainage, stoniness, or lack of nutrients.

Class 3 Flat or rolling land with severe limitations to pastoral production.

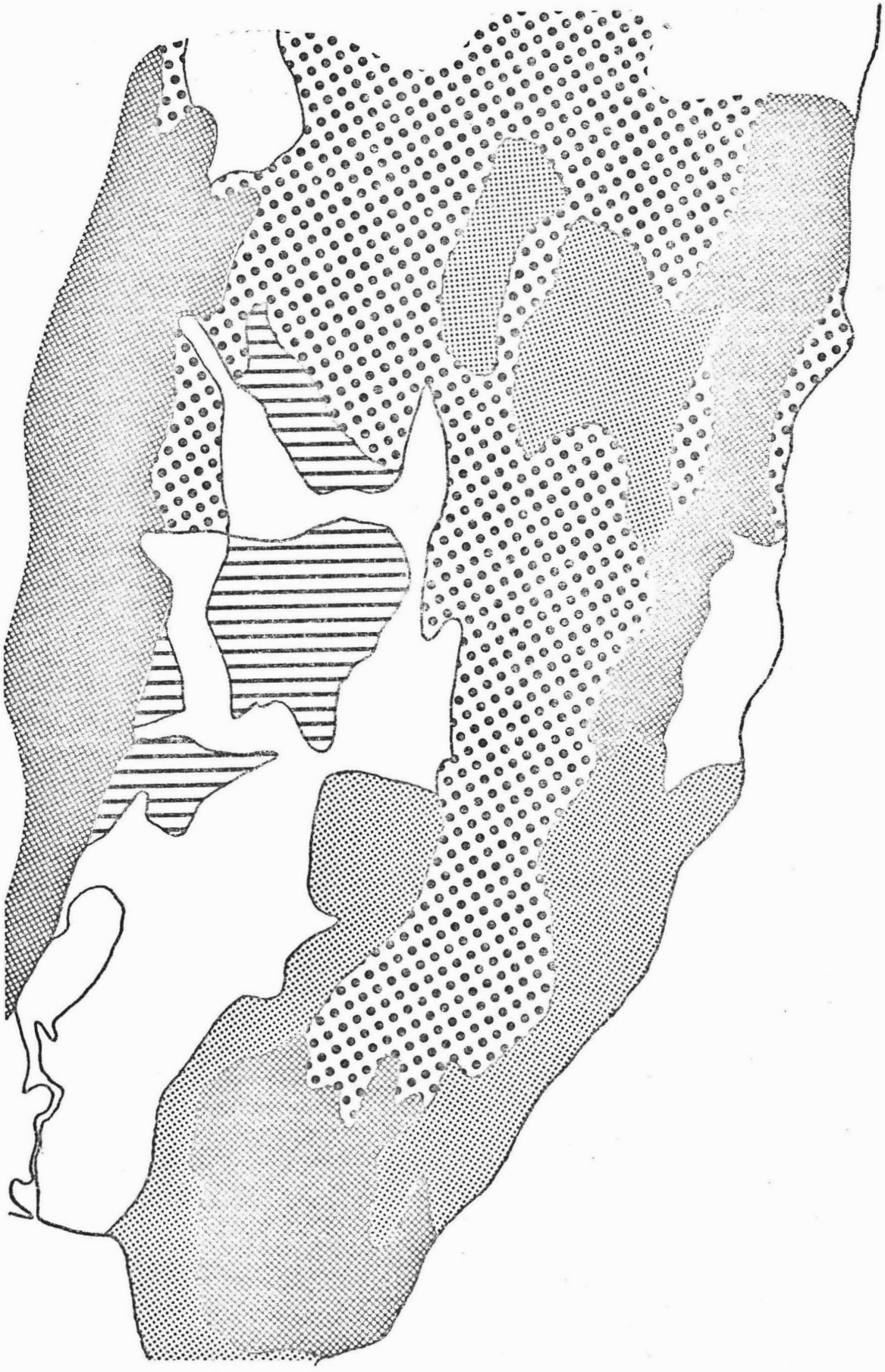
Class 4 Soils of hilly or steep land with slight to moderate limitations to pastoral production, caused by lack of nutrients.

Class 5 Soils of hilly or steep land with moderate to severe limitations to pastoral production, caused by moisture stress, erosion, or lack of nutrients.

Class 6 Soils of hilly or steep land with severe limitations to pastoral production, caused by rapid erosion or lack of nutrients.

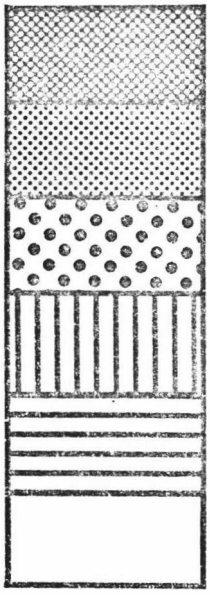
Figure 3.6

Potential for Pastoral use classification of the survey area.



Source NZ Soil Bureau Bulletin 26(1) 'Soils of NZ' Part 1.

Key to Potential for Pastoral use Map.



Class 6

Class 5

Class 4

Class 3

Class 2

Class 1

Approximate areas of each class in the survey area are:

Class 1	30,000 ha
Class 2	110,000
Class 3	insig.
Class 4	170,000
Class 5	140,000
Class 6	150,000
	600,000

4 FACTORS AFFECTING LAMBING PERCENTAGE

4.1 Introduction

This chapter is a review of literature on the subject of factors affecting lambing percentage.

The factors affecting lambing percentage can be subdivided into two groups. One group is concerned with the day to day management of the flock and the other is concerned with the breeding, selection, or culling of the animals in the flock.

In the section on day to day management, a time sequence is followed, beginning with pre-tupping management, and ending with lambing and post-lambing management. In the section on pre-tupping management, reference is made to hogget management, and the manner in which this can affect later performance, and also to general animal health and growth.

In the section on breeding management, a discussion is provided on selection and culling procedures, and on cross breeding.

4.2 Animal management

4.2.1 Pre-tupping management

4.2.1.1 Hogget nutrition

Good management of ewe hoggets is not just a matter of producing better fed hoggets, but also of producing potentially better breeders, carrying more wool, and stronger in

constitution. The potential of a ewe is fixed by its breeding, but the expression of this potential is largely determined by the ewe's treatment as a hogget. Good feeding, shepherding and management is essential during hogget growth.

Coop (1964) has reported on extensive work, relating the effect of liveweightat mating on the lambing percentages of two-tooth (2th) and older ewes. He found that as the liveweight of the ewe decreases, the percentage of barren ewes increases only slowly until a liveweight of about 40 kg is reached, below which there is a rapid rise in barrenness. This effect was independent of the age of the ewe, but it is a bigger problem with the 2th ewe at its first mating, than with older ewes since mature liveweight has not been reached at this age. Coop concluded that 2ths below 40 kg in liveweight were very prone to barrenness, and that the aim of hogget management should be to have liveweight above this level at tupping. He also stated that the liveweight reached by a ewe as a 2th sets a limit to its lifetime size and production. Coop also determined, over a large number of sheep and years, that as liveweight increases above 40 kg the twinning rate increases by about 13 percent per 10 kg increase in liveweight. That is, for each 100 ewes lambing 13 extra lambs will be born for each 10 kg increase in liveweight per ewe. Coop's work involved ewes of the Corriedale and Romney breeds.

The hogget management problem then is how to get replacement 2th ewes to a 'reasonable' weight at mating. The aim should be to attain a 2th liveweight of at least 40 kg at mating. The additional costs of attaining higher liveweights should be compared with an expected increase of 13 percent in twinning rate per 10 kg increase in liveweight.

The MAF places much emphasis on hogget liveweight at shearing in September or October, as a measure of hogget rearing success, but recent work by Drew et al. (1973) at the Invermay Agricultural Research Centre has indicated that liveweight at this time may not be important, since substantial gains in liveweight can be made between October and 2th mating,

provided that feed is not limiting. These workers concluded that high-plane winter feeding of Romney hoggets may not be justified, provided feed is not limiting during the following Spring-Summer period. Figure 4.1 shows the Winter and Spring-Summer weight changes for hoggets fed at different planes of nutrition in the experiments of Drew et al.

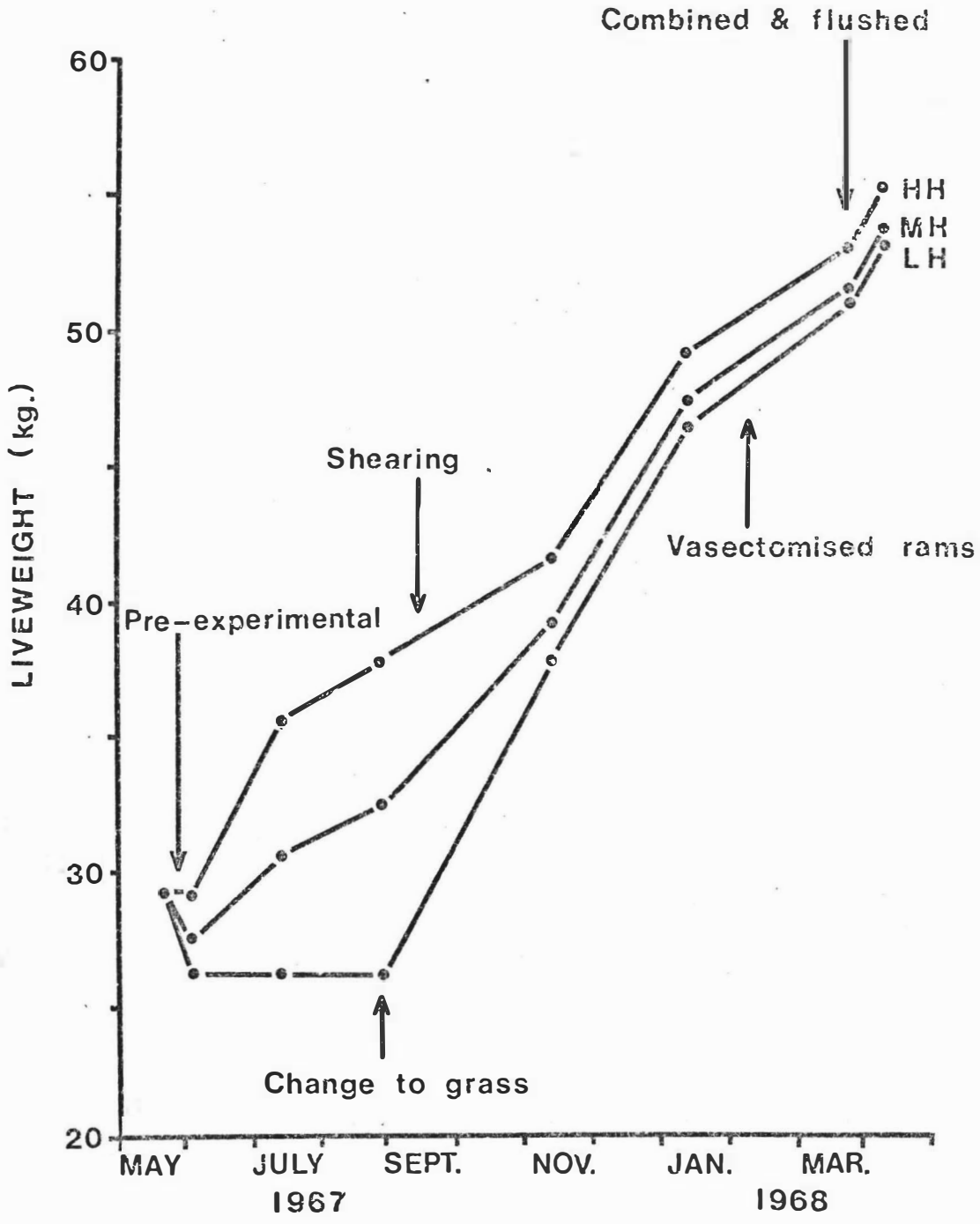
Hogget weight gains over the winter period varied from zero to nine kilograms because of the differences in feeding level, but with a high Spring-Summer level of intake, there was little effect on mating weight, or reproductive performance at first lambing. Spring-Summer nutrition was much more important than Winter nutrition. Regression analysis on this data showed that 83 percent of the variance in twinning rate at first lambing was accounted for by liveweight at mating. Every 10 kg increase in mating weight was associated with a 16 percent increase in twinning rate. The conclusion that must be drawn from this work is that it is the mating weight of the animal that is important, not the way in which it reached this weight. The time of year at which this gain in weight is achieved must be determined by the pasture growth pattern in the area concerned, and the subsequent pasture availability.

It has been demonstrated by Hight and Sinclair (1965, 1967) at the Ruakura Agricultural Research Centre's research station at Manutuke, that the type of pasture hoggets graze in Autumn and early Winter can have a large effect on liveweight gains. Hoggets grazed on white clover dominant, or longer more mature perennial ryegrass pastures, gained more weight than those grazed on shorter, less mature, perennial ryegrass pastures. Hight and Sinclair suggested that the low liveweight gains achieved on the latter pastures probably represented a mild form of hogget 'ill thrift'.

Hogget ill thrift is characterised by a loss of condition, in severe cases to the point of death, even when the quantity of feed available should be sufficient for weight gain to be made. Secondary infections are also common, such as worm infestations and pneumonia. Scouring is also common.

Figure 4.1

Winter and Spring-Summer weight changes in ewe hoggets.



Spelled, leafy, pasture with a high clover content, appears to reduce the likelihood of ill thrift.

The management of hogget grazing is very important. Hoggets are much more sensitive to changes in diet, or other feed stresses, than mature sheep. Hoggets must be shifted immediately they appear to be not gaining weight, and preferably before that time. Most MAF advisory officers are now advocating the use of scales as an accurate guide to hogget thrift, and as an aid to management. The aim of hogget management should be to maximise liveweight by 2th mating within limits of feed availability and cost.

Trace elements have long been cited as the cause of some hogget ill thrift. The two elements on which most work has been done are Cobalt and Selenium. Andrews, Grant and Stephenson (1964) of the Wallaceville Agricultural Research Station, studied weight responses of young sheep to Cobalt and Selenium supplements on the soil types, Kopua silt loam and Dannevirke silt loam. Responses were obtained to both elements, the Cobalt response being the larger. Andrews (1965) stated that a marginal Cobalt deficiency is much more difficult to recognise than more severe Cobalt deficiencies, because of its 'insidious and sporadic nature' Field trials may not reveal any marginal deficiency when carried out in periods or years when the animals are not in a state of Cobalt responsiveness.

Hill, Walker and Taylor (1969) of the Winchmore Irrigation Station treated ewe lambs in the Ashburton county with Selenium and/or Copper, and found that the selenium-treated sheep were heavier, and had higher fleece weights and fecundity, as 2ths, than the non-treated sheep. Copper appeared to have an effect only when used in conjunction with Selenium. In this experiment clinical symptoms of selenium and copper deficiency were not seen in either treated or non-treated sheep. This experiment was carried out on a Lismore silt loam soil type, where there was a record of lamb unthriftiness.

Internal parasites have long been regarded as a serious threat to hogget thrift. Trials at the Winchmore Irrigation Research Station (Walker, 1967) have shown that drenched hoggets gained 2.5 to 4.0 kg more than their undrenched counterparts, over the winter. Other more recent trials in the Wairarapa (Bircham et al. 1972) have shown that drenched animals grow faster over the Autumn and Winter, but that by February, there is little difference in liveweight between drenched and undrenched animals. The authors concluded that there was little value in drenching to try and increase liveweight for the 2th mating. These results were obtained over two seasons, but both were abnormally dry, and it is not known if the results could be repeated in a normal season. They do however indicate that intensive drenching programmes may not be needed in all situations. The authors claimed that the major justification for hogget drenching was in reducing serious hogget ill thrift and mortality during the winter. The drenching of tail-end lines to increase liveweight might be profitable if this brought the liveweight at tupping to over 40 kg. Over the main mob, they said that good grazing management can often maintain hogget thrift and prevent dangerous levels of worm infestations.

Any increase in the liveweight of 2th ewes at mating, brought about by improved hogget nutrition, would appear to increase 2th lambing percentages. When 2th weights are lifted to above 40 kg by improved hogget nutrition, the level of barrenness is reduced, and as they are increased above 40 kg, there is an increase in twinning rate.

4.2.1.2 Effect of ewe liveweight on fertility and fecundity

Wallace (1963) reported on trials carried out at the Ruakura Animal Research Station during 1959 and 1960 to determine the effect of liveweight on the reproductive performance of Romney ewes. Three planes of nutrition were used from mid-December to mid-February, and the effect on the reproductive performance of the ewes is shown below in Table 4.1.

Table 4.1

The effect of level of feeding (mid-December to mid-February) on the reproductive performance of ewes (averages of two seasons).

	High Plane	Medium Plane	Low Plane
Mating weights (kg)	61	55	52
% ewes holding to 1st service	89.4	84.0	79.7
% dry ewes	5.5	6.5	6.1
Av no. of lambs/ewe lambing	1.51	1.34	1.35
% lamb deaths (0-28 days)	13.7	11.2	16.6
Lambing percentage (28 days)	120	107	98

The different feeding treatments had no effect on the onset of the breeding season, but did affect the ease with which ewes got in lamb. In each group, the ewes which returned to service tended to be thinner than average. Those animals which were dry, were in the main very thin ewes of less than, or not much over, 40 kg liveweight. The effect on ovulation rate was also measured and the results are given in Table 4.2.

Table 4.2

Effect of level of feeding (mid-December to mid-February) on the average number of ova produced by ewes killed (average of two seasons).

	High Plane	Medium Plane	Low Plane
Av. no of eggs produced during 2-3 weeks before mating	1.67	1.46	1.32
Av. no of eggs produced during the 1st 2-3 weeks of mating	1.77	1.58	1.53

This work is strongly supported by the work of Coop (1964) at Lincoln College who analysed the records of some 11,000 sheep over a 15 year period. He found that atliveweights above about 40 kg, the incidence of dry ewes was relatively constant, but below this weight, there was a marked increase in barrenness. In both 2th and older ewes, there was a close

relationship between liveweight at mating, and the twinning rate of the ewes that lambed. On average, an extra 10 kg of liveweight was associated with a 13 percent increase in twinning rate. This effect is shown in Figure 4.2. Killeen (1967) in Australia and Allison (1968) at Lincoln College, both reported increases in ovulation rate associated with increased liveweight, but not as great a response as suggested by the work of Coop and Wallace.

Wallace (1963) suggests that a decision has to be made at weaning, as to how feed can be most profitably used. There appears to be no reason why ewes should be deliberately starved after weaning in order to lower their weight, if sufficient feed is available to feed them better. If the feed supply is critical, and ewes have to be restricted after weaning, then the poorer animals should be separated from the others and preferentially fed so as to avoid their losing too much weight and possibly becoming barren.

4.2.1.3 Effect of flushing on fertility and fecundity

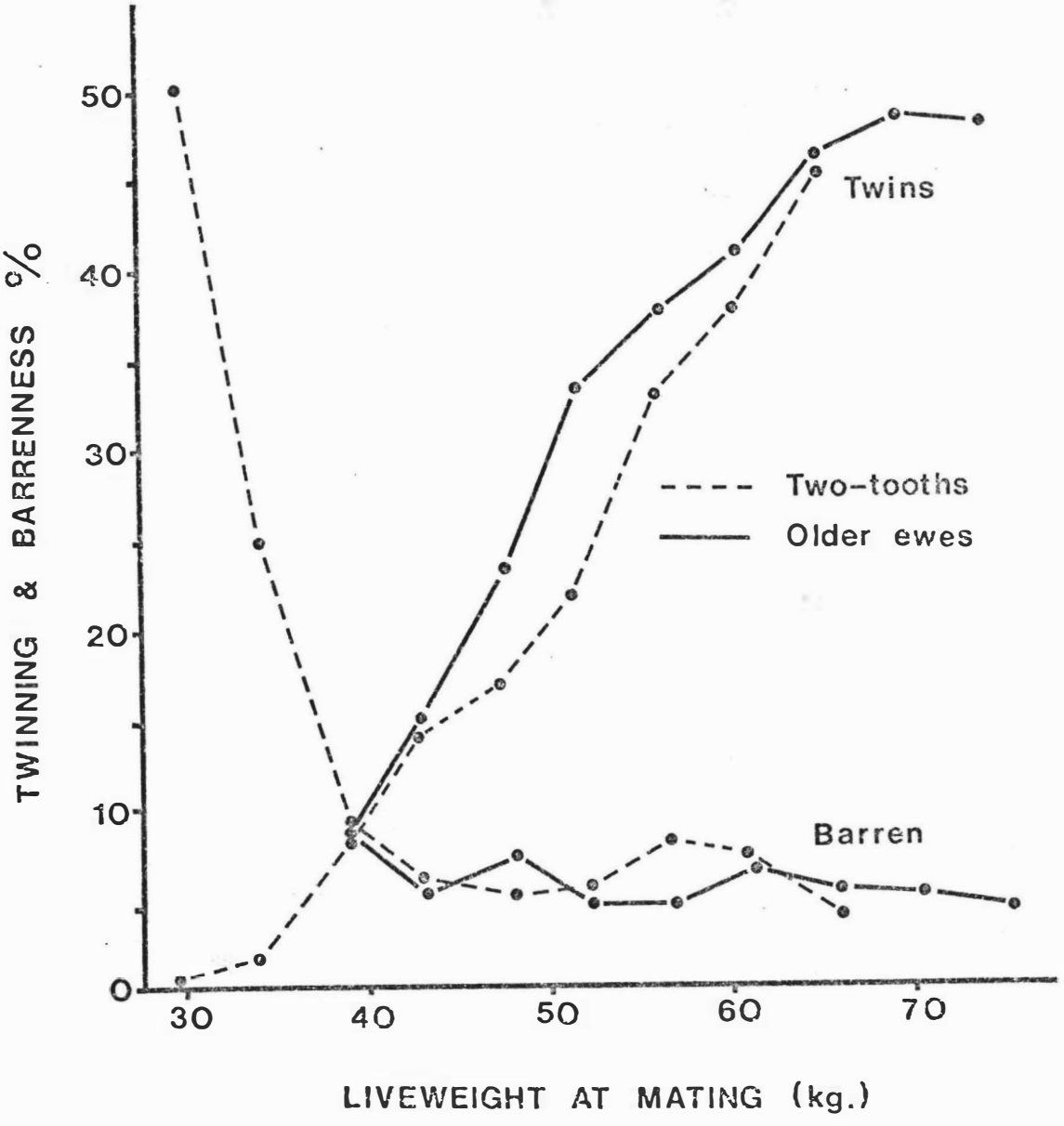
Flushing is the practice of putting ewes onto an improved diet shortly before and during the tupping period, with the objective of raising the lambing percentage.

Wallace (1951) at the Ruakura Animal Research Station was the first to seriously investigate flushing of ewes in this country. Work he carried out in 1949 and 1950 indicated that flushing had no effect in bringing ewes earlier to the ram, and that flushing had the effect of reducing the number of ewes holding to first and second service. Wallace was forced to conclude that flushing made ewes more difficult to get into lamb. However, he also found that flushing increased the percentage of twins. The overall effect was an increase in the number of lambs born, and in final lambing percentage, despite an increase in lamb deaths due to the greater number of twin lambs born. The longer the flushing period, the better were the results obtained.

Coop (1964) in experiments on Lincoln College farms, found that flushing did not appear to reduce the high level of barrenness caused by low condition prior to flushing. He also

Figure 4.2

Relationship between liveweight, barrenness, and twinning.



found that flushing increased the percentage of twins born, and the resultant lambing percentage. Coop (1964) attempted to define the critical period of flushing. His experiments tended to show that nutrition in the three weeks prior to mating was more important than in the first three weeks of mating.

Killeen (1967) in Australia, also concluded that high levels of nutrition during the flushing period increased the ovulation rate in ewes, and that this effect was independent of the effect of liveweight at mating. Coop (1964) suggested that roughly half of most flushing responses could be accounted for by increased liveweight at tupping due to the flushing.

The extent of the flushing response, as measured by Wallace (1951) and Killeen (1967) is discussed below.

Wallace found that a weight differential of five kilograms achieved as a result of flushing resulted in an increase in twinning rate from 13 percent to 27 percent. Coop's work on liveweight indicates that twinning rate should have increased to about 20 percent, due to the increased liveweight. The remainder of the increase in twinning rate must be attributed to the flushing response. Killeen, using Border Leicester-Merino cross ewes, found that an increase in liveweight of 4.6 kilograms, caused by flushing, resulted in an increase in twinning rate from 4.6 percent to 18.8 percent, compared with an expected increase to 10.6 percent if liveweight alone was the effective factor. Both of these results support the suggestion by Coop, that roughly half of most flushing responses can be accounted for by increased liveweight at conception.

4.2.1.4 Pre-tup drenching

The benefits of pre-tup drenching, is a subject widely debated by farmers and farming organisations. The object of administering a pre-tup drench is usually to increase lambing percentages, although it might serve as a means of improving ewe health over the early part of the winter.

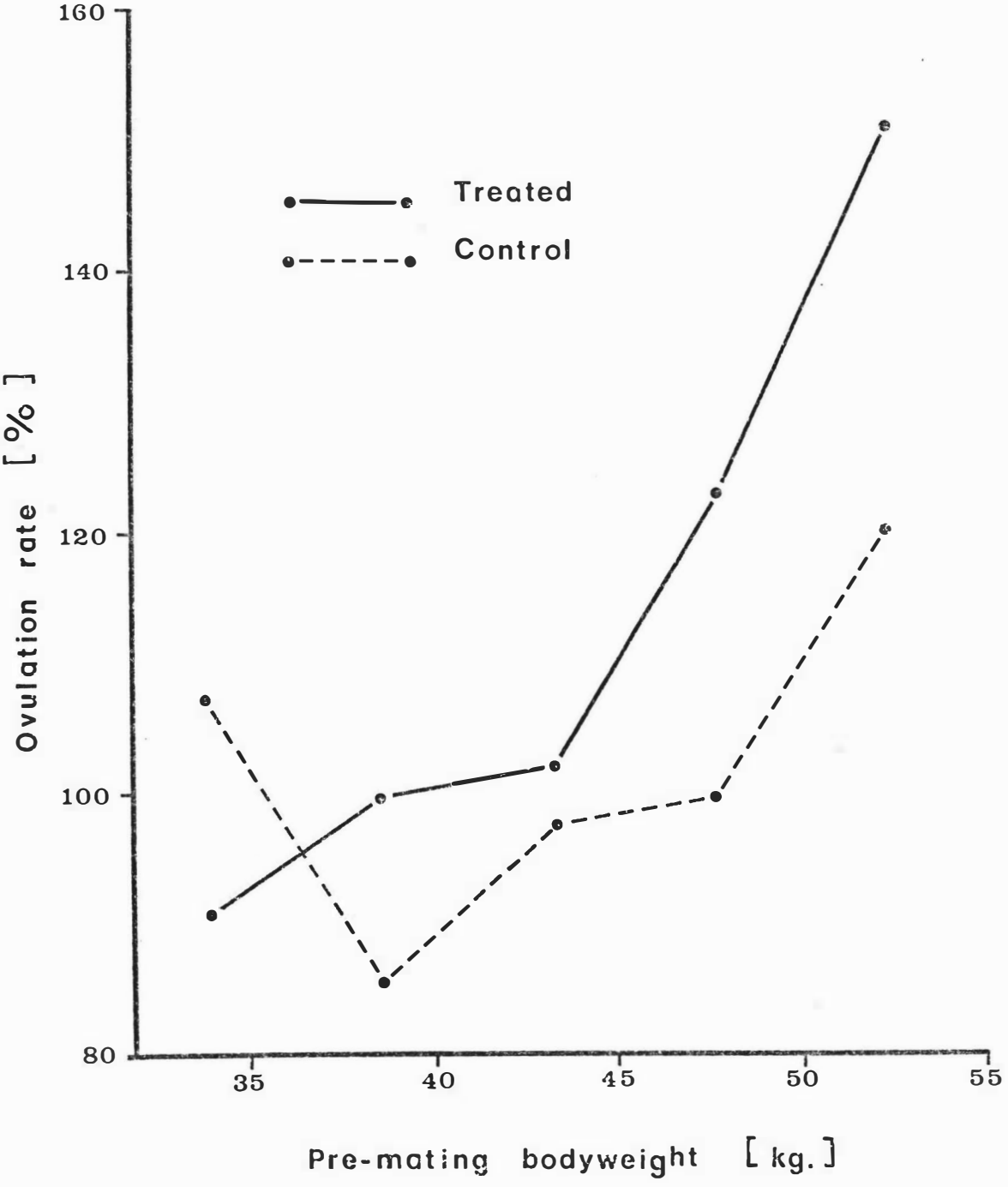
Murray, Leaning and Martin (1971) carried cut a series of trials on stud farms using thiabendazole three weeks prior to mating. They found that the percentage of lambs born, rose by 4.4 in the treated ewes as opposed to the untreated ewes. On individual farms, the increase ranged from -10.9 to 5.9, but there was some suggestion of a clerical error in the figure of -10.9. On average, the percentage of live births increased by 3.2 and the percentage of multiple conceptions, by 3.6. There was no significant treatment effect on the number of barren ewes. Homden, McMullan, Cairns and Leaning (1973) reported on the results of similar trials conducted in commercial flocks. In these trials, the average percentage of lambs born increased by 6.55 in the treated ewes, with a range in individual flocks of -3.5 to 14.4. These workers found a significant ($P < 0.10$) relationship between response to treatment and the proportion of faecal samples showing any nematode eggs. Where the necessary measurements were taken, there was no evidence of liveweight increase, in response to treatment, over the peri-mating period.

Holmden et al. (1973) also reported on work by T D Quinlivan, in which the ovulation rates of 2th ewes were studied following pre-mating treatment with thiabendazole. In this work, ovulation rate appeared to increase more rapidly with increasing body weight, in treated versus untreated ewes. This effect is graphed in Figure 4.3. This work appears to show that lambing percentage is raised by means of an increase in ovulation rate, rather than by some other influence on the reproductive cycle. A minimum weight for 2ths, below which treatment may not be effective, is also indicated.

The only conclusions that can be drawn from work done so far, is that the response to pre-tup drenching is extremely variable, and that the practice may not be justified in all situations.

Figure 4.3.

Relationship between pre-mating bodyweight and ovulation rate in the two-tooth ewe.



4.2.1.5 Ram management

1. Ram nutrition

Bruere (1971) states that rams, like ewes, should be in a forward condition at tupping, and on an increasing plane of nutrition. Pre-tupping worm control is also emphasised. Quinlivan (1963) states that the Romney Marsh Survey noted that the feeding of red clover and lucerne to rams reduced their semen quality. When withdrawn from these feeds, fertility improved. There has been very little work done on plane of nutrition, and specific nutritional effects, in New Zealand.

2. Ram fertility and testing

Work by Fowler and Jenkins (1970) where Merino and Border Leicester-Merino cross ewes were mated in two groups, one with three fertile rams, and the other with two fertile and two infertile rams, showed that in the second group, ten percent of the ewes mated with only infertile rams, and had no chance of pregnancy. Eighty five percent of the ewes mated with at least one infertile ram, and hence had their chances of pregnancy reduced. The conclusion drawn was that had the infertile rams been withdrawn, the lambing percentage would have been higher. The Romney Marsh Survey (Quinlivan, 1963) tested the semen of some 400 rams and recorded the subsequent tupping performance of the rams. They found a direct correlation between semen quality and subsequent performance. Mattner, Braden, and George (1973) gave libido tests to 75 maiden Merino rams, followed by a 48 hour association with ewes in oestrus, and then classified as being inactive (I) or active (A). These rams were then joined with ewe flocks in pairs of either A-A, A-I, or I-I for a period of five weeks. There was no effect on the number of ewes marked by the different ram groupings, but the proportion of marked ewes that lambed was higher in the A-A groups than in the other groups. The proportion of marked ewes that did not lamb as a result of their first marking, was lowest in the A-A groups.

All of these studies indicate the need for some method of testing rams before tupping, to ensure that all rams are fertile and active. Lambourne (1956) reported that there was no evidence to show that the most masculine looking rams were necessarily the most vigourous or most fertile. In two small stud flocks, Edgar (1956) was able to nominate six unsatisfactory rams by means of semen examination and to obtain confirmation of this by their breeding performance.

The final test of a ram's fertility is in his breeding performance, but there are two methods available which can indicate a ram's unsuitability for breeding purposes. The first of these is some form on manual palpation, testing for testicular abnormalities, which can be associated with either physical defects or disease. The most common disease affecting fertility which can be detected in this manner is epididymitis, caused by the Brucella ovis organism. Semen examination is a more rigourous form of ram testing. It can be used both to detect the presence of Brucella organisms and to assess semen quality. It is possible for the semen of a ram to improve or deteriorate in quality, but since most rams test consistently, it is better to use one which has given a good semen sample, than one which might improve.

The concept of compensating for infertile rams by using greater numbers can be dangerous as well as inefficient. If the infertility is caused by a contagious disease such as Brucella, then this can be spread to other animals.

3. Percentage of rams used

Edgar (1965) reported, that in seven trials conducted to measure the effect of ram percentage, there was no significant difference in the number of lambs docked when ewes were mated with one, two or three percent of rams. These results prompted the conclusion that one percent of rams could be safely relied upon, provided that all rams were active and fertile. Dawe et al. (1970) in Australia, also found little difference in the number of ewes mated or the number of dry ewes, where one or three percent of rams were used.

Allison (1972) ran ewes with two, one, and two-thirds of one percent of rams, and found no effect on conception rate.

4. Age of rams

McMeniman and Beasley (1970) found no difference in lambing percentage caused by using maiden or older rams. The older rams served more ewes in the first six days of mating, but subsequently there was no difference. More of the ewes mated to older rams returned to service. This experiment was carried out at a ram/ewe ratio of 1/27 and the authors stated that an advantage to the older rams may be more evident at lower ratios than this. Croker and Lindsay (1972) found that young (18 month) rams were less efficient at mating than older rams. They did not mate with as many of the oestrous ewes, especially when mated at low percentages (1.2%). In the groups with younger rams, more ewes were mated with only one or two rams.

5. Dominance of rams

Mattner et al. (1967) stated that dominance of one ram over another was associated with size or aggressiveness rather than sexual vigour. They found that dominance was clearly established soon after the introduction of the rams into the flock and thereafter the subordinate ram avoided contact with the dominant ram, and was rarely molested. Where two rams were present in a flock of 200 ewes, only the dominant one had a harem, and the rate of service of the subordinate ram was not affected by the presence of the dominant ram. It was only when the rams were in close proximity, that the performance of the subordinate ram was affected.

4.2.2 Tupping management

4.2.2.1 Factors affecting the onset of the breeding season

McDonald (1971) stated that all breeds of sheep in New Zealand showed a well defined season within which they will breed. However, there is wide variation between breeds in the length

of the breeding season. Breeds such as the Corriedale, Polled Dorset, Dorset Horn, and Polwarth, breed over a longer period than the Romney, Perendale, Cheviot, Coopworth or Border Leicester. The Merino has an even longer breeding season.

Within a breed, the light/dark ratio is the primary factor responsible for the onset of the breeding season (Yeates, 1949, Hafez, 1952). Temperature may modify this photoperiodic effect, but the level of nutrition will not have any effect, except where there is severe undernutrition.

Edgar (1965) showed that the breeding season of Romney ewes could be advanced by joining ewes with rams prior to the onset of oestrus. The mean data of onset of the breeding season was advanced by ten days, as a result of joining the rams twenty days earlier. Edgar's results are shown in Figure 4.4.

In a second experiment, reported by Edgar (1965), the breeding season was progressively advanced in ewes joined in late January, compared with those joined in February, and those joined in early March. Coop and Clark (1968) in the South Island, found that the breeding season of Corriedale and Romney ewes could be advanced by ten to fifteen days by running rams with ewes before the breeding season.

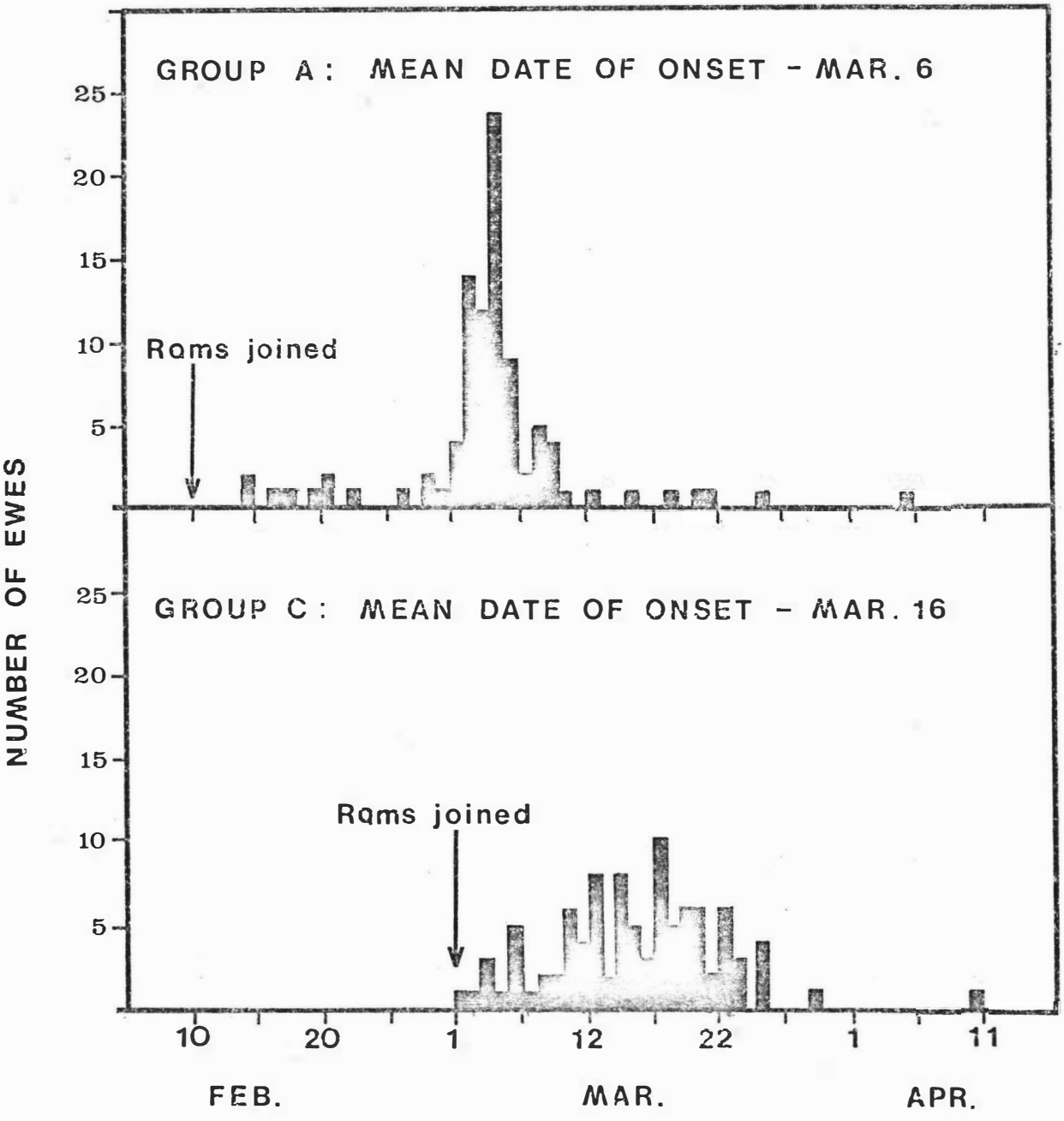
4.2.2.2 Timing of mating within the breeding season

Reeve and Robinson (1953) stated that the average number of births per ewe rises until the middle of the mating season, and then declines. They stated that, although there are differences between breeds and regions in this characteristic, the maximum rate of twinning is in the middle rather than the start of the breeding season. McDonald and Ch'ang (1966) counted the number of corpora lutea formed after each oestrus in Romney ewes, and determined the following mean numbers of ova shed at the first three ovulations.

ovulation 1	1.71 ± 0.06 ova
ovulation 2	1.85 ± 0.05 ova
ovulation 3	1.88 ± 0.05 ova

Figure 4.4

Effect of time of joining the rams on the onset of the breeding season in ewes



Over the period of study, liveweight remained practically constant. Quinlivan and Martin (1969) found a significant linear decrease in the incidence of ewes which returned to service, with later time of mating. Of the ewes which did not return to service, more of those mated near the end of the breeding season, than those mated earlier, proved to be barren. Because of the greater number of ewes which returned to service at the beginning of the mating season, there was a significant linear increase in the total number of lambs born per ewe mated. Significantly more lambs died from those ewes mated earlier in the breeding season, than from those mated later. Quinlivan and Martin were led to the conclusion that a period of 'maximum reproductive efficiency' occurs within the breeding season, characterised by a maximum oestrous response, minimum return to service and incidence of barren ewes, maximum lamb drop, and minimum lamb losses.

4.2.2.3 Duration of the tupping period

Quinlivan (1963), studying mating periods from 52 to 125 days in Romney flocks found that the longer the mating period, the higher the lambing percentage. However, he noted that as the lambing period was extended, the number of small, late lambs became a problem. Quinlivan stated that a tupping period of about 80 days appeared to be optimal. Martin (1967) showed in Romney flocks that 90 percent of lambs were born in the first six weeks of lambing, and the other 10 percent were spread out over later dates. Late-born lambs tended to be the poorer ones. Martin advocated the replacement of breed-type rams with those of a fat-lamb sire after six weeks, to ensure that none of the progeny of ewes mated after this time entered the flock, and to aid late lamb growth and saleability.

4.2.2.4 Syncronisation of oestrus

The presence of rams before the onset of oestrus in the ewe flock, will not only advance the breeding season (Edgar, 1965) but will also cause a large number of ewes to come into oestrus during a relatively short period. This effect is evident in Figure 4.4.

Coop and Clark (1968) in Canterbury and Southland, using ram-induced syncronisation, achieved the following results, with Romney and Corriedale ewes.

1. 80 percent of ewes mated in a six day period
2. 55-66 percent of ewes lambing in one week
3. 12 percent of ewes lambing on one day (predictable to within two days).

McMeniman and Beasley (1970), when mating rams with teased and unteased maiden ewes, reported no effect on the number of ewes mated or on the lambing percentage. The major advantage of syncronisation was to confine lambing to a shorter period.

The effect of syncronisation lasts for several oestrous periods (Cairney, 1966a), and therefore mating need not be carried out at the first syncronised oestrus of the season, but can be delayed to the second or third oestrus, when ovulation rates are higher.

4.2.2.5 Two-tooth management at mating

Lambourne (1956) at Ruakura, studied the effect of age on the mating behaviour of ewes and obtained the results in Table 4.3.

Table 4.3

Effect of ewe's age on mating behaviour

	Age of ewe		
	2-tooth	4-tooth	older
Number of times mated	1.9 (1-5)	4.3 (1-10)	4.3 (2-8)
Number of rams mating with each ewe	1.3	1.7	2.6
Interval between first and last mating (hours)	3.3 (1-6)	6.8 (1-22)	15.0 (2-23)

The table clearly shows that two-tooth ewes are mated fewer times in an oestrous period, are mated by fewer rams, and are in oestrous for a shorter period of time, than older ewes.

Inkster (1956) ran both two-tooth and mature ewes under intensive (150 ewes on 29 acres, mustered frequently) and extensive (150 ewes on 105 acres, and left alone) conditions, and recorded the percentages of ewes that were dry, and the average lambing date. The results are shown in Table 4.4.

Table 4.4

Effect of management during tupping on lambing percentage.

		Intensive group	Extensive group
% Dry ewes	Two-tooths	27.4	48.9
	Mature ewes	24.7	19.6
Av. lambing date	Two-tooths	9 Sept	14 Sept
	Mature ewes	8 Sept	9 Sept

The conclusion was drawn that under the intensive system of management, more two-tooths met, and were served by, the rams early in the tupping season, than under the extensive system. Hence, there were less dry ewes and a more concentrated lambing. No such effect was apparent in mature ewes. This is in accord with the findings of Lambourne (1956).

Inkster made the following recommendations:

1. Run two-tooths separately from mature ewes at tupping
2. Select smaller easier paddocks for two-tooth tupping
3. Muster two-tooths frequently at tupping.

McClure (1960) reported on trials done by Inkster in 1958 and 1959 to determine the effect of pre-tup shearing on two-tooth lambing performance. The results achieved in these trials are shown in Tables 4.5 and 4.6.

Table 4.5

Lambing performance of two-tooth ewes (Waikeria 1958 and 1959)

	1958		1959	
	Shorn	Unshorn	Shorn	Unshorn
% rearing lambs (to docking)	82	60	86	70
% losing lambs	12	17	6	6
% ewes lambing	94	77	92	76
% failing to lamb	6	23	8	24

Table 4.6

Lambing performance of two-tooth ewes (Ruakura Out-station, 1959).

	Shorn	Unshorn
% of ewes lambing	93	90
% lambs born	100	96
% lambs alive at three days	84	74
Lambing percentage (lambs alive at 28 days)	84	72

Tomaszewska and Dobbie (1967) reported on trials on two-tooth shearing from 1964 to 1966, and concluded that the pre-tup shearing of two-tooth ewes in the weight range 45 to 50 kg will raise lambing percentages if plenty of good feed is available after shearing. Shearing is unlikely to increase the lambing percentage of two-tooths below 40 kg or above 55 kg. Irrespective of whether two-tooths are small, medium or large, if feed is in short supply, or of poor quality, then pre-tup shearing can decrease lambing percentages.

4.2.3 Management from tupping to lambing

4.2.3.1 Nutrition of ewes

Most of the research carried out on the nutrition of ewes from tupping to lambing suggests that there is negligible effect in restricting the diet of ewes early in pregnancy. Quinlivan (1964) reported that, in four-tooth ewes which had lambed as two-tooths and conceived to first service as four tooths, 23 percent of fertilised ova present after mating could not be accounted for immediately prior to birth. He also found that ewes gaining weight after mating lost no

less embryos than those losing weight over this period. Quinlivan et al. (1966) found that the period of greatest pre-natal mortality in four-tooth ewes not returning to service, was the first thirty days of pregnancy. After 30 days, 22 percent of fertilised ova were unaccounted for in ewes which had lambed as two-tooths, and 16.6 percent in those not lambing as two-tooths. The period of maximum loss appeared to be immediately prior to the 18th day of pregnancy. Losses from abortion or mummification after this period were 1.3 to 5.3 percent in the two groups respectively. Similar results were obtained with ewes conceiving to second or third service. Mattner and Braden (1967) also noted that losses of fertilised ova and embryos was high, especially where ovulation rates were high. Killeen (1967) also noted higher losses of ova from multiple ovulation than single ovulation ewes. He found that the level of nutrition at this time had no effect on reproductive performance. McDonald (1969) stated that stress or underfeeding would have to be extreme before there was any noticeable effect on embryonic mortality, and that it was extremely doubtful that any management practice implemented by a farmer would reduce these losses. Coop and Clark (1969) restricted the nutrition of ewes from two to seven weeks after tupping, for periods of five to eight weeks, and found no effect on reproductive performance.

In contrast, the last month of pregnancy is a very important period in ewe feeding, and there are a number of conditions resulting from incorrect feeding over this period, which will lead to reduced lambing percentages. These are:

1. Pregnancy toxaemia
2. Hypocalcaemia
3. Birth of very large lambs
4. Birth of very small lambs

1. Pregnancy toxaemia (sleepy sickness)[1]

This is a common disease of pregnant ewes, often resulting from over-feeding in early pregnancy, and subsequent under-feeding in late pregnancy. Those ewes carrying twins or large single lambs are most prone to the disease, and it is less common in younger sheep. Without treatment, the disease is usually fatal, but ewes can recover if treated early enough. Prevention consists of avoiding feed shortages in late pregnancy by restricting feed intake early in pregnancy, and saving feed so as to provide an increasing level of feeding over the last six weeks of pregnancy.

2. Hypocalcaemia (milk fever)[1]

This disease can occur from six weeks before, to six weeks after, lambing and is caused by a sudden fall in blood calcium levels. Predisposing factors are sudden stresses or checks in feeding, or sudden changes to lush feed. Treatment is by dosing with calcium borogluconate. In about fifty percent of cases, ewes which have had milk fever will have dead lambs. Prevention consists of avoiding checks or sudden changes in feed.

3. Birth of very large lambs

This condition leads to lambing difficulties especially in maiden ewes. Many large lambs die, either at birth or shortly after, as a result of rupture of the liver and internal haemorrhage. Death of ewes is also common if shepherding is not intensive. The overfeeding of ewes carrying single foetuses, in late pregnancy, should be avoided in order to reduce these losses. A later section on lamb mortality covers this topic more fully.

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1. from: 'The New Zealand Farmers' Veterinary Guide' published by The NZ Dairy Exporter, Wellington.

4. Birth of very small lambs

Under-nutrition in late pregnancy can lead to the birth of small weak lambs, especially where ewes are carrying twin foetuses. These lambs have a reduced chance of survival, especially in bad weather (Hight and Jury, 1969). This topic is also more fully covered in a later section on lamb mortality.

Cairney (1964, 1966b), Hight (1968) and Hight and Jury (1969) all advocate a policy of saving feed early in pregnancy in order to provide a controlled, rising plane of nutrition in late pregnancy, as a means of overcoming most of these difficulties. Dividing the flock in early and late lambers is a further step towards providing optimal feeding during late pregnancy. The most positive way of doing this is by running harnessed rams with the ewes at tupping, and dividing the flock on the basis of tupping date. In the absence of such information, visual division of the flock on the basis of udder development in late pregnancy, can be useful. It would be very advantageous to be able to divide the flock on the basis of the number of foetuses carried, but at present no commercially useful system is available for determining this information. Such a division of the flock would allow the differential feeding of single and twin bearing ewes.

4.2.3.2 Pre-lamb drenching

The object of pre-lamb drenching is to control the rise in parasite egg output which occurs six to eight weeks after the start of lambing. Brunsdon (1971) stated that this 'post-parturient rise' in parasite egg output is associated with lactation rather than pregnancy and parturition. The rise appears to be triggered by some hormonal or physiological change but may be modified by other stress factors such as nutrition. Brunsdon suggested that the inconsistent response obtained to prelamb drenching can be attributed to variations in the level of the post-parturient rise and the composition of the infection present, and concluded that pre-lamb drenching is not justified in all situations. Cairns

(1971) reported on work done in the Wairarapa, where pre-lamb drenching resulted in an improvement in wool quality, and a corrected 100 day lamb weight advantage of 1.1 kg. Cairns explained this in terms of an improvement in the thrift of the ewe during the stress period of lambing and early lactation, resulting in an improvement in milking ability. He also concluded that the response would vary from year to year, and from district to district.

4.2.3.3 Pre-lamb shearing

The practice of shearing ewes prior to lambing is not widespread, except in the special case of in-lamb hoggets. One argument for pre-lamb shearing is that shorn ewes will seek shelter more readily at lambing, increasing lamb survival in bad weather, (Frengley 1964). This argument is not widely accepted. Frengley noted other management advantages of pre-lamb shearing not related to lambing percentage, but these are outside the scope of this study. Pre-lamb shearing can increase the likelihood of milk fever, especially if a ready supply of good feed is not available immediately after shearing. Pre-lamb shearing is also dangerous from the point of view of ewe losses. A severe storm shortly after shearing could result in a number of deaths.

4.2.4 Lambing management

4.2.4.1 Introduction

The only way in which lambing management can affect lambing percentages is through the loss of either ewes or lambs up until the time lambing percentage is calculated. Ewe losses can result from incorrect feeding or disease, and lamb losses can result from abortion, difficult births, starvation or disease. Regardless of management, there is a proportion of lambs that will not survive up to weaning, (McDonald, 1969). The magnitude of the proportion that does not survive is dependent on a number of factors, weather being one of the most important. No one can predict at mating, the weather that will prevail at lambing, but the later the lambing, the lower the probability of bad weather.

4.2.4.2 Condensation of lambing

Condensation of lambing, through syncronisation, can reduce losses if the weather at the peak of lambing is good, but if the weather is bad, then losses can be high. A more prolonged lambing will minimise losses in a particular storm, but will increase the probability of a storm during the lambing period. Without syncronisation, losses will be more regular and seldom very high, whereas with syncronisation, they will be more variable. Another alternative is to split the flock into two or more groups and syncronise each group to lamb at different times. This results in more than one lambing peak, and normally, not all of these peaks would be affected by bad weather. In the Wairarapa, farmers can usually count on at least one spell of bad weather over the lambing period, and if this coincides with a period of concentrated lambing, losses will be high.

Losses from the weather are difficult to reduce, but Hight and Jury (1969) showed that, even in reasonable weather, lamb losses can be very high. It is these losses, not directly associated with the weather, that are more easily influenced by management.

4.2.4.3 Nutrition

Hight and Jury (1969), over a period of nine years, analysed lamb deaths on Romney and Border Leicester-Romney cross flocks, and the results are shown in Tables 4.7 and 4.8.

Table 4.7

Cause-of-death analysis.

		% of deaths	
Cause of death	total	singles	multiples
Dystokia	32.3%	44.6%	16.0%
Starvation	26.5	15.1	41.7
Infections	11.6		
Uterine deaths	10.3		
Abnormalities	1.4		
Misadventure	3.9		
Undiagnosed	14.0		

Table 4.8

Time-of-death analysis.

Time of death	% of deaths Singles	Multiples	Total
At birth	37%	20%	
1-3 days	19	32	
4-7 days	5	6	
8 days - weaning	13	18	
Unknown			23

In the study, 17.8% of lambs born were dead, missing or fostered, before weaning.

Hight and Jury studied the relationship between birth weight and lamb survival in the above flocks, and derived the following optimal birth weights to minimise lamb losses.

singles 3.9-5.0 kg
multiples 3.2-4.5 kg

Ideally, ewes should be fed so as to achieve these birth-weights, but with no reliable, commercial, method of detecting whether or not a ewe will have twins, this is not possible.

4.2.4.4 Disease

Most of the diseases causing lamb deaths can be controlled by vaccination. The most important diseases affecting lamb survival are, Pulpy kidney, Tetanus, Blackleg, Malignant oedema, and Navel infections. Since it is virtually impossible to vaccinate the lambs directly, before docking, the most effective way of dealing with these diseases is by vaccination of the ewe. There are a number of commercial vaccines now available, either for individual diseases, or combinations of diseases, and advice on how to use them is readily available.

Mineral defficiency diseases can be a problem in some areas, the most common problems being with Selenium, Cobalt, or Iodine. Diagnosis of these defficiencies is not difficult

and remedial treatment is usually cheap and easy. The most significant mineral defficiency in the Wairarapa is of Selenium. There are some areas where Selenium levels are marginal, but this is easily remedied by the administration of Selenium in the usual sheep drenching programme. The additional cost involved is very small.

4.2.4.5 Shepherding

There are two methods of shepherding that can be used to reduce lamb losses caused by dystokia and starvation. The first is a system of intensive shepherding at lambing, and the second is a system of no shepherding at lambing.

The success of the first method is very dependent on shepherding skill. Unnecessary or careless shepherding can cause some lamb losses. This approach involves the finding of ewes which are in trouble at lambing, and taking measures to correct this. Ewes which are having difficulty delivering their lambs are aided, and lambs which are mis-mothered or weak are artificially reared or mothered onto ewes which have lost lambs. This approach can involve a great deal of time, and the cost of setting up pens or sheds for mothering up.

The alternative method, of not shepherding, is becoming popular, especially on harder or less accessible country. There are two main arguments in favour of this approach. The first is that shepherding, in itself, causes problems. Lambing ewes are distrubed, and more likely to leave their lambs, causing mis-mothering problems. The second is that lambing difficulties and poor mothering ability can be bred out of a flock much more easily by not shepherding at lambing. Those ewes with small pelvic dimensions, or other factors predisposing to difficult births, are eliminated from the flock by a process of natural selection, as are their progeny. Similarly, those ewes which have poor maternal instincts and lose their lambs, show as wet-dries and can be culled. The aim is to breed an 'easy-care' sheep, which does not require intensive shepherding to maintain low lamb

losses. The effect of not shepherding at lambing is long term, and because of this, research into the best intensity of shepherding to reduce losses is very difficult.

4.2.4.6 Post-lambing nutrition

Any effect of post-lambing nutrition on lambing percentage is likely to be small, unless extreme stress is placed on the animals. The main effect of nutrition at this time is on lamb growth rate, through both milk yield, and feed available directly to the lamb. Coop, Clark and Claro (1972) showed that if ewes were in good condition, and adequately fed up to lambing, and were then restricted for periods of up to three weeks, there was very little effect on lamb growth rate up to weaning. There was however a larger effect on twin than single lambs.

4.3 Breeding management

4.3.1 Selection of replacement stock

The selection of replacement ewes and rams has to be carried out each year, and the effectiveness of this selection is very important in controlling the productivity of the flock. Selection for increased lambing percentage is more difficult than for some other productive characteristics, since no direct measure of lambing percentage can be made before selection. There are, however, a number of measurable characteristics, related to potential lambing percentage, which can be used as the basis of selection. Lambing percentage is also a heritable characteristic (Rae and Ch'ang, 1955) and selection can be carried out on the basis of the lambing percentages of dam and granddam.

4.3.1.1 Selection of replacement ewes

The extent of selection of replacement ewes is very dependent on the present lambing percentage of the flock, the degree of culling, and the death rate. A low lambing percentage, a high death rate or culling rate, or an early culling age, reduces the number of ewe hoggets from which replacements can be selected, or increases the number of replacements

needed. As the lambing percentage of the flock increases, the degree of selection pressure that can be applied to increase lambing percentage and other desirable (productive) characteristics, can be increased. This results in higher possible rates of gain from selection, provided that the variability of the population being selected from does not decrease. Where little selection can be done, due either to limited numbers from which to select, or the need for many replacements, then the rate of gain will be correspondingly low.

Assuming there are some possibilities for selection, the difficulty lies in choosing the basis of selection or culling. Ewe lambs with obvious physical faults should be culled immediately. Ewes with undershot or overshot jaws, or other deformities, are of no value for breeding purposes. The possibilities for selecting for increased lambing percentage are much more limited on commercial sheep farms than on stud farms. On stud farms, the records of individual animals are available, and can be used to determine a 'productivity index' such as that suggested by Rae (1963). In commercial flocks, the farmer tries to group animals of different potential lambing percentage, and selection must be between groups, rather than individual animals. There are several ways of achieving these groupings. There are:-

1. Weight
2. Birth rank
3. Hogget oestrus or lambing
4. Other characteristics, eg. face cover
5. Replacements from 'elite' flock.

1. Weight

Selection on the basis of estimated liveweight is probably the most widely used method of selecting replacement ewes. Estimates of the heritability of weaning weight in the NZ Romney ewe range from 0.23 to 0.35 (Ch'ang and Rae, 1961). Assuming that weaning weight is positively correlated with two-tooth and mature liveweight, there would appear to be

value in selecting hoggets on the basis of liveweight, as a method of increasing future fertility.

2. Birth rank

Rae and Ch'ang (1955) estimated the heritability of 'number of lambs reared' in the NZ Romney ewe as being between zero to 0.15, which is in agreement with most overseas estimates (Reeve and Robertson, 1953). Wallace (1958) however, showed a worthwhile response to selection for this characteristic. Rae and Ch'ang (1955) found an increase in lambing percentage of 9.45% where ewes were born as twins as opposed to singles. Wallace (1958) selected replacement Romney ewes on the twinning record of their dams, over a period of ten years, and came to the following conclusions:-

(a) The lambing percentage, of those ewes which lambed, was appreciably higher in the 'high fertility' flock, than in the other flocks. The differences were greater in the second five years of the experiment, than in the first five years, indicating that some progress in selection had been made.

(c) The mortality of lambs was highest in the 'high fertility' flock. This was thought to be due to the high incidence of twinning in this group.

(d) In the two-tooth ewes, the 'effective' lambing percentage, based on lambs alive after 28 days, and total ewes mated, was lowest in the 'high fertility' flock. This was due to the high proportion of dry two-tooths, and the high lamb mortality. In all other age groups, the effective lambing percentage in the 'high fertility' flock, was higher than in the other flocks.

The marking of lambs born as twins serves a double purpose. Firstly, it allows the direct selection of these lambs into the flock, and secondly, allowances can be made, in both hogget weight and two-tooth performance, for lambs born as twins. In hard conditions, ewes born as twins may be of

lower weight at two-tooth tupping, and if not identified, negative selection for birth rank could easily occur.

3. Hogget oestrus or lambing

Liveweight is often considered a measure of sexual maturity, for the purpose of selecting replacement ewes, but there is a more direct method of measuring this. This is by recording sexual activity in the hogget, prior to its being selected. Ch'ang (1967) recorded the incidence of hogget oestrus in the Romney breed, and then studied subsequent lambing performance. The results are shown in Table 4.9.

Table 4.9

Relationship between number of hogget oestruses and subsequent lambing performance.

Number of hogget oestruses	Two-tooth lambing %	Average % 1st 3 lambings
0	73	95
1	89	111
2	91	114
3	101	112
4	109	123
5+	102	120

The above lambing percentages were based on the number of lambs born per 100 ewes mated.

Table 4.10 shows the relationship between lambing percentage and October hogget liveweight, for the same animals.

Table 4.10

Relationship between lambing percentage and October hogget liveweight.

October liveweight (kg)	Two-tooth lambing %	Average % 1st 3 lambings
≤ 31.8	71	100
31.9-36.3	80	98
36.4-40.8	89	111
40.9-45.4	106	118
≥ 45.5	112	128

Hight (1968) ran Romney and Border Leicester-Romney cross hoggets with harnessed, vasectomised rams, and showed an increase of 23% in the numbers of lambs produced by two-tooths which had shown oestrus as hoggets, as opposed to those which had not. This trial involved 703 animals over two years.

The measurement of sexual activity in the hogget is not a difficult procedure. There are two approaches that can be used. The first is to run the ewe hoggets with harnessed, vasectomised rams, and to separate out those hoggets which have been marked. If one wanted to measure the number of oestrus periods, then a regular change of crayon colour in the harness would be necessary. The second approach is to mate hoggets with entire rams, and to select on the basis of hogget lambing performance. This latter method has the added attraction of increasing the number of lambs born in a flock of fixed numbers, thus increasing returns per ewe. Allison (1973) showed a depression of 0.2 lambs per ewe mated, for two-tooth Romney and BLX ewes which were mated as hoggets, but also showed, that over the ewe's lifetime, those mated as hoggets produced 0.8 more lambs. Allison suggested this depression in two-tooth lambing performance might be allieviated by early weaning and additional feeding of hoggets which have lambed.

In order to be able to select animals on the basis of hogget oestrus or liveweight, it is necessary that all ewe hoggets are treated the same, so that differences between animals reflect inherent differences rather than environmental differences. A complicating factor here is the effect of the lower liveweight, and corresponding lower maturity, of hoggets born as twins.

4. Other characteristics (face cover)

Inkster (1958) reported a relationship between the extent of facial wool cover and twinning rate in Romney ewes. Table 4.11 shows the incidence of multiple births, as a percentage of ewes mated, for ewes of different face cover characteristics, in flocks selected for and against fertility, at Ruakura.

Table 4.11

Incidence of multiple births in ewes with differing facial wool cover (multiple births/ewes mated)

	very covered	covered	slightly covered	open
Low fertility flock	8.6	11.2	11.9	15.8
Control flock	10.5	10.4	16.9	18.2
High fertility flock	19.0	30.6	32.2	33.3
All flocks	11.6	16.5	23.0	25.2

In each flock, the incidence of twinning increased with decreasing facial cover. The conclusion drawn was that regardless of fertility strain, the open faced sheep in the strain are the most fertile.

Quinlivan (1963) surveyed a number of stud and commercial properties and studied the lambing percentages of Romney ewes with differing face cover characteristics. The results, shown in Table 4.12, reveal a similar situation as that disclosed by Inkster.

Table 4.12

Relationship between fertility and face cover grade

	Open faced	Medium face cover	Woolly faced
Stud sheep			
Lambing percentage	104	98	96
Total dry ewes (%)	16	13	12
Flock sheep			
Lambing percentage	112	102	100
Total dry ewes (%)	11	12	13

Face cover is a characteristic which can be selected for in rams as well as ewes, and the selection of rams with reduced face cover is the quickest way of reducing the average face cover of the flock.

5. Replacements from 'elite' flock

There is one further form of ewe selection, which can be used to raise the fertility of a flock. . This is the selection of 'above average' performers from within the ewe flock, and the forming of an 'elite' flock. This is an approach used extensively by ram breeders, both in the stud industry, and in group breeding schemes. In the commercial situation, ewes which produce twins are identified, and if they produce twins again the following year, then they enter the 'elite' flock where they are mated with 'top' rams to rapidly improve the productivity of the flock. The progeny of these ewes must prove themselves in order to remain in the elite flock. Where the supply of rams with a known high fertility background is limited, this system allows the most efficient use of these rams, by mating them with the top producing ewes. The problems of marking ewes producing twins, are much the same as those encountered in marking twin lambs, but marking can often initially be limited to two-tooth ewes, and their performance followed in later years.

4.3.1.2 Selection of rams

The influence of one ram with a high fertility background, can be imparted to upward of a hundred offspring in a single year and hence affect the performance of fifty replacement ewes for each year he is used. Thus selection of rams is potentially the quickest and most efficient way of improving productivity in a flock, through breeding. Because a single ram can have such a significant effect on future flock productivity, a great deal of care should be taken with ram selection.

Four main ram sources are available to farmers:-

1. Registered rams from stud flocks
2. Nonregistered rams from stud or commercial flocks
3. Rams from group breeding schemes
4. Rams of the farmer's own breeding.

The most useful information that a farmer can have to aid his selection is information on the performance of the dams of the rams available. Most breeders now use a system whereby they rate animals in terms of the performance of the ram's dam and granddam, and a number of ram variables, such as weaning weight, wool weight, and wool quality. The precise rating system, or the weights placed on different characteristics, can vary between breeders, and a buyer must decide if the rating system used suits his requirements. Financial limitations must also be considered. In general, the higher a ram's rating, the higher his price. Other factors such as reasonable conformation and physical soundness must be considered, but performance must be the ultimate selection criterion.

The buying of nonregistered rams from stud or commercial farmers can be a risky investment, as adequate, accurate, records for these animals are often not available. The breeding of one's own rams, has advantages in that one is certain of the rams fertility background, but the rate of genetic progress tends to be slow. Money saved by breeding ones' own rams may be more than offset by a reduction in the rate of increase in flock production characteristics.

4.3.2 Selection of culled stock

The counterpart of selecting stock for replacement in a breeding flock is the selection of stock to be culled. Where the overall objective is to increase the productivity of a flock, the aim will be to identify those ewes whose current performance is poor and whose progeny will be of low productivity. Decisions as to the extent of culling will depend on a number of factors, including the stage of development of the farm, the present productivity of the flock, the economic climate, and the particular farm management system being used.

4.3.2.1 Culling of dry/dry two-tooth ewes

The most important culling decisions have to be made with respect to the two-tooth ewe, since this is the age group most prone to barrenness. There have been conflicing reports

on the extent to which barrenness as a two-tooth is repeatable at subsequent lambings. Edgar (1958) found that dry two-tooths are just as likely to lamb as four-tooths, as two-tooths rearing lambs, while Barton (1947) and Wallace (1958) found that the performance of four-tooths, dry as two-tooths was poorer than that of four-tooths, wet as two-tooths. Wallace suggested that the reason for the apparent conflict lay in the cause of the barrenness. He distinguished three types of infertility in two-tooth ewes. Firstly, there was absolute infertility, in which case the ewe would never produce a lamb, secondly, there was inherent poor fertility, in which case dry two-tooths would always perform poorer than those lambing as two-tooths, and thirdly, there was temporary infertility. Where the proportion of dry two-tooths is high, temporary infertility is often the cause, and environmental and management factors are often at fault. Where two-tooths are poorly grown, there is likely to be a high degree of temporary infertility, especially where many of the two-tooths are born and reared as twins. Many of these ewes have high inherent fertility, but the expression of this has been limited by their stage of development. Where the proportion of dry two-tooths is low, there is likely to be little temporary infertility, and most of the barrenness will be the result of absolute infertility or inherent poor fertility.

The different types of two-tooth infertility must be considered when formulating a culling policy. The identification of all dry two-tooths, even if they are not culled, allows checks to be made on their subsequent performance. Where two-tooths are poorly grown, and a high proportion are dry, alternative policies could be to cull none, or to cull those born as singles rather than those born as twins. The latter would be dependent on the marking of twin lambs at lambing. Where two-tooths are well grown, and the proportion dry is small, consideration should be given to the policy of culling all dries, since most will be either absolutely infertile, or of inherent poor fertility.

Another possibility is to run ewes, dry as two-tooths, with a fat lamb sire in the following year, so that no progeny

will enter the flock. This could be especially useful where farmers are trying to keep up numbers for development purposes. Ewes which produced twins, or perhaps even singles, would be eligible to re-enter the breeding flock in the following year. The main problem with this course of action is that the number of replacement ewe lambs will be reduced, thus reducing the potential for selection.

4.3.2.2 Culling of older dry/dry ewes

Rae (1963) suggested that if a dry two-tooth is dry again as a four-tooth, then she should be culled. There is a high probability that she is either absolutely infertile or of very low inherent fertility. Hight (1968) stated that all dry ewes should be identified, and wherever there is scope, should be culled. He suggested that older dry ewes should be culled before two-tooth dry ewes.

4.3.2.3 Culling of wet/dry ewes

A wet/dry ewe is one who carries her lamb to full term, and then loses it for some reason. Adverse weather is a major cause of wet/dry ewes and consideration of this factor should be made before culling such ewes. Martin (1965) reported on Romney Survey work investigating the repeatability of the wet/dry condition at four-tooth and older ages. Of the ewes wet/dry as four-tooths, 80 percent produced normally the following year, but only 57 percent performed normally for the rest of their lives. In the other 43 percent, the dry/dry and wet/dry condition recurred regularly. On this basis, the Survey concluded that the wet/dry condition was repeatable, but that the extent of repeatability was very dependent on the cause of lamb loss. In many cases it is difficult to differentiate between a ewe which has lost her lamb because of bad weather, and one which is directly responsible for the loss of her lamb.

Ewes which have to be assisted at lambing should also be considered as wet/dry, even if they eventually rear the lamb, and should be identified as such. The other major causes of the wet/dry condition are, disease, ewes which have

abandoned their lambs, or ewes which could not feed their lambs due to an inadequate milk supply or deformed udder or teats.

4.3.2.4 Culling for age

It has been common practice for many years for hill country farmers to sell all ewes as five year olds, and not to retain any past this age. This meant that the farmer had a saleable line of ewes to sell to the fat lamb farmer, who could expect at least one further good lambing performance from them. There is, however, an alternative policy which is becoming more popular. This involves the retention of these five year old ewes for a further year or two, and the selling of old ewes, fat to the works. These farmers often do not cull for age at all, but only on performance and constitution.

4.3.3 Crossbreeding

4.3.3.1 Purposes of crossbreeding[1]

Crossbreeding can be used to introduce new breed characteristics into a flock, while also imparting increased productivity due to hybrid vigour, especially to the first cross lambs and ewes. Crossbreeding can be especially useful where the present ewe flock is not suited to the environment, and productivity is low. Hybrid vigour, or heterosis, is a measure of the amount by which the production of the first cross progeny differs from the average of their straight-bred parents. Hybrid vigour is most likely to occur in traits such as fertility, viability and growth, all associated with the natural fitness of the animal. Hybrid vigour is more pronounced in first-cross animals than in second-cross animals, and by the third-cross it has largely disappeared. With concurrent selection however, hybrid vigour can lead to a more permanent genetic improvement, since more lambs are available for selection, and replacements can be chosen more carefully.

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1. 'Increase your lambing percentage', No 2, 'Crossbreeding can help' MAF Advisory Services Division, Masterton.

The major disadvantage of crossbreeding is that it can introduce some management problems, especially where the crossbreeding policy involves the maintenance of separate flocks. These problems are most evident at tupping and lambing.

4.3.3.2 Choice of breeds

Before attempting crossbreeding, the farmer must find out why his present ewes are not producing satisfactorily, why his lambing percentages are low, or what other productive traits need to be improved. He must then decide on a breed which will improve these characteristics. The breed should also be suited to the environment. Some breeds are better adapted to harsh or easy environments than others. Note should be taken of any faults these breeds have, such as susceptability to metabolic diseases or footrot. Does the breed have some poor production characteristic, and if so, how important is it? After all these factors have been considered, it may be possible to evaluate the likely results of certain crosses, and to choose the most suitable. Whatever cross is finally decided upon, there must be a ready supply of rams with the genetic potential to increase production.

The Romney farmer, contemplating crossbreeding, has two main alternatives available to him. These are to cross to form a Border-Leicester-Romney cross, or Coopworth, flock, or to cross to form a Perendale flock. The method of achieving these crosses may vary, but these are the usual end results. There are other crosses which have been tried, such as the Polled Dorset - Perendale cross and the Merino - Romney cross, but at the moment these are not in general use.

The Perendale cross

Peren et al. (1951) reported on trials at Tuapaka with Cheviot-Romney cross ewes over the period 1944 to 1950. Some of the productive characteristics recorded over that period are summarised in Table 4.13.

Table 4.13

Productive characteristics of Romney vs. Romney-Cheviot cross ewes at Tuapaka (Summary 1944 to 1950).

	Romney	Romney-Cheviot cross
% ewe losses	5.4	3.0
% dry ewes at shearing	20.8	13.4
Average lambing %	85	116
% 2th ewes culled for lack of development only	37.8	2.7

Border Leicester-Romney cross

Larson and McDonald (1971) studied differences in ovulation rate between first cross Border Leicester-Romney cross, and Romney two-tooth ewes, by counting corpora lutea, and showed an average ovulation rate of 1.34 in the Border Leicester-Romney cross ewes compared with an average ovulation rate of 1.10 in the Romney ewes. Lang and Hight (1967) and Allison (1968) had already noted a similar difference in hoggets and older ewes respectively. Hight and Jury (1969) found that, within sex and birth rank, the survival rate of lambs increased from the Romney to the second cross and then declined with interbreeding to the third and fourth cross.

Information on different breeds and crosses is readily attainable from Breed Societies.

4.3.3.3 Crossbreeding methods

There are several ways in which crossbreeding can be used to improve breeding flocks. They vary mostly in the speed of the changeover and in the complexity of the management problems involved.

1. First cross ewes x interbred rams

With this method the Romney ewe is first mated to a ram of the other breed in the cross to produce a crossbred (F1) animal. These crossbred ewes are then mated with a crossbred ram to maintain the crossbreed. Consider the formation of a Perendale flock in this manner:-

Cheviot ram x Romney ewe = halfbred Cheviot-Romney F1
Perendale ram x Halfbred ewe = Perendale

This method involves the replacement of all rams at the outset, with those of the Cheviot breed. All Romney ewes in the flock will continue to be mated with the Cheviot, until they are culled or die. As the crossbred ewes come into the flock as replacements, Perendale rams are used to maintain the cross. After five years (assuming ewes are culled at five years) no Romney ewes remain, and Perendale rams are used over the whole flock. At any one time, all ewes are either halfbred, Perendale or Romney. The method does however involve the use of two different ram breeds, and necessitates the separation of the Romney and crossbred ewes at tupping. There is an adaptation of this method where the farmer buys rams of the new breed instead of Romneys in his normal ram replacement programme, but this slows down the changeover and further complicates management. At some stage the farmer would have ewes mated to rams of both parent breeds, and crossbred rams, all in one year. The method may be useful where the supply of good rams of the introduced breed is very limited.

2. Grading up

This is a slower method, but is easier to carry out since there is no necessity to separate out the different tupping groups. Consider again the formation of a Perendale flock. In this method all rams are replaced by Perendales, and a Perendale ewe flock is built up by repeated crossing.

Perendale ram x Romney ewe = 1/4 Cheviot-Romney (C-R)
Perendale ram x 1/4 C-R ewe = 5/8 C-R
Perendale ram x 5/8 C-R ewe = 7/16 C-R
Perendale ram x 7/16 C-R ewe = 15/32 C-R

It will obviously take many years for the entire flock to reach this stage. The main problem is the wide range of crossbreeds in the flock at any one time. The effect of hybrid vigour is also somewhat suppressed.

3. Use of first-cross rams

The continued use of first-cross rams has an advantage in that it maintains some hybrid vigour in the flock, but the supply of genetically superior first-cross rams is usually very limited. The South Island Halfbred is bred in this manner.

4. Alternating ram breeds

This is the least used method of crossbreeding. The alternate use of different sire breeds maintains a high degree of variability in the flock. Its main advantage is that hybrid vigour may be maintained for a longer period. Management can become very complicated, if different crosses in the flock are to go to different sires.

5. SURVEY RESULTS (PHYSICAL ASPECTS)

5.1 Topography

Some idea of the topography of the area as a whole can be gained from the notes on the survey area, but there was considerable variation in the topography of individual farms in the survey.

Altitudes ranged from a minimum of 0 metres to a maximum of 550 metres, and most farms had wide variations within the property, ranging from 90 to 430 metres. The average variation in altitude within farms was about 250 metres. Variation in altitude for each farm is shown in Table D.1 (Appendix D).

An attempt was made to subdivide the area of each farm into three classes based on contour. These classes were:-

a. Flat or rolling land
b. Steep but cultivable land
c. Steep and uncultivable land

Table D.1 (Appendix D) also shows this subdivision for each of the survey farms. The distribution of farms of differing contour is shown below in Table 5.1.

Table 5.1

Distribution of farms of differing contour

Percentage uncultivable	≤30	31-40	41-50	51-60	61-70	>70
Number of farms	2	2	2	2	2	10

Percentage flat or easy rolling	0-5	6-10	11-15	16-20
Number of farms	11	3	5	1

The survey farms can be divided into three groups on the basis of sheep breed. These groups are:-

(a) Farms with entirely Romney flocks (R) (farms 1-7)
(b) Farms with Border Leicester-Romney cross, Coopworth, or a mixture of these and Romney. (BLX) (farms 8-13)
(c) Farms with Perendale, Perendale-Romney cross, or a mixture of these with Romney (P) (farms 14-20).

Table 5.2 shows the differences in land class between farms carrying different breeds of sheep.

Table 5.2

Topography of farms versus breed of sheep

	BLX	R	P
% area uncultivable (avge)	49.3	64.7	70.0
% area flat or rolling (avge)	8.1	4.6	5.4

5.2 Climate

This is also largely covered in the description of the survey area, but the average rainfall on the survey farms is given in Table D2, (Appendix D), and the distribution of farms by rainfall is shown in Table 5.3.

Table 5.3

Distribution of farms by rainfall.

Average rainfall (mm)	≤1000	1001-1100	1101-1200	1201-1300	≥1301
Number of farms	4	4	7	1	4

5.3 Farm size

For most purposes in this study, grazed, or effective area, has been used as the criterion on which other figures are based. The use of total farm area would be very misleading in a number of cases where the grazed area falls to as low as 65% of total farm area. Table D3 (Appendix D) shows the total area, and subdivisions of this, for each farm in the survey. The effective area of farms varied from 267 to 722 hectares, with an average of 474 hectares. The distribution of farms by effective area is shown in Table 5.4.

Table 5.4

Distribution of farms by effective area.

Effective area (ha)	≤300	301-400	401-500	501-600	601-700	700+
Number of farms	2	3	7	5	2	1

Table 5.5 shows the average effective area of the farms in each breed group.

Table 5.5

Effective land area for each breed group.

Breed	Average effective area (ha)
R.	438
BLX.	432
P.	545

The larger area and steeper topography of those farms running Perendales appears to reflect the trend for this breed to be used in more extensive and harder conditions. Under these conditions increased acreages are needed for an efficient farming unit, due to the lower productivity of the land. Larger farms have also tended to move into Perendales due to their reputation for being less labour intensive, and hence lowering labour overheads.

5.4 Sheep breeds

The three main breeds found on the survey farms, were the Romney, the Coopworth or Border Leicester-Romney cross, and

the Perendale. Also to be found were crosses of the latter two with the Romney.

A high proportion of farms were in the process of changing breed during the period covered by the study. The number of 'Romney farmers' in 1969 was eight, but one of these had Perendale replacements ready to enter the breeding flock in the next season. The other seven retained the Romney breed for the remainder of the time period covered. Of the six farmers running Coopworth or Border Leicester-Romney cross ewes, two had fully changed over at the start of the time period covered, three had only partially changed over, and one had a flock that was basically the result of back-crossing the Border Leicester-Romney cross to the Romney. At the end of the time period covered, four had entirely crossbred flocks, one still had some Romney ewes, and the sixth still had his backcross. Originally there were six farmers running Perendales, but this increased to seven after the first year. Of the original six, only one was running Perendales exclusively, but of the seven at the end of the period, three were running only Perendales, three were running Perendales and Romneys, and one was running a Perendale-Romney cross flock.

For the purposes of analysis, the twenty farms were subdivided as explained in the section on topography.

Three farmers were running commercial stud flocks as well as their main flocks. There was one such farm in each breed group. For analytical purposes, income from the stud enterprise was ignored, and replaced by income which would have been received had the rams sold, been sold as fat wether lambs with those of the main flock.

5.5 Stocking rates

The calculation of stocking rate involves the use of some standard which allows all stock to be expressed in terms of their use of the farm area or the available pasture. The most common system in use is that of the 'Ewe Equivalent'.

This system expresses all classes of stock in terms of the amount of feed required throughout the year, using the requirements of a breeding ewe as a common unit, having a value of one.

In lieu of any better system, at this time, it has been used in this study. The main point of contention is the values which should be given to other classes of stock, in terms of ewe equivalents. The most widely used values are those used by Coop[1], but after consultation with advisory and research personnel, and farmers, these figures have been modified to those shown on Table 5.6.

Table 5.6

Ewe equivalent conversion table.

Class of stock	Ewe equivalents (e.e.)
Ewes.	
Border Leicester cross	1.1
Other breeds	1.0
Ewe hoggets	0.8
Wether hoggets	0.7
Rams	0.8
Other sheep	0.7
Breeding cows (run with bull)	6.5
Rising 2 year heifers	5.0
Rising 2 year steers	5.0
Weaner heifers	4.0
Weaner steers	4.5
Bulls and other cattle	5.0

The most important changes have been to rate ewe hoggets at 0.8 ewe equivalents, and Border Leicester cross ewes at 1.1 e.e. These changes were made only after serious consideration of the importance now placed on the nutrition of replacement stock, and after consultation with farmers running Border Leicester cross ewes.

The use of the ewe equivalent system has one serious drawback in that it does not take into account the changing pattern of feed requirements of each class of stock, throughout

1. I E Coop, NZ Agric.Sci. Vol.1, No.3, Nov. 1965.

the year, but it can be a useful measure for interfarm comparison.

For the purpose of investigation into stocking rate, farm nine has been omitted, because of a highly abnormal situation on this farm. Additional acreage was acquired in the 1971-1972 financial year, and stock figures reflect this action. Additional stock was carried over the 1971 winter with the express purpose of stocking this additional land. Stock sales and purchases over this period were also greatly affected. With such a small sample of farms, this could cause misleading interpretations to be made of any figures derived, and therefore the farm was omitted from the analysis.

Stocking rates have been derived on the basis of grazed, or effective area, rather than total area, because of the great variation between farms in the proportion of grazed to total area.

Tables D4, D5, D6, D7 (Appendix D) give the stocking rates for all farms involved in the survey as at the 30th June in the years 1969, 1970, 1971, 1972 and Table D8 (Appendix D) gives the average stocking rate for each farm, over the study period.

Table 5.7 shows the average total stocking rate for the years 1969 to 1972, and also the subdivisions of this into sheep and cattle ewe equivalents.

Table 5.7

Average stocking rates for years 1969 to 1972

	Year				
	1969	1970	1971	1972	Av
Av.total e.e./ha.	9.38	9.72	10.11	10.19	9.85
Av.e.e. (sheep)/ha.	6.28	6.63	6.84	6.85	6.65
Av.e.e.(cattle)/ha.	3.10	3.09	3.27	3.34	3.20

Stocking rate over this period increased by an average of 7.6% but the proportion of sheep and cattle ewe equivalents,

averaged over all farms, did not change significantly. This ratio is shown in Table 5.8.

Table 5.8

Ratio of sheep e.e. to cattle e.e. (average all farms).

	Year				
	1969	1970	1971	1972	Av.
Ratio of $\frac{\text{e.e.(sheep)}}{\text{e.e.(cattle)}}$	2.03	2.14	2.09	2.05	2.08

The ratio of e.e.(sheep) to e.e.(cattle) does not show the trend towards cattle that might have been expected from the market situation for sheep and cattle products over this period. The most probable reason for there being little change, would be that on most of these farms, the only cattle policy that would be considered would be one of breeding, involving a large capital commitment, and long term planning. Most farmers were reluctant to change their farming system for what might have been (and infact was) a temporary drop in sheep returns. If the survey had been done on easier country, suitable for fattening policies, then a change from sheep to cattle may have been more evident.

Dividing the farms into the three breed sub-groups, the changes in sheep e.e./ha. are shown in Table 5.9.

Table 5.9

Average sheep e.e./ha. for each breed subgroup.

	Year				
	1969	1970	1971	1972	Av.
R.	6.77	7.05	7.20	7.18	7.05
BLX	7.28	7.95	8.04	7.89	7.79
P.	5.29	5.48	5.81	5.94	5.63

The greatest increase in sheep e.e. was in the Perendale group of farms with an average increase of 12.3%, followed by the Romney group with 8.7% and the Border Leicester cross group

with 8.4%. This trend is to be expected, as the farms in the Perendale group were less developed, and developing faster than those in the other groups.

Changes in cattle stocking rate over the period 1969 to 1972 are presented in Table 5.10. The greatest increase was in the Border Leicester cross group with an average increase of 24.3%. The increases in the Romney and Perendale groups averaged 7.5% and -0.6% respectively.

Table 5.10

Average cattle e.e./ha. for each breed subgroup.

	Year				
	1969	1970	1971	1972	Av.
R.	3.34	3.41	3.38	3.59	3.43
BLX	2.84	2.96	3.27	3.53	3.15
P.	3.07	2.91	3.17	3.05	3.05

The farms in the Border Leicester cross group were generally more fully developed, and on easier country, than those in the other groups, and this situation is more favourable for intensive cattle farming.

Table 5.11 presents information on changes in total ewe equivalents per hectare. The Border Leicester cross group had the highest average increase of 12.9%, followed by the Perendale group with 7.5% and the Romney group with 6.5%.

Table 5.11

Average total e.e./ha. for each breed subgroup.

	Year				
	1969	1970	1971	1972	Av.
R.	10.11	10.46	10.58	10.77	10.48
BLX	10.12	10.91	11.31	11.42	10.94
P.	8.36	8.39	8.98	8.99	8.68

5.6 Lambing percentages (hoggets excluded)

Lambing percentages (docking), survival to sale percentages, and the difference between these, for the years 1969 to 1971 are shown in Tables D9, D10, D11 (Appendix D). The average of these figures, for each farm is shown in Table D12 (Appendix D). Table 5.12 shows the average lambing percentage (docking) for the farms in the survey, with the exception of farm nine, divided into three subgroups, and averaged over all farms. Table 5.13 similarly shows survival to sale percentage, and Table 5.14 shows the loss in percentage between docking and 'survival to sale'.

Table 5.12

Average lambing percentage (docking)

Breed	1969	1970	1971	av. 1969-71
All breeds	98.4	97.9	100.9	99.1
R.	94.8	92.3	95.9	94.3
BLX	107.3	107.2	107.8	107.4
P.	94.3	95.4	100.1	96.6

Table 5.13

Average survival to sale percentage

Breed	1969	1970	1971	av. 1969-71
All breeds	95.5	95.0	97.8	96.1
R.	91.9	89.0	93.5	91.5
BLX	104.8	104.8	104.6	104.7
P.	91.1	92.6	96.2	93.3

Table 5.14

Average losses in percentage from docking to 'S. to S.'.

Breed	1969	1970	1971	Av. 1969-71
All breeds	2.9	2.9	3.1	3.0
R.	2.9	3.3	2.4	2.8
BLX	2.5	2.4	3.2	2.7
P.	3.2	2.8	3.9	3.3

It is very difficult to determine the reason for the changes shown in the tables, due to the large number of factors affecting final lambing percentage. Climatic conditions at critical times of the year, particularly at tupping and lambing have a very large effect, as well as breeding, culling, feeding and other management practices. The average figures presented are from a very small sample of farms, and the variation in lambing percentage, both within and between, individual farms is very great.

5.7 Wool production

Table D13 (Appendix D) shows wool weight per sheep ewe equivalent, for each of the farms in the survey, for the three years studied. Table 5.15 gives a summary of this information, as averages over all farms except farm nine, and as averages for each breed subgroup.

Table 5.15

Average wool weights per sheep ewe equivalent (kg).

Breed	1969-70	1970-71	1971-72	Average
All breeds	4.53	5.00	4.92	4.82
R.	4.71	5.33	5.32	5.12
BLX	4.89	5.35	5.01	5.08
P.	3.98	4.41	4.44	4.28

Changes in wool weights per ewe equivalent are hard to explain in terms of productivity. A slow improvement might have been expected, but wide fluctuations as shown are more difficult to account for. Differences in feeding or other factors affecting wool growth are probably the main reasons for the variations, but there could be others, such as the carrying over of wool from one year to the next, or changes in shearing or crutching dates.

5.8 Farm income

Tables D14, D15 and D16 (Appendix D) show returns from sales less stock purchases for the three years studied. These

returns have been adjusted so as to take account of stock increases and decreases. Stock gained or lost over the year has been valued according to a standard set of values, which approximate the values of stock over this period. These values are shown in Table 5.16.

Table 5.16

Prices used for calculating value of stock increases.

Ewes	$6.00	Breeding cows	$100
Ewe hoggets	5.00	Rising 2 yr Hfrs	85
Ram & W.Hgts	5.50	Rising 2 yr Strs	95
Rams	20.00	Weaner Heifers	65
Other sheep	5.00	Weaner Steers	75
		Bulls	200

The purpose of this adjustment was to put each farm in a similar situation of zero stock change from year to year, where comparisons may be more valid.

Table D17 (Appendix D) shows the adjusted nett income from sheep, per ewe equivalent in sheep, over the three years. The data in Tables D14 to D17 is summarised in Tables 5.17 to 5.20.

Table 5.17

Income from farm enterprises (adjusted for stock changes) average all farms

	1969-70	1970-71	1971-72	Av.
Sheep ($/ha.)	21.43	20.06	17.85	19.78
Wool ($/ha.)	15.53	16.41	20.14	17.36
Cattle ($/ha.)	15.70	19.46	23.00	19.39
Total ($/ha.)	52.66	56.03	60.99	56.56
Total ($/e.e.)	5.49	5.63	5.92	5.68
Sheep total ($/e.e.)	5.64	5.30	5.49	5.48

Table 5.18

Income from farm enterprises (adjusted for stock change)
Average (R) group.

	1969-70	1970-71	1971-72	Av.
Sheep ($/ha.)	20.86	18.90	18.07	19.28
Wool ($/ha.)	17.34	18.11	21.82	19.09
Cattle ($/ha.)	16.71	18.39	21.70	18.93
Total ($/ha.)	54.91	55.40	61.59	57.30
Total ($/e.e.)	5.36	5.23	5.77	5.45
Sheep total ($/e.e.)	5.41	5.01	5.40	5.27

Table 5.19

Income from farm enterprises (adjusted for stock change)
Average (BLX) group

	1969-70	1970-71	1971-72	Av.
Sheep ($/ha.)	26.90	26.08	21.10	24.69
Wool ($/ha.)	17.61	19.61	22.95	20.06
Cattle ($ha/ha.)	17.72	22.05	27.28	22.35
Total ($/ha.)	62.22	67.74	71.33	67.10
Total ($/e.e.)	6.16	6.22	6.30	6.23
Sheep total ($/e.e.)	6.15	5.83	5.77	5.92

Table 5.20

Income from farm enterprises (adjusted for stock change)
Average (P) group.

	1969-70	1970-71	1971.72	Av.
Sheep ($/ha.)	17.52	17.20	15.31	16.68
Wool ($/ha.)	11.10	12.18	16.45	13.24
Cattle ($/ha.)	12.83	18.69	21.23	17.58
Total ($/ha.)	41.45	48.07	52.99	47.50
Total ($/e.e.)	4.99	5.56	5.75	5.43
Sheep total ($/e.e.)	5.42	5.20	5.37	5.33

5.9 Changes in sources of income

Table 5.17 reveals that the average income from farm enterprises (adjusted for stock changes) increased by 15.9% over the period 1969 to 1972. Over this period average stocking rate increased by 7.6% from 9.38 to 10.19 e.e./ha., and this explains part of the increase in income. The remainder of the change can be attributed to changes in productivity and prices.

Over the three years, the percentage of income derived from sheep fell significantly. From the data in Table 5.17, the following percentages of income from sheep, was derived.

1969-70	70.2% of income derived from sheep
1970-71	65.1
1971-72	62.3

This is in spite of an increase in wool prices in the last year. A major cause might be expected to be a change in the proportion of sheep and cattle ewe equivalents, but this is not the case, as shown by Table 5.8 earlier.

Over this period, the average income received from sheep sales per hectare fell, but due to increased wool prices, and increased productivity, the total income per ewe equivalent in sheep has remained relatively static.

Over the same period, despite no real change in productivity, the average income from cattle increased by 46.5% from $15.70 to $23.00 per hectare. This is the most significant factor in the shift of income from sheep to cattle. These trends are upheld within all breed subgroups of farms, as can be checked from Tables 5.18, 5.19 and 5.20.

Market changes in the 1972-73 year were very great, and increases in farm income, especially in that derived from sheep, completely altered the situation revealed above. The percentage of income derived from sheep rose again to about 75% despite an improving market for cattle products.

6. SURVEY RESULTS (MANAGERIAL ASPECTS)[1].

6.1 Animal management

6.1.1 Pre-tupping management

6.1.1.1 Hogget nutrition

All farmers weaned hoggets onto the best pastures available on the farm, preferably pastures with a high clover content. An attempt was made to maintain a high level of feeding for as long as possible into the winter. Only one farmer used a fodder crop as an additional source of winter feed for his hoggets. All farmers recognised the need to maximise weight gain in ewe hoggets, in order to maximise two-tooth lambing percentages. Many, however, claimed that the weight gains they achieved were severely limited by a shortage of feed, especially in the Autumn period.

Nine farmers mated their ewe hoggets in 1971, all except one achieving reasonable lambing percentages. Table 6.1 shows the percentage of hoggets mated, for each farm practising hogget mating.

Table 6.1

Hogget lambing performance, 1971

Farm		% ewe hoggets mated	lambing percentage
1	Romney	30	28.1
6		100	28.1
8		100	29.1
9		16	47.5
11	B.L. cross	100	24.7
12		82	25.0
13		50	3.0
18	Perendale	50	92.0
19		100	25.0

1. Management practices as for 1971-1972 farming year.

As can be seen from the table, over half of those farmers mating hoggets were running BLX ewes. Only one third of those farmers mating hoggets attempted to mate all their hoggets.

Those farmers who were mating their hoggets, drafted out the in-lamb hoggets in late winter or at hogget shearing, and gave them preferential feeding from this time until their two-tooth mating.

Those farmers not mating their hoggets were reluctant to do so, either because they felt that they could not get their hoggets in lamb, or because they could not feed their lambing hoggets well enough to prevent a reduced two-tooth performance.

All farmers drenched their ewe hoggets at some time after weaning and two gave pre-weaning drenches. Twelve drenched ewe hoggets approximately monthly from weaning to winter, five drenched approximately bimonthly, and three drenched as they saw a need, generally averaging two or three drenchings from weaning to winter. Six farmers included some Selenium in their drenches. Only seven farmers used one brand of drench exclusively, the other thirteen alternating drenches occasionally or regularly, in order to cover as wide a range of parasites as possible.

6.1.1.2 Ewe liveweight

No information on ewe liveweight was collected on the survey farms, but information was collected on some of the ewe management factors which could be expected to affect liveweight at mating. The most important of these was considered to be ewe nutrition from weaning to tupping.

All farmers restricted the nutrition of their ewes, to some extent, after weaning. Seven of the farmers separated out the poorer ewes and gave them preferential feeding, two farmers preferentially fed their five year old ewes, and two preferentially fed their two-tooth ewes.

Eleven farmers had a policy of mob-stocking ewes from weaning until shortly before tupping, cleaning up rough feed initially, and then moving mobs around the farm. Three farmers mob-stocked for only a short period, and then set-stocked until tupping, and six farmers set-stocked their ewes from weaning to tupping. Two farmers who mob-stocked their ewes, said, that in very dry summers they set-stocked ewes over this period.

6.1.1.3 Ewe flushing

Six of the twenty farmers claimed that they could not provide flushing feed for their ewes prior to tupping. The main reason given was that there was simply insufficient feed at this time. They claimed that if they attempted to save feed for flushing, their ewes would have to be severely restricted prior to flushing, with a resultant loss of liveweight. All the other farmers made some attempt to provide an increased level of feeding from about three weeks prior to tupping until the feed ran out. However, they said that in many years the amount of flushing was insignificant.

Of the six farmers not providing flushing feed, four were running Perendale ewes, one Romneys, and the other Border Leicester cross.

6.1.1.4 Pre-tup drenching

Nine farmers pre-tup drenched all their ewes, and four others pre-tup drenched a proportion of the ewe flock. One farmer drenched those ewes in poorer condition (about a third of the flock), another drenched two-tooth and old ewes, and two others drenched only two-tooth ewes. Several farmers expressed doubts as to the effectiveness of their drenching programme and were considering limiting it to those ewes in poorer condition. This was in spite of the relative cheapness of drenches at the time of the survey.

6.1.1.5 Ram management

Preparation for tupping

Thirteen of the farmers shore all their rams prior to tupping, four in December, six in January, and three in February. Three others shore only recently bought rams prior to tupping and crutched the others, and four only crutched rams prior to tupping.

Five farmers used a footrot vaccine on rams, the remainder just checked for footrot and trimmed hooves.

Virtually all rams were drenched prior to tupping, most of them twice.

Fertility testing

Three farmers had all rams tested for fertility, by means of semen sample. Two of these farmers tested annually and the other biannually. Of the others, two had only new rams fertility tested in this way, and had the remaining rams checked for abnormalities by palpation only. One farmer had semen tests done only on selected rams suspected of infertility. Of the remaining farmers, eight checked fertility by palpation only, and six did not check at all.

Percentage of rams

The percentage of rams run with mixed age ewes during the main tupping period averaged 1.45% and ranged from 1.0 to 2.5%. The percentage of rams mated with two-tooth ewes ranged from 1.0 to 3.0% with an average of 1.66%. Table 6.2 shows the average percentage of rams mated with ewes, for each breed group. Table 6.3 shows the distribution of farms using different ram percentages.

Table 6.2

Average ram percentage of breed subgroups

Breed	Av. ram % (M.A. ewes)	Av. ram % (2th ewes)
Romney	1.64	1.93
BLX	1.12	1.27
Perendale	1.53	1.69

Table 6.3

Number of farms using different ram percentages

	Ram percentage									
Flock	0.50	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
M.A. ewes	-	6	6	2	-	5	-	1	-	-
2th ewes	-	5	3	4	1	3	-	3	-	1
Hoggets	1	4	1	2	-	1	-	-	-	-

Age of rams

Ten farmers avoided mating two-tooth rams with two-tooth ewes but the others did not feel that such action was warranted. Those farmers who avoided the use of two-tooth rams with two-tooth ewes usually gave as their reason that shy two-tooth ewes mated with inexperienced rams led to low lambing percentages, in their two-tooth flocks.

6.1.2 Tupping management

6.1.2.1 Time and duration of mating

The dates rams were put out ranged from 20th February to 7th April. Half the farmers put out their rams in the third week of March, and the average date was 19th March.

The length of time rams were out, excluding those out to mark late ewes, averaged 7.1 weeks with a range of five to twelve weeks. Figure 6.1 shows the distribution of farms with differing tupping commencement dates, and duration of tupping. Table 6.4 shows the average date of commencement of tupping, and the average duration of the tupping period, for each breed subgroup.

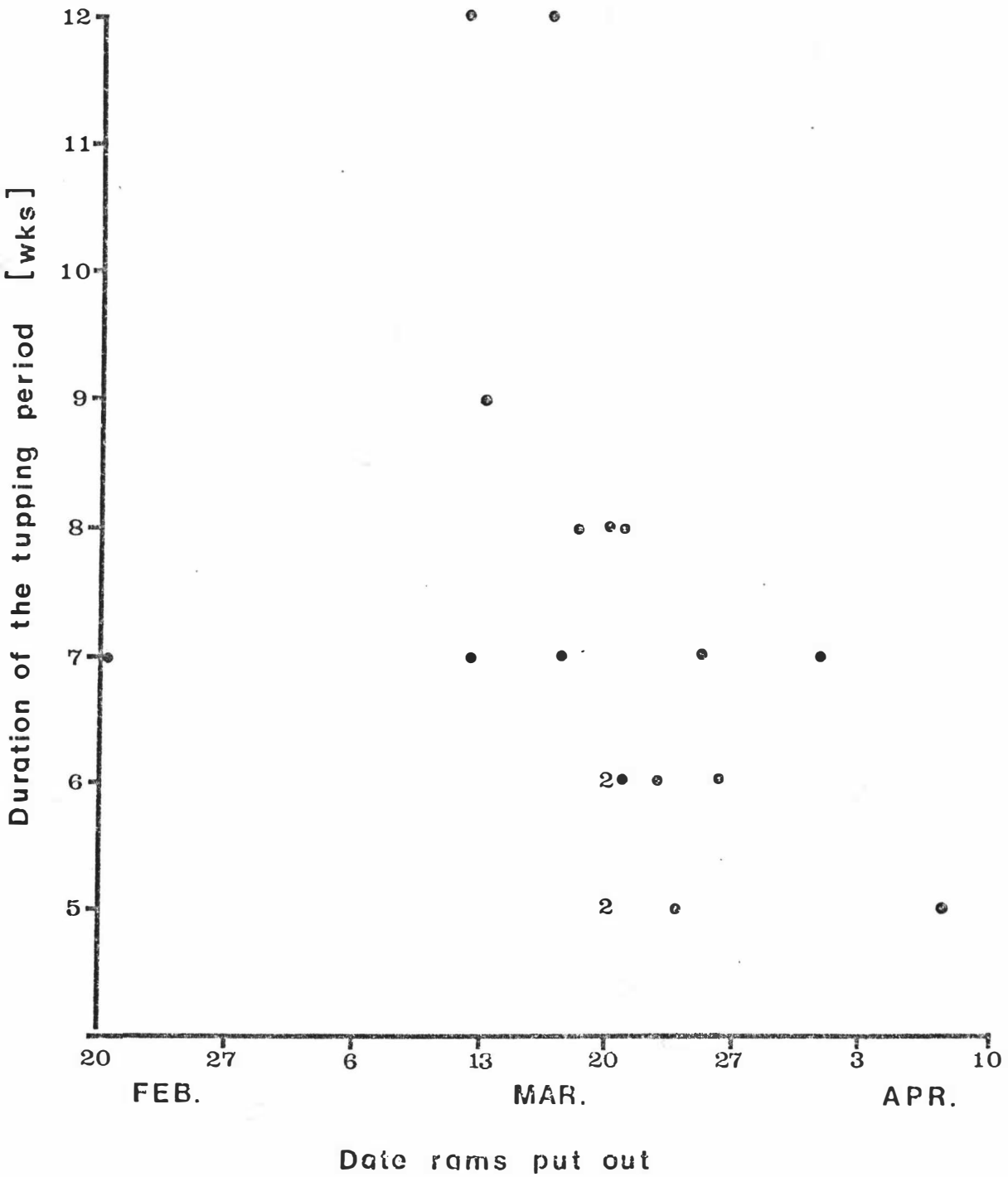
Table 6.4

Date and duration of tupping within breed subgroups.

	Average date	Average duration (wks)
Romney	22nd March	6.7
B.L.X.	23rd March	7.3
Perendale	14th March	7.3

Figure 6.1

Date of tupping vs. duration of tupping on the survey farms.



6.1.2.2 Syncronisation of oestrus

Seven farmers used teaser rams for syncronisation. Two of these farmers had done so for a number of years but were ceasing to do so in 1972 to see the effect. They thought that the effect of quitting would be negligible. The other five farmers used either entire or vasectomised rams, put out up to four or five weeks before tupping, in order to syncronise oestrus and lambing. Three of these farmers were definite about a more concentrated lambing, with a higher proportion of ewes in lamb in the first oestrus cycle of tupping. They recognised the risk of storms during a concentrated lambing period, but claimed that this was more than compensated for by ease of management at lambing. The other two farmers practising syncronisation were less sure of the effectiveness of their teaser rams.

6.1.2.3 2th management at mating

Only one farmer ran his two-tooth ewes with his older ewes at mating. Of the others, 17 mated their two-tooths on smaller, easier, paddocks, usually at a higher stocking rate than the mixed-age ewes. Thirteen of these farmers also provided better feed at this time. Twelve farmers used a higher percentage of rams with two-tooths, the increase in percentage ranging from 0.25% to 0.50%. Five farmers mobbed up two-tooth ewes occasionally during the mating period in order to mix ewes and rams.

Fifteen farmers pre-tup shore two-tooth ewes at times ranging from nine to one week prior to tupping. Most of these farmers pre-tup shore about four weeks before tupping. Four of those farmers not pre-tup shearing their two-tooths were running Perendale ewes which they claimed did not need shearing at this time, especially if hogget shearing was delayed.

6.1.2.4 Identification of mated ewes

Thirteen farmers identified ewes mated late in the tupping period, or not conceiving at mating, by means of either harnessed rams or the use of fat-lamb sires after the main

mating period was over. Ten used harnessed rams and five used fat lamb sires, for this purpose.

Three farmers used harnessed rams during the main mating period, to identify ewes mated at different stages of tupping, as an aid to lambing management.

6.1.3 Management from tupping to lambing

6.1.3.1 Ewe nutrition

Advocates of set stocking and rotational grazing over the winter, were both well represented, nine farmers favouring set stocking and eleven favouring rotational grazing. Of the seven Romney farmers, six were rotational grazing, of the six Border Leicester cross farmers, two were rotational grazing, and, of the seven Perendale farmers, three were rotational grazing.

6.1.3.2 Prelamb drenching

Thirteen farmers practised prelamb drenching, and in general were enthusiastic about the results. They claimed much cleaner sheep, healthier lambs, and better growth rates.

6.1.3.3 Prelamb shearing

No farmer prelamb shore his ewes every year. One farmer did so every second year because of his policy of shearing every eight months, i.e. three times in two years. The only other prelamb shearing done was of hoggets, by those farmers mating their hoggets.

6.1.4 Lambing management

6.1.4.1 Ewe nutrition

All except two farmers set-stocked over the lambing period. Those farmers rotational grazing through the winter changed to the set-stocking system from one month to several days prior to the start of lambing. The other two farms maintained a rotational grazing system into the lambing period, sheding out lambing ewes as lambing progressed.

All except one farmer attempted to separate out dry and late-lambing ewes prior to the start of lambing, nine by means of udder development and ten by means of tupping markings.

On five farms, two-tooth ewes were run in the same mob as older ewes at lambing. Three of these farms were running Perendale ewes. On the other fifteen farms, the two-tooth ewes were separated from the rest of the flock at lambing, and generally grazed on better feed and in easier paddocks.

6.1.4.2 Lamb deaths

All farmers quoted starvation as a major cause of lamb deaths, and twelve quoted dystokia as another major cause. There was a marked absence of farmers, with Perendale or Perendale cross flocks, listing dystokia as a major cause of deaths. Only two out of seven had any dystokia problems, and these two were still carrying a high proportion of Romney ewes.

Other major causes of lamb deaths listed by farmers are shown in Table 6.5.

Table 6.5

Other causes of lamb deaths listed by farmers

Cause	No. of farmers listing this cause
Toxoplasmosis	5
Tetanus	5
Pulpy kidney	4
Navel infection	3
Misadventure	3

Those farmers with disease problems, as listed above, had overcome them to a large extent by vaccination.

Thirteen farmers vaccinated ewes prior to lambing with vaccines ranging from Pulpy kidney vaccine only, to 'five-in-one' vaccines. Ten farmers vaccinated lambs at docking, all for Pulpy kidney, and two for tetanus.

6.1.4.3 Shepherding

Two farmers did not shepherd at lambing at all, both running Border Leicester cross ewes. Four others did only very light shepherding, three running Perendales, and one Romneys, and the remainder shepherded relatively intensively, i.e. at least once per day.

Seven farmers marked twin lambs in their mixed-age and two-tooth flocks for culling and breeding purposes, and another four marked twins in an 'elite' flock from which they were trying to breed a nucleus of high-producing ewes and/or rams.

Eleven farmers marked all ewes assisted at lambing, either by earmarking or tagging, for future culling.

6.1.5 Weaning management and lamb sales

Weaning management

The length of time from the start of lambing to weaning ranged from 93 to 133 days with an average of 113 days. There were no breed differences in the number of days from lambing to weaning. The distribution of farms with different spells before weaning is shown in Table 6.6.

Table 6.6

Number of days from lambing to weaning

	No. of days				
	90-99	100-109	110-119	120-129	130+
No. of farms	2	7	5	5	1

The date of weaning ranged from 10th November to 1st January. On five farms this date coincided with ewe shearing. Two farmers weaned in November, both running Perendale ewes, and two farmers weaned at New Year, one running Romney ewes and the other Border Leicester cross ewes. The average date of weaning was one week earlier in the Perendale flocks than in the others, as were the tupping and lambing dates.

Lamb sales

Twelve farms sold all wether lambs fat, and the remainder sold a proportion fat, and the remainder as stores. There was no breed effect, with three Romney farmers, two Border Leicester cross farmers, and three Perendale farmers, not selling all their wether lambs fat.

6.2 Breeding management

6.2.1 Selection of replacement stock

6.2.1.1 Selection of replacement ewes

The survey farmers were asked how they selected their replacement ewes from those available, and gave the methods shown in Table 6.7.

Table 6.7

Farmers' basis of selection of replacement ewes

Basis of selection	Number of farmers
Wool type	17
Visual assess. of condition	15
Hogget lambing or oestrus	10
Birth rank	6
Hogget liveweight (measured)	5
Wool weight	2

Most farmers were still relying heavily on their own visual appraisal as a method of selection, although an increasing proportion were using the results of hogget lambing or oestrus as a guide to selection.

The percentage of ewe hoggets wintered, that were required as replacements, varied from 38% to 87% and averaged 73%. On nine farms the percentage needed was over 80%, and this did not allow for a great deal of selection for productive characteristics, but only for basic culling for severe faults.

6.2.1.2 Selection of rams

Thirteen of the survey farmers bought stud rams for use in their flocks, and five bought non-registered flock rams. Only one was participating in a group breeding scheme of any kind, but seven were using rams which they had bred themselves. Only two of these seven farmers used their own rams exclusively, the others also buying stud rams, except the one in the group breeding scheme.

Farmers were asked for their basis of selection of rams, and those points considered by farmers are shown in Table 6.8.

Table 6.8

Farmers' basis of selection of rams

Basis of ram selection	Number of farmers
Performance records	17
Birth rank	7
Wool	5
Visual assessment	4
Weaning weight	1

Farmers were becoming very aware of the need for high performance rams, and were now demanding performance records for any stud sheep that they bought. Some farmers had changed from their traditional sources of rams because they could not obtain adequate performance records.

6.2.2 Selection of culled stock

6.2.2.1 Culling of dry/dry ewes

All farmers culled ewes which failed to get into lamb, including two-tooths.

6.2.2.2 Culling of wet/dry ewes

Only six farmers gave ewes which lost lambs another chance. The remainder culled all these ewes together with those giving lambing trouble.

6.2.2.3 Culling for age

Twelve farmers culled their ewes at five years of age, although two of these farmers kept the best of the five year olds for another year. Of the remainder, four culled at six years of age, and four did not cull at all for age, but just for condition and the ability to produce and rear a lamb. If a ewe was still in good condition, and producing a lamb, at eight years of age, then she retained her position in the flock. This practice meant that farmers did not have any 'lines' of cast-for-age ewes for sale, and virtually all culls were sold as fat ewes. However, the farmers considered that this policy allowed them to reduce the number of replacements needed, improve the selection of replacement stock, and give better sales of stock surplus to replacement requirements.

6.2.3 Crossbreeding

6.2.3.1 Reasons for not crossbreeding

The seven Romney farmers were asked why they had not followed the example of many other farmers in the district, and tried crossbreeding. The reasons they gave are given below.

Five farmers considered their present flock's performance to be satisfactory, and were thus not interested in crossbreeding. Of these five, one was also running a Romney stud enterprise. Another farmer stated that he had considered crossbreeding, but had a dislike of Perendales, and he considered his farm to be too hard for Border Leicester cross ewes. The seventh farmer considered that there was still considerable scope for improved performance within the Romney breed, and it was on this method of improving performance that he would concentrate. An eighth farmer, running Perendale ewes was changing back to Romney. He bought the farm with Perendale ewes, but did not like them.

6.2.3.2 Reasons for crossbreeding

Those farmers who had used brossbreeding were asked for the reasons that they were not satisfied with their previous Romney flocks, and had considered crossbreeding.

Of those farmers who changed to Border Leicester cross ewes, all six claimed that they were disappointed with the lambing percentages of the Romney flocks that they ran at the time. Three farmers were also experiencing severe lambing problems, with a high percentage of assisted births, and mis-mothering problems.

Of the six farmers who changed to Perendale flocks, all changed in order to ease management problems, and improve grazing management. Four farmers claimed that an expected increase in lambing performance was a major reason for crossbreeding.

6.2.3.3 Reasons for choice of breed

Of the six farmers choosing the Border Leicester cross, five had done so because of the high lambing percentages attributed to the Border Leicester cross ewe. Five also considered the contour of their farms to be too easy to consider the Perendale as an alternative. Three were impressed by the growth rate of the Border Leicester cross fat lambs, and one farmer was specifically attracted by the mothering ability of the Border Leicester cross ewe.

Of the farmers choosing the Perendale, six considered their farms to be too hard for the Border Leicester cross, three were very interested in the 'easy care' attributes of the Perendale ewe, two were concerned about the future of coarse wools and wanted to increase the fineness of their wool, and one was especially interested in an increased survival rate of lambs.

6.2.3.4 Methods of crossbreeding

The crossbreeding methods used varied widely.

Of the farmers with Border Leicester cross flocks, only one bought all Border Leicester rams, and then as the crossbred progeny entered the ewe flock, replaced these rams with Border Leicester cross rams. Two farmers had introduced the Border Leicester rams first to selected two-tooth and mixed-age ewes and had continued to mate the remaining ewes with

Romney rams until they were culled. One farmer introduced Border Leicester rams over a period of two years, and then introduced Border Leicester cross rams to mate with the cross-bred progeny. One farmer bought Border Leicester instead of Romney rams, as his annual replacements, and another used Border Leicester rams for a few years and then changed back to Romney rams. This farmer was again using Border Leicester rams in 1972.

All of these farmers, if they had the opportunity of restarting their crossbreeding programmes would have followed the example of the first farmer mentioned, who bought all Border Leicester rams, and then later replaced them with Border Leicester cross rams.

Of those farmers running Perendale flocks, one bought Perendale ewes with the farm, and was in the process of replacing his Perendale rams with Romney rams, and breeding back to the Romney. Three farmers bought all Cheviot rams and then Perendale rams, as the first cross progeny entered the flock. Another farmer mated Perendale rams with the ewes in the main flush of tupping, for two cycles, and another bought Perendale rams as his annual ram replacements. Both of these latter farmers would, if they were crossbreeding again, replace all rams with Cheviots, then Perendales, as did the other three farmers. One other farmer mated his best ewes to the Cheviot ram, the bulk of his ewes to the Perendale ram, and the coarse-wooled ewes to the Romney. He claimed that this had worked well and he would adopt the same procedure if he were starting again.

7. ANALYSIS OF FACTORS DETERMINING LAMBING PERCENTAGES ON THE SURVEY FARMS

7.1 Introduction

In this chapter an attempt is made to relate the physical features of the survey farms, and the management practices used on the survey farms, to the lambing percentages achieved. It is recognised that this is a very difficult task, as there are a very large number of factors which affect lambing

percentage. There is virtually no way in which the effects of one factor can be separated out from those of other factors, unless the effect overrides the effects of all the other factors. The task is made even more difficult by the small size of the survey. Taking account of the fact that there are three breed groups represented, each of which should be regarded separately, the number of farms of similar physical nature, or employing similar management techniques, is very small. This makes any statistical analysis of the existence, or extent, of any relationship, virtually impossible.

This problem was recognised when the study was commenced. There appeared to be two approaches which could be used to tackle the study. One was to attempt a small survey to evaluate the extent, and problems, of implementation of management techniques recommended in the research literature, and then to apply this information to case farms to see if management could be improved. The second approach which could have been used was one of building up a model of the hill-country sheepfarming situation, examining the relationships between lambing percentages and those factors affecting lambing percentages, and the interrelationships between these factors. In order to determine the parameters of such a model, information would have to be collected from a very large number of farms, or over a very large number of years, or from a complex research programme. Pursuing this latter approach was felt to be a task outside the possibilities of a masterate thesis. The first approach was thus used, despite the expected problem in determining relationships between factors thought to affect lambing percentage, and lambing percentage.

In the following sections, some simple analysis is attempted, and an attempt is made to explain some of the trends which appear.

7.2 The relationship between physical features of the survey farms, and lambing percentages

7.2.1 Topography

Figure 7.1 shows the relationship between topography and lambing percentage, within breed groups. This is achieved by plotting average docking percentages over the years 1969 to 1971 against the percentage of the farm area uncultivable. There do not appear to be any consistent trends, and it must be concluded that topography alone is not an overriding determinant of lambing percentage. The distribution of breeds on farms of different topography is however clearly seen.

7.2.2 Median altitude

Figure 7.2 shows the relationship between median altitude (maximum altitude + minimum altitude/2) and lambing percentage, within breed groups. There appears to be some decrease in lambing percentage with altitude in the Romney and BLX groups, but no such decrease in the Perendale group. Drawing inferences from this is dangerous, but it would appear that the Perendale is less affected by farming conditions at higher altitudes.

7.2.3 Rainfall

During a survey in Hawkes Bay, McDonald (1969) showed a pattern of increasing lambing percentage with increasing rainfall, but this relationship is not evident in this sample of survey farms. Average rainfall is plotted against average lambing percentage in Figure 7.3. A better relationship might have been obtained if the distribution of rainfall through the year, for each farm, was available. This could be related to seasonal feed availability. Management could however mask, even the effect of rainfall distribution.

Figure 7.1

Relationship between topography and average lambing percentage on the survey farms.

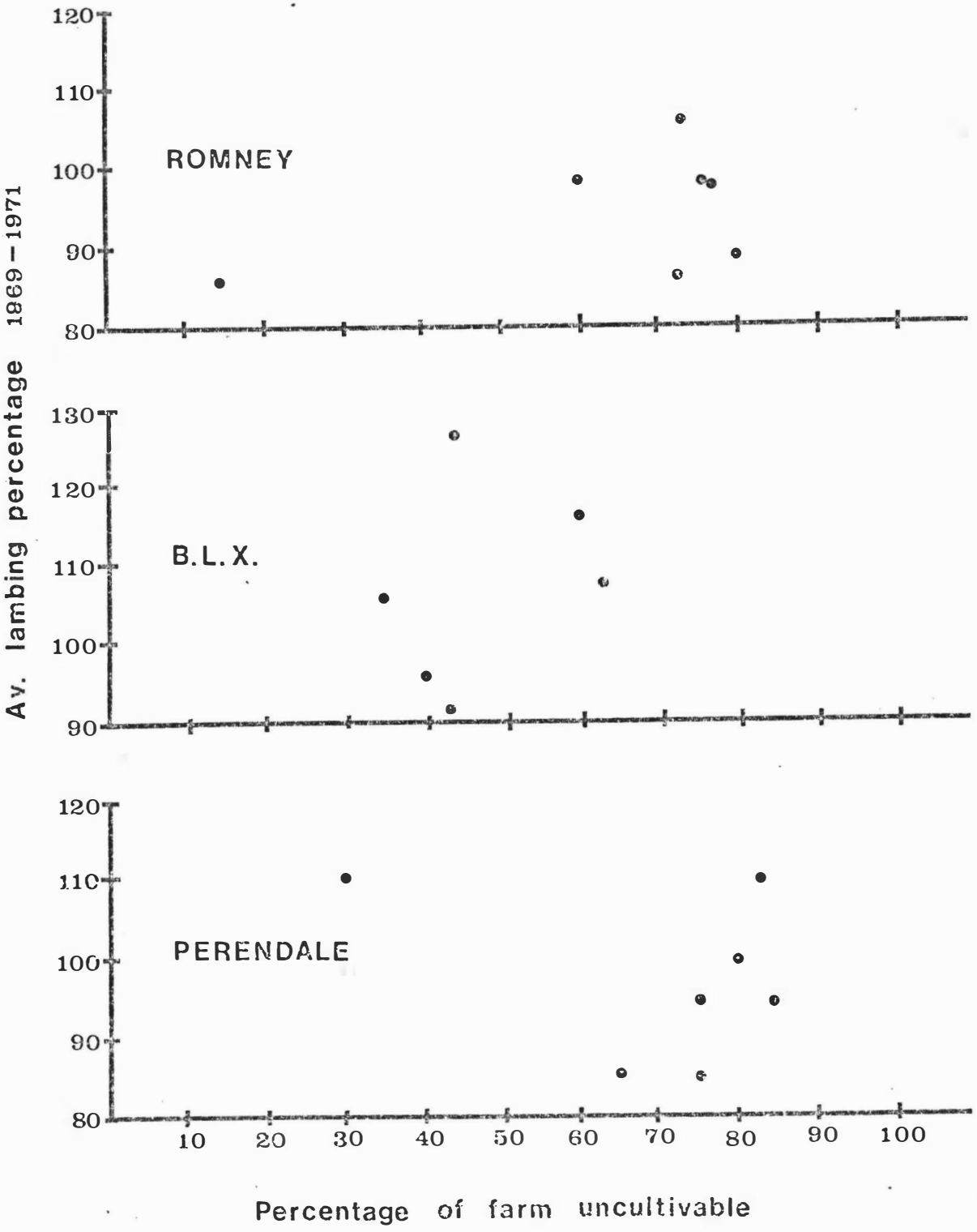


Figure 7.2

Relationship between median altitude and average lambing percentage on the survey farms.

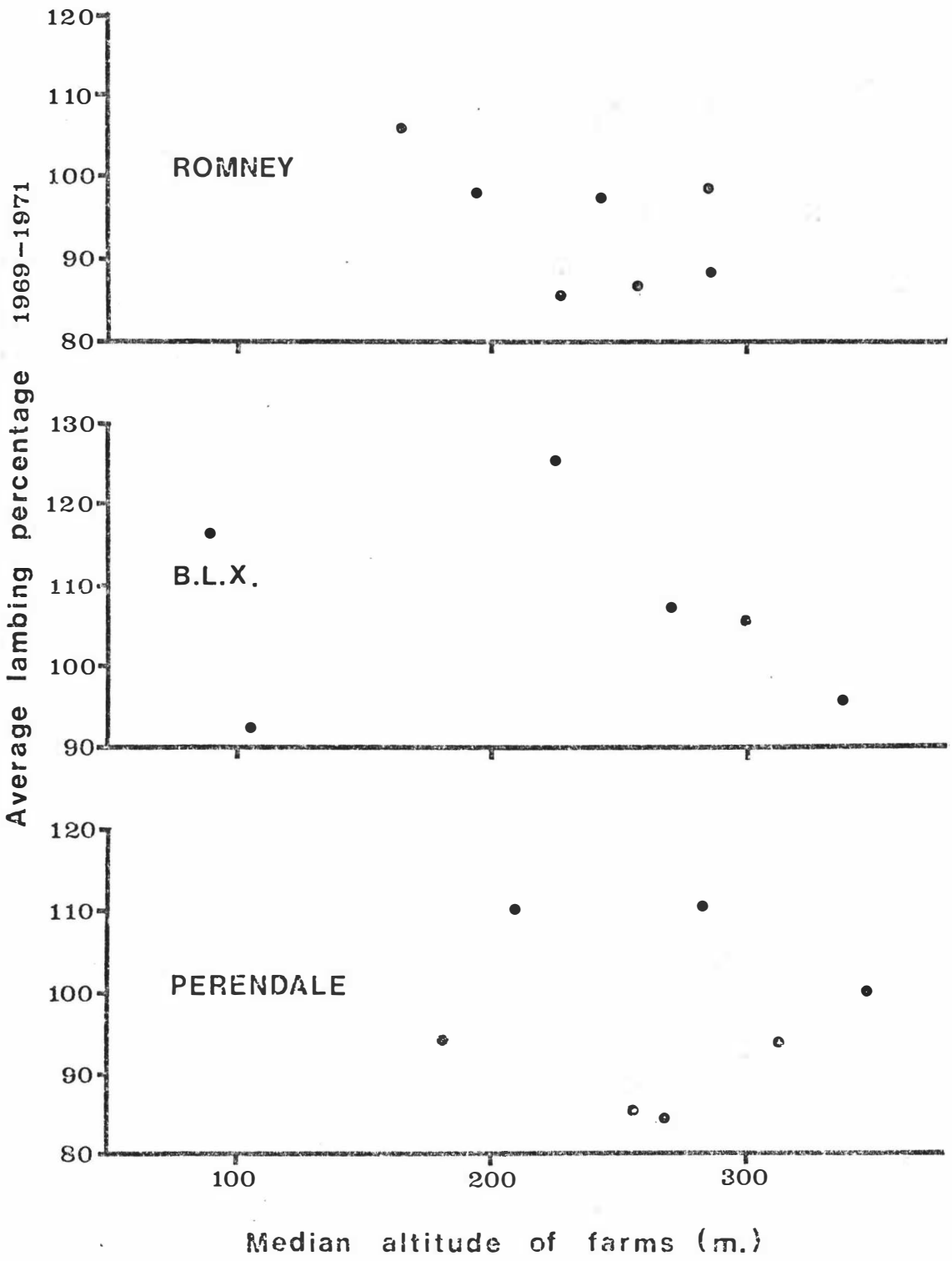
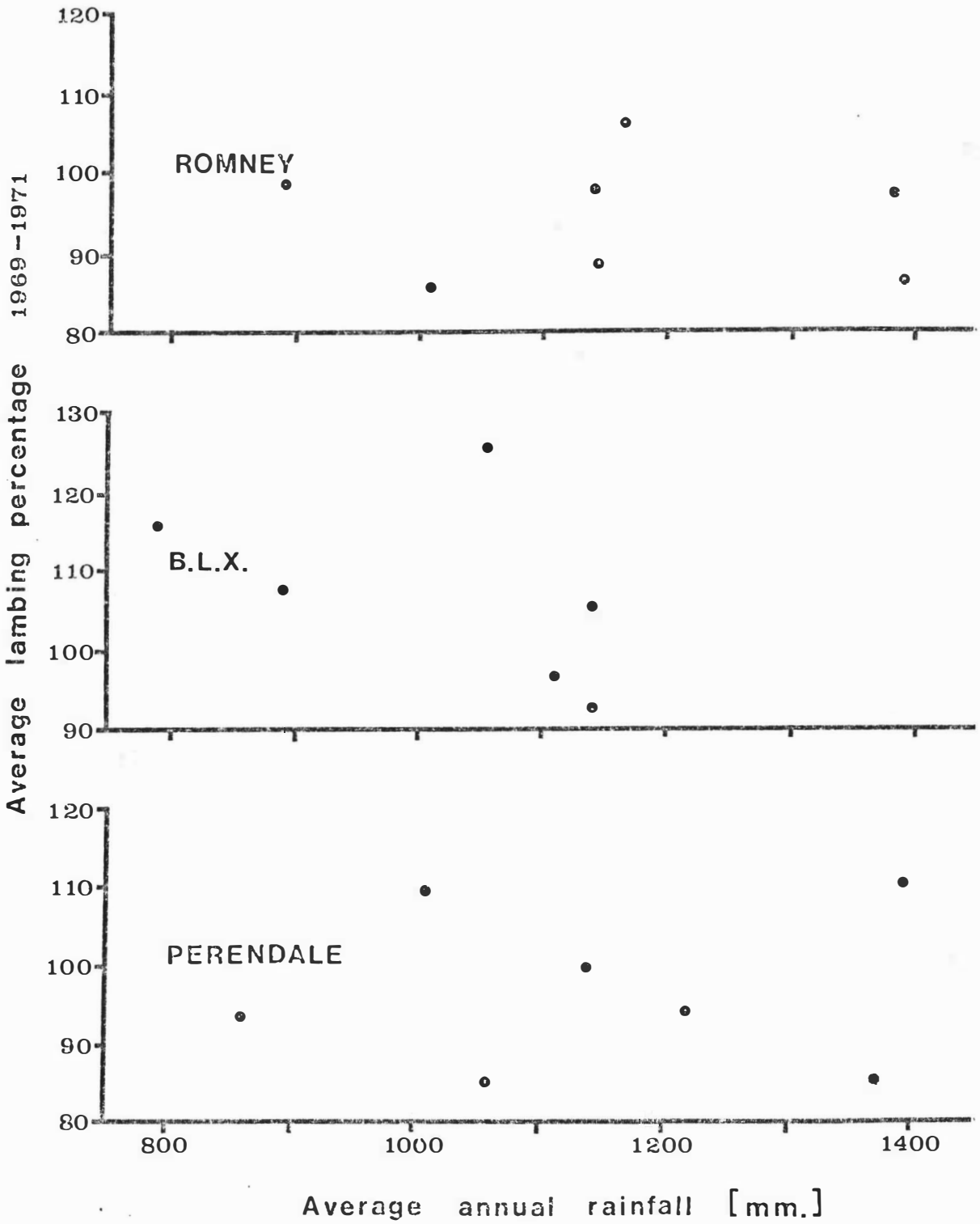


Figure 7.3

Relationship between average annual rainfall and average lambing percentage on the survey farms.



7.2.4 Stocking rate

Watson (1965) suggests that lambing percentage, and other productive characteristics, can be related to stocking rate. Figure 7.4 attempts to show a relationship between stocking rate and lambing percentage on the survey farms. Generally, there appears to be no relationship, except for some indication of higher lambing percentage with higher stocking rate in the Romney group and lower lambing percentage with higher stocking rate in the B.L.X. group. In such a small sample of farms, however, this could easily be a chance event. The effect of stocking rate on lambing percentage can really only be measured on an individual farm, at a given stage of development, with a given set of inputs, and given management practices. Any attempt to examine this relationship from survey data, even within breeds, is difficult.

7.3 The relationship between management practices employed on the survey farms, and lambing percentages

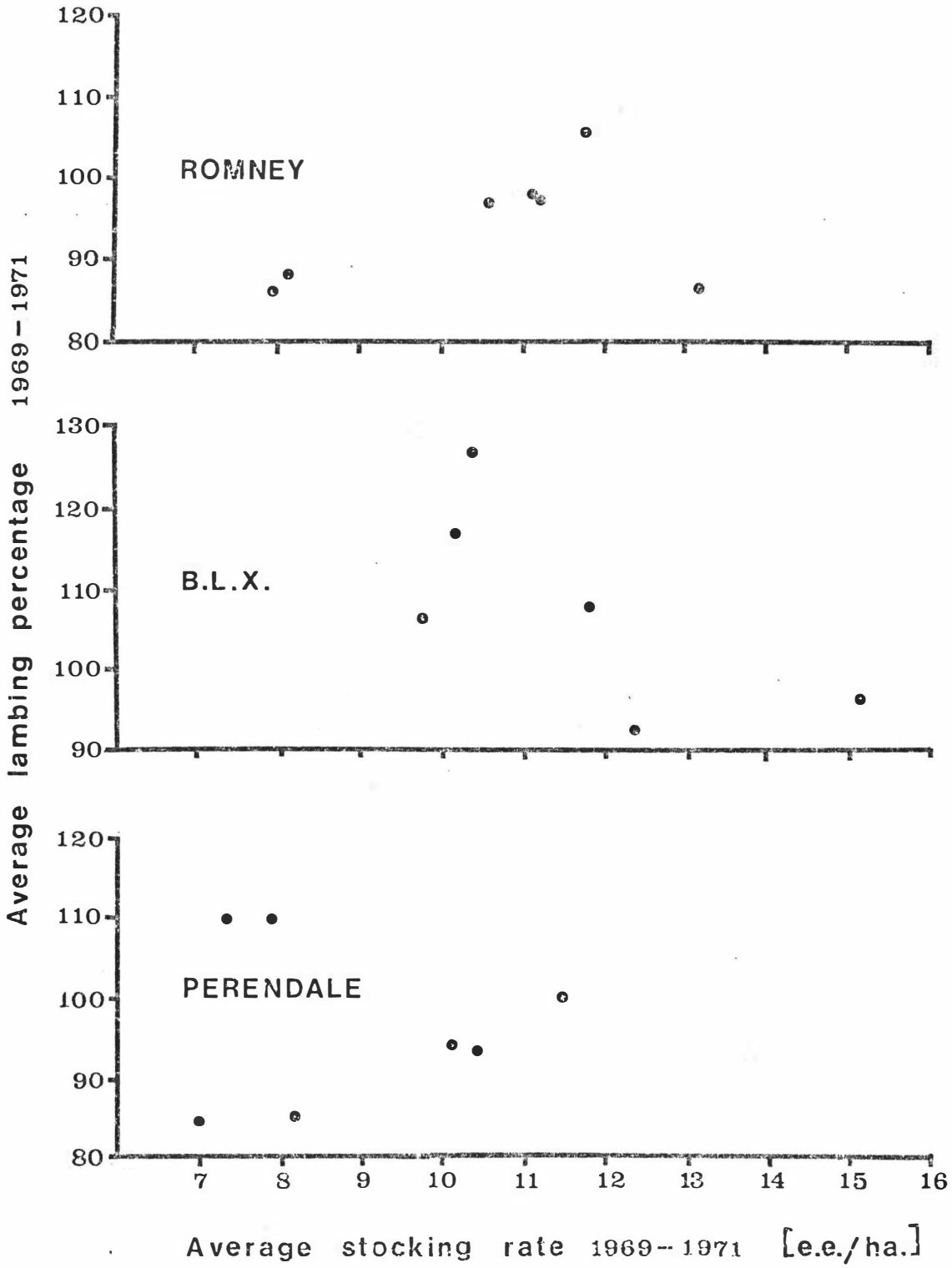
7.3.1 Animal management practices

7.3.1.1 Hogget management

The best method of gauging the effectiveness of hogget management is to measure the liveweights of hoggets at different times of the year. This information was not collected on the survey farms, and so cannot be related to later lambing percentages. However, information on some of the hogget management practices was collected. All farmers claimed that they fed their hoggets as well as possible after weaning. Without liveweight data to substantiate this, no analysis can be attempted of the relationship between feeding at this time and later lambing percentages. Hogget wintering methods, however, varied somewhat from farm to farm, although the limited number of farms again makes analysis difficult. Two of the Romney farmers used the traditional 'hogget block' method of wintering, leaving hoggets on a specific area of the farm for the winter period. These two farms had the highest (105.8%) and lowest (85.4%) average lambing percentages at

Figure 7.4

Relationship between average stocking rate and average lambing percentage on the survey farms.



docking, in the Romney group of farms. Those farmers in the Romney group who wintered their hoggets on good feed on the better areas of the farm, had a range of lambing percentages between the other two. Two of the B.L.X. farmers also used the 'hogget block' system of wintering, one having an average lambing percentage for the group, and the other the highest lambing percentage. Two of the Perendale farmers had a specific hogget block, and both had lambing percentages below the group average. Again liveweight changes were not measured, and these may have been more closely related to lambing percentages.

Ewe hogget drenching

Table 7.1 shows the average lambing percentages of those farmers drenching ewe hoggets monthly, bimonthly, or at irregular intervals. The figures in brackets in each of the following tables are the number of farms in each group.

Table 7.1

Average lambing percentages (docking) for groups of survey farms drenching ewe hoggets monthly, bimonthly, or irregularly.

Frequency of ewe hogget drenching	Breed group			
	Romney	B.L.X.	Perendale	Average
monthly	94.7 (5)	106.4 (2)	93.1 (4)	96.3 (11)
bimonthly	88.3 (1)	103.2 (3)	100.0 (1)	99.6 (5)
irregularly	98.5 (1)	-	101.9 (2)	100.8 (3)

Again, it is impossible to draw any conclusions from these average lambing percentages, especially when there is only one farm in some groups.

Hogget mating

The average lambing percentages of those farms mating ewe hoggets and those farms not mating ewe hoggets is shown in Table 7.2.

Table 7.2

Average lambing percentages (docking) for groups of survey farms mating ewe hoggets and not mating ewe hoggets.

Mating of ewe hoggets (1971)	Breed group			
	Romney	B.L.X.	Perendale	Average
Yes	102.1 (2)	105.6 (5)	105.0 (2)	106.7 (9)
No	91.5 (5)	116.7 (1)	93.5 (5)	94.5 (11)

There appears to be a trend towards increased lambing percentages on those farms where hogget mating is practised, (excluding the one B.L.X. farm). It is very unlikely, however, that there is a causal relationship. Those farms on which hoggets are mated are generally those where hoggets are faster maturing, due either to better farming conditions or better hogget management in some way.

The major way in which hogget management can affect lambing percentages is through the liveweight of the two-tooth ewe at mating. The success of hogget management techniques can be related to this tupping weight, and it is this overall result of hogget management which is most likely to affect lambing percentages. Since these weights were not recorded, no further analysis can be done.

7.3.1.2 Pre-tupping ewe management

Post-weaning ewe nutrition

Management of the ewe flock at this time affects lambing percentages through weight changes prior to tupping. Since these weight changes were not recorded, the analysis carried out must again be superficial. Table 7.3 shows the average lambing percentages for groups of farmers who mob-stock, set-stock, or mob-stock then set-stock, over the post-weaning period.

Table 7.3

Average lambing percentages (docking) for groups of survey farms using different grazing systems after weaning.

Grazing system in use	Breed group			
	Romney	B.L.X.	Perendale	Average
Mob-stocking	94.7 (5)	106.4 (2)	93.1 (4)	93.3 (11)
Set-stocking	93.4 (2)	117.2 (2)	105.1 (2)	105.2 (6)
M-s then s-s	-	98.8 (2)	93.7 (1)	97.1 (3)

Again, the evidence is not conclusive, but there appears to be a trend towards higher lambing percentages where ewes are set-stocked over this period. If we assume that set-stocking minimises weight losses, or maximises weight gains, over this period, then this is in agreement with research work.

Flushing

Again, no weights are available to measure the extent of flushing on the survey farms, but the average lambing percentages of those farms where flushing was attempted, and those farms where flushing was not attempted, are shown in Table 7.4.

Table 7.4

Average lambing percentages (docking) for groups of survey farms attempting, and not attempting, flushing.

Flushing attempted.	Breed group			
	Romney	B.L.X.	Perendale	Average
Yes	92.5 (6)	110.6 (5)	104.6 (3)	101.5 (14)
No	105.8 (1)	91.6 (1)	90.6 (4)	93.3 (6)

Since only few farmers did not attempt to flush ewes, interpretation is difficult, but it appears that those farms where ewes were flushed, had, in general, higher lambing percentages.

Pre-tup drenching

Table 7.5 shows the average lambing percentages of those farms where pre-tup drenching was, and was not, practiced.

Table 7.5

Average lambing percentages (docking) for groups of survey farms practicing, and not practicing, pretup drenching of ewes.

Ewes pre-tup drenched	Breed group			
	Romney	B.L.X.	Perendale	Average
Yes	97.8 (5)	110.7 (4)	96.9 (4)	101.5 (13)
No	85.9 (2)	101.0 (2)	96.2 (3)	94.6 (7)

Those farmers who were practising pre-tup drenching had higher lambing percentages in all breed groups, but again it would be wrong to assume that all the difference shown is as a result of pre-tup drenching.

Use of teaser rams

Table 7.6 shows no consistent relationship between the use of teaser rams before tupping, and the average lambing percentages on the survey farms.

Table 7.6

Average lambing percentages (docking) for groups of survey farms using, or not using teaser rams before tupping.

Use of teaser Rams	Breed group			
	Romney	B.L.X.	Perendale	Average
Yes	92.3 (2)	117.2 (2)	92.8 (3)	99.6 (7)
No	95.1 (5)	102.6 (4)	99.5 (4)	98.8 (13)

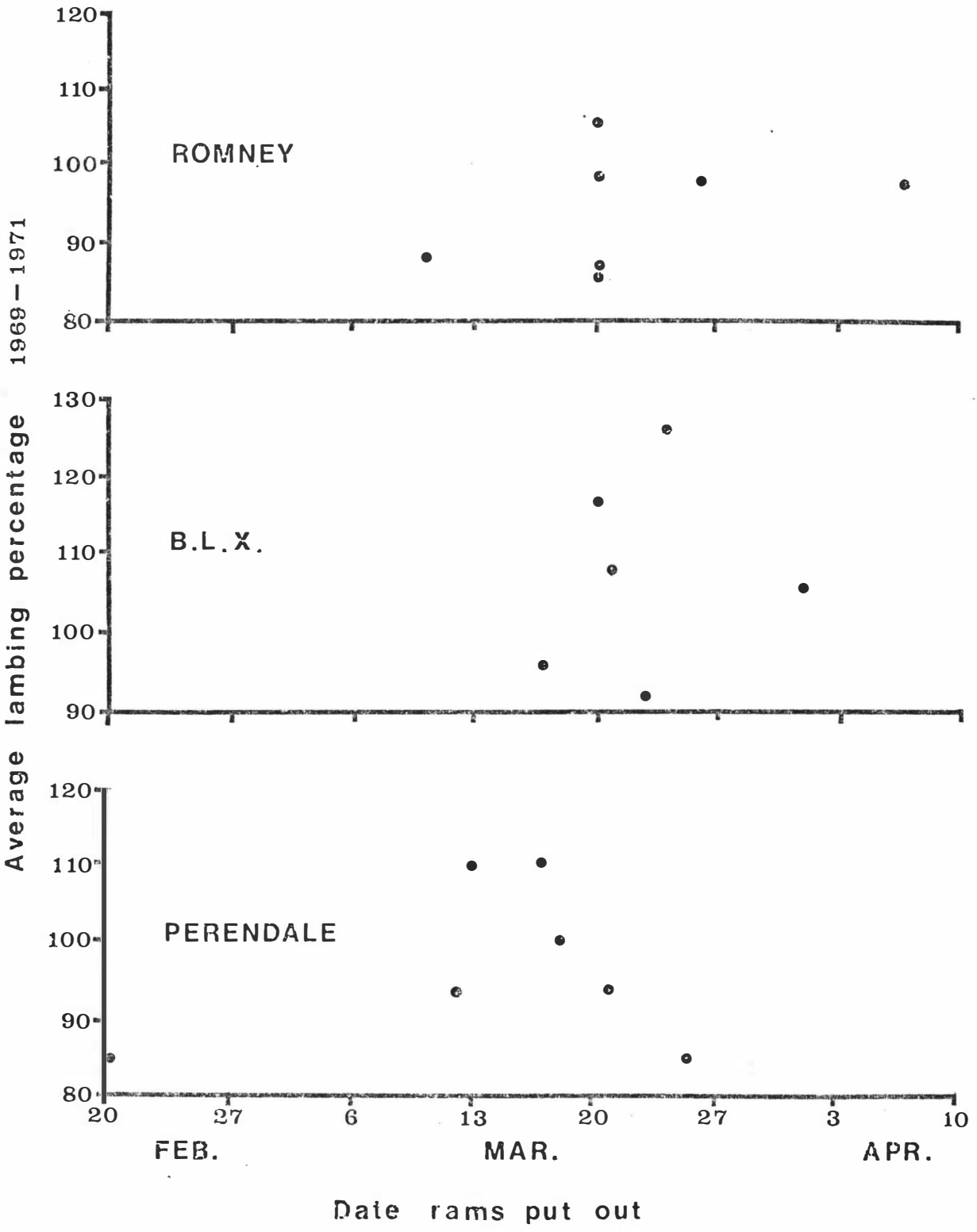
7.3.1.3 Tupping management

Tupping date

The relationship between tupping date and lambing percentage is examined in Figure 7.5 in which average lambing percentage (docking) is plotted against tupping date. There appears to be no definite trend in such a small sample of farms.

Figure 7.5

Relationship between tupping date and average lambing percentage on the survey farms.



Duration of the tupping period

The relationship between the duration of the tupping period and lambing percentage is examined in Figure 7.6, in which tupping duration, in weeks, is plotted against the average lambing percentage (docking) for each survey farm. The fact that in the Romney and B.L.X. groups, the farms with the highest lambing percentages have the shortest tupping durations, may not be indicative of a causal relationship, but it does reveal that long tupping periods are not needed for high lambing percentages.

Percentage of rams run with ewes

The relationship between the percentage of rams run with ewes, and average lambing percentage is shown in Figure 7.7. Again there is no evidence to suggest that higher ram percentages have resulted in higher lambing percentages on the survey farms.

Two-tooth mating management

Ideally the effect of two-tooth mating management should be measured on the two-tooth lambing percentage. However, these have not been separated out from those of the rest of the flock, on the survey farms. Table 7.7 shows the two-tooth management practices used by survey farmers at tupping, and the average lambing percentages for each farm over the years 1969 to 1971. Where a practice is used, it is marked with an asterisk.

Again, analysis and interpretation is difficult, if not impossible. Those farms in the Romney group, on which all the practices were used, had the lowest lambing percentages. This should not be taken to mean that the implementation of these practices will reduce lambing percentages. There appears to be no discernable trend towards higher lambing percentages, with any one practice, or combination of practices.

Figure 7.6

Relationship between duration of the tupping period and average lambing percentage on the survey farms.

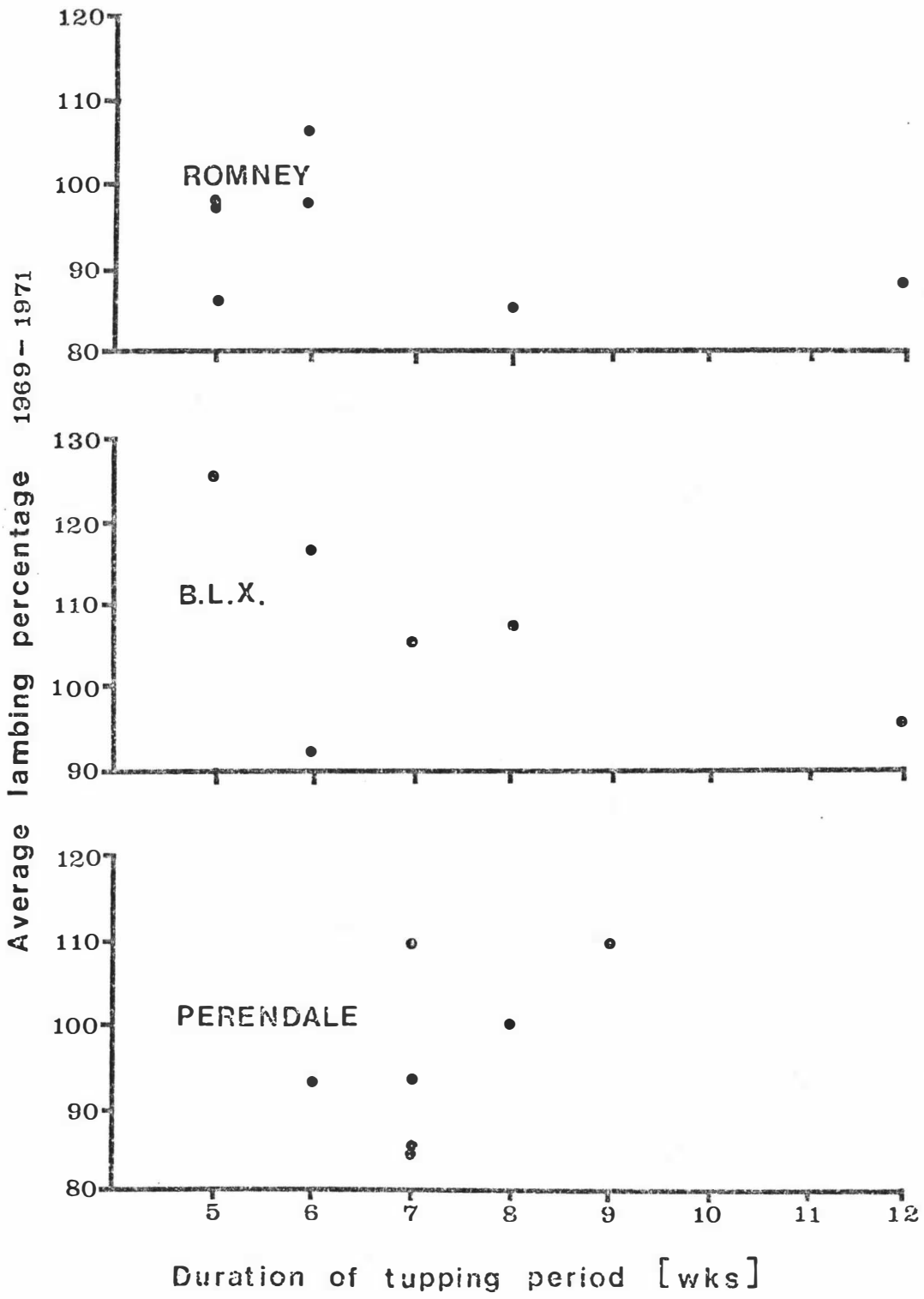


Figure 7.7.

Relationship between the percentage of rams run with the ewes at mating and average lambing percentage on the survey farms.

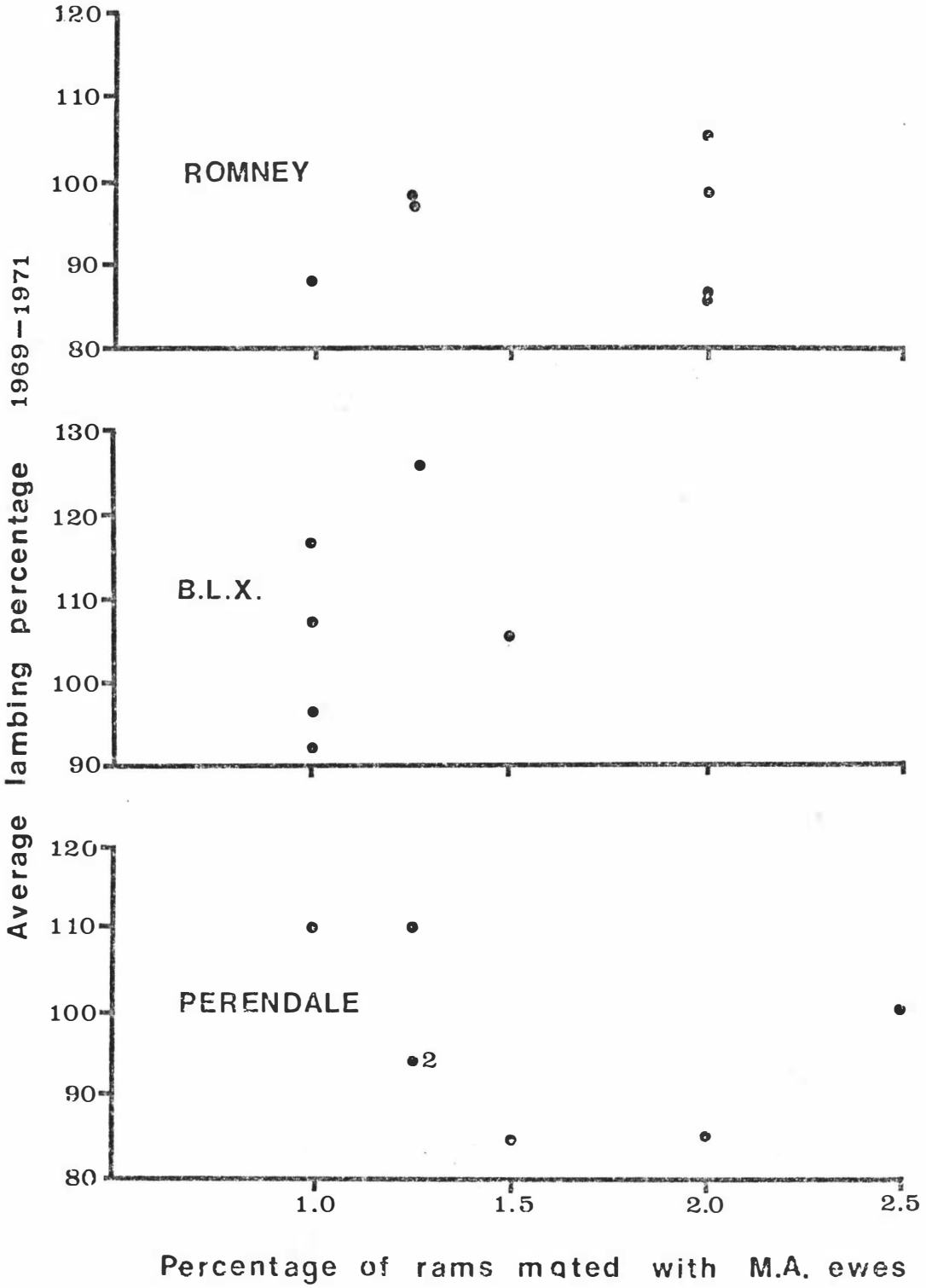


Table 7.7

Two-tooth management practices used by survey farmers at tupping.

Farm Number	Increased percentage of rams.	Smaller, easier, paddocks.	Better feed	Mobbing up of ewes	Average lambing percentage 1969-71 (docking)
R					
1		*	*		105.8
2	*	*	*		88.5
3	*	*	*		98.5
4	*	*	*	*	86.3
5	*	*		*	97.9
6					98.3
7	*	*	*	*	85.4
B.L.X.					
8	*	*		*	107.5
9		*			96.0
10		*	*		116.7
11		*	*		106.0
12	*	*			129.6
13	*	*	*		91.6
P					
14		*	*		84.7
15	*	*	*		84.1
16		*	*		93.7
17	*			*	110.1
18					100.00
19	*	*	*		109.9
20	*	*	*		93.7

7.3.1.4 Winter management of ewes

It is again difficult to quantify winter management practices, without liveweight data. Table 7.8 presents the average lambing percentages of those farms where ewes are set-stocked and mob-stocked over the winter.

Again, no conclusive inferences can be drawn from this table, due to the small sample size involved.

Table 7.8

Average lambing percentages (docking) for groups of survey farms set-stocking, or mob-stocking, ewe flocks over the winter.

System of winter stocking	Breed group			
	Romney	B.L.X.	Perendale	Average
Set-stocking	97.9 (1)	108.0 (4)	93.2 (4)	100.3 (9)
Mob-stocking	93.8 (6)	106.4 (2)	101.2 (3)	98.1 (11)

7.3.1.5 Pre-lambing management

Ewe nutrition

In the Romney group of farms, the highest lambing percentage was achieved on a farm where a mob-stocking system was maintained until all ewes had lambed. Lambed ewes were left behind as the rotation progressed. In the B.L.X. group of farms, the highest lambing percentage was obtained on a farm where all ewes were set-stocked from two to four weeks prior to lambing. In the Perendale group of farms, the two highest lambing percentages were obtained on farms where ewes were set stocked just before lambing. All other farmers in the survey began a set-stocking system from one to six weeks before lambing. No relationship was evident between time of set stocking and average lambing percentage.

Separation of late-lambing and dry ewes

All except one farmer attempted to separate out late lambing and dry ewes, ten by means of tupping markings, and nine by udder development immediately prior to lambing. The reason for this practice on many farms was not to try and control feeding, but to concentrate shepherding labour on those ewes lambing or about to lamb. The average lambing percentages of farms where this separation was done by tupping markings and by uddering, are shown in Table 7.9.

Again, there appears to be no consistent relationship.

Table 7.9

Average lambing percentages (docking) for groups of survey farms separating late-lambing and dry ewes by means of tupping markings and uddering.

Method of separation.	Breed groups			
	Romney	B.L.X.	Perendale	Average
Tupping markings	94.4 (3)	98.4 (3)	99.6 (4)	97.7 (10)
Uddering	96.9 (4)	116.5 (3)	88.9 (2)	101.6 (9)

Pre-lamb drenching

Table 7.10 shows average lambing percentages on farms practicing pre-lamb drenching and farms not practicing pre-lamb drenching.

Table 7.10

Average lambing percentages (docking) for groups of survey farms practicing, and not practicing, pre-lamb drenching of ewes.

Pre-lamb drenching	Breed groups			
	Romney	B.L.X.	Perendale	Average
Yes	95.3 (5)	106.7 (3)	94.5 (5)	97.6 (13)
No	92.1 (2)	108.2 (3)	101.9 (2)	101.7 (7)

Again, there is no evidence of a constant relationship.

7.3.1.6 Lambing management

Shepherding at lambing

Farmers were classified on the basis of whether they shepherded intensively (at least once a day) or shepherded little or not at all at lambing. Table 7.11 shows the average lambing percentages of these grouping of farmers.

The table appears to show higher lambing percentages on those farms where little or no shepherding was carried out. It is dangerous to suggest, however, that the lack of shepherding

is causing the higher lambing percentages. It can be concluded, though, that limited or nil shepherding need not restrict lambing percentages.

Table 7.11

Average lambing percentages (docking) for groups of survey farms where shepherding at lambing was, or was not, intensive.

Shepherding intensity	Breed groups			
	Romney	B.L.X.	Perendale	Average
Intensive	93.7 (6)	105.1 (4)	89.1 (4)	95.6 (14)
Little or none	98.3 (1)	112.1 (2)	106.7 (3)	107.1 (6)

Mothering up

Table 7.12 shows the average lambing percentages achieved on those farms practicing mothering up, and those no practicing mothering up.

Table 7.12

Average lambing percentages (docking) for groups of survey farms where mothering up was, and was not, practiced.

Mothering up	Breed groups			
	Romney	B.L.X.	Perendale	Average
Yes	95.4 (5)	104.8 (3)	87.5 (3)	95.8 (11)
No	91.9 (2)	110.1 (3)	103.4 (4)	103.1 (9)

The situation revealed here is very similar to that revealed with shepherding at lambing. Although there may be no causal relationship, failure to mother up orphan lambs does not appear to limit lambing percentages.

7.3.1.7 Method of lamb sales

Farmers were classified on the basis of whether surplus wether lambs were sold as fat lambs, or as a mixture of fat and store lambs. The average lambing percentages of these two groups is shown in Table 7.13.

Table 7.13

Average lambing percentages (docking) for groups of survey farms where wether lambs were sold fat, or as a mixture of fat and store.

Method of lamb sales	Breed groups			
	Romney	B.L.X.	Perendale	Average
Fat	93.9 (4)	111.4 (4)	96.9 (4)	100.7 (12)
Fat and store	95.0 (3)	99.6 (2)	96.2 (3)	96.6 (8)

The reason this analysis was attempted was the feeling that farmers may have been placing too much emphasis on the fattening of all lambs, at the expense of restricting feed for the ewe and ewe hogget flocks, resulting in reduced lambing percentages. However, this effect is not apparent on the survey farms. The method of sale of wether lambs may be more closely related to the stage of development of farms, and feed availability on individual farms.

7.3.2 Breeding management practices

7.3.2.1 Selection of ewe replacements

Table 7.14 shows the methods used by survey farmers in their selection of replacement ewes, and the average lambing percentages over the years 1969 to 1971.

In the B.L.X. and Perendale groups of farms, the farmers with the highest lambing percentages used measured liveweight as a method of replacement selection. In the Romney group of farms, two of the highest lambing percentages were achieved on farms where measured liveweight was used. All those farmers selecting on the basis of hogget lambing or oestrus, in the Romney group, had high lambing percentages, as did the two farmers selecting on this basis in the Perendale group. There appears to be a trend towards lower lambing percentages where selection is based on wool, or visual assessment of condition, alone.

Table 7.14

Ewe replacement selection methods used by survey farmers

Farm No.	Selection methods: Measured liveweight	Hogget lambing or oestrus	Birth rank	Wool	Visual assessment of condition	Average lambing percentage 1969-1971 (docking)
R						
1		*		*	*	105.8
2				*	*	88.3
3	*	*	*	*		98.5
4	*		*	*		86.3
5			*	*	*	97.9
6	*	*	*	*	*	98.3
7				*	*	85.4
B.L.X.						
8		*		*	*	107.5
9		*		*	*	96.0
10		*			*	116.7
11					*	106.0
12	*	*	*	*		126.9
13		*			*	91.6
P						
14				*	*	84.7
15			*	*	*	84.1
16				*	*	93.7
17				*	*	110.1
18		*		*		100.0
19	*	*		*		109.9
20				*	*	93.7

7.3.2.2 Selection of ram replacements

Table 7.15 shows the methods used by survey farmers to select rams for their flocks, and the average lambing percentages of these flocks for the years 1969 to 1971. As can be seen from the table, all except three farmers selected on the basis of full performance records supplied by the ram breeder, although several took account of other characteristics as well. It is difficult to pick up any significant trends in lambing percentage resulting from the methods of ram selection shown.

Table 7.15

Ram replacement selection methods used by survey farmers

Farm No.	Selection methods: Full performance records	Birth rank.	Weaning weight	Wool	Visual assessment	Average lambing percentage 1969-1971 (docking)
R						
1	*	*		*		105.8
2	*				*	88.3
3	*					98.5
4	*					86.3
5	*	*		*		97.9
6	*	*	*			98.3
7	*					85.4
B.L.X.						
8	*			*	*	107.5
9		*		*		96.0
10	*	*				116.7
11	*					106.0
12	*					126.9
13	*					91.6
P						
14	*					84.7
15		*				84.1
16	*					93.7
17				*	*	110.1
18	*	*				100.0
19	*					109.9
20	*				*	93.7

7.3.2.3 Selection of ewes for culling

Table 7.16 shows the basis of culling used by the survey farmers and the average lambing percentages achieved over the years 1969 to 1971. Those farmers not culling wet-dry ewes did not necessarily have low lambing percentages, but where lambing percentages were high, there may have been few wet/dry ewes. Those farmers who were able to cull on condition, appear to have higher average lambing percentages than those not culling on condition, but again this

culling may be result of high lambing percentages, rather than the cause of high lambing percentages. Several farmers did not cull for age at all, but their lambing percentages do not appear to have suffered. Where culling for age is not practiced, there appears to be more opportunity for culling for productive characteristics.

Table 7.16

Basis of ewe culling used by survey farmers

Farm No	Culling methods					Average lambing percentage 1969-1971 (docking)
	Dry/dry ewes	Wet/dry ewes	Ewe condition.	Culling for age 5 yr	Culling for age 6 yr	
R						
1	*		*	*	*	105.8
2	*	*		*		88.3
3	*	*			*	98.5
4	*	*			*	86.3
5	*	*	*			97.9
6	*	*	*		*	98.3
7	*			*		85.4
B.L.X.						
8	*	*	*	*		107.5
9	*	*	*	*		96.0
10	*			*		116.7
11	*		*	*		106.0
12	*	*	*			126.9
13	*	*		*		91.6
P						
14	*	*		*	*	84.7
15	*	*			*	84.1
16	*	*	*	*		93.7
17	*	*		*		110.1
18	*			*		100.0
19	*	*	*			109.9
20	*		*			93.7

8. CASE FARM STUDIES

8.1 Introduction

In this chapter, the problem of trying to increase lambing percentages is studied on two case farms. The present situation on these two farms is described, in terms of both physical details and management policies, and suggestions are made as to the possibilities for management changes to increase lambing percentages. These suggestions are made on the basis of the research cited in the literature review and the results achieved on other survey farms. Problems which might be encountered in the implementation of these changes are also considered. The final section in this chapter analyses the financial effect of an increase in lambing percentage from 90% to 100%.

8.2 Selection of farms for case studies

Two farms were selected from the twenty survey farms as the bases for case studies. Both of these farms had achieved lambing percentages around the 90% level for several years, and couldn't seem to be able to improve above this level. They represented, however, two very different situations.

The first farm was on hard hill country, with a large area of the farm still not in production, and quite severe scrub regeneration problems on the developed area of the farm. Stocking was not very high (7.56 e.e./ha) with only about 25% of ewe equivalents being in cattle.

The second farm was on easy hill country, and was almost fully developed. Stocking rate was only a little higher (7.99 e.e./ha) but over 40% of these ewe equivalents were in cattle. The stocking rates shown above were calculated on the basis of grazed area, not total area.

Both farms were running Romney flocks.

It was felt that these two farms accurately represented these two common farming situations in the Wairarapa.

Some assumptions have been made about production on these two case farms, as will be seen later, but the production assumed is very similar to that actually achieved, on the farms forming bases for the studies. Stocking has also been slightly adjusted to present a situation of static stock numbers in each stock class from year to year. The management policies described for the case farms are those employed on the corresponding survey farms.

8.3 Description of case farms

8.3.1 Physical data

		Farm A	Farm B
Farm area (ha)	a) total	500	640
	b) grazed	360	620
	c) developable	120	10
Topography (% total farm area)			
	a) flat or easy rolling	-	15
	b) steep but cultivable	20	70
	c) steep and uncultivable	80	15
Altitude (metres)			
	a) minimum	120	180
	b) maximum	450	270
Av. rainfall (mm/year)		1140	1010
Aspect		S.E.	S&N
Soils[1]	a) type	Steepland soils assoc. with the YG Earths, formed on mudstones and argillite.	YG Earth intergrades to YB Earths, formed on silstones.
	b) major classification of pastoral suitability	6	4
Perm. labour units		1	1.5
Subdivision			
no. of grazing paddocks		16	17
Fertilizer (tonnes)			
	a) super phosphate	40	95
	b) lime	-	40

1. NZ Soil Bureau Bulletin, 26(1). 1968.

8.3.2 Stock wintered

	Farm A	Farm B
Sheep		
Ewes (Romney)	1500	2150
Ewe hoggets	600	850
Wether hoggets	20	50
Rams	25	45
e.e. (sheep)	2014	2901
e.e. (sheep)/eff. ha.	5.59	4.68
Cattle		
Cows (RWB)	70	200
18 month heifers (NRWB)	20	35
Weaner heifers	25	50
Weaner steers	10	80
Bulls	2	5
e.e. (cattle)	710	2050
e.e. (cattle)/eff. ha.	1.97	3.31
Total e.e./eff.ha.	7.56	7.99

8.3.3 Stock policies

Sheep policies

Farm A has a policy of breeding its own Romney, two-tooth, replacement ewes, and selling wether lambs in store and fat condition. In most years more wether lambs are sold in store condition than in fat condition, but in years of good summer growth, a higher proportion of wether lambs are fattened. Some culling of ewe lambs is carried out before wintering as hoggets, usually about 30% of total culling up to two-tooth mating. The remainder of the ewe replacement culling is carried out before two-tooth mating, the surplus being sold as two-tooth ewes. Culling is carried out within the ewe flock for the dry/dry and wet/dry condition, and all ewes are culled at five years of age.

Farm B has a very similar policy except that all wether lambs are sold in fat condition, as are culled ewe lambs, surplus to those wintered as hoggets. Culling is not

carried out for the wet/dry condition as on farm A, but all dry/dry and five year old ewes are culled.

Cattle policies

Farm A has a policy of breeding from Angus-Hereford cross cows, selling most steers as weaners in the Autumn, and the remainder as 18 month steers in the following Autumn. Surplus heifers to replacement requirements are sold as weaners.

Farm B has a policy of breeding and selling steers as yearlings in the Spring, selling most surplus heifers as weaners in the Autumn, and the remainder as yearlings in the Spring.

Neither farm was calving cows as two year olds.

8.3.4 Present production of case farms

Assumptions

1. Equal numbers of male and female stock born.
2. Ewe lamb losses from weaning to wintering, two percent of those wintered.
3. Wether lamb losses from weaning to wintering, 50% of those wintered (includes those slaughtered for farm meat.
4. Ewe hogget losses four percent.
5. Ewe losses five percent per year[2].
6. Flock culling of ewes at five percent per year[2].
7. Lambing percentage (at weaning), 90%.

Sheep production (based on assumptions above)

		Farm A	Farm B
1.	Breeding ewes	1500	2150
2.	Lambs weaned (90%)	1350	1935
3.	Ewe lambs	675	968
4.	Wether lambs	675	967
5.	Ewe hoggets wintered	600	850

2. In practice, one might expect low losses and high culling with young ewes and vice versa with older ewes. The total figure of 10% per year seems reasonable.

		Farm A	Farm B
6.	Losses from 3) to 5)	12	17
	Ewe lambs to sell	63	101
8.	Wether hoggets wintered	20	50
9.	Losses from 4) to 8)	10	25
	Wether lambs to sell	63	101
10.	Two-tooth replacements needed	436	625
11.	Losses of ewe hoggets	24	34
	Surplus two-tooth ewes to sell	140	191
12.	Numbers of ewes by age groups		
	(a) 2th	436	625
	(b) 4th	392	563
	(c) 6th	353	507
	(d) 4 yr	318	456
	CFA 5 yr old ewes to sell	276	410
	Mixed age cull ewes to sell	60	84

Wool production

Farm A	2014 sheep e.e. at 5.0 kg/e.e.	10,070 kg.
Farm B	2901 sheep e.e. at 5.5 kg/e.e.	15,955 kg.

Cattle production

		Farm A	Farm B
1.	Breeding cows	70	200
2.	Calves (at 90% calving)	63	180
3.	Heifer calves	31	90
4.	Steer calves	32	90
5.	Weaner heifers wintered	25	50
6.	Losses from 3) to 5)	1	3
	Weaner heifers to sell	5	37
7.	18 month heifers wintered	20	35
8.	Losses from 5) to 7)	1	2
	Yearling heifers to sell	-	13
	18 month heifers to sell	4	-
9.	Weaner steers wintered	10	80
10.	Losses from 4) to 9)	1	3
	Weaner steers to sell	21	7
11.	Losses from 9) to sale	-	2
	Yearling steers for sale	-	70
	18 month steers for sale	10	8
	Cull cows for sale	?	?

8.3.5 Present management policies

8.3.5.1 Animal management

(a) Pre-tupping management

Hogget management

	Farm A	Farm B
Date of weaning	1st December	10th December
Age of first lambs at weaning	116 days	116 days
Type of pasture that hoggets weaned onto	Best available saved pasture	Best available saved pasture
Hogget wintering system	Separate hogget block	Continued on the best available pasture
Frequency of ewe lamb/hogget drenching till winter	About every six weeks	About every six weeks
Ewe hogget mating	No	No
Selenium drenching	Once	No

Ewe management

Grazing system immediately after weaning	Ewes set-stocked in a limited number of paddocks	Ewes mob-stocked
Grazing system later in the Summer	Same	Same
Flushing treatments imposed	Try to increase feed intake and quality from about three weeks before tupping	Try to increase feed intake and quality from about three weeks before tupping
Any preferential ewe feeding	Poorest of the older ewes	No
Pre-tup drenching	All ewes	No

Ram management

Semen testing	No	No
Shearing before tupping	New rams only	New rams only
Nutrition before tupping	Well fed and drenched	Well fed, but kept fit in a hill paddock

Ram management (contd.)

	Farm A	Farm B
Vaccinations	No	For Brucella ovis
Percentage of rams used		
with M.A. ewes	1.0	2.0
with 2th ewes	1.0	2.0+
Age of rams used with M.A. ewes	M.A.	M.A.
with 2th ewes	M.A. and hoggets	4th

(b) Tupping management

General

Date of rams put out	10th March	20th March
Duration of the tupping period	12 weeks	8 weeks
Use of teaser rams	No	No
Use of ram harnesses at mating	No	No
Shifting of rams during the mating period	Yes	No

Two-tooth management at mating

Higher ram percentage with 2ths	No	Slightly
Smaller, easier paddocks	Yes	Yes
Better feed	Yes	Yes
Mobbing up	No	Yes
Pre-tup shearing	No	Yes

(c) Management from tupping to lambing

Winter ewe grazing system	Mob-stocking	Mob-stocking
Pre-lamb drenching	Yes	No
Pre-lamb shearing	No	No

(d) Lambing management

	Farm A	Farm B
Ewe grazing system	Set-stocked	Set-stocked
Separate lambing of 2ths	Yes	Yes
Separation of dry and late-lambing ewes	by udder development	By udder development
Main causes of lamb losses	Dystokia starvation	Starvation misadventure tetanus (slight)
Lamb vaccinations	No	Pulpy kidney, anti-tetanus
Ewe vaccinations	Pulpy kidney	No
Shepherding	Intensive	Intensive
Mothering up	Some	None
Twin marking	Selected flock only	No
Marking of assisted ewes	Difficult ones only	No
Marking of lambs of assisted ewes	No	Yes (culled)

8.3.5.2 Breeding management

(a) Selection of replacement ewes

	Farm A	F Farm B
Methods of selection used	Mainly on consitution when shorn, as hoggets. Some culling for obvious faults, as lambs	Visual assessment of weight. Intensive selection for wool type

(b) Selection of rams

Source of rams	Stud rams and own breeding	Stud rams
Basis of ram selection	Birth rank, wool weight and type, weaning weight	Full performance records

(c) Selection of culled stock

	Farm A	Farm B
Culling of dry/dry ewes	All culled	All culled
Culling of wet-dry ewes	Most culled, 2ths another chance	Culled to a separate 'cull' flock
Culling for age	Most at five years rest at six years	All at five years

8.4 Methods available for increasing lambing percentages on the case farms

There are two approaches that can be used in trying to increase lambing percentage in a particular flock. One involves concentrating on animal management throughout the year, to gain the maximum reproductive response from the existing stock. The second approach involves the improvement of the potential reproductive characteristics of the flock by breeding. This improved reproductive potential can then be utilised by improved animal management.

8.4.1 Possibilities for improved animal management

8.4.1.1 Grazing management and the utilisation of feed supplies

Most of the grazing management problems on the two case farms, arise as a result of the pasture growth pattern in the area. The Ministry of Agriculture and Fisheries have determined a pasture growth pattern for their research area at Masterton, and this is shown in Figure 8.1. This is an average of only three years production, and production was extremely variable between these years, but the general pattern is well illustrated. For comparison, the equivalent pasture growth pattern is given for the Bay of Plenty area, in Figure 8.2.

There are three periods during which grazing management can have a significant effect on lambing percentages. These are:-

(a) The entire period of ewe hogget grazing.
(b) The period from weaning to tupping.
(c) The last month of pregnancy.

Figure 8.1

Average monthly pasture production (Masterton)[1]

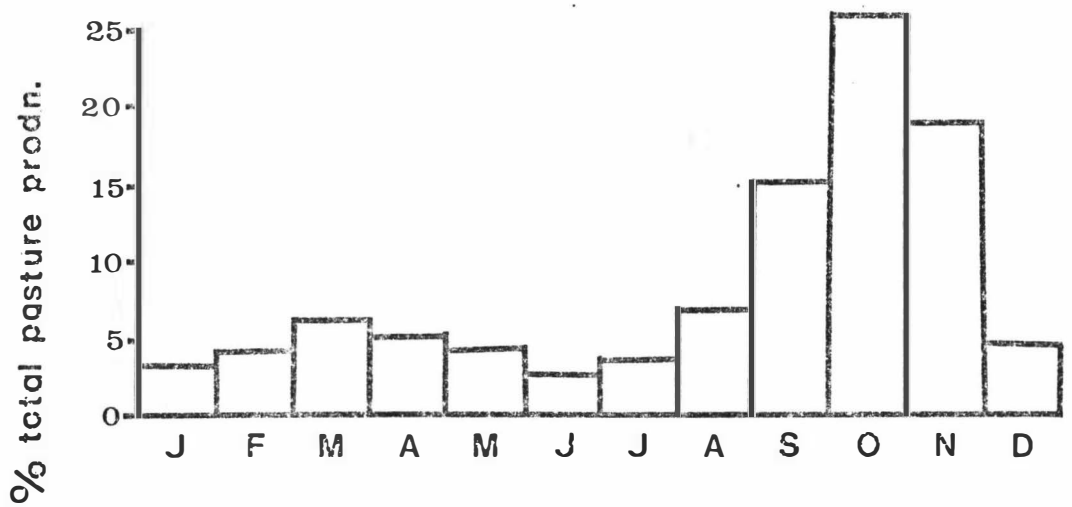
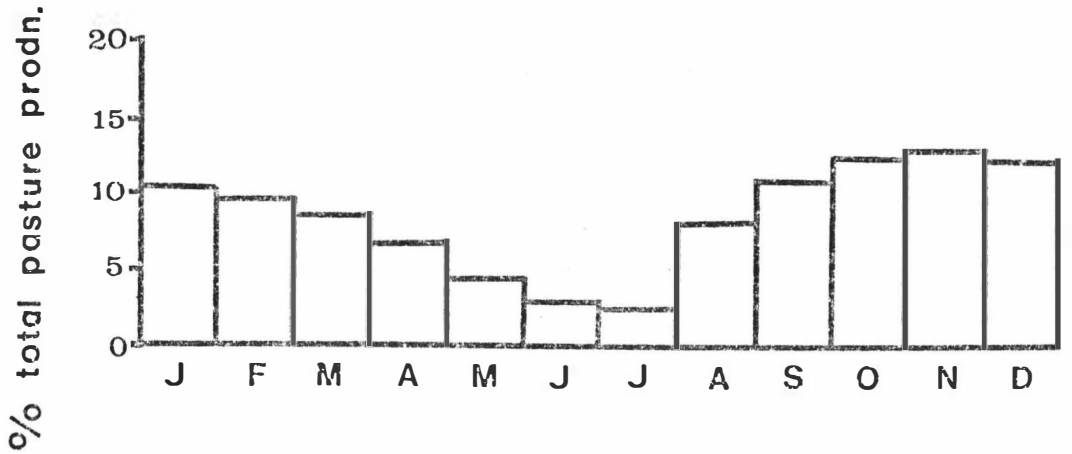


Figure 8.2

Average monthly pasture production (Bay of Plenty)[2]



1. Source: MAF, Masterton.
2. Source: Lincoln College Farmers Budget Manual.

(a) Ewe hogget nutrition

The aim of ewe hogget nutrition should be to reach as high a liveweight as economically possible by two-tooth mating. How this weight gain is achieved does not seem to be important. It is the final weight that is important.

Both case farmers fed their ewe hoggets on the best pasture available after weaning. On case farm A, the hoggets were then wintered on a 'hogget block' and largely left to their own devices until after lambing, whereas on case farm B the policy of providing the best feed available was continued. At lambing, and during lactation, on both farms, the ewe flock was given preferential feeding over the hoggets. After weaning, the rising two-tooth ewes were fed similarly to the remainder of the ewe flock. Drenching of ewe hoggets was done on both farms at intervals of about six weeks, from weaning to wintering.

There appears to be some room for improvement in this system. In order to maximise liveweight by two-tooth mating, a constant check must be kept on the hoggets' liveweight and condition. The best way in which this can be done is by the regular weighing of a representative sample of the hogget flock. This allows for much more positive corrective measures to be taken when liveweight gain slows down, stops, or becomes negative. Weighing will reveal this situation much more quickly.than any form of visual assessment. Regular weighing will also reveal the need for any additional hogget drenching.

The pasture production pattern shown in Figure 8.1 reveals that over 25% of the year's pasture production occurs in October, and nearly 60% of the year's pasture production occurs in the three months of September, October and November. The utilisation of the feed grown at this time is therefore very important. There is a sharp decline in feed production and quality after November. This period of high pasture production would seem to be the most obvious period during which fast liveweight gains in hoggets could be made, but both case farmers virtually ignored their hoggets over this period and concentrated their efforts on hogget feeding

before the winter. Low weight gains over this earlier period might be acceptable if they could be compensated for by fast weight gains in the Spring. There is however, a need to ensure that there is sufficient feed available, up until two-tooth tupping, to at least maintain this increased liveweight. A state of falling liveweight before tupping appears to be condusive to low lambing percentages.

The low pasture production over the summer months suggests that this period might be better suited to feeding replacement ewe hoggets and ewes before tupping, than to trying to fatten all wether lambs. The increased lambing percentages achieved by the better feeding of ewes and ewe replacements over this pre-tupping period may more than compensate for the slight reduction in returns resulting from selling lambs on the store market.

The possibility of a winter crop for hoggets could also be raised. This would have more application on case farm B, which has a suitable contour. Unless such a cropping policy complemented a necessary pasture renewal policy, it is doubtful whether this practice would be economic. It would probably be far more economic to try and improve grazing management or to buy in supplementary feed.

(b) Pre-tupping nutrition of ewes

Research work indicates that it is preferable not to allow ewes to lose weight from weaning to tupping. The higher the liveweight of ewes at tupping, the higher the lambing percentages achieved.

On case farm A ewes were set-stocked after weaning, in a few paddocks, at a high stocking rate, while other classes of stock were allowed preferential grazing. On case farm B, the ewe flock was grazed in one mob, at a high stocking rate, and used to clean up rough feed, and feed remaining after grazing with lambs or cattle.

Some attempt was made on both farms to build up flushing feed, to be fed to the ewes from about three weeks prior to tupping.

The weighing of ewes to measure weight changes over this period would have been very useful to see the effect of these grazing systems. However, comparisons between the farms would not be valid, due to the quite different farming situations. Regular sample weighings of ewes would appear to have a commercial use in ensuring that ewe liveweights did not fall after weaning. If liveweights were seen to be falling, then additional feed could be supplied, either by using feed that was being saved for flushing, or by supplying supplementary feed in some form. Research quoted earlier suggested that the use of feed to maintain liveweight over this period would be preferable to saving feed for flushing, at the cost of losing liveweight.

(c) Prelambing nutrition of ewes

The last month of pregnancy is a period where grazing must be very carefully managed. Over or under-nutrition, at this time, can cause losses of ewes and/or lambs.

Ewe losses can result from pregnancy toxaemia (caused by over-nutrition in early pregnancy and under-nutrition in late pregnancy), hypocalcaemia (caused by sudden stresses or checks in feeding), and dystokia (difficult births caused by large lambs as a result of over feeding in late pregnancy).

Lamb losses can result from dystokia, or under feeding of ewes, resulting in the birth of small, weak lambs.

Ideally a farmer would like to know exactly when each ewe was due to lamb, and whether the ewe was carrying a single lamb or twins. If he knew this information, the farmer could control each ewe's feeding to minimise ewe and lamb losses. Both case farmers divided their flocks into early and late lambers, before lambing, on the basis of udder development, but there may be advantages in a more precise method of lambing date prediction. This is most easily achieved by the use of ram harnesses at mating, and the regular changing of marker colours. Ewes mated at different stages of the tupping period can then be identified and separated into lambing groups before lambing. The amount of additional

work involved in this procedure is not excessive, and there are several other advantages. Rams can be checked when changing marker colours, inactive or infertile rams can be identified, by the lack of marked ewes or excessive numbers of marked ewes returning to service, and ewes not marked at all, can be assumed dry and need not be wintered.

When a commercially applicable method of determining the number of foetuses carried by a ewe, becomes available, this will further aid the grazing management of the ewe flock prior to lambing. Some farmers claim reasonable success in separating twin-bearing ewes from single-bearing ewes, prior to lambing, by walking the ewes, in a mob, along a race. Those ewes carrying twins are said to drop back to the rear of the mob, and can be drafted off from the others.

8.4.1.2 Other pre-tupping management practices

(a) Pre-tup drenching of ewes

On case farm B, no pre-tup drenching of ewes was carried out. Some increase in lambing percentage might result from drenching, but the extent of the response varies widely from farm to farm and from year to year.

With thiabendazole drench selling at nine cents per ewe dose, Table 8.1 shows the increase in lambing percentage needed to cover the drench cost. If the cost of labour was added, at the same price as the drench, then the increase in lambing percentage would have to be double that shown in the table.

Table 8.1

Increase in lambing percentage needed to cover the cost of pre-tup drenching.

Lamb price ($)	Additional lambs reared per 100 ewes to cover drench cost.
4.00	2.25
5.50	1.73
7.00	1.29
8.50	1.06
10.00	0.90
11.50	0.78

(b) Ram management

Neither case farmer had semen tests performed on his rams, both using only manual palpation to check for disease. Semen testing will reveal many more causes of infertility than will manual palpation for epididymitis. The use of any infertile rams can cause lambing percentage problems, since some ewes mate with only one ram when they are in oestrus. If this ram is infertile, then the ewe has no chance of conceiving. The policy of increasing the percentage of rams to compensate for a few infertile rams is therefore not entirely effective. Also, if the ram infertility is caused by a contagious disease, then this disease can be quickly transmitted to other sheep in the flock. Semen testing would mean that lower percentages of rams could be used safely, and disease transmission would be reduced.

8.4.1.3 Tupping management practices

(a) Date and duration of tupping

Research data suggests that later tupping will result in higher lambing percentages, due to the increasing ovulation rate of ewes with successive ovulations, within the breeding season. On farm A, rams were introduced to the ewe flock ten days earlier than the average of the survey farms. Delaying the introduction of the rams would mean that a greater number of ewes would have begun cycling at the time of introduction. A greater number of ewes would be mated at their second, or later, ovulation, when ovulation rates are higher. Tupping date must be related to feed availability at mating and lambing, but within these limits, the later that tupping can be delayed, the higher will be the resultant lambing percentage.

Another effect of later tupping is that a greater number of ewes will be mated in the first 34 days, or two oestrous periods, after the rams are introduced. This is because a greater number of ewes will be cycling. Consequently, the duration of the mating period can be reduced, without significantly affecting lambing percentages. The tupping period must be shortened if the problem of very late lambs is to be avoided.

(b) Mobbing up of two-tooth ewes

The logic behind the practice of mobbing up two-tooth ewes periodically during the tupping period, is that two-tooth ewes are shy breeders, and are in oestrus for a shorter period than older ewes. Mixing of ewes and rams periodically, ensures that any harem formations are broken up and ewes in oestrus have a more equitable chance of meeting a ram at this time. This practice was not, but should be, employed on case farm A.

(c) Pre-tup shearing of two-tooth ewes

The practice of pre-tup shearing two-tooth ewes was not used on farm A. The farmer justified this by referring to research which showed that lambing percentages could actually be reduced if the shorn two-tooth ewes could not be fed well after shearing. Also, his two-tooth ewes were rather light in condition, and might not respond to shearing, even if feed was available. There may be room for more flexability in the implementation of this practice. In those years when feed is not so limiting, two-tooth shearing may be useful in increasing lambing percentages, on farm A.

8.4.1.4 Lambing management practices

The effect of lambing management on lambing percentages is through the control of ewe or lamb losses. Many of these losses are beyond the farmer's control, and must be accepted as a normal part of the farming system. Some of the losses are a function of ewe grazing management in late pregnancy, as discussed earlier. The remaining losses are controllable by management at lambing, as are some of the losses due to incorrect ewe grazing management.

(a) Losses from disease

No particular disease appears to be a great source of lamb losses on the case farms, with the present vaccination programme, but this could be checked by the veterinary analysis of at least a sample of dead lambs.

(b) Shepherding

Both farmers shepherd intensively at lambing (at least once per day), and so losses due to misadventure or lambing difficulties should be minimal. Whether this intensive shepherding promotes higher lambing percentages in the long run, is debatable, as discussed in the chapter on factors affecting lambing percentages, but lack of shepherding could not be advanced as a reason for the present low lambing percentages of the flocks.

(c) Mothering up of lambs to foster ewes

This practice is not attempted on farm B, and is only sparingly used on farm A, but it is doubtful whether an intensive mothering up campaign would have much effect on lambing percentages. It would almost certainly not be an economic practice, considering the value of the time involved.

8.4.1.5 Summary of the possibilities for increasing lambing percentages, through improved animal management

Farm A

(a) Improved hogget nutrition, by the implementation of regular weighing of hoggets.
(b) Improved ewe nutrition from weaning to tupping, also using weighing as a management aid.
(c) Use of ram harnesses at tupping to control the pre-lambing feeding of ewes.
(d) Semen testing of rams for fertility.
(e) Use of a later tupping date.
(f) Mobbing up of two-tooth ewes at tupping.
(g) Pre-tup shearing of two-tooth ewes when feed supplies permit.

Farm B

(a), (b), (c), and (d) as above for Farm A.
(h) Pre-tup drenching of ewes, at least on a trial basis.

8.4.2 Possibilities for improved breeding management

8.4.2.1 Selection of replacement ewes

Both case farmers were using only visual assessment as their criterion for selecting ewe replacements. There are a number of other methods available which would provide a much more effective basis of selection for improved productivity, in particular, improved lambing percentage. These methods apply to the stock remaining after culling for obvious faults such as deformities.

(a) Selection on the basis of measured liveweight

This is perhaps the easiest of the alternative methods of ewe replacement selection. Weight can be measured at any time in the life of the ewe, from weaning until two-tooth mating, and the lighter animals culled. Ideally, corrections should be made for birth rank and for birth date, but these are not usually known in a commercial flock. The most convenient time to measure hogget liveweight is often at hogget shearing. The ranking of animals, on the basis of liveweight, is unlikely to change from this time until two-tooth mating, if all animals are treated similarly. By hogget shearing, ewe liveweight is also not greatly affected by birth rank.

Selection on the basis of measured liveweight would appear to have application on both case farms, especially in conjunction with a regular programme of weighing samples of ewe and hogget flocks for grazing management purposes.

(b) Selection of the basis of lamb birth rank

This is a more sophisticated method of replacement selection, involving considerably more work, but one which will ensure that the ewe replacements entering the flock are the progeny of high producing ewes. There are two ways in which twin ewe lambs can be marked. The first involves the marking of the lamb at, or near, birth while the lamb is still relatively easy to catch. The marking done at this time can be permanent, by means of earmarks or tags, or temporary,

using an aerosol raddle. Temporary marks are replaced at docking, with either earmarks or tags. The second method involves the sheding out of twinning ewes at lambing, and the running of this 'twinning' mob separately until docking, when permanent marking can be carried out. This method has an added advantage in that it also allows easy identification of the twin-producing ewe, without having to catch the ewe at lambing.

Both methods are time consuming and would require either the hiring of extra labour or the reallocation of time previously spent on some other forms of shepherding at lambing. Some farmers have compromised, and started marking twins only in their two-tooth flocks, in order to learn the best techniques. Six of the twenty farmers surveyed were marking all twin ewe lambs born, and after an initial period of difficulty, now found that the procedure was much simpler than they had first anticipated. All of these six farmers marked twin ewe lambs at birth, five by means of an aerosol raddle, and the other by earmarking. All of these farmers were enthusiastic about the much more positive selection of ewe replacements possible with twin marking.

This method of ewe replacement selection would appear to have a place on both the case farms, particularly on farm B, which was of relatively easy contour, and where lamb marking problems would be minimal. Some of the survey farms where twin marking was done, were on very steep and broken country, but the farmers managed quite well.

(c) Selection on the basis of hogget oestrous activity

This is probably the most direct method of measuring the fertility level of ewe replacements. Hogget oestrous activity also appears to be highly correlated with hogget liveweight, at the time of recording oestrous activity, and at hogget shearing. Ten of the farms in the survey used hogget oestrus as a method of selecting ewe replacements. Of these ten, nine were mating ewe hoggets with entire rams and selecting on hogget lambing performance. The other farmer ran harnessed, vasectomised, rams with the ewe hoggets, and selected on the basis of tupping markings.

This method of selection is very dependent on having well grown hoggets by the time the rams are put out. In the Wairarapa, this time is usually about the end of April. If the average weight is not above about 34 kg at this time, then very few hoggets will be mated or marked.

The choice between using entire or vasectomised rams is one of whether or not the farmer wants his hoggets in lamb. In-lamb hoggets require considerably more feed than dry hoggets, and if they are to maintain weight and lamb again as two-tooths, then this high level of feeding must be maintained up until two-tooth tupping. Even where lambing ewe hoggets are well fed, some depression in two-tooth lambing percentages is possible, but this usually recovers at later lambings. If vasectomised rams are used, the percentage of rams can be kept very low, so that only a few rams are needed. This does not require a large capital outlay, and involves virtually no work, except for the permanent marking of those hoggets marked by the rams.

Because of the ease of this method of identifying oestrous hoggets, its adoption on both case farms is recommended, at least on a trial basis.

8.4.2.2 Selection of rams

The rams used must be those with the highest fertility background available, subject to financial limitations. In general, rams with a high fertility background or rating command a high price. Both case farmers bought stud rams on the basis of fertility rating, but these rams were used over the whole flock, only on farm B. On farm A, these rams were used mainly on a small elite flock of high producing ewes, selected from the main flock. Rams were then bred from this elite flock, and used over the remainder of the ewes. Rams of the farmers own breeding had only been in use for one year, however, and it was too early to determine any effect of this policy. This would appear to be a cheap source of rams, but in order to be worthwhile, the fertility rating of these home bred rams must be high. The farmer concerned, did not consider individual parental performance when

selecting his ram hoggets. He considered only birth rank, weaning weight, and wool. This may appear to be a weakness in his breeding scheme, but it must be remembered that all ewes in the elite flock are proven high producers. Some improvement in selection might be possible by selecting on individual parental performance, but the extent of this improvement could be very small.

8.4.2.3 Selection of culled stock

(a) Culling of dry/dry ewes

Both farmers culled all dry/dry ewes, including two-tooths, so there appears to be little room for improvement in this practice.

(b) Culling of wet/dry ewes

On farm A, all wet/dry ewes were marked, and most culled, excluding two-tooths, which were given another chance. On farm B, all wet/dry ewes were marked and then kept in a separate mob, so that they could be shepherded more intensively at lambing. Ewe lambs were not kept from this mob.
On farm A, the culling of wet/dry ewes was limited by the amount of selection desired of ewe replacements. If all wet/dry ewes were culled, the number of ewe replacements needed to maintain the flock would preclude effective selection of ewe replacements. In order to cull all wet/dry ewes, a practice such as used on farm B might be useful. The banishing of all wet/dry ewes to a separate flock, ensures that while ewe numbers are maintained, no progeny of these wet/dry ewes will enter the flock. This policy would appear to have much more application on a development situation, where it is important to keep stock numbers up, than it has on a more developed farm such as farm B.

Due to the relatively low lambing percentages on the two case farms, it appears difficult to increase the extent of culling for the wet/dry condition without affecting the possibilities for ewe replacement selection.

(c) Culling for age

An increasing number of farmers are now rejecting the concept of culling for age, and are adopting a policy of culling only for performance or constitution. Both case farmers culled at five years of age, but on case farm A, the very best of the five year old ewes were retained for a further year. There would appear to be much more justification for culling at five years of age on farm A than on farm B, due to the considerably harder farming conditions. Farmer A had tried to carry all five year old ewes for another year, but had heavy losses of ewes and did not continue the practice. Farmer B had not tried retaining ewes for another year, because of the loss of income that he feared from not having a good line of five year old ewes to sell each year.

The retention of five year old ewes, or at least the best of them, has a number of advantages which must be weighed against any possible losses in direct income. The retention of these proven ewes increases the amount of culling which can be carried out, either of ewe replacements, or wet/dry ewes. This is assuming that flock size is kept constant. These older ewes are also likely to be more prolific than incoming two-tooth ewes, and so lambing percentage could be raised immediately.

The long term benefits of improved selection are probably the most important. The retaining of five year old ewes would, if combined with the improved methods of ewe selection discussed before, raise the lambing percentage of the flock to an extent that covers any decreased revenue from ewe sales.

8.4.2.4 Crossbreeding

Purposes of crossbreeding

Crossbreeding is not easily reversible, without selling all crossbred stock, and replacing with purebred stock. The buying of suitable rams for crossbreeding can also involve considerable expenditure. For these reasons, a policy of crossbreeding should not be adopted lightly. The farmer must have a sound reason for considering cross-breeding, and this

will usually be that he is not satisfied with some feature of his present flock's production.

In this study we are concerned with farmers who are not satisfied with the lambing percentage of their flocks. They are, therefore, looking at crossbreeding policies which will increase lambing percentages. Lambing percentage is, however, not the only variable affecting income from sheep. Other variables such as saleability of stock, wool weight, and wool type, are also very important. The aim of crossbreeding must be to improve lambing percentages, without an overshadowing deterioration in these other variables.

Choice of breeds

The choice of breed will be determined by the reason for present low lambing percentages, the farm environment, and the other production characteristics of the breed. If the lambing percentage problem is caused by high lamb losses, then a breed which has hardier lambs, might be needed. If it is caused by low ovulation rates, then a breed with a high ovulation rate is desired. Some breeds, such as the Perendale, are much more suited to hard environments than other breeds.

There are two main breed crosses, which can be considered on hill-country farms in the Wairarapa. These are, the crossing of Romney ewes with Cheviot rams to form a Perendale flock, and the crossing of Romney ewes with Border Leicester rams to form a Border Leicester x Romney (BLX) flock. The situations in which these two crosses should be made are very different, and are represented by the two case farms.

The Perendale is regarded as a hardy breed, which will produce satisfactorily under much harder conditions than most other commercial breeds. The Perendale is a very active sheep, and will graze land usually ignored by other breeds. It is thus suited to farms where development is progressing on hard, steep country, and where a high grazing intensity must be maintained. This is the situation on case farm A. The Perendale is also regarded as an 'easy-care' breed, with a

reduced requirement for shepherding, particularly at lambing. Those farmers in the survey who had changed to Perendale flocks, were generally farming more extensive properties which were not fully developed. They had changed breed, not only to increase lambing percentages, but also to reduce labour requirements and to improve grazing management. They had, however, experienced significant increases in lambing percentages, as a result of their crossbreeding.

The conversion of the Romney ewe flock, on case Farm A, to a Perendale flock is therefore recommended, both to increase lambing percentage and to aid management.

The B.L.X. is regarded as a much 'softer' breed, which will not withstand the same hard conditions as the Perendale, without a deterioration in performance. The use of the cross is therefore usually restricted to more developed properties, where feed can be provided. The B.L.X. ewe has a higher ovulation rate than the Romney ewe, when farmed under favourable conditions, and it is this characteristic which prompted the B.L.X. farmers in the survey to introduce this cross. These farmers were not satisfied with the previous lambing percentages of their flocks, and considered cross-breeding the most efficient way of increasing lambing percentages. All except one of these farmers had much improved lambing percentages as a result of their cross-breeding. The other farmer had only been crossbreeding for four years, and although his lambing percentage had increased somewhat initially, it was still well below that of the other B.L.X. farmers. This farm was not on very hard country, and it was felt that the main reason for the failure to further increase lambing percentages was that the farm was overstocked. Several of the B.L.X. farmers in the survey, stated that they could not carry as many B.L.X. ewes as they had Romney ewes, and still benefit from the high lambing percentages of the B.L.X. ewe. They felt that a reduction in ewe numbers of up to ten percent could be needed, if the farm was already fully stocked. They still, however, thought that the change was warranted, due to the vastly improved reproductive performance of the B.L.X. ewes.

Farm B appears to be in an ideal situation to change to a B.L.X. flock, since the farm is almost fully developed, and is growing good pastures.

Methods and cost of crossbreeding

Virtually all farmers in the survey, who were now running crossbred flocks, agreed as to the method of crossbreeding that they would adopt if crossbreeding now. Most had learnt that other methods were complicated to implement and difficult to manage. The method that they all agreed on, was to sell all Romney rams, and to replace with those of the other breed in the cross (Cheviot or Border Leicester). These rams are mated with the Romney ewes to produce halfbred animals. As the halfbred ewes enter the flock as replacements, they are mated with crossbred (Perendale or Coopworth) rams to maintain the crossbreed. Assuming culling at five years or age, all Cheviot or Border Leicester rams will have been replaced by Perendale or Coopworth rams in five years. The only management feature that could cause problems, is that the Romney and crossbred ewes must be kept separate at tupping.

This is the method of crossbreeding recommended on both case farms.

The cost of crossbreeding in this way is not excessive. The only major cost is in the initial purchase of Cheviot or Border Leicester rams. In order for the system to be effective, all Romney rams must be replaced at the outset, because all replacements coming into the flock should be crossbred, to simplify management. Buying of the Perendale or Coopworth rams is done gradually, as the Cheviot or Border Leicester rams are phased out, and will be part of the normal ram replacement policy, and not an additional cost.

8.4.2.5 Summary of the possibilities for increasing lambing percentages through improved breeding management

Farm A

(a) Improved selection of replacement ewes, especially by weighing and the recording of hogget oestrous

activity, and possibly by the recording of birth rank.

(b) Culling of all wet/dry ewes from the main flock, and relegation to a 'cull' flock.

(c) Retention of a higher proportion of five year old ewes for another year.

(d) Crossbreeding to form a Perendale flock.

Farm B

(a) Improved selection of replacement ewes by weighing and the recording of birth rank and hogget oestrous activity.

(b) Culling of all wet/dry ewes.

(c) Retention of all five year old ewes for a further year.

(d) Crossbreeding to form a B.L.X. flock.

8.5 Effects of an increased lambing percentage

Assumptions

1. Additional ewe lambs culled as lambs rather than being wintered as ewe hoggets.

2. Additional wether lambs sold as lambs.

These two assumptions have been made so as to not affect the winter stocking rate of the case farms. If additional ewe hoggets were wintered, some changes in management may be necessary to accomodate the increased numbers. The culling of replacements as ewe lambs can be very effective, if a policy of marking twin lambs, or lambs from high producing ewes, is followed, as there is no advantage in delaying culling on this basis to a later date. In the absence of such a policy, early culling would have to be done on the basis of liveweight, or whatever other criteria was available.

If additional ewe lambs could be kept until the autumn, selection could be done on the basis of oestrus activity when run with teaser rams.

As a result of these first two assumptions, it is also assumed that lamb losses from weaning to wintering will remain the same, with an increased lambing percentage.

3. Additional feed requirements negligible.

This is conditional on additional lambs being sold virtually straight after, or at weaning. If lambs are to be kept later than this then allowances would have to be made for increased feed consumption until such stock were sold. In order to uphold this assumption, many of the additional lambs would have to be sold on the store market.

In the Wairarapa, feed over the lactation period is rarely limiting, so the slight increase in ewe requirements for an additional 10% of lambs weaned will be of little importance.

4. Non-interference with existing cattle policies.

Again this is dependent on additional lambs being sold at or near weaning, so as to not affect cattle fattening policies. Farm A would be more likely to be affected than farm B, due to its policy of selling weaners in the Autumn, rather than yearlings in the Spring. Some opportunities to fatten cattle in the Autumn may be lost if additional sheep are carried over this period.

Consider a 100% weaning percentage under these assumptions.

	Farm A	Farm B
Lambs reared (90%)	1350	1935
Lambs reared (100%)	1500	2150
Additional lambs reared	150	215
Additional ewe lambs to sell	75	107
Additional wether lambs to sell	75	108

There are also now more opportunities for the culling of replacement stock, as measured by the selection ratio of two-tooths required to ewe lambs reared.

	Farm A	Farm B
Selection ratio (90%)	436/675 = 64.6%	625/968 = 64.6%
Selection ratio (100%)	436/750 = 58.1%	625/1075 = 58.1%

The value of the additional stock sold will be proportional to the stock prices in any particular year. Table 8.2 shows the additional gross income which would be received at different lamb prices, over a range of $3.50 to $11.00 for ewe lambs, and $4.50 to $12.00 for wether lambs.

Table 8.2

Value of additional lambs ($)

Lamb prices ($)			
Ewe	Wether	Farm A	Farm B
3.50	4.50	600.0	860.5
5.00	6.00	825.0	1183.0
6.50	7.50	1050.0	1505.5
8.00	9.00	1275.0	1828.0
9.50	10.50	1500.0	2150.5
11.00	12.00	1725.0	2473.0

The greater potential for selection of ewe replacements should also result in an indirect increase in income at a later date. If the additional selection that can be carried out is efficient, and allows the selection of more productive animals, and the culling of less productive animals, then gains in overall flock productivity should be evident when these replacements start producing.

9. GENERAL RECOMMENDATIONS AND CONCLUSIONS

9.1 Factors limiting lambing percentages in the Wairarapa

9.1.1 Climate and feed supply pattern

Many of the survey farmers, when they were asked what they considered to be the factors most limiting lambing percentages on their farm, gave climate and feed availability as their answer. They claimed that with a more settled climate and a better feed availability pattern, they could increase their

lambing percentages. This may be so, but it does not explain the high lambing percentages which are achieved on other neighbouring farms with the same climate and feed availability problems. These latter farmers seem to be able to manage their feed supplies, or their farm operations, so that the feed supply is less of a limiting factor. Farmers who claim that climate and feed form their major limitations to lambing percentage, are implying that their management is already optimal for the conditions. This is rarely, if ever so, and these farmers, in general, have not been able to effectively gear their management to the climate and the feed availability pattern.

9.1.2 Management

On some farms, management is limiting lambing percentage. These farmers appear to be either ignorant of, or indifferent to, many of the management practices employed as a matter of course by other more successful farmers. Prime examples are farmers who persist in ignoring hogget nutrition requirements, ewe nutrition requirements from weaning to tupping, and the improvement of stock by scientific selection and culling for productivity. As long as these farmers persist in their present management practices, there appears to be little chance of a permanent improvement in lambing percentages on these farms.

9.1.3 Genetic potential of existing stock

This was also recognised as a major limitation to lambing percentage, by farmers in the survey. Many realised that the nucleus of their breeding flocks comprised ewes of mediocre genetic potential, with respect to lambing percentage. They put much of the blame for this situation on past over-emphasis on selection for other productive characteristics, particularly wool, and for non-productive characteristics such as shape of the head. This must be the situation with many flocks in the Wairarapa, particularly those of the Romney breed. Many farmers feel that the potential lambing percentage of their Romney flocks has fallen to such an extent, that crossbreeding is the only effective answer.

9.1.4 Farmer indifference

This is the most difficult limiting factor to overcome. Some farmers, particularly those in older age groups, are simply not interested in how they can increase lambing percentages. They consider that they are making a comfortable living now, and that any effort put into increasing lambing percentages would not be worthwhile. Their incomes might improve somewhat, but they would either have to undertake farm development work, which they have no desire to do, or lose a high proportion of this additional income in tax. It is very difficult to put forward a logical argument for increasing lambing percentages, to such a farmer, whose objective in farming is not to maximise monetary gain. Unless such a farmer has to improve his productivity, in order to maintain a reasonable standard of living, he is simply not interested.

9.2 Effects of a general improvement in lambing percentages in the survey area

In 1969 there were approximately 1,812,000 breeding ewes in the survey area, with an average lambing percentage of 91.2%[1]. If the average lambing percentage of these ewes could be raised to 100 percent, this would result in an increase of 159,456 lambs docked. Assuming all the increase in numbers were sold as lambs, this would result in an income increase of $956,736 at an average price of $6.00 per lamb, and $1,435,104 at $9 per lamb. Some of this increased income would be offset by additional costs, but it would mean a very sizeable increase in production from the area.

9.3 Recommendations for improving lambing percentages in the Wairarapa survey area

9.3.1 Improvement by animal management

9.3.1.1 Grazing management

The most important aspect of animal management which could lead to increasing lambing percentages is grazing management.

---

1. The Wairarapa District Situation, Farm Advisory Division, MAF, Masterton. (1970)

Improved grazing management at the hogget stage, prior to tupping, and prior to lambing, could lead to significant increases in lambing percentage on many Wairarapa hill-country farms.

The most important tool for controlling grazing management, at the hogget stage, and prior to mating, is a set of scales. The weighing of sheep is becoming increasingly popular, as a method of determining grazing requirements throughout the year, and many farmers are now convinced as to the effectiveness of such a practice. In the control of grazing prior to lambing, the most important information that can help, is the approximate date of lambing. This is easily obtained by the use of ram harnesses at mating. The division of the ewe flock into lambing groups, on the basis of tupping date, allows much more control to be exerted on grazing management at this time. This results in reduced lambing troubles and reduced lamb losses. When a commercial method of identifying twin and single foetuses before lambing becomes available, this will allow even more control of pre-lambing grazing.

9.3.1.2 Lambing management

There is divided opinion among farmers as to the management that should be employed at lambing. One group advocates intensive shepherding to reduce losses from lambing difficulties and mis-mothering. Another group advocates a policy of 'nil-shepherding', with the aim of reducing lambing troubles and mis-mothering by a process of natural selection. There is a third method of management which involves the replacement of the traditional shepherding tasks with new ones such as twin marking, and the marking of ewes requiring assistance and their lambs. This policy is designed to fit in with improved selection and culling policies. The choice between these different forms of shepherding has to be made by the individual farmer, but the method which appears most likely to result in a permanent increase in lambing percentage is the third. For this reason it is recommended that farmers shift some of their shepherding emphasis at lambing, from practices such as mothering up and the assistance of hopeless ewes, to the marking of animals for later selection or culling.

9.3.2 Improvement by breeding management

9.3.2.1 Introduction

This is the area in which there appears to be most opportunity for improving lambing percentages. Breeding management controls the reproductive potential of the flock, and so, the limits to which lambing percentage can be raised. Any improvement in reproductive potential must be achieved through breeding management. Breeding management can take three forms. The first two forms, those of selection of replacements and culling of ewes, do not involve the introduction of new genetic stock into the flock. The third form of breeding management involves the introduction of this new genetic stock, by crossbreeding with breeds more prolific in the particular farming situation.

9.3.2.2 Selection procedures

There is considerable scope on most Wairarapa hill-country farms for an improvement in replacement selection procedures. The most significant improvements could be made by the introduction of the following selection techniques:

(a) Selection on the basis of measured liveweight of ewe replacements
(b) Selection on the basis of birth rank
(c) Selection on the basis of hogget oestrous activity.

Some or all of these methods would appear to have applications on most farms in the survey area.

9.3.2.3 Culling procedures

Culling procedures could also be improved in some cases. Culling should be as rigorous as possible, without detrimentally affecting the extent of selection of ewe replacements. Ideally, all wet/dry and dry/dry ewes should be culled, at least from the flock from which replacements are to be drawn. Culling for age also appears to be an outdated idea, especially where an improvement in lambing percentages is sought. Ewes should be culled only when they become unproductive or are so poor in constitution that losses increase to an unprofitable level.

9.3.2.4 Crossbreeding

The answer to many of the survey area's lambing percentage problems would seem to be crossbreeding. The Romney breed is not ideally suited to the hard hill-country of the Wairarapa, and can be outproduced on the easy country by the Border Leicester Romney cross. For this reason, all farmers interested in increasing their lambing percentages, should give serious consideration to crossbreeding. Initial costs of crossbreeding can be high, but it is one of the quickest and most effective methods of increasing lambing percentages. Discounting the initial cost over a number of years makes crossbreeding a definite economic proposition on most farms.

9.4 Conclusions

The main aim of this study was to collect information on the management practices used by farmers in the survey area, and to suggest changes in these practices which might increase lambing percentages. This aim was to be achieved by surveying a relatively small number of farms, and collecting detailed management information, as opposed to surveying a larger number of farms in a more superficial manner. It was felt that an adequate understanding of the importance of management practices could be obtained from the information collected on a small number of farms, together with research information. This however proved difficult, in that it was hard to relate survey information to lambing percentages on the survey farms. The complex nature of the factors affecting lambing percentage, and the interactions between these factors, caused this difficulty. Because of this, there was no hope of confirming the relationships established in research work. There may be a need for such confirmation if farmers are to adopt practices recommended by researchers.

Another point which has arisen during the study is that while there is much evidence to suggest that liveweight, and liveweight changes at critical times of the year, are major factors affecting lambing percentages, there is very little information available on the way in which management practices affect liveweight. The effects of different grazing systems

on liveweight are not clearly understood. There may be a need for these relationships to be explored, especially if the trend towards the increased use of scales as a management tool continues. Liveweight information alone is of little use, unless the farmer knows how to control liveweight by management.

The recommendations that have been made earlier in this chapter, for increasing lambing percentages in the survey area, are very general and it is not intended that they be regarded as explicit instructions for increasing lambing percentages. The practices recommended do however have considerable application for increasing lambing percentages on many farms in the area.

APPENDIX A: NZ LAMBING PERCENTAGES[1]

Average lambing percentages in New Zealand have fallen steadily since peaking in 1966. This is shown in Figure A1 in which M.A.F. estimates of lambing percentage are plotted. Table A1 shows the M.A.F. estimates of lambing percentages by land districts, for the years 1960, 1970, 1972, 1973.

Table A1

Estimated lambing percentages in land districts.

	Year			
Land district	1960	1970	1972	1973
Northland	88.9	85.8	89.5	89.6
Auckland		84.8	85.8	85.9
S.Auck., B of P	93.8	83.8	84.5	88.1
East Coast	83.5	89.1	89.2	86.1
Hawke's Bay	96.5	94.6	93.3	89.8
Taranaki	92.3	84.6	81.6	85.6
Wellington	93.6	88.8	90.0	90.6
North Island	93.0	88.1	88.6	88.5
Marlborough	92.0	91.3	97.0	93.8
Nelson	94.3	90.0	89.9	84.9
Westland	106.8	84.4	92.7	99.9
Canterbury	100.3	100.2	97.6	92.4
Otago	104.1	100.5	96.8	97.4
Southland	114.0	102.5	101.4	99.6
South Island	104.5	100.2	98.3	94.9

Some of the decline in lambing percentages over the last eight years can be blamed on dry seasons and reduced top-dressing as a result of economic changes, but it may be that the influences of breeding and management are being overlooked.

Lambing percentages in the Wellington land district, which includes the survey area, do not appear to have dropped as much as in other areas, but this is no reason for complacency. An average lambing percentage of 90.6% in 1973 cannot be considered a satisfactory situation.

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1. NZ Farmer, Vol.95, No.9, May 9, 1974: 57.

Figure A1

Estimated New Zealand average lambing percentages, 1950 to 1973.

APPENDIX B: INTRODUCTORY LETTER TO SURVEY FARMERS

Agricultural Economics and
Farm Management Dept.,
Tiritea Building,
Massey University.

Dear Mr

You may have heard that I am making a study of factors affecting lambing percentages in the Wairarapa. This study is being undertaken as a thesis topic in my studies towards a Masters degree in Farm Management at Massey University. The work is being assisted by a Department of Agriculture research grant and is under the supervision of the Farm Management Department of the University.

In brief, the aims of the study are as follows:-

1. To study the problems faced by farmers in the Wairarapa in trying to increase lambing percentages.

2. To study the ways in which farmers have attempted to increase percentages, and the results of these efforts.

3. To determine the effects of increasing lambing percentage on the management of farms and the financial position of farmers.

The study will involve visits to a number of farmers, in particular to learn of their problems and successes as regards lambing percentages, but also to try and get some idea of the current farming situation. These visits would take the form of a discussion with the farmer, preferably during a look over the farm, followed by an examination of stock records, and if possible, financial records.

I have selected your farm as a possibility for study and I am sure that any help you could provide would be very useful in the study.

If you would consider the matter, I would be very grateful. I will telephone you within the next two weeks to discover your reaction to my proposal. At this point, if you are willing, we should be able to arrange a suitable date for my visit.

Your sincerely,

T S Clarkson

APPENDIX C: QUESTIONNAIRE AND DATA SHEET (ABBREVIATED)

WAIRARAPA LAMBING PERCENTAGE SURVEY

FARMER _____

Age: _____

Status: _____

Date of possession: _____

Ownership: _____

FARM:

Total area: _____ Grazed area: _____

Freehold area: _____

Leasehold area: _____

State of the non-grazed area: _____

Possibilities for development: _____

Altitude: _____ Rainfall: _____

Spread of R. _____

Temperatures: _____

Land classification:

Flat and rolling: _____

Steep cultivable: _____

Uncultivable: _____

Soil types and areas: _____

Aspect: _____

Erosion conditions: _____

Balance date: _____

Water supply:

Main source of water: _____

Number of dams: _____

Adequacy: _____

Access and subdivision:

Number of main paddocks: _____

Average size: _____

Is this enough: _____

Races: _____

Road access: _____

Particular difficulties: _____

Labour:

Amount and type of labour: _____

Costs: _____

AMT of responsibility: _____

Effectiveness: _____

PASTURE AND CROP MANAGEMENT:

Fertilizer practice:

	1969-70	1970-71	1971-72	Normal
SUPER P				
K SUPER P				
LIME				
NITROGEN				
OTHER				

Method of application: _____

Costs: _____

Timing of applications: _____

Trace elements used: _____

Regrassing policy: 1969-70 1970-71 1971-72

Areas:

Methods used:

Supplementary feeding: 69-70 70-71 71-72

Fodder crops: areas: _____

types: _____

Hay: areas: _____

bales: _____

bought in: _____

Silage: areas: _____

Other:

Cashing cropping:

Unusual features:

Livestock data: Year:

Class	Numbers wintered and breeds	E.E.	Losses
Ewe hgts			
2th ewes			
4th ewes			
6th ewes			
4yr ewes			
5yr ewes			
5yr ewes			
Wth hgts			
Rams			
Bdg cows			
R1Y hfr			
R2Y Hfr			
R1Y Str			
R2Y Str			
R3Y Str			
Bulls			
Lambing percentage: Overall: 2th:		Calving %:	

Wool production:

Total wool clip: Average price:

Wool/e.e.: Wool/acre:

Stock purchases: Year:

Classes	Dates, numbers and prices
Ewes	
Rams	
Bulls	
Others	

Stock sales: Year:

Classes	Dates, numbers, weights and prices
Fat lambs	
Store lambs	
Wethers	
2th ewes	
CFA ewes	
Fat ewes	
Cattle	

MANAGEMENT POLICIES:

Basic sheep policy:

Breeding for store market: _____

Breeding and fattening: _____

Stud: _____

Changes in the last 5 years: _____

Reasons for changes: _____

Ewe replacement:

Present method of selection:

Liveweight: _____

Wool weight: _____

Wool type: _____

Dam performance: _____

Birth rank: _____

Why have you chosen this method?

How long have you been selecting on this basis?

What did you previously select on?

What benefits have you got from the present method?

Do you expect to change your method of selection?

Why?

Culling procedures: Methods used: dry/drys: _____

wet/drys: _____

weight: _____

condition: _____

age: _____

Why do you use these methods?

How long have you been culling on this basis?

What did you previously cull on?

What benefits have you got from the present methods?

Do you intend to change this policy?
Why?

Ram replacement:

Method used: purchase of stud rams: ____
purchase of flock rams: ____
breeding scheme: ____
own breeding: ____

Reasons?
How long have you been doing this?
How did you get your rams before then?
Do you intend changing your source of rams?
Why?

What is your basis of ram selection:

Birth rank of ram: ____
Wool weight or type: ____
Weaning weight: ____
Parental performance: ____
Other: ____

Why do you select on this basis?
How long have you been selecting on this basis?
How did you select before?
What benefits have you got from your present method of selection?
Do you intend to change this?
Why?

Post-weaning management:

Dates of weaning: ____

Dates of shearing: ewes: ____ costs: ____
hgts: ____ ____
lambs: ____ ____
2nd sh: ____ ____

Reasons for choosing these dates:
When did you change to this system?
What benefits did you get from the change?
Do you intend to continue this?

Lamb/hogget drenching:

ewes: number of times: ____
when: ____
wethers: number of times: ____
when: ____

Drench used: _____

When did you adopt this drenching policy?

What drenching did you do before this?

What benefits have you got from the present system?

Do you intend to continue the same drenching programme this season?

Lamb/hogget sales:

Method of sale: works: _____
yards: _____
other: _____

Why have you chosen this method?

Dipping:

Method used: _____
Timing: _____
Costs: _____

Post-weaning feeding:

Ewes: preferential feeding of poorest?
type of pasture weaned onto:
TYPE of pasture closer to tupping:
At what stocking rates?

Hoggets: type of pasture onto which weaned:
type of pasture later:
at what stocking rates?

Rams: feeding over the summer:
feeding closer to tupping:

How long has this system been in operation?

How does this system differ from the system before then?

What advantages have you got from the change?

Have you had to change any other policies as a result of this? (i.e. have you made any associated changes in cattle management?)

Tupping management:

Dates: M.A. Ewes: _____ Duration: _____
2th ewes: _____ _____
Hoggets: _____ _____

Has this been changed recently?

What changes were made?

Why?

What results have you had from the change?

Do you attempt to flush your ewes at tupping?
Over what period?
Do you think that you are getting them to gain weight?
When you have reasonable flushing conditions, have you noticed an improvement in %?
Do you intend changing your flushing in any way? Why?
Do you shear your ewes prior to tupping?
How long have you been doing this?
Why do you do it?
Does it have any effect on performance?
Do you intend to continue with this?
Do you give your 2ths any preferential treatment at tupping?

higher rams%: _____
smaller easier paddocks: _____
better feed: _____
mobbing up: _____

Do you think these have any effect on 2th %?
Do you pre-tup drench your ewes?
How long have you been doing this?
Do you think it has had any effect?
Do you intend continuing this?
Do you mate your hoggets?
How long have you been doing this?
Why do you do it?
Are you satisfied with the results?
Do you intend to change this policy? Why?
What percentage of rams do you use?

M.A. Ewes: ___
2th ewes: ___
Hoggets: ___

What age of rams do you use?

M.A. Ewes: ___
2th ewes: ___
Hoggets: ___

What are the advantages of using these ages of rams?
Do you use teaser rams before tupping? (Ent. or Vas.)?
How long have you been doing this?
Has it had any effect?
Do you get your rams fertility tested?

Have you discovered infertile rams that would otherwise have been used in the flock?
Will you continue this?
What other preparation for tupping do you give your rams?
Shearing: ___
Foot checks: ___
Nutrition: ___
Other: ___
Do you shift rams around among the ewes during the tupping period? Why?
Do you identify late tupped ewes by:
Harness:
Fat L sire:
Why do you do this?
How long have you done this?
Do you use mating harnesses for other than late-tupped ewes?
Why?
How long have you done this?
Has it simplified later management?
Do you intend to continue with it?

Post-tupping management:

What kind of feed does the ewe flock go onto after tupping?
Are they rotationally grazed or set stocked?
At what stocking rate?
Is this a change from previous practices?
How long are they kept on this system?
How do you change it as lambing approaches?
How do you feed your hoggets over this winter period?
Do they 'do well' under this system?

Lambing management:

Do you pre-lamb shear? Why?
How long have you been doing this?
Do you pre-lamb drench? Why?
Have you noticed any major effects?
Do you intend continuing pre-lamb drenching?
Do you try and sort ewes into early and late lambers before lambing?
How do you do this?
What success do you have?

What ewe grazing system do you use at lambing?

set stocking:

rotational grazing/sheding:

other:

Do you treat 2ths and hoggets differently?

How long have you used this system?

What system did you use before?

What advantages have you got from the change?

Do you intend changing again? Why?

How often do you shepherd at lambing?

M.A. ewes: _____

2th ewes: _____

Hoggets: _____

Do you do any mothering up?

Do you consider it worth the effort?

What do you spend your time on, on a lambing beat?

Mothering up: _____

Cast ewes: _____

Lambing ewes: _____

Marking twins: _____

Other: _____

Do you mark ewes that have been assisted? How?

How long have you been doing this?

If you mark twin lambs, how do you do this?

How long have you been doing this?

How many ewes would you assist in lambing?

How many do you think would die if unassisted?

Do you consider the problem of marking twins to be over-rated? Why?

What proportion of lamb deaths, in your experience, occur at, or within one week of, lambing?

Do you think that management can help in reducing these losses? How?

Have you ever had any analysis done of dead lambs?

What have the results been?

What do you consider to be the major causes of death?

Dystokia: ___

Starvation: ___

Navel Inf: ___

Pulpy K: ___

Tetanus: ___

Other: ___

Docking procedures:

Method of docking:

Vaccinations:

Age and sex markings:

Have any changes in docking procedures helped to reduce losses of lambs following docking?

Do you vaccinate your ewes? Why?

Crossbreeding:

What was your reason for crossbreeding rather than carrying staright Romney sheep?

Why did you choose the _____ rather than some other breed?

When did you start crossbreeding?

How did you start?

Would you have started in some other way or with some other breed if you were starting now? Why?

How long did it take for noticable effects of the crossbreeding to start occuring? What were these effects?

Does your crossbreeding policy involve the maintaining of separate breeds in different flocks?

Does this complicate your management significantly? What changes have you had to make?

Would you advise other farmers in your area to go into cross-breeding if they have not done so?

Are there any major pitfalls that you would warn them about?

General:

What do you consider to be the major factors affecting and limiting lambing percentages on your farm?

What measures are you taking to try and overcome this problem?

Do you consider that this is the same factor limiting percentages on other farms in the area?

Do you consider that effort put into trying to increase lambing percentages is worth while?

Do you consider that other variables such as cattle performance or wool, or lamb weights are more important?

Level of indebtedness:

Bank overdraft: _____

SAC: _____

Marginal lands: _____

Other: _____

Government valuation as at: _____

Unimproved value: _____

Value of Impts: _____

Current valuation: _____

Income summary:

	1969-70	1970-71	1971-72
Wool			
Sheep			
Cattle			
Other			

Would you please make available to Mr Clarkson any of my accounts and records relevant to his study.

_____

APPENDIX D: DETAILS OF SURVEY FARMS AND PRODUCTION

Table D1

Survey farm altitudes and topography classes

Farm No.	Max.alt.	Min.alt.	Land class (%) (a)	(b)	(c)
1	270 m	60 m	7	20	73
2	450	120	0	20	80
3	300	90	4	20	76
4	330	150	3	25	72
5	360	120	3	20	77
6	390	180	0	40	60
7	270	180	15	70	15
8	390	150	12	25	63
9	550	120	20	40	40
10	180	0	15	25	60
11	360	240	12	50	38
12	330	120	7	50	43
13	210	0	3	45	52
14	390	120	5	30	65
15	420	120	5	10	75
16	450	180	2	15	83
17	420	150	8	62	30
18	450	240	0	20	80
19	330	90	3	15	82
20	270	90	15	10	75

For all tables in Appendix D:

Farms 1-7 Romney

Farms 8-13 B.L.X.

Farms 14-20 Perendale.

Table D2

Survey farms - Average rainfall

Farm No.	Av. rainfall (mm)
1	1160
2	1140
3	890
4	1390
5	1370
6	1140
7	1010
8	890
9	1120
10	790
11	1140
12	1060
13	1140
14	1370
15	1060
16	1220
17	1390
18	1140
19	1010
20	860

Source: Farmer records or records of neighbouring farms.

Table D3

Farm area

Farm No	Total area (ha)	Grazed area	Area ungrazed but capable of development	Waste area or trees
1	475	305	-	170
2	513	364	121	28
3	461	445	-	16
4	540	494	20	26
5	470	437	-	33
6	411	405	-	6
7	635	619	-	16
8	537	534	-	3
9	273	267	-	6
10	513	485	-	28
11	656	506	130	20
12	504	376	100	28
13	640	424	174	42
14	784	582	162	40
15	678	672	-	6
16	472	461	-	11
17	586	546	28	12
18	286	275	-	11
19	618	558	32	28
20	725	722	-	3

Table D4

Stocking rate as at 30th June 1972

Farm No.	e.e.(sheep)/ha	e.e.(cattle)/ha.	Total e.e./ha.
1	9.44	2.57	12.01
2	5.63	2.03	7.66
3	8.20	3.34	11.54
4	7.41	6.47	13.88
5	8.08	2.84	10.92
6	8.25	3.03	11.28
7	4.77	3.68	8.45
8	8.57	3.06	11.63
9	10.77	2.30	13.03
10	7.31	4.50	11.81
11	6.92	3.21	10.13
12	5.78	5.09	10.87
13	10.72	1.98	12.70
14	5.31	2.79	8.10
15	5.46	1.88	7.34
16	6.15	4.40	10.55
17	4.60	3.56	8.16
18	8.90	3.21	12.11
19	5.19	2.77	7.96
20	7.17	3.24	10.41

Table D5

Stocking rate as at 30th June 1971

Farm No.	e.e.(sheep)/ha	e.e.(cattle)/ha.	Total e.e./ha
1	9.22	2.50	11.72
2	5.56	2.52	8.08
3	8.13	2.77	11.00
4	7.93	6.47	14.40
5	7.93	2.52	10.45
6	8.30	2.77	11.07
7	4.69	3.29	7.98
8	8.70	3.24	11.94
9	13.57	2.37	15.94
10	7.04	4.08	11.12
11	6.92	2.77	9.69
12	5.91	4.74	10.65
13	11.59	1.68	13.27
14	5.93	2.42	8.35
15	5.12	1.85	6.97
16	6.03	4.94	10.97
17	4.74	3.90	8.64
18	8.80	2.92	11.72
19	4.50	2.74	7.24
20	6.92	3.76	10.68

Table D6

Stocking rate as at 30th June 1970

Farm No.	e.e.(sheep)/ha.	e.e.(cattle)/ha.	Total e.e./ha
1	8.99	2.99	11.98
2	6.42	2.20	8.62
3	8.03	2.87	10.90
4	6.70	6.30	13.00
5	7.93	2.52	10.45
6	8.23	2.97	11.16
7	4.67	3.34	8.01
8	9.27	3.19	12.46
9	12.97	3.19	16.16
10	6.84	3.73	10.57
11	6.77	2.52	9.29
12	6.05	4.10	10.15
13	10.67	1.33	12.00
14	5.36	2.77	8.13
15	4.72	2.08	6.80
16	6.65	3.11	9.76
17	4.18	3.01	7.19
18	8.38	3.21	11.59
19	4.45	2.69	7.14
20	6.20	3.66	9.86

Table D7

Stocking rate as at 30th June 1969

Farm No.	e.e.(sheep)/ha.	e.e.(cattle)/ha.	Total e.e./ha.
1	8.06	3.36	11.42
2	6.08	2.27	8.35
3	8.20	2.74	10.94
4	6.05	5.63	11.68
5	7.93	2.52	10.45
6	8.06	3.29	11.35
7	4.42	3.16	7.58
8	7.96	3.04	11.00
9	13.02	2.10	15.12
10	5.86	3.56	9.42
11	7.29	2.25	9.54
12	5.51	3.83	9.34
13	9.61	1.61	11.22
14	5.39	2.87	8.26
15	4.60	2.05	6.65
16	6.65	3.48	10.13
17	3.73	3.85	7.58
18	7.81	2.87	10.68
19	4.45	2.74	7.19
20	5.86	3.66	9.52

Table D8

Survey farms - average stocking rates (1969-1972)

Farm No.	e.e.(sheep)/ha.	e.e.(cattle)/ha.	Total e.e./ha.
1	8.93	2.86	11.79
2	5.92	2.26	8.18
3	8.14	2.93	11.07
4	7.02	6.22	13.24
5	7.97	2.60	10.57
6	8.21	3.02	11.23
7	4.64	3.37	8.01
8	8.63	3.13	11.76
9	12.58	2.49	15.07
10	6.76	3.97	10.73
11	6.98	2.69	9.67
12	5.81	4.44	10.25
13	10.65	1.65	12.30
14	5.50	2.71	8.21
15	4.98	1.97	6.95
16	6.37	3.98	10.35
17	4.31	3.58	7.89
18	8.47	3.05	11.52
19	4.65	2.74	7.39
20	6.54	3.58	10.12

Table D9

Lambing percentage (docking), survival to sale percentage, and differences, 1969

Farm No.	Docking %	S to S%	Losses (docking to S to S)
1	99.4	98.0	1.4
2	87.0	83.0	4.0
3	103.6	102.0	1.6
4	87.9	86.0	1.9
5	97.0	93.0	4.0
6	100.0	95.8	4.2
7	88.6	85.4	3.2
8	118.0	117.0	1.0
9	97.0	90.7	6.3
10	115.0	113.0	2.0
11	99.0	97.9	1.1
12	129.0	127.0	2.0
13	85.8	83.0	2.8
14	86.0	84.6	1.4
15	79.1	77.4	1.7
16	91.0	88.5	2.5
17	106.3	95.5	9.8
18	100.0	97.5	2.5
19	104.9	102.7	2.2
20	93.0	91.2	1.8

Table D10

Lambing percentage (docking), survival to sale percentage, and differences, 1970.

Farm No.	Docking %	S to S%	Losses (docking to S to S)
1	110.0	108.5	1.5
2	88.0	84.0	4.0
3	89.1	87.0	2.1
4	81.3	77.0	4.3
5	98.2	93.2	5.0
6	98.0	96.0	2.0
7	81.8	77.6	4.2
8	97.4	95.0	2.4
9	96.0	93.5	2.5
10	118.0	115.8	2.2
11	104.0	101.0	3.0
12	132.6	131.0	1.6
13	95.2	92.7	2.5
14	88.0	82.7	5.3
15	80.5	79.3	1.2
16	88.0	87.4	1.6
17	112.1	105.0	7.1
18	100.0	98.7	1.3
19	108.0	105.3	3.3
20	91.0	89.5	1.5

Table D11

Lambing percentage (docking), survival to sale percentage, and differences, 1971

Farm No.	Docking %	S to S%	Losses (docking to S to S)
1	108.0	107.5	0.5
2	90.0	87.2	2.8
3	102.9	101.0	1.9
4	89.6	85.5	4.1
5	98.4	94.9	3.5
6	97.0	95.0	2.0
7	85.1	83.5	1.6
8	107.0	105.0	2.0
9	95.0	89.7	5.3
10	117.0	115.0	2.0
11	115.0	110.6	4.4
12	119.1	116.0	3.1
13	93.7	91.0	2.7
14	80.0	73.3	6.5
15	92.6	91.3	1.3
16	102.0	99.6	2.4
17	111.8	102.8	9.0
18	100.0	96.6	3.4
19	117.0	115.8	1.2
20	97.0	94.0	3.0

Table D12

Average lambing percentage (docking), average survival to sale percentage, and differences, 1969-1971

Farm No	Docking %	S to S %	Losses (docking to S to S)
1	105.8	104.7	1.1
2	88.3	84.7	3.6
3	98.5	96.7	1.8
4	86.3	82.8	3.5
5	97.9	93.7	4.2
6	98.3	95.6	2.7
7	85.4	82.2	3.2
8	107.5	105.7	1.8
9	96.0	91.3	4.7
10	116.7	114.6	2.1
11	106.0	103.2	2.8
12	126.9	124.7	2.2
13	91.6	88.9	2.7
14	84.7	80.3	1.4
15	84.1	82.7	1.4
16	93.7	91.8	1.9
17	110.1	101.1	9.0
18	100.0	97.6	2.4
19	109.9	107.9	2.0
20	93.7	91.6	2.1

Table D13

Wool weight per ewe equivalent in sheep
(Kilograms)

Farm No	1969-1970	1970-1971	1971-1972
1	5.10	5.69	5.20
2	3.82	4.41	5.37
3	5.30	5.62	5.16
4	5.46	5.65	4.89
5	3.60	4.53	4.92
6	5.53	5.86	6.06
7	5.05	5.56	5.65
8	4.91	5.33	5.45
9	3.90	4.65	4.02
10	5.27	5.35	5.06
11	4.34	5.19	5.08
12	5.35	5.29	5.35
13	4.57	5.58	4.12
14	3.72	4.55	3.83
15	3.70	4.05	5.04
16	3.83	4.45	4.76
17	4.29	4.67	4.45
18	3.83	4.06	4.20
19	4.34	4.69	4.65
20	3.99	4.40	4.18

Table D14

Income from nett sales, adjusted for stock change, 1969-70.

Farm No	Sheep ($/ha)	Wool ($/ha)	Cattle ($/ha)	Total ($/ha)	Total ($/e.e.)
1	31.28	20.91	5.41	57.60	5.05
2	14.70	10.16	7.61	32.47	3.89
3	23.80	23.03	17.62	64.45	5.89
4	20.26	16.75	37.04	74.05	5.23
5	-	22.07	-	-	-
6	24.98	23.65	16.31	64.94	5.72
7	13.91	11.12	20.21	45.24	5.96
8	33.93	19.72	24.88	78.53	7.14
9	32.22	23.67	28.94	84.29	5.62
10	25.11	16.33	21.50	62.94	6.69
11	21.18	14.63	13.96	49.77	5.22
12	28.11	15.37	26.29	69.77	7.47
13	26.19	21.40	1.95	49.54	4.46
14	9.32	10.28	11.07	30.67	3.70
15	9.69	8.20	10.87	28.76	4.33
16	17.12	12.55	12.82	42.49	4.20
17	16.04	8.70	11.05	35.79	4.72
18	27.27	17.22	14.13	58.62	5.49
19	16.43	10.58	11.94	38.95	5.42
20	26.37	12.08	17.89	56.34	5.92

Table D15

Income from nett sales, adjusted for stock change, 1970-71.

Farm No	Sheep ($/ha)	Wool ($/ha)	Cattle ($/ha)	Total ($/ha)	Total ($/e.e.)
1	28.86	24.36	14.20	67.42	5.63
2	6.99	12.63	14.43	33.05	3.95
3	19.87	21.84	20.53	62.24	5.71
4	18.41	17.45	37.39	73.25	5.64
5	23.52	16.53	17.35	57.40	5.49
6	23.60	13.38	5.09	52.07	4.67
7	11.02	11.54	19.77	42.33	5.29
8	28.81	23.94	23.65	76.40	6.13
9	35.71	26.69	-2.42	59.98	3.71
10	26.44	17.74	26.07	70.25	6.64
11	22.31	14.33	17.30	53.94	5.81
12	22.13	14.60	32.54	69.27	6.82
13	30.72	18.08	10.67	59.41	5.78
14	14.45	11.64	11.89	37.48	4.66
15	12.75	8.82	8.85	30.52	4.33
16	17.00	13.91	23.77	54.68	5.60
17	15.67	9.88	37.24	62.79	8.73
18	27.38	17.42	8.60	53.40	4.61
19	16.06	10.30	18.98	45.34	6.35
20	17.10	13.76	21.50	52.36	5.31

Table D16

Income from nett sales, adjusted for stock change, 1971-72.

Farm No	Sheep ($/ha)	Wool ($/ha)	Cattle ($/ha)	Total ($/ha)	Total ($/e.e.)
1	25.62	26.81	9.79	62.22	5.31
2	13.27	15.69	6.15	35.11	4.35
3	19.67	28.84	27.33	73.84	6.78
4	14.63	20.68	43.36	78.67	5.47
5	23.97	21.82	21.67	67.46	6.45
6	18.38	27.75	19.77	65.90	5.95
7	10.97	13.17	23.85	47.99	6.01
8	21.82	30.57	25.45	77.84	6.52
9	27.18	32.22	45.20	104.60	6.56
10	22.02	18.09	39.64	79.75	7.17
11	21.25	22.19	23.15	66.59	6.88
12	22.68	17.50	37.31	77.49	7.28
13	17.74	26.42	10.87	55.03	4.15
14	9.61	13.44	19.30	42.35	5.07
15	14.51	16.48	15.37	44.36	6.65
16	15.32	17.05	25.75	58.12	5.30
17	12.70	12.08	31.23	56.01	6.48
18	19.14	24.49	23.65	67.28	5.74
19	16.04	13.42	21.70	51.16	7.06
20	19.84	18.21	11.61	49.66	4.65

Table D17

Total sheep income per sheep ewe equivalent, nett of purchases, and adjusted for stock change.

Farm No	1969-70	1970-71	1971-72
1	6.49	5.92	5.69
2	4.08	3.05	5.21
3	5.70	5.21	5.73
4	6.10	5.35	4.46
5	-	5.06	5.78
6	6.05	5.72	5.56
7	5.64	4.84	5.15
8	6.75	5.70	6.03
9	4.30	4.81	4.35
10	7.07	6.45	5.69
11	4.92	5.41	6.29
12	7.88	6.05	6.89
13	5.00	5.50	3.81
14	3.64	4.85	3.88
15	3.89	4.59	6.06
16	4.46	4.65	5.37
17	6.13	6.12	5.23
18	5.69	5.35	4.95
19	6.09	5.94	6.54
20	6.58	4.88	5.58

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