A STUDY OF MANAGEMENT PRACTICES AND PRODUCTIVE PERFORMANCE ON A SAMPLE OF HILL COUNTRY SHEEP FARMS IN NORTH-EAST WAIRARAPA.

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I accept responsibility for any errors or omissions in this report.

ABSTRACT

The research reported in this thesis was directed towards the analysis of the inter-relationships between management practices and productive performance on a survey group of 30 north-east Wairarapa hill country farms. The initial survey, which essentially concentrated on the period between ewe weaning and tupping, incorporated a combination of mail and personal interview techniques. In addition, sample liveweights of ewe hoggets in autumn (April 1) and of two tooth and mixed aged (MA) ewes prior to mating were obtained to describe production levels more objectively.

Preliminary results and apparent opportunities for improving the management of existing production systems were presented to the survey farmers as a group. As a consequence, a follow-up mail survey directed at management practices and associated production levels during the winter and spring (post-mating to weaning) was implemented in August 1983. Sample liveweights of ewe hoggets at spring shearing and ewe and lamb weights at weaning were collected. Results were discussed with the 29 participating farmers.

Descriptive statistical methods (e.g. frequencies, cross-tabulation) were initially used to describe farm physical characteristics and the management systems employed. Subsequently, multivariate techniques (regression and MANOVA) were used to estimate the relative importance of different management strategies and farm physical characteristics on system performance.

The major recommendation from this study is that increased emphasis should be placed on rearing ewe lambs

so that they achieve a liveweight of 35 kg or more by May 1. The average April 1 ewe lamb liveweight on the survey farms in 1983 was 30.2 kg (range, 18.7 - 40.0 kg). Other recommendations include mid-October or later commencement of calving, delaying ewe mating until April 1, earlier weaning of lambs and calves in dry summer areas (8-10 weeks and 12 weeks average age respectively) and increasing the winter rotation lengths of ewes. It is suggested that a large proportion of the potential level of production on hill country can be realised inexpensively through relatively small changes to existing management practices (such as those mentioned above) and associated management control of production system performance.

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CHAPTER ONE

INTRODUCTION

1.0 CHAPTER OUTLINE

In this chapter the background to setting up the study is described in relation to the New Zealand hill country resource and more specifically to the Wairarapa region. A section is devoted to defining the discipline of farm management and the characteristics of farm management research. The order of the thesis is briefly outlined in the final section of the chapter.

1.1 HILL COUNTRY FARMING IN NEW ZEALAND

Of the 13 million hectare (ha) of pastoral land in New Zealand about 4.5 million ha can be classed as being predominantly non-ploughable or hill country (Tripe 1979). Approximately 3.6 million ha (80%) of the hill country receives an annual rainfall of between 1,000 - 2,500 mm, while the remaining 20% receives about 350 - 1,000 mm per annum. (Brougham & Grant 1976). These areas are usually referred to as wet or moist and dry hill country with respective average stocking rates of 10.4 and 4.0 stock units per hectare (SU/ha) (Hight 1976). The estimated 7,700 farms in these areas carried approximately 34.6 million ewe equivalents or about 45% of the total New Zealand livestock population in 1981 (NZMWBES 1982).

Hill country plays an important part in the structure of the New Zealand pastoral farming industry by acting as a reservoir of breeding ewes, surplus lambs and cattle for the farms on flat and rolling country. The rapid increase in horticultural production, urban sprawl and to some extent changes in the dairying industry during the 1970's reduced the area of lowland available for "finishing" hill country livestock. This, combined with changing economic conditions, has led to a greater emphasis being placed on the hill country farmer to produce a product ready for export and to increase stock numbers.

The potential to increase production on hill country has been estimated by several authors. Brougham (1973) suggested that by removing phosphate limitations, carrying capacities could be tripled. Hight (1976) estimated that hill country production could be improved by 50% on a national basis, with increases of over 100% on the wetter and higher fertility areas. A massive 280% increase above the 1973 Meat and Wool Boards average carrying capacity of 10.4 SU/ha for easy hill country was calculated by Grant (1974).

Such statements clearly indicate that considerable differences exist between average practice and the levels of pasture and animal production achieved under experimental conditions. The reasons why these differences exist are complex, and include sociological, political and financial factors as well as the mix of biological and physical inputs (Maughan and Ward 1978, Kaplan 1979). However, an estimated 10% of hill country farmers are achieving a level of output which is close to the potentials suggested by scientists (Table 1.1).

Table 1.1 SHEEP AND BEEF FARM PERFORMANCE VARIATION

Farm Class	Lowest	Median	Highest
Stocking Rate (su/ha)			
N.I. Hard Hill country	4.64	8.54	15.31
N.I. Hill Country	5.86	10.35	15.38
Lambing Percentage (%)			
N.I. Hard Hill Country	60.5	88.8	118.6
N.I. Hill Country	67.8	91.6	147.6
Calving Percentage (%)			
N.I. Hard Hill Country	31.9	77.2	93.7
N.I. Hill Country	33.3	85.0	109.6

SOURCE: Taylor (1982).

Thus there are two immediate areas requiring further research: first, that of increasing the level of production on those farms producing well below their potential and secondly, to find solutions to the technological problems faced by the "top" echelon of farmers. This study is concerned with both of these aspects.

1.2 FARM MANAGEMENT AND FARM MANAGEMENT RESEARCH

1.2.1 FARM MANAGEMENT

Management is the act or manner of controlling the process of executing a given policy (Loftus and Cary 1980, Random House Dictionary 1980). There is virtually universal agreement that the fundamental processes of management are planning, organising and controlling (Greenwood 1965).

Management is referred to as a process because it involves a systematic series of actions which are directed towards some end. Thus management, because it is inherently associated with human activity, can be applied to a wide variety of areas including industry, marketing, horticulture and personal as well as farming (Meij 1965).

Characteristics of Planning, Organising and Controlling

Koontz and O'Donnell (1972) defined planning as: "deciding in advance what to do, how to do it, when to do it and who is to do it." Planning therefore involves the allocation of resources in a manner which best satisfies the objectives of the individual (Barnard and Nix 1973). Although incomplete information normally restricts the accuracy of planning, the absence of a plan means that the outcome is left to chance. The act of planning requires a conscious mental consideration of possible outcomes in relation to each individual farm situation.

Organising, or the grouping together of activities necessary to attain objectives and the development of a structure to carry out farming functions (Yuill 1970, Koontz and O'Donnell 1972), is less obvious in owner-operated farming situations where the farmer represents all levels of management, than in industry where management levels are usually readily distinguished. Organisation is however necessary to ensure the ordered allocation of resources, the attainment of objectives and the operation of the farm system within the constraints of its environment.

Control (or operating) is the process of measuring and correcting the performance of the various enterprises in order to ensure that objectives, and the plans devised to attain them, are being accomplished (Koontz and O'Donnell 1972, Donald 1979). Control involves three steps:

1. a plan and the establishment of standards or criteria against which results can be measured. These may be physical, financial or expressed in any other term which enables the measurement of the outcome of a plan;
2. measurement of performance against the standards;
3. attempting to correct deviations from the plan.

There are three points in time at which control can be applied (Koontz and O'Donnell 1972, Barnard and Nix 1973). First, the manager can analyse the results of a previous plan to identify where, how and why failures occurred and take steps to avoid recurrence of mistakes. Secondly, deviations from the plan can be corrected as they occur. The third and most effective means of control is to anticipate when deviations from the plan may occur and to take preventative action to ensure that potential deviations do not materialise.

To control without planning is meaningless; unless there is a pre-determined direction and objective to be obtained there is no way of determining whether the results are in the required direction (Koontz and O'Donnell 1972). The two processes both require and generate information and must be associated with the appropriate mechanisms which enable the transfer of information from one to the other. In practice, the processes of farm management overlap (Barnard and Nix 1973) and the distinction between planning, organising and controlling is not always clear.

The Farm Management Process

Planning and control, and to a lesser extent organising, can be carried out within the framework of the farm management process (Bradford and Johnson 1953), which involves the following eight functions (Candler and Sargent 1965):

1. Formulation of goals and objectives;
2. Recognition and definition of a problem or recognition of an opportunity;
3. Obtaining information;
4. Specification and analysis of alternatives;
5. Choosing an alternative;
6. Implementation of the alternative selected, recognising that taking no action may be a valid alternative;
7. Bearing responsibility for the decision or action taken;
8. Evaluating the outcome.

This process is essentially the same as the problem-solving process which can be applied to any field of management (Yuill 1970). To find a solution which best meets the desired goals, parts of the procedure may need to be repeated several times, but the steps need not necessarily occur in the sequence shown or indeed within a specified period of time. Information for example may be collected over a number of years.

An Example of the Application of the Farm Management Process

Application of the farm management process on a sheep farm is discussed in the following example in relation to improving lamb percentages. The various steps of the farm management process are shown in brackets.

The farmer has a goal (long-term aspiration) of 130% lambing with minimal shepherding at lambing, but still being able to draft most surplus lambs at a carcass weight of 13.0 kg by the end of February (Step 1). Lambing percentages have averaged 85% over the previous 5 seasons. It is apparent that some factor(s) are limiting lambing performance and the farmer begins to collate information to determine what these might be (Steps 2 and 3). This may involve additional reading of farming publications, arranging for the local farm advisory officer (FAO) to visit and the analysis of farm records. The latter could include:

stocking rate,
lambing percentages of two tooth and MA ewes,
percentages of dry/dry and wet/dry ewes,
lamb losses (%),
ewe losses (%),
lambing date,
weaning date,
length of mating period (lambing spread),
average ewe age at culling,
average carcass weight of prime lambs.

In practice, not all of this data is recorded by the farmer in question. In fact, some of this data may have no relevance to the process of increasing knowledge and understanding about factors influencing lambing percentages. Likewise, some data having an important bearing on this process may be omitted. Although the farmer monitors only some of his input and performance parameters, he considers that he has an overall appreciation of year to year trends. The subsequent analysis carried out with the FAO indicates: that average lamb carcass weights were 0.5 kg lighter than expected, the proportion of dry dries is above the district average at 6% for the flock and mating is three weeks earlier than most of the local farmers.

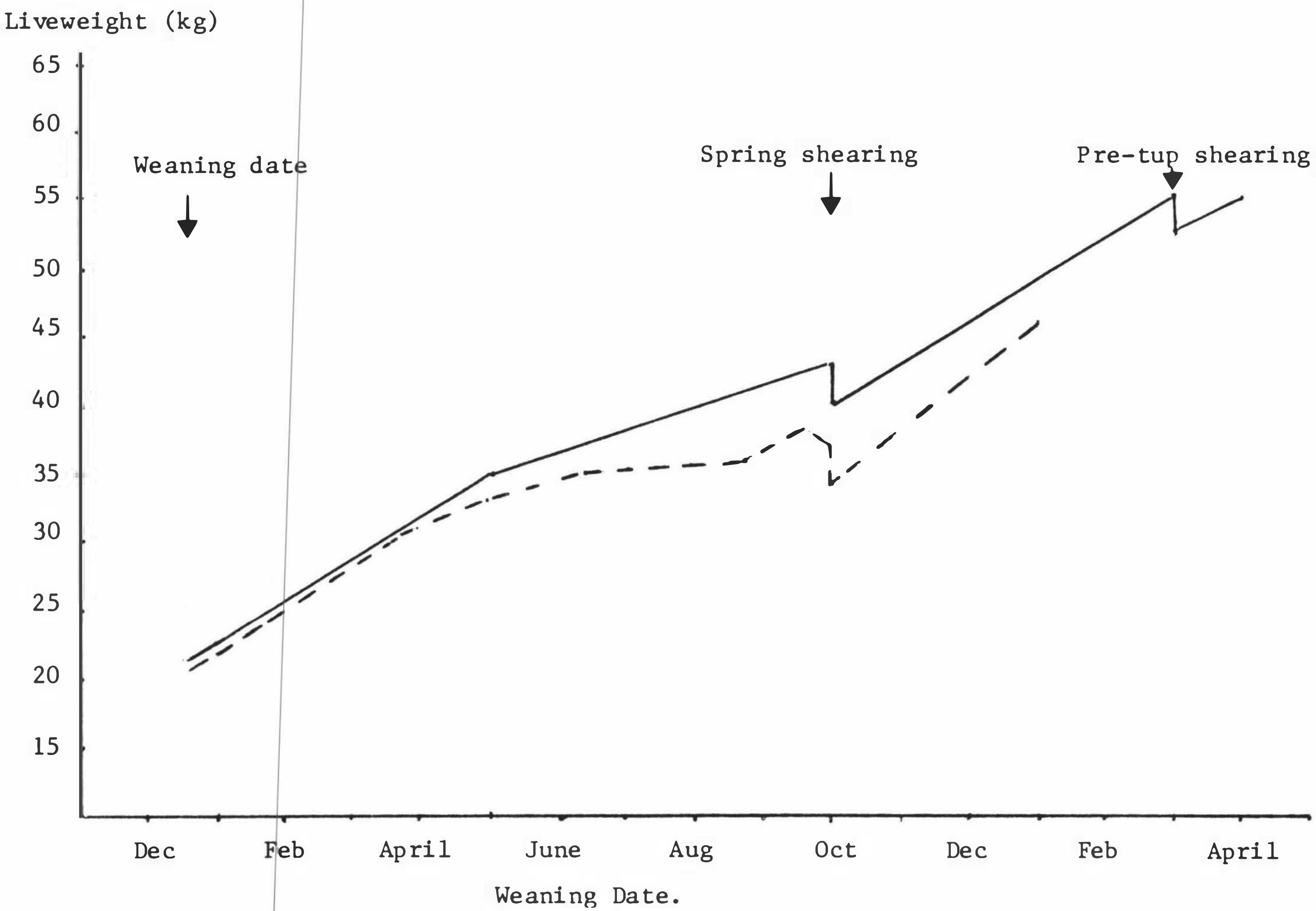
The FAO also brought a set of scales along and although it was early January, suggested that a sample of MA ewes, lambs and maiden two tooths be weighed. The farmer estimated that the respective weights would be 48, 25 and 45 kg - the scales indicated average weights of 42, 22 and 40 kg. This previously missing information clearly indicated that low liveweights were currently a problem and historically had been so because of the low average liveweight of older ewes, and their relatively small frames.

The FAO outlined some alternative courses of action which could improve lambing performance (Step 4). These included buying fully recorded rams from a high fertility flock, cross-breeding, moving mating dates so as to be in line with the rest of the district, and implementing a programme to increase two tooth liveweights to 55 kg at mating. The farmer was generally happy with these recommendations, but was not keen to be involved in a cross-breeding programme.

The lower than expected liveweights surprised the farmer and he formed a mental objective to have two tooths averaging 50 kg by tupping within 2 years and 55 kg after 5 years (Steps 1 and 5). This required re-planning some of his existing grazing and management practices, reviewing lamb selling policies and deciding on an objective means of measuring liveweight to monitor progress (Step 6).

The two tooth management plan was summarised into a graphical representation of liveweight targets and average liveweight gains against time (Figure 1.1). To ensure that the changes in management were having the desired effect and/or that implementation was correct, regular weighings were carried out (Step 8). These results were plotted against those of the plan.

Figure 1.1 TWO TOOTH MANAGEMENT PLAN SUMMARY (-) AND ACTUAL RESULTS (--).



After 12 months the ewe lambs, which originally weighed 22 kg, had reached a two tooth weight of 46 kg, and the new crop of lambs weighed 25 kg. The farmer considered that the two tooths were the best and most even line ever (Step 8), but dry conditions which are normal in February and March meant that the 50 kg weight at mating was unlikely to be achieved. (Under these conditions it appears that management strategies should be revised to achieve target tupping weights by New Year). The actual and planned liveweight profiles (Figure 1.1) reveal other areas of management which could be improved (Steps 7 and 8). Lamb weaning weights are low, indicating that management prior to weaning needs to be evaluated, especially in view of the fact that dry summer conditions make it difficult to achieve steady gains in lambs through to the end of March (Step 2). The farmer sets himself an additional objective; 25 kg lambs at weaning at 12 weeks of age (Step 1). Ewe hoggets also lost weight at the spring shearing because wet weather held up the shearers for a week. While there was feed on the hogget block at the back of the farm, 1.5 km from the woolshed, it was impractical to take the mob back to this area for a few days while waiting for the weather to clear. The hoggets therefore grazed short pastures near the woolshed instead. The farmer makes a note to have at least one paddock near the woolshed prepared for hogget shearing in the subsequent years (Step 2).

And so the process of management continues. This example demonstrates the three processes of management. Initially the farmer was involved in a planning exercise. Essentially this required the definition of an appropriate production system to enable required liveweight gains to be achieved. This was followed by organising such things as paddock shifts, drenching programmes and the equipment necessary to implement the plan. Finally the control process was exercised by monitoring the success or otherwise of the plan and its implementation. Information thus obtained indicated the need for changes to the plan (e.g. reaching 50 kg two-tooth liveweight earlier and obtaining higher lamb weaning weights) and identifying aspects of the plan which could have been implemented more efficiently (e.g. better organisation of pastures at shearing). However, the three processes soon become interwoven. Thus controlling the original plan led to development of new plans and changes in organisation, and these in turn could lead to further changes in management until ultimately the farmer's goals were attained.

Some of the distinct characteristics of farm management are evident in the example outlined, including:

1. The complexity of the farming system which involves a biological production system directed by a human resource. Thus the low lambing percentage problem was related to lambing dates, ewe liveweights and genetic quality of the stock. These factors in turn are determined by a large number of other variables, many of which are inter-related. For example, the early lambing may be designed to improve lamb drafting weights to help compensate for the lower number of lambs available for sale.

2. The need for knowledge from a wide variety of subjects (Johnson 1957, Castle and Becker 1962). The planning of the liveweight gain profile required, for example, a consideration of the type of grazing management system (set stocking versus rotational grazing and feeding allowances) and selling policies (timing, prices and markets), while the control process required the monitoring and interpretation of liveweight data and other results of the plan so that the correct adjustments were made.

3. The absence of complete information. The problem of low lambing percentage was more sharply defined after

obtaining liveweight data, but the period of the year which contributed most to low liveweights did not become evident until records had been kept for at least 12 months. Lack of information may also be simply due to the fact that existing records had not been analyzed (Barnard 1975).

4. The lack of control over some parts of the farming system. Although the farmer had implemented a feeding plan which would allow ad lib feeding at and after hogget shearing, no contingency plan was made for wet weather. Consequently, an operation which normally took one day was stretched over one week and the hoggets lost weight.

Despite these difficulties, systematic application of the farm management process assisted this farmer to achieve his goals. This may mean that numerous short term objectives are specified. Although the attainment of the high lambing percentage goal is likely to improve the farmer's financial returns, the non-economic aspiration of establishing a high performing flock may be equally as important. The goals and objectives of farmers are thus varied and may include both economic and non-economic motives. A fundamental objective of all farmers however is to generate sufficient profit to meet the basic living expenses of the farm family.

It is not uncommon for a farmer, such as the one described, to have a neighbour who is already regularly achieving a lambing performance of 130% despite the land resource of the two properties being almost identical. The neighbour does not have a weighing programme, use the local FAO, or attend many field days. Furthermore he has difficulty describing his farming system because a very flexible approach is taken. This farmer could be described as being an "artist" because he is able to achieve his goals and objectives apparently without a clearly defined system of planning, implementation or control. Such farmers have posed problems to researchers attempting to define the discipline of farm management.

It is clear from this example that the fundamental change in farmer behaviour has been that of embarking on a more systematic process of enquiry with the aim of improving the effectiveness of the cyclic learning process. In this example the FAO has intervened in this process at the invitation of the farmer.

Definition of Farm Management

A definition of farm management should reflect the special characteristics of farm versus other forms of management. This has led to a considerable debate in the professional journals and literature (Dillon 1980, Long 1981) and the offering of a large number of definitions (Black et al 1953, Bradford and Johnson 1953, Efferson 1953, Heady and Jensen 1957, Yang 1958, Castle and Becker 1962, Candler and Sargent 1965, Giles and Stansfied 1980, Sharma and Sharma 1981).

Most of the definitions recognise that farm management involves: farmer objectives, the manipulation of resources and the absence of complete information for decision making, but place different emphasis on these aspects. Thus some authors refer to decision making and implementation as an "art" because farmers do not outwardly exhibit a scientific and systematic process for achieving objectives. Similarly some authors have emphasised the business aspects of management, particularly those from America, rather than taking a more general approach which includes non-economic criteria for success.

For the purposes of this thesis Dillon's (1980) definition is accepted:

> "(Farm management is) the process by which resources and situations are manipulated by the farm manager in trying with less than full information to achieve his goals."

It should also be recognised that the activity of learning is embodied in the farm management process.

1.2.2 FARM MANAGEMENT RESEARCH

Research is a systematic method of inquiry that is orientated to the solving of problems (Drew 1980, Davies 1968). Farm management research is concerned with any activity (by both farmers and others) that assists either directly or indirectly with the process of farm management. The objective of this research is to provide the client(s), which may include scientists, advisors or farmers, with information which will ultimately improve the implementation of the management process and benefit the welfare of farmers and society.

Farm management research therefore covers a wide range of topics and may be concerned with any one of the processes of management - planning, organising and control - and the inter-relationships between these processes. The majority of farm management research, however, has been in the field of designing new production systems and the development of new planning methods rather than of studying of means of improving day to day management or of understanding the manager in more precise terms so that farm plans are devised within the capability of the farm manager.

One might ask why this imbalance has occurred, particularly in view of the fact that farm management people themselves have criticised this weakness (Camm 1968, Davies 1968, Nix 1979). There are a number of possible reasons, including:

1. A misconception of what farm management research involves. Candler and Sargent (1965), for example, defined farm management research as being concerned with the first four and last functions of the farm management process. They went on to state:
"Whilst the motivation of farmers and their education in problem recognition is important, most current farm management research methods are concerned with Steps 3 and 4. Step 8 is of lesser significance in a dynamic agricultural situation."
This definition, as exemplified by their list of possible research topics, essentially precludes the study of organisation and control processes.

   In a similar vein it has been claimed that, in a dynamic agriculture, most farm management research should relate to problems arising from new technology and changes in cost/price relationships (Candler 1962, Camm 1968).
   However, farm management problems may equally arise, for example, due to the lack of formal management systems for implementing farm policy.

2. The development of computers. The rapid growth in the capacity of computors since 1950 enabled the development of sophisticated techniques for planning and simulating farm systems. These fields, in the main, have proved to be more attractive to researchers than the generally more mundane investigations of direct on-farm problems and farmer behaviour (Nix 1979). Furthermore the

main-frame computors were inaccessible to, and not understood by, most farmers. The development of micro-computors, which have a much wider commercial audience, has already brought changes in the direction of farm management research and there is a renewed interest in the collection and analysis of data at the farm level to help farmers make more efficient decisions. A number of lessons already learnt in relation to the field of information should not be disregarded. The collection of more information and in more detail may help researchers to validate farm systems models (and therefore help farmers indirectly), but in most instances a better understanding and simplification of existing data and methods of measurement/interpretation is required at the farm level. Feed budgeting, for example, becomes an increasingly important part of management as stocking rates increase if productivity is to be maintained. However, the majority of New Zealand sheep farmers do not yet understand in sufficient detail, terminology such as "kg DM" despite its widespread use by agricultural researchers during the last decade. The overlooking of such an apparently small matter as this is one of the primary reasons why Controlled Grazing Systems (C.G.S.) plans have not been successfully implemented on many sheep farms.

3. The failure of farm management researchers to either recognise or correctly define problems and opportunities at the farm level. It has been said that the problems of implementation are often not appreciated until one has become involved in the decision making process (Ridler 1983, pers comm). It is unrealistic to expect every farm management researcher to gain such "in-the-field" experience. The methodology, therefore, for determining more accurately when, how and why management problems occur, particularly those concerned with organisation and control, needs to be refined.

4. The lack of adequately trained people in the field of farm management able to investigate farmer behaviour. For example, relatively little is yet known about what factors motivate farmers. Thus, there are a number of farmers who are well aware of the technical and financial implications of new production methods but do not have the confidence to change. Perhaps researchers should be finding out why New Zealand hill country farmers are not achieving the claimed 50% (and greater) obtainable increases in production (Hight 1976, Grant 1974), rather than simply continually reminding them that such potential exists, and how it might be achieved. It is not necessary for farm management researchers to broaden their already wide requirement for competence in physical and financial aspects of farming (Johnson 1957), but they must be able to define problem areas and use the results obtained from co-operative studies with other research specialists to improve management processes. Industrial management has already proven that the involvement of experts in psychology, sociology, personal management and quality control can be well worth while.

A second concern with farm management research (again recognised by farm management researchers: Camm 1968, Davies 1968, Mentz and Longworth 1976, Nix 1979, Hardaker and Anderson 1981) is that many of the planning models and management aids directed at the farming community have been poorly received. This situation suggests that this research has not represented the decision problems of greatest interest to farm managers and/or that farmers and farm advisors have not been able to operate or interpret the programmes (Mentz and Longworth 1976). Buggie (1977) points out that, in the main, models are developed by people who represent the top 10-15% of the population in intellectual ability, but are intended for consumption by people who are generally closer to average intelligence. The failure of some farm management research may, therefore, be due simply to an intellectual constraint (Buggie 1977).

Farm management research then should be more concerned with:

1. The ability of the farmer to implement the plan, remembering that some farmers (the so-called "artists") will require relatively little help to assimilate new information, analyse it and make decisions, while others will require a carefully prepared and detailed set of decision rules and operating procedures;
2. What can be done to change farmer behaviour in the efficiency of implementation? That is, are there ways of making poor farmers into good farmers and good farmers into better farmers?

In summary then, farm management research should be based on the problems/opportunities faced by farm managers. This is not to say that there is no place for the development of new methodology which appears to have little direct relevance to farming (Nix 1979). Such speculative research can lead to the identification of deficiencies in existing experimental data and indicate the direction in which future farm management research and research in other disciplines should proceed (Pollard 1972). The criteria by which farm management research can be judged as being worthwhile is whether or not, at some point in time, it assists farmers in implementing the management process. However, this brief review indicates the possibility that organisation and control aspects of farm management research have been neglected relative to management research in the planning field.

1.3 MOTIVATION FOR THE STUDY

Many of the management techniques, developed by dairy farmers during the past 25 years have direct relevance to the management of sheep farms; particularly those techniques related to grazing management. The national push by the Ministry of Agriculture and Fisheries (MAF) in the 1980's for the adoption of C.G.S. on sheep farms, primarily involves principles which have been developed and tested under dairy farming conditions. While sheep farmers on easier flat and rolling country have successfully adopted many of these techniques, such as long winter rotations, those on steeper slopes have been slower, overall as a group, to make changes. The reasons for this are not clear.

In Section 1.1 the potential to improve production nationally from hill country was outlined. Within the Wairarapa region a similar potential to increase productivity exists. A Wairarapa hill country study group (Anon 1976) estimated that stock numbers could be increased by 50% on the drier hill country, and 30% overall in the Wairarapa over a period of 10-15 years providing financial (primarily due to Government policy) and physical constraints were removed. Suggestions for the latter included improved management of pastures and stock, more efficient use of fertiliser and lime and an advancement in techniques for establishing improved pasture species.

The potential to increase production is also revealed in the levels of performance of a group of Wairarapa properties monitored during the period 1974-1983 (Table 1.2). Even if allowances are made for variations between properties due to state of development and location, it is apparent that there is a considerable range in farm productivity within and between seasons. Potential for improvement clearly exists on the low to average producing properties.

Table 1.2 PHYSICAL PRODUCTION OF WAIRARAPA FARM IMPROVEMENT CLUB GROUP 1 MEMBERS (1974-1983)[1]

Performance Variable		Year									
		1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Stocking Rate	Highest	13.8	13.1	13.7	13.7	13.1	14.2	14.8	14.5	13.9	-
SU/eff./ha	Lowest	7.6	8.4	8.4	9.1	6.5	7.4	8.0	8.2	5.6	-
	Average	10.6	10.7	10.5	11.1	10.4	10.6	10.7	10.8	9.9	10.1
Lambing %	Highest	119.6	114.0	123.1	114.3	96.5	120.5	118.0	132.5	122.6	-
(Survival to sale or flock)	Lowest	73.0	68.0	70.0	81.2	45.6	74.3	69.6	77.1	46.9	-
	Average	91.8	93.3	96.3	98.2	72.1	87.4	87.0	98.6	82.2	100.5
Calving %	Highest	96.5	96.0	95.1	96.1	94.2	96.6	98.0	98.5	100.0	-
(Survival to sale or herd)	Lowest	76.0	69.0	63.5	72.7	55.6	63.8	72.2	78.3	29.8	-
	Average	87.9	86.5	85.8	86.2	79.6	85.5	83.7	88.5	78.3	89.6
Wool Production	Highest	6.50	6.60	6.62	7.44	6.23	6.40	6.64	7.23	6.27	-
(Kg/SU)	Lowest	3.70	3.80	4.20	4.62	3.80	3.98	4.17	3.68	2.14	-
	Average	5.25	5.30	5.13	5.94	4.70	4.85	5.04	5.36	4.45	5.48
Number of Farms		42	42	42	42	42	42	50	50	50	56

1 Figures provided by Mr D.O. Baker, Farm Management Consultant, Masterton.

At Massey University's Riverside property, techniques for increasing productivity have been investigated as stocking rates increased from 9.6 su/eff ha in 1978 to 14.9 su/eff ha in 1981 and then maintained at this level for two seasons (Table 1.3) (Parker and Lowe 1980, Parker 1983). The increases in stock numbers necessitated changes to the original grazing system of 20-40 day rotations throughout the year and the timing of various stock operations.

Table 1.3 RIVERSIDE: PRODUCTION AND PERFORMANCE (1978-1983).

Year - Variable	1978/79	1979/80	1980/81	1981/82	1982/83
Winter stocking rate (SU/eff ha)	9.6	12.4	13.5	14.9	14.8
Wool production (kg/eff ha)	51	61	76	67	66
Lambing % (Lambs docked/ewes mated)	83	91	105	90	107
Number of lambs sold	2737	3226	4013	4211	6196
Ave. lamb c/c weight (kg)	-	-	-	12.31	12.27
Two tooth live-weight at mating (kg)	-	-	49	50	50

Modifications to the farming system have included: the adoption of a slow (100 day) winter rotation to ensure a pasture cover of 1,000 kg DM/ha or more at the commencement of lambing, conservation of late spring/early summer surplus pasture for use as a flushing feed and to ensure an adequate pasture cover going into the winter (1,500 kg DM/ha on May 1), commencing mating of ewes on April 10 rather than March 1 to achieve a better match of stock feed requirements and pasture growth rates, and early weaning (average age of 8-9 weeks) of lambs to provide maximum opportunity for ewes to regain liveweight before the drier summer months of February and March. Management has placed an increasing reliance on forward control to avoid potential feed shortages/surpluses by monitoring the production system more intensively. Information collected includes regular feed budgets, sheep liveweights and faecal egg counts, and annual soil tests and strategic herbage analysis.

Although Riverside is generally regarded as being atypical of most of the Wairarapa region because of its large area of flats, the experiences gained between 1978 and 1983 gave reason to believe that similar changes in farming systems could be made on Wairarapa hill country properties with the view to economically improving pasture and animal performance. It was considered to be a worthwhile exercise to evaluate the changes made to Riverside's management and production methods, along with other research findings, in the wider local community.

1.4 CHOICE OF THE WEANING TO TUPPING PERIOD

The weaning to tupping period is of fundamental importance to sheep farmers because management decisions made during this period, more than any other, can influence the physical and financial performance of the farm. It also is the most difficult period of the year to manage pastures and stock successfully, yet it has, as indicated by the dearth of relevant scientific publications, largely been overlooked by agricultural researchers.

The difficulty for management arises primarily because 60 to 80% of annual growth, in temperate climate regions such as New Zealand, occurs during a three to four month period in the spring and early summer (Campbell 1966, Rattray 1982). Failure to control pastures during this period results in a high proportion of rank pasture in a reproductive state, that affects subsequent pasture composition, pasture quality and pasture growth. This accentuates the common shortage of pasture due to dry conditions in February and March and contributes to the lower herbage quality and rate of growth at this time of the year (Korte and Sheath 1979, Baars et al 1981).

During the same period, high liveweight gains are required in most classes of livestock, particularly the younger age groups. While liveweight gains on hill country properties are frequently satisfactory in November and December, subsequent bodygrowth in the next three months is often poor due to lack of high quality feed. The failure to achieve target liveweight gains during this period or to flush ewes is reflected in low stock performance or the adoption of less efficient farming systems on a high proportion of New Zealand hill country farms. (For example, the mating of beef cattle heifers at 27 months rather than 15 months of age (Smeaton 1981).

The weaning to tupping period was therefore seen to be a particularly interesting and challenging time of the year requiring further study. Seven hill country farmers known to the author were contacted by telephone to test their reaction to the proposal. They were asked:

> "Which of the three periods of the year; weaning to tupping, tupping to lambing or lambing to weaning do you find the most difficult in terms of management?"

Three indicated the tupping to lambing period, three mentioned weaning to tupping and one the months from lambing to weaning. The variation in answers were related to farm location (which particularly affected summer rainfall), and the state of farm development. Fully developed farms with more intensive subdivision had fewer problems with the winter period.

One of the main grazing management problems of the weaning to tupping period was the rapidity of change, and the difficulty of sustaining pasture quality and maintaining liveweight gain in priority classes of stock. All seven farmers agreed that improvements to management systems could be made during this time of year. Although all seven farmers recognised management problems during the weaning to tupping period it was less apparent that strategies to overcome them were well known.

1.4.1 DEFINITION OF THE WEANING TO TUPPING PERIOD

There is considerable variation between hill country farms in the southern North Island in the timing of lamb weaning and tupping. Thus weaning can occur from the first week of November until the last week of January. Similarly, the commencement date for tupping ranges from the beginning of February until mid-April.

The weaning to tupping period in this study refers to the time interval, mid-November to mid-April for ewe and lamb management, but has been widened to include the month of October for the discussion of two tooth and cattle management.

The term "late spring to autumn" used particularly in relation to pasture management, should be interpreted as being the period from October to mid-April.

1.5 OBJECTIVES OF THE STUDY

The objectives of the study can be considered within the context of designing improved farming systems:

1. to obtain a description of the management systems currently used during the weaning to tupping period;
2. to identify problem areas for management and opportunities for improvements to be made to existing farming systems;
3. to develop recommendations, on the basis of survey results, field observations at Riverside and other experimental findings, which could improve management and the level of production on the survey properties and similar properties in the Wairarapa. This could also indicate areas requiring further research in the Wairarapa. In addition, recognition of problems and opportunities and the recommendations developed from the analysis of results could provide a guide to local advisory workers, as to where the extension effort could be most usefully employed.

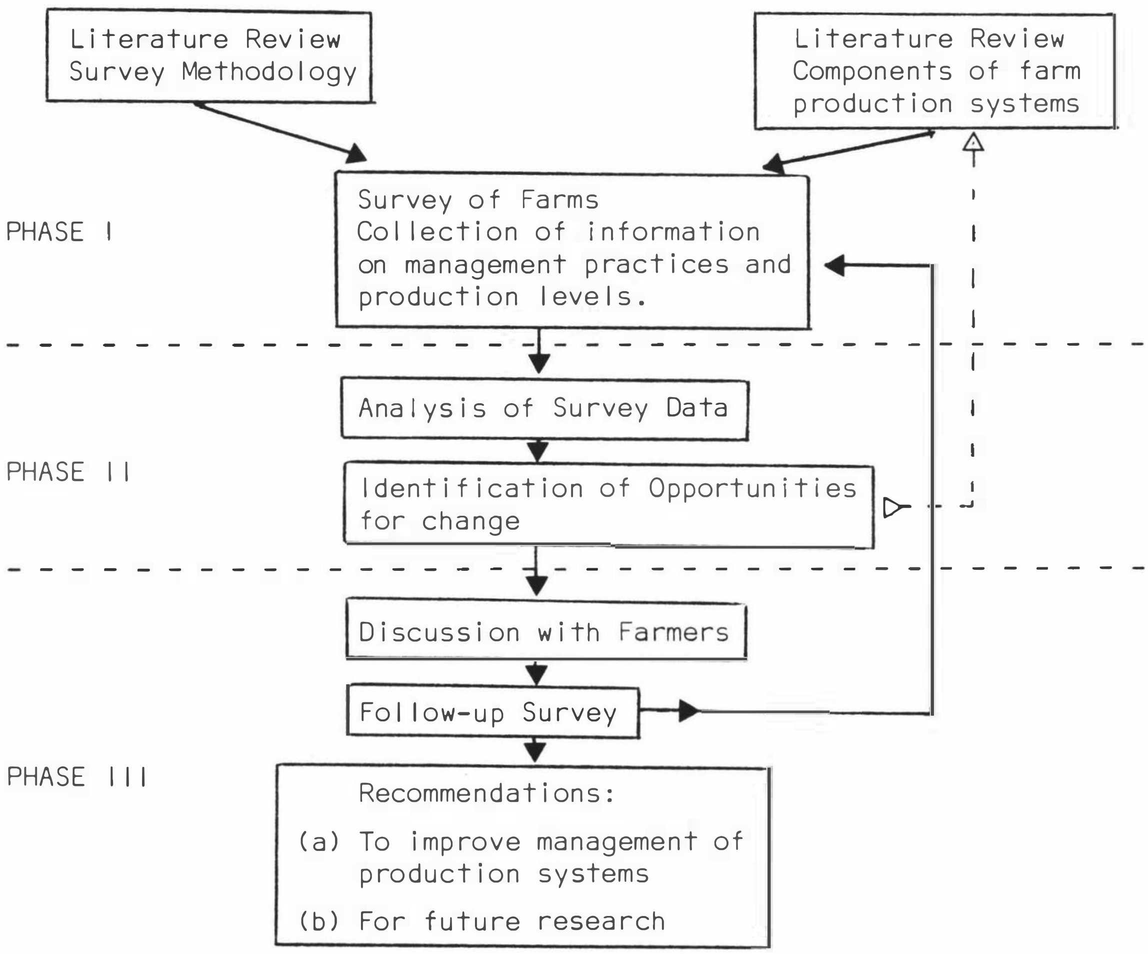
A fourth, less direct, objective is to evaluate the role of Riverside farm in the Wairarapa including, as previously mentioned, the verification of research completed at Riverside.

1.6 THESIS RESEARCH METHODOLOGY

The research reported in this thesis is directed towards analysis of the inter-relationships between management practices and productive performance on a survey group of Wairarapa hill country farms. This research does not encompass analysis of the profitability of alternative production systems or management practices.

The research methodology adopted in this study is summarised in Figure 1.2. A literature review of survey methodology guided the techniques used to collect primary information concerning management practices and productive performance relevant to the period of the production cycle under study (weaning to tupping). A review of literature relating management practices to productive performance for sheep/beef farming systems, guided survey content and survey data analysis.

Figure 1.2 THESIS RESEARCH METHODOLOGY



The likely interactions between the large number of components which make up grassland farming systems posed problems in relation to the type and availability of information required to meet the stated research objectives. In general, farmers describe their management practices in subjective terms and in many cases only limited objective data is available to describe production levels (Barnard 1975). Where livestock weighing was not a normal practice on survey farms, arrangements were therefore made to obtain ewe mating liveweights and autumn (1 April) hogget live-weights. In a follow-up survey, spring (1 October) hogget liveweights and ewe and lamb liveweights at weaning were obtained.

Analysis of the inter-relationships between management practices and productive performance of various components of survey farm systems was compared with results reported in the literature. The objective during this phase of the study was to identify potentially superior management practices in terms of system output. This analysis was also expected to highlight what additional information would be needed for a more detailed analysis of specific aspects of the farming systems under study.

The third phase of the study involved a presentation of apparent opportunities for improving the management of existing production systems (as identified during phase two) to the survey farmers as a group. Discussion of the feasibility of implementation and likely impact on productive performance provided farmer feed-back on the analysis of management opportunities undertaken during phase two. This interactive phase maintained farmer interest, and provided some indication of farmer beliefs and attitudes concerning changes to management practices. In addition, the farmers were able to identify where additional information was required about the inter-relationships between management practice and system performance.

As a result of the analysis conducted in phase two and the interactive discussion with survey farmers in phase three, a follow-up survey was conducted in an effort to more fully analyse the productive inter-relationships involved.

In summary, this research is directed towards management control of production system performance. The degree of control achieved on different farms in a survey area and the mechanisms by which this is achieved are examined. It is not the objective of this research to determine the profitability of alternative production systems (with their associated management systems). Nor has it been possible to explore in detail farmer beliefs and attitudes towards management and production systems. These topics will be examined in greater depth in future research. The present study is therefore regarded as part of a longer term farm management research programme by the author.

1.7 THESIS OUTLINE

In Chapter Two the selection of survey farms, the preparation of the "weaning to tupping" questionnaire and its administration, and methods of analysis are presented. Chapter Three includes descriptive information about the survey area, farms and farmers.

Pasture management practices on the survey farms are reported in Chapter Four. In the succeeding four chapters (Five to Eight), details of sheep and cattle management are presented. This provides background information for Chapter Nine, in which the impact of management practices on ewe lamb and two tooth autumn liveweights are investigated within a multivariate context.

A report of the meeting with survey farmers, at which initial results and recommendations were presented makes up most of Chapter Ten. The areas of management in which the survey farmers would like more information are also described.

The setting-up, administration and analysis of the responses of a follow-up mail survey of winter and spring management is discussed in Chapter Eleven. This chapter also contains results of the re-investigation of some of the initial survey data incorporating the additional information obtained from the second survey.

In Chapter Twelve, the findings of the two surveys are summarised and recommendations as to how current management practices and production levels might be improved on farms in the survey area and in similar hill country environments in the wider farming community are drawn. The methodology used in this study is also appraised and opportunities for improvement are discussed.

CHAPTER TWO

PREPARATION AND ADMINISTRATION OF THE SURVEY

2.0 INTRODUCTION AND CHAPTER OUTLINE

Prior knowledge of production and management systems during the weaning to tupping period on hill country farms suggests that a relatively complex set of biological inter-relationships may be involved. Relative to the objectives of this study as presented in Section 1.5, it was apparent from the review of survey literature (References consulted are listed in Appendix A) that there would be risks associated with collection of information only by mail or telephone survey. However, while the review of survey literature suggested that the required information would be best obtained from an intensive farm management interview survey with a relatively small population of farmers, it seemed apparent that both mail and telephone survey techniques could be used to advantage.

By making use of an initial mail questionnaire, the farmers subsequently surveyed by interview would be aware of the type of information sought and during the period between receiving the questionnaire and the interview they would be able to keep an improved record of events relevant to the survey as well as improve their recall of information from earlier in the season. In addition, a farmer could complete most of the questionnaire prior to the visit which would free up time for a wider ranging discussion of production and management aspects relevant to the property and for farm inspection.

The telephone survey method could be used to obtain supplementary data to that collected by the mail-interview survey. For example, in this study, data obtained by telephone subsequent to the interview survey included lambing percentages and hogget liveweights at spring shearing.

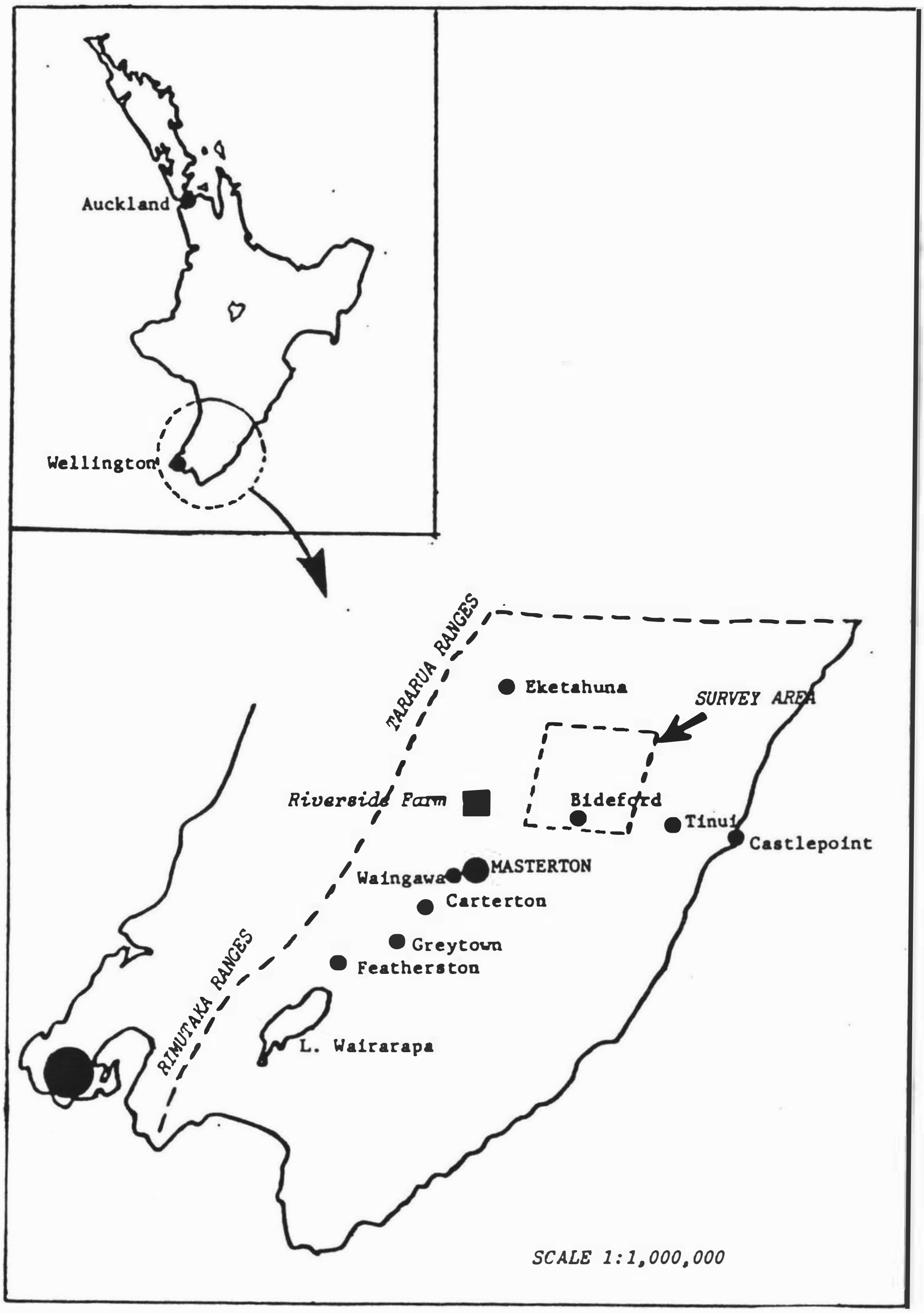
In this chapter the selection of the survey districts and sample population are described. This is followed by an account of the administration of the survey, including the timing of farm visits and the preparation of questionnaires for computer analysis. In the final section the statistical methods used to analyse the survey data are outlined.

2.1 SELECTION OF THE SURVEY AREA AND SURVEY FARMERS

2.1.1 SELECTION OF THE SURVEY AREA

The study was restricted to the Wairarapa region, primarily because of the author's association with Riverside Farm (Map 2.1). This provided a major advantage because many of the advisors, researchers and a number of the farmers in the area were already known to the author. Following discussions with local MAF advisory officers, a private farm consultant, the Wairarapa Catchment Board and Valuation Department, it was decided to further limit the survey area to the Wangaehu, Ihuraua, and Bideford districts to enable a more intensive investigation and to minimise travelling distances. These districts were considered to be representative of the very broad range of environmental conditions and hill country sheep farming systems in the Wairarapa (Booth and Gibbs 1969, Clarkson 1974, Donaldson 1982). Thus, the northern end of the survey area reflects the higher rainfall areas such as Eketahuna and the foothills of the western Ruahine ranges, while the drier lower Bideford district approach the conditions farmed nearer to the eastern coastline. (A more

Map 2.1 LOCATION OF WAIRARAPA REGION IN RELATION TO THE NORTH ISLAND (Inset)



detailed description of the survey area boundaries and physical characteristics is included in Chapter 3).

2.1.2 SELECTION OF THE SURVEY FARMS

Each of the 47 farmers identified within the survey region were contacted by letter in January 1983. The letter explained the purpose of the survey, the major areas of interest, the type of information required and asked the farmer to give consideration to making himself available for the survey.

Two weeks after sending the letter each of the farmers were contacted by telephone and asked the following questions:

1. Are you willing to be included in the survey? If the reply was no, the remaining questions were not asked. In a few cases farmers requested some additional information about the time involved and the type of data required before giving a response.
2. Do you weigh your sheep?
3. Would you be prepared to weigh a sample of 50 ewe lambs, 50 maiden two-tooths and 50 MA ewes sometime during the three week period prior to the ram going out? If the farmer did not have access to a set of scales they were asked whether they would be agreeable for the weighing to be done by MAF staff.
4. What is the proposed tupping date in 1983? This question was asked to facilitate the preparation of a weighing schedule for MAF technicians and to indicate when the interview survey could commence on each farm. (The definition of the survey period required that the questionnaire be completed after the rams had been put out).

After these questions had been completed, it was explained that a group of 30 farmers would be selected from those willing to be surveyed. The average duration of telephone conversation for this survey was about five minutes.

Of the 47 farmers contacted, 4 were not prepared to be surveyed and 4 were reluctant to be involved but would if there were insufficient other willing participants. The fact that no financial information, other than the current seasons lamb prices, was required appeared to make several of the farmers more willing to be involved.

The reasons why the 4 farmers who did not wish or were unable to be surveyed were:

1 selling farm.
1 death subsequent to telephoning.
1 recently purchased the farm and was very busy.
1 would rather not participate.

The 4 reluctant farmers felt that either their farm was too small (1), they were too old (2), they were too busy (1), or that the information from their farm would be of little use (1).

The final sample of 30 farmers was therefore selected from a group of 39. Although the author felt confident that the 4 reluctant farmers would have participated if required, their first wishes were respected. With such a high proportion of the survey area's farmer population (64%) included in the sample, the advantages of random selection were questionable. Four farms of particular interest, either because of performance (high and low) or the type of farming operation, were deliberately included. There was insufficient information readily available about each of the farms to stratify the population on the basis of farm area or stocking rate, and except for the four special cases, the remaining 26 farms were selected randomly from a hat containing 35 names.

Fourteen of the 30 farmers required MAF assistance for weighing livestock. Eight of the final group were members of the Wairarapa Farm Improvement Club and in some cases were also involved with MAF. Eleven farmers had contacts with the MAF and a high proportion of these were members of the Wangaehu-Bideford discussion group. The remaining farmers were not involved with either the MAF or the Farm Improvement Club, although they may have sought expert agricultural advice from other sources. One of the farms, for example, was supervised by a farm management consultant.

A change was made to the final sample after one of the selected farmers withdrew in March because of other committments. A replacement farmer was chosen from the 9 remaining willing farmers.

Selected farmers were posted a copy of the questionnaire on 14 February 1983, and asked to complete as much of the questionnaire as possible before the farm visit in April/May, as this would enable more time to be spent looking over the farm and discussing the answers given. Farmers not selected were written an explanatory letter and thanked for their co-operation.

2.2 QUESTIONNAIRE DESIGN FOR THE WANGAEHU-BIDEFORD SURVEY

2.2.1 BACKGROUND INFORMATION

A number of farming questionnaires were studied to formulate ideas about questionnaire layout and question design (Cronin 1968, McClatchy 1966, Milne 1969, Wesney 1964, Smith 1971, Halford 1971, MacGillivary 1972). The D.S.I.R. (Grasslands Division) Wairarapa survey of 1982, the 1982 MAF Controlled Grazing Systems Survey, Clarkson's (1974) survey of lambing percentages in the Wairarapa and the 1978 MAF Akitio Survey (Shepherd and Arthur-Warsop 1980) were particularly useful and several questions or variations of questions from these surveys were included in the Wangaehu-Bideford study. A mail questionnaire prepared by the Massey University Market Research Centre (1981) provided helpful guide-lines for laying out coding boxes and questions.

2.2.2 FORMULATION OF QUESTIONS

The formulation of questions was essentially based on an imaginary draft of the final report, including the tables and diagrams required to express the findings of the survey. Such an approach is difficult to follow, especially where uncertainty exists about the type of information that can be collected. However, the exercise forces the researcher to give careful consideration to the research question(s) being posed, and the type of answers that will yield analysable data. By following this procedure many irrelevant questions are removed, and frequently less obvious and seemingly unrelated questions included. Candler's (1965) remark that: "...unless the information collected is used by someone then it might as well not have been collected" was observed throughout.

The guidelines for question preparation were based on those presented by Warwick and Lininger (1975). These were:

1. Are the words simple, direct and familiar to all respondents?

2. Is the question as clear and specific as possible?

3. Are the questions leading or loaded?

4. Can the question be shortened without loss of meaning?

5. Does the question read well?

Other useful pointers were obtained from Payne (1951) and Smith (1981).

2.2.3 QUESTIONNAIRE LAYOUT

The questionnaire was divided into seven sections and included a total of 31 pages (Copies of the final questionnaire are available on request from the Agricultural Economics and Farm Management Department). Section A requested descriptive information about the farm and farmer, such as tenure, areas and numbers of paddocks, fertiliser practices, water supply, stock numbers and social factors. Generally the farmer would be familiar with these details and this would help to increase his confidence for answering more difficult questions in subsequent sections. Sections B and C dealt with grazing management policies and stock performance data for sheep and cattle respectively. Questions relating to stock buying and selling were included in section D, while those concerning animal health problems and drenching programmes were grouped together in section E. Stock weighing was covered in section F and the final section G, included two general questions concerning the weaning to tupping period.

Wherever possible, questions were arranged in the same sequence as management decisions for sheep and cattle would occur in practice. It was thought that this logical progression would help to "jog" the farmer's memory, as well as avoid confusion created by unnecessary chopping and changing. Thus the sheep section arbitrarily commenced with tupping in 1982 and worked through each successive farming operation until the joining of rams in 1983.

Questions concerning management other than that within the weaning to tupping period were included where the information was of direct relevance to the study. Hence details about the level of pasture grazed at lambing were collected because of its likely relationship with weaning management decisions.

2.2.4 QUESTION TYPE

Most of the questions could be classified within the following groups: open-ended or free answer, two-way or dichotomous and multiple-choice (Payne 1951). The remainder included variations of these and tabulated questions (Wesney 1964).

Dichotomous questions which provided two definite options and an answer in the form of; Yes/No, like/dislike, agree/disagree were used extensively throughout the questionnaire. These provided simplicity and required relatively little time to answer; an important consideration because of the length of the questionnaire. In addition, two-way questions are easy to code and analyse. These questions were usually followed by more detailed questions or used as an introduction to a segment by an instruction indicating which section the respondent should pass onto.

Multiple-choice questions were used where there was a variety of possible responses or differences in degree (for example, ranking of the climatic variables). These questions are quick to answer and are generally easy to code for analysis. There is a danger of putting words in the respondents mouth or of providing him with acceptable or face-saving answers which he would not have considered if left to his own resources. On the other hand, the listed options may prevent the respondent from overlooking factors which appear so obvious that they are taken for granted. Care was taken while constructing these questions to include all reasonable options, otherwise an incorrect or no-response would have been likely. This problem was largely overcome by including a category for other options in which the respondent could specify the appropriate answer for his situation. The disadvantage of this approach is that coding and analysis tends to become more complicated.

Open-ended questions were asked where the farmer's views, opinions or reasons were sought. The respondent could therefore enter any answer which was appropriate to his situation. These responses were given close attention during the interview, and additional information to that provided by the respondent was often obtained by impromptu supplementary questions. This was particularly useful for following up the reasons why certain management practices were adopted.

Open-ended questions can pose problems during the interview because it is difficult to record verbatim spoken answers while attempting to maintain the flow of the discussion. Retaining the original sense of the reply during coding can also be difficult. The first of these problems is hard to resolve when an interview guide or schedule is used and can be a major cause of bias in the survey results (Ong, 1982). In the Wangaehu-Bideford survey, the combination of a mail questionnaire/

interview enabled farmers to record their own responses prior to the interview. During the interview these responses then only had to be checked for clarity and completeness.

Tabulated questions or calendars concerned with the collection of information about time-related variables were used to summarise grazing management plans. Table layout was based on the format successfully used by the MAF Controlled Grazing Survey (1982). Their main advantage was that complicated information could be summarised into a relatively small space and could be elicited by a single question or a simple set of instructions. By collecting details of mob sizes and paddock grazing durations, an appreciation of the grazing management system employed and stock grazing priorities could be quickly ascertained during the interview. This avoided the need to ask a multitude of questions about the pattern of stock shifts during farm inspection. The completion of the grazing management calendars also seemed to help the farmers to remember details relevant to other questions in the questionnaire and provided a check at the analysis stage for consistancy of answers. Their major disadvantage was coding.

2.2.5 PRE-TESTING THE QUESTIONNAIRE

A draft copy of the questionnaire was pre-tested with three farm managers and was also checked by three members of the Agricultural Economics and Farm Management Department at Massey University, four MAF farm advisory officers (including two from the Wairarapa), a Wairarapa based private farm management consultant and a scientist at the D.S.I.R. who had been involved in the Grasslands Wairarapa survey.

Pre-testers were asked to provide information about the period of time required to complete the questionnaire, logic of question order, adequacy of space for open-ended replies, word useage and spelling, question clarity and topics omitted that they considered relevant to the survey. Pre-testers were also asked to indicate sections or questions they considered irrelevant.

Several changes were made to question wording and page layout and one section concerning sources of farming information was omitted because the value of the information was considered to be relatively low and omission would reduce the questionnaire length.

Two copies of the final questionnaire per farmer surveyed were then printed.

2.3 TIME OF THE SURVEY

The first interview took place on 14 March 1983. After the first two visits it became apparent that two farm visits per day could be completed, and the last farm was visited on 12 May. Only five farms could be surveyed in March, because the majority of farmers joined rams after 1 April.

The data collected related primarily to the October-April period of the current season (from 1 July 1982). The information sought was therefore relatively fresh in the minds of the respondents. This was particularly important as most of the information required had not been formerly recorded, and heavy reliance was placed on farmer memory. However, three years of records were collected for performance variables such as lambing and calving percentages, and several check questions were included to take account of changes made to management in the season of interest and practices which were not normal for the farm.

2.4 INTERVIEW PROCEDURE

Farmers were contacted by telephone one week prior to the proposed farm visit. The technique adopted by Milne (1969) and Cronin (1968) of telephoning the night prior to the visit was found to be unsatisfactory. Farmers had reasonably busy schedules but with advance notice were able to make arrangements to free-up time for the interview. The second advantage of early notification was that it provided time for those farmers who had not started to fill in the questionnaire, to give it some attention prior to the visit. A third plus for this system was that it was much easier to arrange the visiting timetable: it was considerably more difficult to arrange morning and afternoon visits of properties, within close proximity of each other, at short notice.

The procedure was to arrive at the first farm for the day at about 8.30 a.m. A brief personal introduction and discussion of current events, such as stock prices, pasture growth or the weather (of about five minutes) was the initial step in the interview. This helped to put the farmer at ease. The author's association with Riverside proved to be a considerable advantage in this regard as most of the farmers were aware of its operation and respected the work that was being done. The questionnaire was then discussed. Whether or not the farmer had spent time filling in the questionnaire was the most important factor affecting the length of this stage of the interview. For a completed questionnaire with full comments, between 3/4 and 1½ hours were required, but if no details had been filled in then 1½ to 2½ hours were required. Only three farmers were in the latter category, although most had left some questions that they were unsure of to be completed at the time of the visit.

Answers given were checked for correctness of question interpretation and for completeness. In addition, the checking and discussing of answers provided a good understanding of the farm, farmer and management prior to inspection of the farm. Factors shown by the questionnaire to be of particular interest then became topics of conversation in the paddock.

Farm inspection took up the remainder of the time before the visit was completed at 12.00 noon. Access to farms in the autumn was still good [1] and inspection was made either by four wheel drive vehicle, wheel tractor or motorbike transport. This allowed a large proportion of the farm to be seen and an appreciation of special problems such as access, weeds, water supply, sub-division or topography to be gained. These aspects were noted in the report on each farm, written during the evening after the visit. Reference to the farmer's personal situation

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[1] This is an important consideration for surveys requiring farm inspection. Wet ground conditions, which limit even motorbike access, will prevent a detailed look over many hill country properties.

(family position, financial circumstances if mentioned, philosophy on farming or comments about the future direction that farming should take) was also made in the report as well as any other factors which might require consideration when evaluating the survey results.

Every effort was made to see as many classes of livestock as possible and to gain an in-the-field appreciation of their management. Photographs of topography, pastures, water supply, stock, or unusual features were taken on nearly all of the farms. These are used in this thesis to improve the reader's appreciation of the survey region and were of considerable assistance at the analysis stage of the research (up to 8 months after the farm visits).

The second farm visit for the day commenced at about 1.00 p.m. and was usually completed by 5.00 p.m. The latest interview/farm inspection went to 5.30 p.m. This made for a full day after the 1½ hour journeys either way from Palmerston North and the writing of a report on each farm in the evening.

The questionnaire-interview combination in this survey worked very well. It is doubtful whether two farms could have been visited per day using the schedule or free-form interview approach alone. The greatest saving of time was in the area of collecting descriptive information about the farm and farmer which comprised about one third of the questionnaire (Section A). The farmer was also able to follow through the questions with a second questionnaire while his copy was being checked. Thus questions could be read as well as asked orally. This seemed most valuable at the end of a long interview when both the respondent and interviewer were beginning to tire.

2.5 COMPUTER CODING AND ANALYSIS

2.5.1 INTRODUCTION

A decision was made in the early stages of questionnaire preparation to analyse the results on the PRIME computer at Massey University using the SPSS programme (Nie et al 1974). This programme provides a comprehensive set of procedures for data transformation and file manipulation, as well as a large number of statistical routines for analysis of research data. Data entry and analysis required no special skills and comprehensive user manuals are readily available.

The questionnaire was therefore laid out with a right hand margin, incorporating data entry coding boxes. Boxes were placed directly opposite the corresponding question and numbered according to the column of data entry. At the completion of every 80 columns, a new record was commenced.

Preparation of the code boxes required an estimation of the number of possible answers and the dimension of each reply. A single box could facilitate nine possible options; for answers with a larger potential range of replies or more than one digit, the number of boxes was increased accordingly.

2.5.2 CODING OF RESPONSES

A code manual for the questionnaire was prepared after the completion of field work. This involved labelling each question or separate piece of information with a variable name of up to eight letters and coding the responses by number. Care was taken in choosing the variable names to select labels which were descriptive and could not be mistaken for other variables. For example, lambing percentages for the 1980, 1981, and 1982 seasons were identified by the respective variable names LBCENT8Ø, LBCENT81 and LBCENT82.

Stock numbers, tonnes of fertiliser applied, lambing percentages and similar metric data were entered directly into the appropriate code boxes. If these variables had been coded prior to entry (e.g. placing age variables into categories such as 20-30 years, 31-40 years etc.) subsequent analysis would have been restricted to statistical techniques suitable for ordinal data.

Dichotomous questions with Yes/No response options were consistently coded No=1 and Yes=2, although in some cases the code was expanded to include results of the following question or information obtained from supplementary questions asked during the interview. This is shown in the following example:

Question: Have you had a soil test done in the last 3 years?

Yes No

Supplementary interview question: Who carried out the soil test?

Variable name SOILTEST

Possible replies and associated code numbers;

(1) No
(2) No, but have had soil tests
(3) Yes - MAF
(4) Yes - private testing firm or fertiliser company
(5) Both (3) and (4)

Responses to multiple-choice questions were coded in the same order as options listed in the questionnaire, with additional codes provided for answers given to the "other" option and for combinations where the farmer had ticked more than one alternative. These were relatively simple to code.

Every attempt was made to classify open-ended questions to maintain the original sense of the answer, but for some questions this was almost impossible because of the wide range of responses. The boundaries of the code groups in these instances had to be widened. However, with only 30 individual cases, it was relatively easy to check back from the computer print-out to the original questionnaire reply and to add individual comments where necessary.

The code (5) in the above example resembles the most common problem experienced during coding. In some instances it was necessary to have codes for all the listed options and every possible combination of the options.[1] It was therefore very easy, with multiple choice or open-ended questions with four or five main options, to be in a situation which required more categories than the prefixed coding spaces provided. Compromises between coding accuracy and code entry therefore had to be made. This problem may be overcome by preparing code sheets after the survey has been completed and the variation in the response is known, or by making generous provision for data entry

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1. Payne (1951) suggests that this indicates poor question design, but if each of the listed options is used individually this criticism does not seem to be valid. The alternative of printing all possible combinations would have made the questions unnecessarily long with the only gain being simplified coding.

for questions likely to be affected. The former option is not as attractive because the link between the code number and the response is less direct, and the latter is not practical with a large questionnaire such as the Wangaehu-Bideford survey. (With 18 records of 80 columns, the survey results represented a very large data set even though there were only 30 cases).

In hindsight the method of coding dates was not satisfactory for the type of analysis required. Dates were entered as shown in the example below:

12/3/83 would be coded 12 3 under the variable name MATEMA (i.e. date of MA ewe mating).

It would have been preferable to have recorded the day and month more distinctly by providing separate variable names for day and month. The frequencies of events could then have been grouped more readily into months or converted to the number of days from a specified date (for example, average lamb age at weaning in days).

Similarly, an alternative question design to ranking of problems such as weeds and pests would have facilitated easier analysis. The ranking system used relied on the farmers to include a zero ranking where no problem existed. However there is sometimes a tendency to over-rank or a need to rank several options at the same level. In these situations ranking is less appropriate than a scaled system provided for each individual variable as shown in the following example:

Example of alternative question design for ranking pasture pests: (tick the appropriate box)

	Very Serious	Serious	Minor	No Problem
Rabbits	☐	☐	☐	☐
Crickets	☐	☐	☐	☐
Other Pests	☐	☐	☐	☐

Other than these minor problems no difficulties were experienced with coding or computing.

2.5.3 PROBLEM QUESTIONS

In general, farmers appeared to experience few problems interpreting questions in the manner which was intended. The awareness that a personal interview was to take place made several farmers hesitant to supply details to some questions until the replies could be discussed in person, although their interpretation was still usually correct.

Most farmers had difficulty answering the following question: "How do you decide when this management (i.e. to minimise the amount of seedhead in the pasture) should begin?" This seemed to be because this part of management occurred automatically without too much thought as to the reason why seedhead control should commence at a particular time. The question could have been broken down into two or three more specific parts.

The question:
"In a year when feed is short in the spring, do you wean
earlier? ☐
later? ☐
should have included a third option - no change. After the first visit this mistake was identified and the third choice was always given at subsequent interviews.

It was assumed prior to the survey that the farming population would be familiar with grazing management terminology, such as rotation length. However, this was sometimes interpreted as being the period of time stock grazed an individual paddock. In fairness to the farmers, however, it was not always easy to estimate rotation lengths when up to four different classes of stock grazed a paddock in sequence. In these circumstances the uncertainty was whether the rotation length referred to the interval between grazings of a paddock by one class of stock or whether it referred to the time period between paddock grazings regardless of the stock class. Similarly, the interpretation was not clear if the stock had commenced a rotation which had subsequently been discontinued because of a water supply problem or change in plan. It would therefore have been preferable to have clearly defined the terms rotation length, paddock spelling interval and paddock grazing duration. The problem of discontinued or changed rotations is virtually impossible to overcome.

The mail-interview questionnaire approach provided a major advantage by enabling question problems to be identified and corrected in the field. When a question appeared to be posing problems with interpretation, either because of incorrect answers or no response, a mental record was kept and at subsequent interviews the answers were checked or the question was explained in more detail. The fact that relatively few and minor problems were experienced by farmers in completing the questionnaire, vindicated the time spent pre-testing the questionnaire.

2.6 STATISTICAL ANALYSIS

Two types of statistical analysis of the survey data were necessary to meet the objectives of this study. First, descriptive statistical methods to quantify either frequencies, proportions or simple relationships between variables were required to describe farm physical characteristics and the management systems employed. Statistical methods such as frequencies, cross-tabulation, analysis of variance and single equation regression, and their associated tests of significance, were appropriate for this purpose. The SPSS manual (Nie et al 1974) provides a description of these statistical tests and estimating procedures.

Secondly, statistical methods were required to analyse "cause and effect" relationships. The objective here is to estimate the relative importance of different management strategies and farm physical characteristics on system performance. In this context, the most common technique used in New Zealand farm management research to date has been simple or multiple regression analysis (Watson and Cant 1972, Eggelton 1973, Lee 1977, Fitzharris 1982). Single equation simple or multiple regression analysis is appropriate where system performance is characterised by a single output (dependent variable). However, where system performance is characterised by more than one output, multivariate analysis of data is called for (Kendal 1975). In this situation, Wind and Denny (1974) have explained the advantage of multivariate analysis as follows:
"Multivariate analysis techniques explicitly take into account the fact that two or more response variables will usually be correlated. That is, significant differences may be found under a univariate approach when, in fact, an overall test of the multiple responses would not show significant differences. Conversely, an overall difference may be detected by a multivariate

approach in cases where univariate tests suggest no differences."

A number of statistical methods are included under the general heading of multivariate analysis, but given the generally quantitative nature of the survey data and the objectives of this study, multivariate regression analysis has been considered most appropriate.

CHAPTER THREE

THE SURVEY AREA

3.0 CHAPTER OUTLINE

About one third of the survey questionnaire was devoted to collecting physical, performance, management and social information about each of the farms. This background information is necessary to understand the farming systems and the reasons for their adoption, described in the subsequent chapters. A description of the survey area, and its relationship with the Wairarapa region is included in the first part of the chapter. In the final section the variability within the survey population and its representativeness of other regions in the North Island is discussed.

3.1 THE SURVEY AREA

3.1.1 LOCATION

As described previously (Section 2.1), the survey area essentially includes those farms bounding either side of the "ring" road formed by the Wangaehu Valley, Daggs and Bideford Valley roads and the no exit roads along this route, in north-eastern Wairarapa (Maps 2.1 and 3.1). The western boundary lies 500 m west of the top of the Rangitumau Range, and the eastern boundary runs approximately 5 km south of the Bideford Valley road (Plates 3.1 and 3.2).

These boundaries define an area of about 288 square kilometres which supported an estimated 285,000 SU in June 1982, as well as several large privately owned pine plantations (Plate 3.5).

The closest service centre is Masterton for the majority of farms, which is about 60 minutes car travelling time from the most remote farm at the end of the Maringi Road. The

Plate 3.1 Top of the Rangitumau Range (Farm 6) looking north towards the Ihuraua district. Note the limestone rocks in the foreground.

Plate 3.2 Erosion during September 1977 is still clearly visible in southern Bideford. Note the use of electric outrigger to stock-proof old conventional fence.

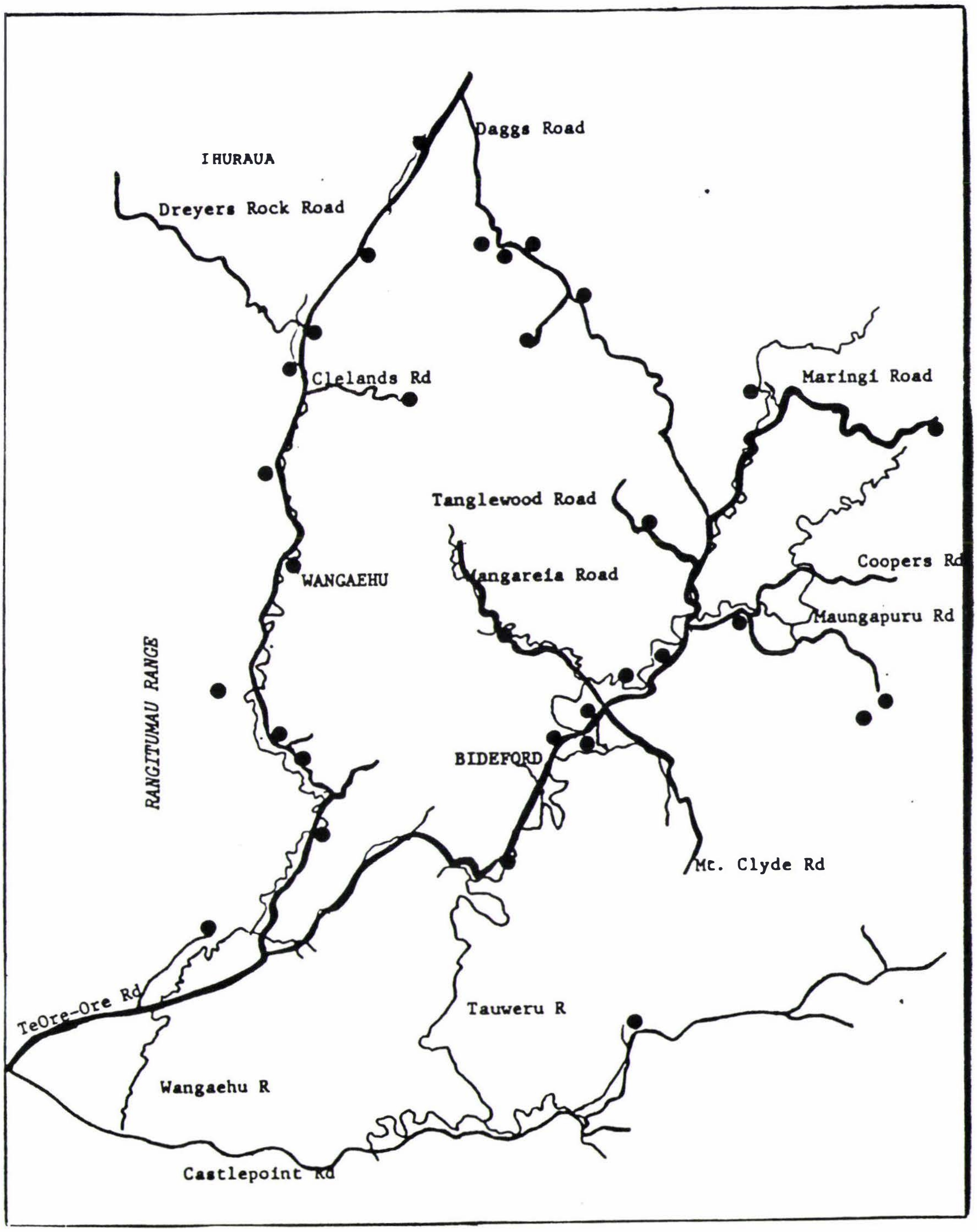
Ihuraua district is between 30 and 40 minutes drive from Eketahuna where there are service shops for most rural requirements and a small set of sale yards. However, the majority of stock sold is auctioned at the sale yards or slaughtered at the freezing works at Waingawa. Stock are trucked to works in Central Hawkes Bay or the Manawatu.

Fertiliser is available either from the bulk store at Taratahi, or directly from the rail sidings at Mauriceville or Eketahuna. Lime is available from the works at Mauriceville, although about 800 tonnes of lime are quarried annually on one of the survey farms backing onto the Rangitumau Range (Plates 3.1 and 3.6).

Children of primary school age attend the local Ihuraua or Bideford district schools, or bus to Masterton daily where the secondary schools are located.

There are two district halls; at Wangaehu and Bideford, which are used for occasional social functions. Several of the survey farmers are members of the Bideford Golf Club and an informal women's tennis group meets in the Bideford area during the summer months. Otherwise most social activities are centred around Masterton.

Map 3.1 LOCATION OF THE SURVEY FARMERS



3.1.2 CLIMATE

Long term climatic data for the Waingawa Meterological Station, near Masterton (Map 2.1) is shown in Table 3.1. Additional information in this section mainly relates to data collected on the survey farms.

Rainfall

Annual rainfall ranged from 900 to 1,250 mm on the survey farms where records were kept. There was less variability in annual rainfall, 1,000 - 1,100 mm p.a., at sites where long-term averages were available (Table 3.2). There is a wide fluctuation from month to month, both within and between years (refer also to Appendix B). The unpredictability of rainfall means that dry spells may occur in the late spring, summer or late autumn. Alternatively, excessive rainfall in the late winter and early spring, such as in September 1977, can lead to extensive slip erosion in the steeper hill country (See Plates 3.2, 3.3 and 3.4 and September 1977 rainfall record: Appendix B).

At Horoeka (north Bideford) there is an average of 132 days of rain per year. This compares with the long-term average of 155 days at Waingawa (although at Waingawa more precise measurements are taken).

In most years one or two snowfalls which may remain on the ground for up to 78 hours can be expected during the winter period.

Rainfall for the 1982/83 October-March period is shown in Table 3.2. In all districts rainfall was below average, but the most severe shortfall was in the lower altitude southern areas.

Table 3.1 WAINGAWA METEROLOGICAL STATION RECORDS (July 1982 to June 1983)

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June
Rainfall	78 (106)	43 (99)	55 (79)	77 (76)	52 (70)	89 (74)	22 (63)	29 (60)	58 (67)	69 (77)	170 (99)	62 (101)
Mean air temp. (°C)	6.6 (7.1)	8.1 (8.1)	9.9 (10.0)	9.9 (12.0)	15.2 (13.6)	14.4 (15.9)	16.4 (17.3)	16.4 (12.2)	17.2 (15.6)	13.0 (13.1)	8.2 (10.0)	7.1 (7.1)
Sunshine (hours)	112 (108)	177 (131)	127 (156)	170 (196)	NA (214)	NA (220)	NA (235)	197 (198)	205 (187)	107 (149)	121 (122)	97 (106)
Wind run (km)	199 (196)	197 (207)	186 (234)	245 (234)	314 (233)	222 (227)	287 (224)	208 (215)	232 (199)	193 (190)	182 (201)	236 (199)
Mean 10 cm soil temp. (°C)	5.4 (5.5)	5.8 (6.4)	8.2 (8.5)	9.6 (11.3)	13.7 (14.1)	14.1 (16.6)	15.8 (17.9)	16.1 (17.3)	15.4 (15.5)	11.7 (11.9)	8.6 (8.6)	6.7 (6.3)

Note: Long-term averages are in brackets.

Source: Supplement to N.Z. Gazette. Climatological Tables for July 1982 to April 1983.

Table 3.2 LONG-TERM RAINFALL (MM) AND OCTOBER-MARCH 1982/83 RAINFALL IN THE SURVEY AREA

District	Long Term Rainfall Averages (mm)												Annual
Month	J	F	M	A	M	J	J	A	S	O	N	D	Average
Ihuraua(30)	60	54	70	93	120	122	136	112	99	85	66	92	1109
Wangaehu (102)	70	69	75	85	116	118	124	120	91	85	71	83	1107
Bideford South (23)	55	46	75	93	98	114	128	110	87	73	58	89	1026
Bideford North (17)	54	57	86	106	127	138	139	144	101	87	65	89	1193

( ) number of years rainfall recorded.

Rainfall (October 1982 - March 1983) (mm)

District	Month						Total	Normal	% Normal
	O	N	D	J	F	M			
Ihuraua	89	68	99	31	21	56	364	427	85
Wangaehu	63	44	53	13	26	45	244	378	65
Bideford South	62	49	44	11	23	41	230	396	58
Bideford North	89	49	66	27	37	88	356	438	81

Wind

The prevailing wind in the survey area is north westerly (Plate 3.7). This brings rain to the western part of the survey districts, especially along the Rangitumau Range and the higher altitude areas of the Ihuraua district (Map 3.1) during the late spring and summer months. However less of this rain reaches Bideford (especially in the southern parts) which is the driest region of the survey area. This can be seen by comparing the long-term monthly rainfall averages with the 1982/83 rainfall over the October-March period (Table 3.2).

The long-term average monthly windrun and the 1982/83 windrun for the October to April period (Table 3.1) indicates that the 1982/83 season was exceptionally windy. This was the major factor contributing to the dry summer in the Bideford and Wangaehu districts.

At Tiraumea, about 15 km north of the survey area, the mean annual windspeed for the period 1970-75 was 7.7 m/second. This compares with the 7.9m/second average for the period 1971-76 at Ballantrae Research Station, which is noted as being a very windy farming environment (cited in the Wairarapa Hill Country Committee Report 1976). The highest wind speeds are recorded in the spring and these can quickly deplete soil moisture reserves and reduce spring-early summer pasture growth.

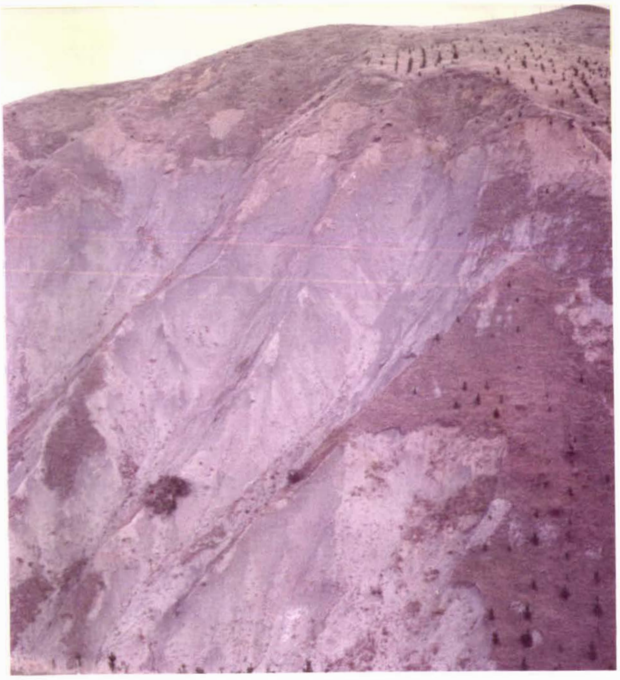


Plate 3.3 Severe erosion on mud-stone soils, south-east Bideford. Area affected has since been retired and planted in pinetrees (Farm 23).

Plate 3.4 Slump erosion and Catchment Board plantings southern Bideford (Farm 24). The dry summer-autumn conditions of 1983 are evident in this photograph taken in March.

Plate 3.5 Privately owned pine plantation on poor soil types, southern Bideford (adjoining Farm 22).

3.1.3 TOPOGRAPHY

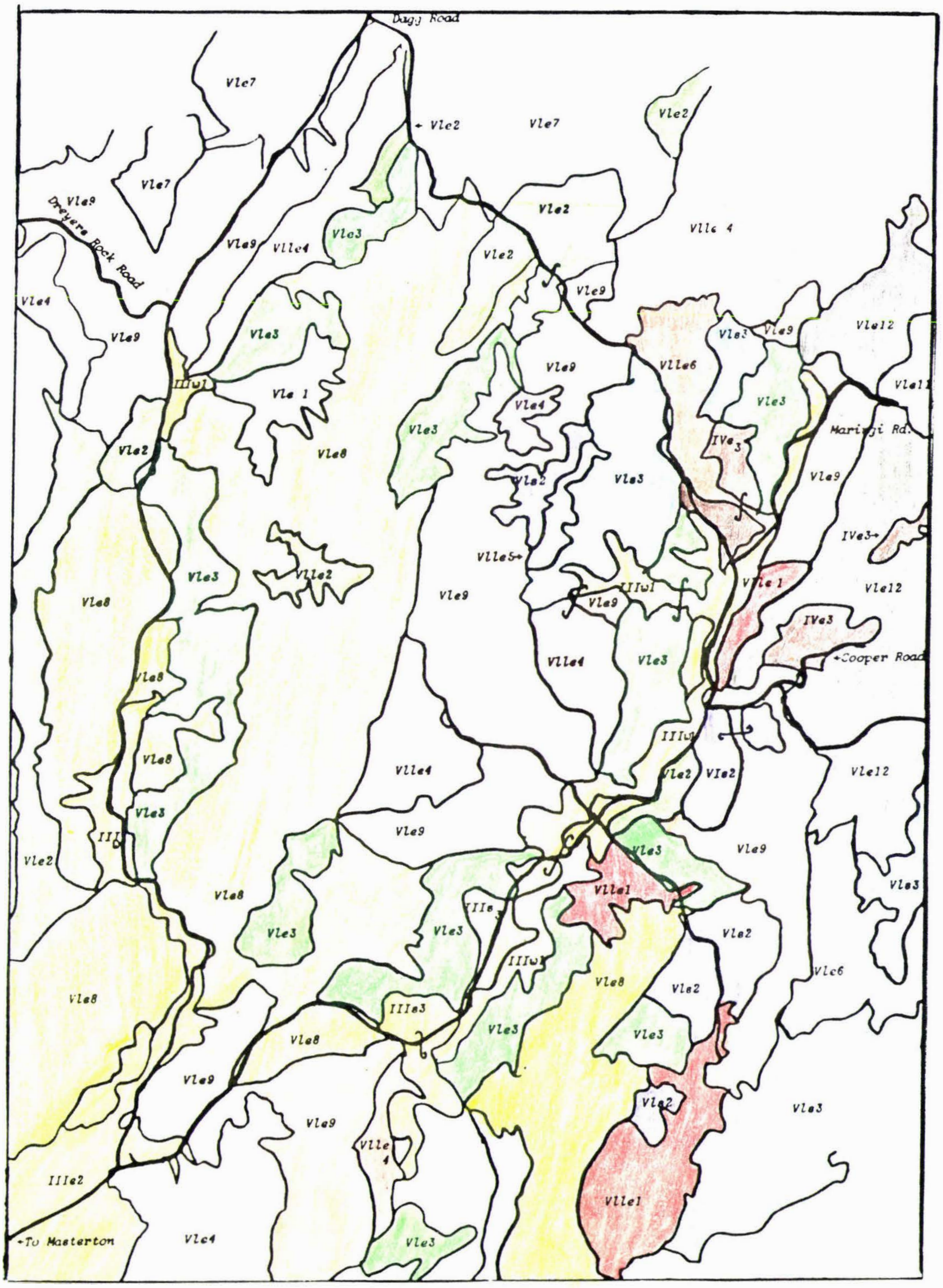
Approximately 3% of the survey area is flat to rolling country of slopes between 0 and 15°. (Class III and some of Class IV on the land classification map - see Map 3.2). The remaining land capability classification is either Class VI or VII; moderately steep to very steep hill country. About 5% of the area has slopes of greater than 35°.

On the Class VI hill country there are segments of easier contoured hills which have been cultivated for pasture development, but most of the hill country is interlaced with steep gullies and narrow valleys. There are occasional small pockets of flats along stream flood plains. On Class VII land the ridges are narrower and more sharply defined posing access problems for stock and transport.

There is widespread evidence of erosion, and the Wairarapa Catchment Board is actively involved on a high proportion of the properties with conservation programmes, mainly involving pole planting but also retiring areas most seriously affected (Plates 3.3 and 3.4).

An appreciation of the topography in the survey area can be gained from the land classification map (Map 3.2), Plates 3.1 to 3.13 and Map 3.3, which shows the main catchment areas and altitudes.

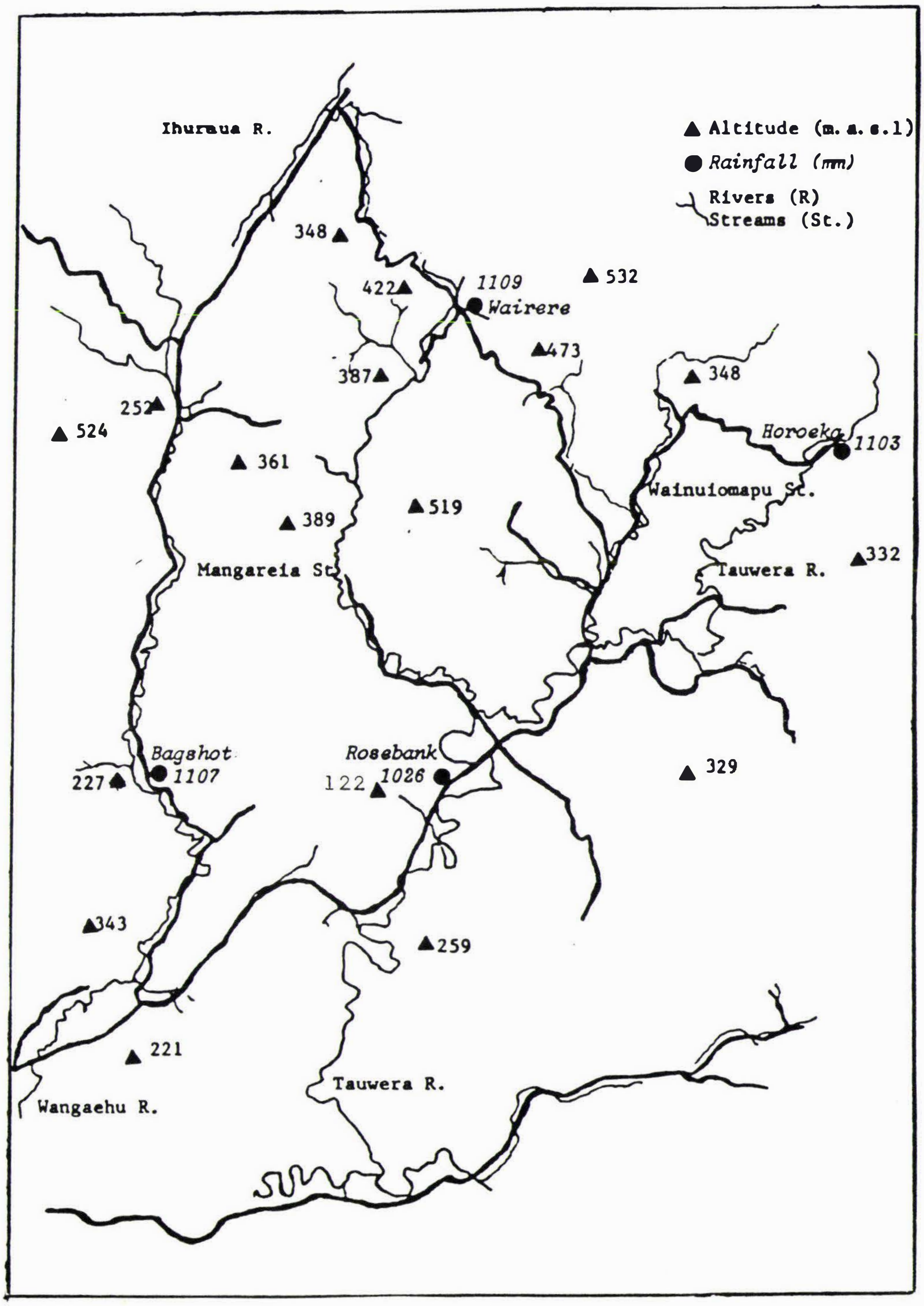
Map 3.2 SURVEY AREA LAND CLASSIFICATION MAP (Derived from N.Z. Land Resource Inventory Worksheet N158)



LAND USE CAPABILITY LEGEND

UNIT	UNIT DESCRIPTION	SLOPE	UNIT	UNIT DESCRIPTION	SLOPE
IIIe2	Rolling loess covered terrace slopes and downs with a severe seasonal soil moisture deficiency. Soils have impeded drainage due to compact subsoils, and a moderate, sheet, rill and wind erosion potential when cultivated.	8-15°	VIe7	Moderately steep to steep fertile mudstone and siltstone hill country in higher rainfall areas. Moderate potential for shallow earthflow and soil slip erosion.	21-35°
IIIw1	Flat, narrow valley bottoms and poorly drained flats, with a moderately high water table, subject to run-off from adjacent higher areas.	0-3°	VIe8	Moderately steep to steep fertile mudstone and siltstone hill country exposed to prevailing winds. Subject to seasonal soil moisture deficiencies and has a moderate potential for shallow earthflow and soil slip erosion.	21-35°
IIIs3	Flat to undulating terraces with heavy textured, compact subsoils which impede drainage.	0-3°	VIe9	Moderately steep to steep sandstone hill country with a moderate soil slip and tunnel gully erosion potential.	21-35°
IVe3	Rolling to strongly rolling downs with heavy textured subsoils, slow internal drainage and a severe sheet and rill erosion potential when cultivated.	8-15° 16-20°	VIe11	Moderately steep to steep 'greywacke' hill country in higher rainfall areas. Moderate potential for sheet scree and soil slip erosion.	21-35°
VIe2	Moderately steep to strong rolling, fertile mudstone and siltstone hill country in higher rainfall areas with a moderate potential for shallow earthflow erosion.	16-20° 21-25°	VIe12	Moderately steep crushed 'argillite' hill country with a severe deep earthflow erosion potential.	21-25°
VIs2	Moderately steep sandstone hill country with stable low fertility soils.	21-25°	VIIe1	Steep fertile mudstone and siltstone hill country with a potential for very severe shallow earthflow erosion.	26-35°
VIe3	Moderately steep to strongly rolling fertile mudstone and siltstone hill country, exposed to prevailing winds with a seasonal soil moisture deficiency.	16-25°	VIIe2	Steep to very steep siltstone and mudstone hill country with a potential for severe soil slip erosion.	26-35° > 35°
VIs3	Moderately steep stable greywacke hill country with seasonal moisture deficiencies.	21-25°	VIIe4	Steep to very steep sandstone hill country with a potential for severe soil slip erosion. Fertility is low and scrub reversion is a continuing problem.	26-35° > 35°
VIe4	Strongly rolling to moderately steep loess covered hill country with a severe seasonal soil moisture deficiency. Moderate potential for soil slip erosion.	8-15°	VIIe5	Steep to very steep 'greywacke' hill country with numerous rock outcrops and shallow soils. Subject to seasonal soil moisture deficiencies and has a potential for moderate sheet, scree and soil slip erosion.	26-35° > 35°
VIs4	Flat stony terraces and fans, with very shallow, stony, low fertility soils.	0-3°			
VIe6	Strongly rolling to moderately steep hill country in wind funnel areas adjacent to the axial ranges. The light textured soils have a moderate wind erosion potential.	16-25°	VIIe6	Moderately steep to steep crushed 'argillite' hill country with a very severe deep earthflow erosion potential.	21-35°

Map 3.3 SURVEY DISTRICTS MAIN CATCHMENT AREAS, ALTITUDE AND RAINFALL COLLECTION SITES



3.1.4 SOILS

The soils of the survey area range from flat naturally fertile alluvium deposits, to very steep low fertility soils prone to severe erosion (Map 3.4 and Plates 3.2, 3.3 and 3.4). These are arranged in a complicated pattern in the landscape, on a variety of parent materials. The soils of the survey area, however, have not been mapped in detail and most of the information reported in this section has been drawn from the Ministry of Works Inventory Sheet N158 (1978). This in turn is based primarily on the 1954 Soil Survey (Soil Bureau Bulletin (N.S.) 5. (1954)) [1].

The parent materials are mainly mudstone and sandstone, with smaller areas of argillaceous and greywacke rocks and siltstone. Portions of the valley floors have more recent soils formed on the flood plains from alluvium deposits (e.g. Ahikouka silt loam), while most of the remaining flat areas and some of the rolling easy hill country consists of loess over gravels, silts, ashes and sands (e.g. Bideford silt loam, Atua silt loam, and Pirinoa silt loam). These medium to high natural fertility soils have potential for cropping where topography allows but are slightly limited by drainage for intensive cropping use. The soils formed on mudstone (e.g. Taihape silt loam and Turakina silt loam steepland soils) have medium to high natural fertility but are prone to severe slumping (Plate 3.5). Soils formed from sandstone parent material, such as Ngaumu fine sandy loam and Kumeroa sandy loam on the

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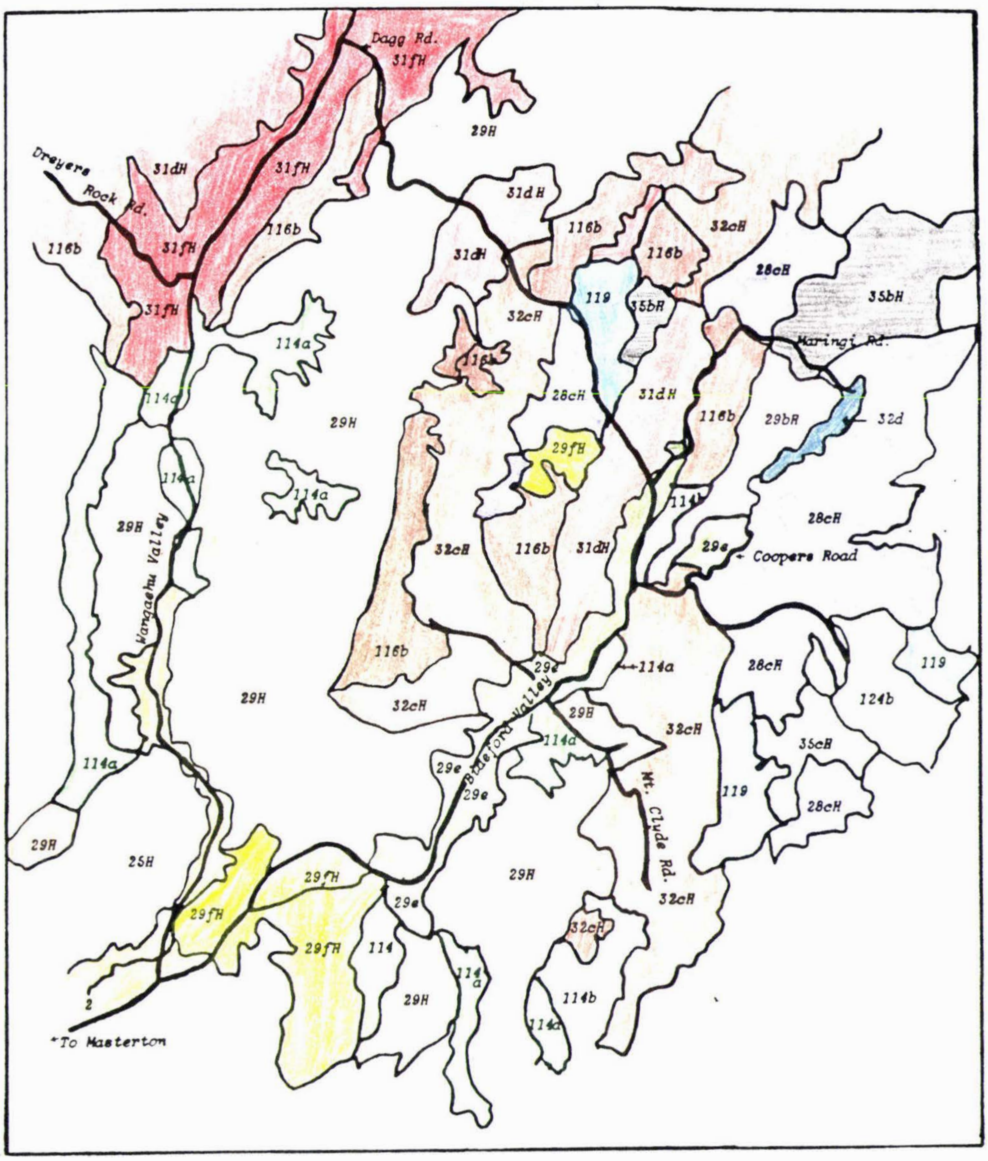
1. The soil map (Map 3.4) has been derived from the Ministry of Works Inventory Sheet N158, but only the major soil types within a defined area are shown. On the worksheet, minor soil types within this area are also listed. As well, the reduction in scale means that many of the finer mapping details have had to be excluded.

Map 3.4 SOIL MAP OF THE SURVEY AREA (Derived from N.Z. Land Resource Inventory Worksheet N158)



SOIL MAP LEGEND

2	Ahikouka silt loam
25H	Mangatea clay loam and silt loam hill soil Waipatiki hill soils
28cH	Whakaroro hill soils
29e	Bideford loam
29H	Atua silt loam, hill soil
29bH	Atua/Pironoa hill soil
29fH	Kumeroa sandy loam
31d 31dH	Purimu silt loam/Purimu silt loam hill soil
31fH	Whetukura sandy loam, hill soil
32cH	Ngaumu fine sandy loam, hill soil
32d	Te Wharau sandy loam
35bH	Kaikouta hill soils
114	Whangaehu loam
114a	Taihape silt loam
114b	Turakina silt loam
116b	Mangamahu silt loam
119	Whareama silt loam
124b	Pahaoa silt loam

other hand have low to medium natural fertility and are prone to scrub reversion problems (Plate 3.8).

Pahaoa silt loam which has a greywacke origin is found on the very steep slopes and can be distinguished by numerous rock outcrops and the shallowness of the soil horizon. Korokoro silt loam is formed on the same parent material but on slopes which are not as steep. Both these soils have low to medium natural fertility.

The Whakarora and Whareama soil types, mainly derived from argillite, have low natural fertility, except where associated with mudstone, and tend to revert to manuka, rushes and tauhinu without regular topdressing. Where slip erosion occurs, recovery is very slow.

Along the Rangitumau Range limestone outcrops are evident (Plate 3.1). One of the surveyed farmers whose property backed onto the range, worked a lime quarry yielding up to 800 tonnes a year for local use (Plate 3.6).

The soils in the survey area then are diverse but are generally of only low to medium natural fertility, suitable for pastoral farming and production forestry. Their major limitations other than fertility are erosion and seasonal moisture deficits, particularly on the lighter soils exposed to the prevailing winds. Regular topdressing with phosphatic fertilisers is necessary and lime is required periodically. (Additional details of the survey area soils may be found in Appendix C, including their pedological groups, and susceptibility to erosion).

Plate 3.6 Lime quarry, Rangitumau Range (Farm 28).

Plate 3.7 The prevailing north-westerly winds in the survey area are shown in the growth form of trees on Farm 20.

Plate 3.8 Undeveloped "native" pasture and scrub in south-east Bideford (Farm 19).

Plate 3.9 Large scale development of Manuka scrub to pasture, under the LDEL scheme, north-east Bideford (Farm 16).

3.1.5 PASTURE PRODUCTION

No detailed information on the pattern of seasonal pasture growth in the Wairarapa was published until 1975 (Radcliffe), although Yeates had presented a mean pasture growth curve in 1973. Both these reports related to the Masterton Research Station, for predominantly ryegrass-white clover pastures on a yellow-grey earth soil. Radcliffe (1975) presented average growth rates and annual production from 5 years of data (Table 3.3). Mean annual climatic data from the nearby Meterological Station is shown in Table 3.1.

Table 3.3 MASTERTON: DAILY PASTURE GROWTH AND STANDARD ERROR (kg DM/ha/day) AT STANDARD CUTTING DATES THROUGHOUT THE YEAR FOR 5 YEARS (SOURCE: RADCLIFFE 1975)

Standard Date	Total Yield	
	Mean	SE
14 June	16.9	6.1
28 June	15.9	4.2
12 July	15.9	4.2
26 July	15.9	4.2
9 August	17.0	5.4
23 August	38.3	13.7
6 September	38.3	13.7
20 September	59.2	13.2
4 October	63.9	17.8
18 October	70.3	20.2
1 November	73.2	11.7
15 November	66.5	8.0
30 November	34.7	20.7
14 December	27.5	25.6
28 December	34.4	22.5
11 January	18.2	17.2
25 January	12.8	18.2
8 February	12.9	18.2
22 February*	7.6	17.0
8 March	22.0	22.8
22 March	23.9	24.8
5 April	14.1	21.2
19 April	23.6	14.1
3 May	32.5	5.3
17 May	25.8	8.9
31 May	23.2	4.9
Annual	10880	2400
Lowest	8970	
Highest	14970	

* Zero yields because of drought in 4 out of 5 years.

The Masterton Research Station data has been adjusted for Riverside farm (annual rainfall 1260 mm, altitude 200 m.a.s.l.) on the basis of data collected from regular feed budgets and other research work in which pasture growth rate information is collected (Table 3.4). Data for two seasons from the Merc Sharp and Dome Research farm at Gladstone is also shown.

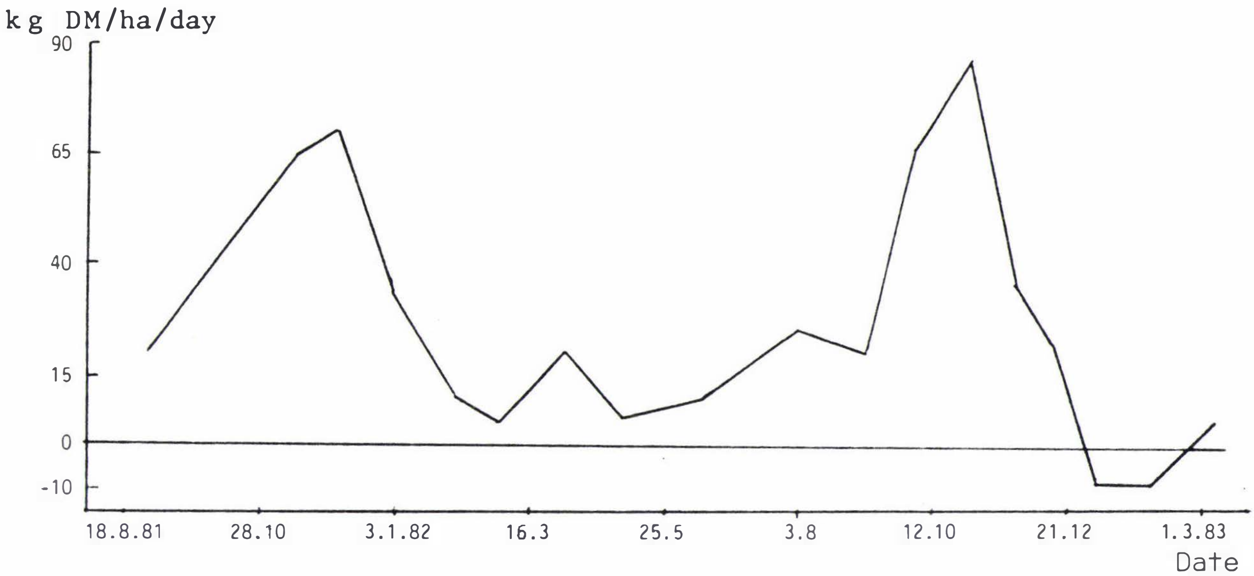
Table 3.4 PASTURE GROWTH RATE DATA (kg DM/ha/day): RIVERSIDE FARM AND GLADSTONE

	Riverside Estimated Average	Gladstone 1977	Gladstone 1978
July	8	11	11
August	18	40	16
September	40	90	31
October	73	63	69
November	65	73	28
December	40	36	22
January	16	59	4
February	10	26	0
March	18	11	5
April	25	23	27
May	20	28	33
June	10	15	23
Annual (kg DM/ha)	10463	14472	8230

In August 1981 a grazing management trial comparing rotational versus set stock grazing of ewes and lambs was commenced at Bideford (Musgrave 1983, pers. comm.) Pasture growth rate data was collected by the difference technique, as explained by Radcliffe (1971), from improved hill country pastures. Annual rainfall at the site is about 1020 mm p.a. and the altitude is approximately

200 m.a.s.l. The mean growth rate curve until March 1983 is shown in Figure 3.1

Figure 3.1 BIDEFORD MEAN GROWTH RATE (kg/ha/day), 1981 - 1983, FROM SIX PADDOCKS ON FARM 25



At each of the sites average annual pasture production is between 10,000 - 11,000 kg DM/ha, but there are variations of up to 50% between years.

The seasonal pattern of growth is marked by very high growth rates commencing with the onset of spring growth in September. This is associated with the rise in soil temperatures (see 10 cm soil temperature readings for Waingawa Table 3.1). High spring growth continues until about the end of November, when soil moisture levels are beginning to decline. In the higher altitude areas, December rainfall is more reliable and high growth rates often continue into January. However, this is offset by lower winter growth rates and a later onset of spring growth, which occurs about the first week of September in the lower altitude, warmer areas of the Wairarapa.

The variability in summer and autumn growth rates is closely dependent on rainfall, and in dry years nil or very low growth may be recorded from January to March. In some years prolonged dry spells continue into the late autumn and have a serious effect on winter management.

Winter growth rates are slow because of low soil temperatures (Table 3.1). Frosts during the winter occur frequently, and one or two snowfalls at altitudes above 250 m.a.s.l. can be expected during most winters.

Seasonal pasture production then is highly variable and unevenly distributed. At Masterton, about 16% of annual pasture production is produced in the winter, 46% in spring, 11% in summer and 22% in autumn (Radcliffe 1975). This seasonal distribution is best adapted to sheep farming systems because stock numbers can be reduced prior to the depression in summer pasture production through the sale of lambs and surplus ewes.

Discussion

The seasonal distribution of pasture production, as indicated by the Bideford results is likely to be comparable to that of other areas of the Wairarapa with similar rainfall. Annual pasture production on the easier improved hill country pastures is probably about 10,500 kg DM/ha and between 7,000 and 8,000 kg DM/ha on the steeper improved pastures. Production on the unimproved low fertility areas could be less than 5,000 kg DM/ha/year (Grant 1974).

The major variations in pasture production in the survey area are due to natural soil fertility (e.g. mudstone versus sandstone soils), altitude, fertiliser history and management. In the northern and higher altitude areas the pattern of pasture production is probably similar to that of Riverside farm. The onset of spring pasture growth is two to three weeks earlier in the lower Bideford and Wangaehu districts, but the former areas appear to experience lower pasture growth rates during January and February.

The improved pastures in the survey area, producing on average 10,500 kg DM/ha/year, presently have the potential to carry 17.1 SU/ha assuming 90% annual utilisation is possible and an allowance of 550 kg DM/SU/year (Rattray 1978). The hard hill country producing 7,500 kg DM/ha, with 80% annual utilisation is capable of supporting 10.9 SU/ha at present.

3.1.6 DISTRICTS WITHIN THE SURVEY AREA

The survey area comprised three districts: Bideford, Wangaehu and Ihuraua (Map 3.1). The characteristics of each, are described in this section.

Bideford

The Bideford district centres on a narrow valley formed along the Tauwera River and its tributaries which is bordered by moderately steep to very steep hill country (Map 3.3). Most farms tend to run from the valley floor back into the hills where natural water supplies consist of mainly unreliable springs and gully streams.

A large portion of the soils in the eastern part of Bideford are derived from crushed argillite parent material (Map 3.4) and have low natural fertility. Erosion damage was the most widespread of the three districts and all the major pine plantations were located in the Bideford area.

Parts of the district are relatively remote with the only access being windy, metal surfaced roads (particularly the Maungapuru and Maringi roads). Several of the farms along these roads had changed hands in recent years.

Wangaehu

The Wangaehu district is formed by a valley between the Rangitumau Range and the medium to rolling hill country that backs onto Bideford (Map 3.3). The farming community is well established and relatively stable.

The predominant soil type, Atua silt loam hill soil, has medium to high natural fertility. In the valley and lower end of the district there are flat areas of high fertility soils suitable for cropping (Map 3.4). Virtually all pastures have been improved.

Ihuraua

The Ihuraua district is considered to have the most effective summer rainfall, although it is exposed to strong and persistent winds, mainly from the north-west. The more reliable late summer pasture growth means that Ihuraua farmers tend to sell lambs later and that flushing of ewes is usually possible.

In general, the soils are of medium to low natural fertility, but nearly all of the pastures are in an improved state.

3.2 THE FARMERS AND FARM LABOUR

3.1.1 THE FARMERS

All except two of the survey farmers came from farming backgrounds, and in some cases represented the third generation to farm the same property. The average period of farm ownership was 12 years (Table 3.5). With the exception of four farms run by managers (4, 15, 18 and 23), all the farms were owner-operated.

Table 3.5 NUMBER OF YEARS OF FARM POSSESSION (excluding properties with managers)

Number of Years Ownership	Number of Farms
5	8
5 - 10	4
11 - 20	4
20	10

In recent years a number of older farmers have either retired, handed over to their sons or sold up. This is reflected in the ages of the survey farmers (Table 3.6)

Table 3.6 AGE GROUPS OF THE FARMERS SURVEYED

Age Group (years)	Number of Farmers
< 30	4
31 - 40	12
41 - 50	7
51 - 60	6
> 60	1
Average age	41 years

The highest educational qualification obtained by 22 farmers was sixth form certificate (Table 3.7). Farmers' wives tended to be more highly qualified than their husbands.

Table 3.7 EDUCATIONAL QUALIFICATIONS OF SURVEY FARMERS AND THEIR WIVES/PARTNERS

	Farmer	Wife	Partner
Up to sixth form certificate	22	11	3
University entrance/seventh form	4	6	1
University degree/diploma	4	7	-
Advanced trade qualification	-	1	-

3.2.2 FARM LABOUR

The 56 full-time labour units on the survey farms looked after an average of 3380 SU each. The highest stock unit to labour unit ratio was 6241:1 and the lowest 1475:1. The fourteen properties run by a single labour unit wintered an average of 3533 SU each (Details of number of labour units and stock units per labour unit are included in Section 3.4.2, Table 3.16).

In general the survey area was well served by contract and casual labour.

3.2.3 HOLIDAYS

Introduction

Between November and January, weaning, shearing, lamb sales, culling of ewes and final selection of two tooth replacements normally occur. In addition, hay or silage may be made and summer forage crops planted. Pasture and stock management at this time of the year is critical in the Wairarapa as pasture growth rates decline with the onset of drier conditions. The sheep farmer therefore cannot readily take time-off over the Christmas break and has to continue farm operations even though most businesses servicing farmers and freezing works are closed from one to two days prior to Christmas until the first week of January. This clash between sheep farming systems and the activities in the rest of the community was therefore seen as a potential management difficulty during the weaning to tupping period.

Results and Discussion

Only 3 farmers indicated that they did not take a regular holiday break, and most had been away in the previous 12 months. The majority of farmers (22) holidayed outside the Wairarapa region. Arrangements for the farm to be looked after during holidays restricted the plans of only one farmer.

Essentially, farmers had learned to live with the Christmas break and had geared up their farming operations accordingly. Shearing, weaning and lamb sales are therefore generally carried out either before Christmas or later in January. The following selection of comments relating to the Christmas holidays express the main feelings of the survey farmers:

"Christmas is a problem - men want to go away but shearing etc. has to be completed. Management would be 10% better without a Christmas break."

"No real problems provided adequate planning is made well in advance of holiday period. Not very keen to go away during the Christmas period, and would probably worry about what was going on."

"The long gap over the Christmas period causes serious disruption to lamb selling policy as freezing works is closed and the sale yards are idle for 3 weeks."

"Four term school year would be better. Holidays do not fit in very well with the farm year."

"Christmas coincides with school holidays. Not a real problem re stock work - but I need to be home to organise."

A holiday break was viewed as being important especially where young families were concerned. Farmers with school-age children tended to be affected more by the seasonal nature of farming than those with grown-up children or no family commitments, who could readily go away at other times of the year. Farms with more than one labour unit or with the farmer's parents living close by, had more flexibility in the timing of holidays.

3.3 FARM DETAILS

3.3.1 FARM AREAS, STATE OF DEVELOPMENT AND TOPOGRAPHY

The average area of the farms surveyed was 602 ha, but there was a large range (from 161 ha to 1496 ha) between the smallest and largest properties. (Table 3.8). Nine farmers had increased the area of their holdings in the last 5 years. The reasons for buying additional land included increasing economic size, making provision for future settlement of sons and retirement, and obtaining special purpose areas for tasks such as hogget rearing and wintering of beef cows.

Table 3.8 FARM AREAS, STATE OF DEVELOPMENT AND TOPOGRAPHY

	Area (ha)		State of Development (ha)			Topography (%)		
Farm Code	Total Area	Improved Pasture	Unimproved Pasture	Non-Grazeable	Potential for Development	Steep	Rolling	Flat
1	450	447	-	3	-	81	11	8
2	161	159	-	2	2	80	18	2
3	359	359	-	-	-	70	15	15
4	586	567	-	19	-	20	62	8
5	981	961	-	20	-	50	49	1
6	437	417	-	20	-	95	5	-
7	567	567	-	-	-	98	-	2
8	492	481	-	11	8	70	30	-
9	575	533	20	22	22	80	10	10
10	536	530	-	6	6	60	22	8
11	245	242	-	3	-	75	25	-
12	257	254	-	3	-	80	-	20
13	411	405	-	6	-	93	7	-
14	344	320	24	-	-	90	10	-
15	1152	810	-	342	308	50	50	-
16	1417	1133	162	122	93	40	50	10
17	378	305	53	20	20	75	22	3
18	803	723	60	20	4	98	-	2
19	500	320	100	80	30	90	10	0
20	417	377	-	40	20	90	10	-
21	1127	1017	-	110	-	85	13	2
22	1255	1214	-	41	-	97	-	3
23	915	768	90	57	-	25	75	-
24	294	263	-	31	20	55	41	4
25	235	223	-	12	-	62	10	28
26	743	670	-	73	-	30	55	15
27	474	429	-	45	16	42	50	8
28	1496	1466	-	30	-	85	5	10
29	223	203	-	20	-	10	50	40
30	235	230	-	5	-	80	20	-
$\bar{x}$ ± SE[1]	602 68	546 61	17 7	39 7	18 11	69 5	24 4	7 2

[1] Standard error of the mean

The majority of farms are fully developed with an average of 90% of the total area in improved pasture. Six farms had areas of unimproved or "native" pastures which had not been oversown or topdressed. These areas were frequently used for calving cows onto to avoid problems with grass staggers in the spring, and in some cases were being maintained in the unimproved state primarily for this purpose. Non-grazeable area varied from 0 up to 30%, and on 12 farms, had some potential to be developed into permanent pasture. On most of the farms parts of the non-grazeable area had been permanently retired and planted in pinetrees, some other exotic species or left in its natural state. In the past two years, three farmers (16, 27 and 29) had developed large areas mainly from gorse and scrub under the Land Development Encouragement Loan (LDEL) scheme. On Farm 16, this development programme would not be completed until 1984 (Plate 3.9).

The farmers were asked to estimate the percentage of the farm area which fell within three broad categories of contour (Table 3.8). This data indicates that the average farm consists of 69% steep or non-cultivatable hills, 24% rolling to moderate hill country and 7% flats. One third of the farms had no flat areas, and nearly two thirds of the properties had more than 70% steep hill country.

In general, the farms can be described as being predominately moderate to steep hill country which are fully-developed into permanent pasture. With a few exceptions the steeper farms tended to be much larger in area.

3.3.2 SUBDIVISION AND SHEEP HANDLING FACILITIES

Number of Paddocks

Details of paddock subdivision for each of the survey farms is shown in Table 3.9. "Holding paddocks" refer to paddocks usually around stockyards or the homestead used for stock handling and grazing small or special purpose mobs (e.g. horses, bulls, rams and killers). They may be up to two hectares in area and tend not to be included in the main farm grazing programme.

The number of "main paddocks" per farm ranged from 10 to 95 with an average of 34. There was a similar degree of variation in the number of holding paddocks.

An appreciation of the intensity of subdivision can be gained by comparing the areas of the smallest, largest and average "main" paddocks. The largest paddock was often on a part of the farm which had yet to be developed or was topographically difficult to fence. In these cases the difference between the average and the largest main paddock areas is high.

There has been a considerable increase in the number of paddocks on most of the farms in the last five years, and only four properties indicated that no additional subdivision had occurred. Nearly half of the farmers had increased the number of paddocks by 30%. However, none of the farms had what the farmers considered to be the "ideal" number of paddocks for management purposes.

Electric fencing had widespread acceptance with 20 farmers using it for permanent subdivision purposes and 2 farmers for temporary break fencing. Criticism of the effectiveness of electric fencing was minor.

Table 3.9 SUBDIVISION ON THE SURVEY FARMS

Farm	Effective Area [1.]	Paddock Numbers		Main Paddock Areas (ha)			Extra Paddocks Fenced since 1978	Ideal Number of Main Paddocks
		Main	Holding	Smallest	Largest	Average		
1	447	40	10	1	49	11	0	48
2	159	24	5	2	12	6	11	40
3	359	29	7	8	36	12	0	31
4	567	36	4	10	60	16	0	44
5	961	42	7	12	40	23	9	57
6	417	27	4	3	42	15	2	30
7	567	45	2	9	29	13	8	60
8	481	35	8	4	22	14	17	40
9	553	33	8	12	57	17	8	40
10	530	25	3	3	89	21	1	30
11	242	30	8	4	14	8	5	40
12	254	28	2	4	37	9	9	36
13	405	24	22	5	28	16	0	35
14	344	20	7	7	30	17	3	30
15	810	30	12	9	73	27	12	100
16	1295	35	3	10	93	37	12	50
17	358	10	4	20	75	35	3	25
18	783	38	11	2	73	20	18	43
19	420	24	6	10	33	17	12	40
20	377	32	5	4	30	12	3	60
21	1017	45	8	5	67	22	6	50
22	1214	43	12	20	54	28	7	50
23	858	28	6	4	92	30	16	38
24	263	46	2	3	12	6	25	48
25	223	32	3	2	11	7	10	35
26	670	51	2	3	30	13	3	60
27	427	35	5	4	61	12	12	55
28	1466	95	12	4	40	15	13	120
29	203	17	10	4	32	11	5	20
30	230	25	2	4	23	9	17	40
$\bar{x} \pm SE$	563 62	34 15	7 4	6 5	45 24	17 8	8 6	46 20

1. Effective area = permanent pasture and unimproved pasture
 = total area - non-grazeable area

Races and Yards

In general all farms had good sheep handling facilities. Long narrow properties and farms with separate land areas, such as on each side of a road, tended to have more sheepyards. The worst example was Farm 14, a property running 3894 ewes and operated by a single labour unit. The farm, 4 km long and 0.75 km wide had one set of sheepyards at the woolshed located at one end of the farm. Extra sheep handling facilities in this situation would be a considerable aid to timeliness of stock handling operations and farmer morale.

Fourteen farms had races to assist with stock movement and vehicle access.

3.3.3 STOCK WATER

Most farms had several sources of water, and had at least one reliable supply during summer dry periods (Table 3.10).

Table 3.10 STOCK WATER SOURCES

Water Source	Number of farms	Reliable during summer dry periods	
		No. of farms	(%)
Open dams	27	17	63
Reticulated dams	12	11	92
Reticulated spring	10	8	80
Reticulated river	10	9	90
Open access to stream	22	18	82
Gully	12	5	42

Plate 3.10 Weed infested open dam, lower Wangaehu district. The effect of dry conditions in March 1983 are evident (Farm 3)

Plate 3.11 Recently cleaned open dam, lower Wangaehu (Farm 4), but showing the problems of mixed grazing of cattle and sheep in hot dry summer weather.

Plate 3.12 Fenced off and planted open dam on Farm 1 (lower Wangaehu). Wangaehu Valley can be seen in background.

Plate 3.13 Clean reticulated trough water on Farm 4. Note the easy rolling topography in foreground and steeper hills of the Rangitumau Range in the background.

The least reliable sources were open dams and gully water. The former tend to become unsafe for stock when the water level is very low and the latter generally dry up after long spells of fine weather (Plates 3.10 and 3.11).

All except 5 farmers were making or planning improvements to stock water supplies. This in part appeared to have been prompted by the difficult conditions experienced during the 1983 summer, following a low rainfall winter and windy spring in 1982. The most common improvement was installation of new dams, and cleaning out existing open dams (11 farmers). (In one instance 41 new dams had been bulldozed in 1983, and three old dams cleaned out). Eight farmers were planning to reticulate from fenced-off dams although the disadvantage that a single mishap (e.g. loss of ballcock, broken hose) could easily result in a major dam being run dry was mentioned several times (Plates 3.12 and 3.13). Reticulation, either by gravity or pump from streams and springs, was planned by six farmers.

Over half (16) of the farms had no problems with water for grazing management. Eleven farmers experienced minor problems of not being able to graze some paddocks or having to break a grazing rotation. Two farmers were forced to set stock in dry seasons. Damage by cattle to open dams in dry conditions were mentioned by two respondents. Stock water quality was considered a problem on 6 farms. These all related to open dams, particularly the older shallower ones, and those that had been pugged by cattle. The main effect of poor quality water was thought to be on lamb and hogget performance.

Except for the northern end of the survey area, the 1983 weaning to tupping period was one of the worst experienced in the Wangaehu-Bideford district for stock water supplies, and on several farms, dams which had not previously failed were dry by February. The extent of the water supply problem may therefore be less than that indicated by the survey. However, even in a normal year, an estimated one third of the farms would still be affected, mainly because of the reliance on stored water. (The rivers and streams in the Wangaehu-Bideford area are relatively small and a significant part of the survey area has no reliable running water source (See Map 3.3)).

Relatively little appears to be known about the effects of water quality on stock, but toxic algae like Anabaena and Microcystis are prevalent in the Wairarapa and may cause deaths following blooms in mid-summer. In the mid 1960's, Wairarapa samples of algae provided strong evidence that stock losses were due to dense numbers of toxic algae in neglected dam sites (Croft 1983, pers. comm.) Lack of finance is limiting the improvements being made, but a significant advance could be made by fencing existing open dams and reticulating from these.

3.3.4 FERTILISER AND LIME

Details of fertiliser and lime tonnages applied in the 1982/83 season compared with normal practice, along with application rates, timing of application, use of trace elements and soil testing were collected. Phosphate fertiliser applications are expressed on the basis of elemental phosphate (P) per SU wintered. Superphosphate was assumed to contain 10%, super 15 15%, DAP 20%, and dicalcic super 5% P.

Phosphate Application Rates

Sixteen farmers decreased phosphate application in 1982/83 compared with normal practice (Table 3.11), but in only 2 cases was no phosphate applied. The maintenance phosphate fertiliser requirement on Wairarapa hill country soils was estimated by Baker and Todd (1981) to be 1.5 kg P/SU. On this basis 15 of the farms received less than the phosphate maintenance requirement in 1982/83 (7 farms in a normal year).

Care needs to be exercised when interpreting these results because of the application rates used. For example, on Farm 15 all of the fertiliser (DAP) in the past two years has been applied to a 40 ha block used for wintering ewes. In general, flatter and more recently developed pastures were topdressed at higher rates. Several farmers said that they would apply more fertiliser if finances were not limiting.

Table 3.11 PHOSPHATE FERTILISER APPLICATION PER STOCK UNIT WINTERED

Farm	Kg P/SU	Kg P/SU Normal
1	1.5	1.9
2	1.2	1.0
3	2.0	2.0
4	0.7	1.1
5	2.3	2.3
6	0.1	1.9
7	2.1	2.1
8	1.3	1.3
9	1.5	2.1
10	1.4	1.4
11	1.6	2.6
12	2.0	2.0
13	0.5	2.5
14	1.5	2.1
15	0.3	0.3
16	1.4	1.9
17	1.8	2.0
18	1.6	1.4
19	1.2	2.0
20	1.0	2.6
21	1.9	1.9
22	0	2.5
23	0	1.3
24	0.4	2.3
25	2.8	2.4
26	2.4	2.1
27	0.8	1.5
28	2.4	2.4
29	0.8	1.6
30	2.1	2.1

Summary

Normal	In 1983:
25	16 applied superphosphate
1	6 applied super 15
3	3 applied dicalcic super
2	2 applied some potassic super
8	10 applied lime
5	8 DAP (3 use this as the sole P source)
0	1 applied urea
0	1 Hatuma special mix
1	2 High analysis crop mix

The trend towards higher analysis fertilisers, which can provide savings in transport and application costs, is reflected in the number of farmers using DAP and Super 15 fertiliser. The time of fertiliser application varied widely but most fertiliser was applied during the period November to April. Ten farmers had made split applications in the 1982/83 season.

Nitrogen, Trace Elements and Lime

Nitrogen was applied in the autumn on 4 farms, in mid-winter on 4 farms and in August on one property. This was in the form of DAP on 8 farms, and urea on 1 property.

Molybdenum and copper were the most common trace elements applied. Copper was applied annually on 3 farms with phosphate. McIvor (1969) reported pasture responses to molybdenum on Marokopa clay loam, (28c), Te Wharau sandy loam (31e) and Purimu silt loam (31dH) which are found in the survey area (see Soil Map 3.4). An investigation by Wells (1969) indicated that Mg, Cu and S could be limiting in some areas of the Wairarapa as the intensity of farming increased.

Four farmers had applied a special mix of trace elements recommended by a private fertiliser company in the 1982/83 season [1] but in view of the results of numerous pasture element composition and livestock mineral drenching trials in the Wairarapa this practice is unlikely to be worthwhile (Grace 1969, Wells 1969, Bruere 1984 pers comm, Farman 1983 pers comm).

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[1] The fertiliser programme on farm 13 is described in detail by Smith (1983(b)).

Lime was applied on 10 properties in 1982/83 compared with 8 in a normal year. Generally, lime was applied to different areas of the farm each year at rates of 500 to 1000 kg/ha every four to six years.

Soil Testing

Soil testing had a high level of acceptance within the survey area, with only 2 farmers having never had soil tests done (Table 3.12). A higher proportion of the farmers who had soil tested since 1980 used private companies to do the analysis. This is similar to the results reported by Syers (1983).

Table 3.12 NUMBER OF FARMERS USING SOIL TESTING SERVICES (29 RESPONSES)

Soil tested	Number of Farmers
Never	2
Prior to 1980	9
Since 1980 by MAF	8
Since 1980 by private company	10

3.3.5 WEEDS AND PESTS

Thistles were by far the most serious and universal weed problem on the survey farms (Table 3.13). Wing, Californian and Scotch thistles were mentioned as the varieties causing problems. Some farmers were spraying or topping (where possible) to control thistles, but the majority took no preventative action. Each of the other pasture weeds; broom, mingi scrub, barley grass, hemlock and rushes received a single mention.

Table 3.13 WEED AND PEST PROBLEMS ON THE SURVEY FARMS

Species	Weed Problems		Pest Problems		
	Ranking	Farms with no problem	Species	Ranking	Farms with no problem
Thistles	1	1	Porina	1	7
Manuka	2	12	Grassgrub	2	10
Gorse	3	14	Rabbits	3	4
Ragwort	4	22	Possum	4	6
Tauhinu	5	26	Slugs	5	17
Blackberry	6	28			

Porina was ranked as the most serious pasture pest (Table 3.13). Damage due to porina and grassgrub was evident on several of the farms in April, especially on areas which had been poorly controlled during early summer and which had a southerly aspect. Other pests mentioned included crickets (4 farms), hares (3), locusts (1) and manuka beetle (3). The latter was causing severe damage to pastures on farm 15, forcing stock numbers to be reduced.

3.4.5 CLIMATE AND SHELTER

Climate Data Collected by the Survey Farmers

Rainfall records were kept by 10 of the survey farmers, although only 4 farmers used them for management purposes. This use essentially appeared to involve a comparison of the expected amount of annual rainfall with the amount recorded to date and adjusting management accordingly.

For example, if late winter and spring rainfall was low, more careful attention was paid to summer management. Two of the older farmers who kept records suggested that the most critical month for rainfall was October; if this was below average then preparations would be made for a dry summer by selling stock early.

There was a common consensus that the wettest months were June to September and the driest period from January to March, with February being the driest month.

Low rainfall and wind were clearly ranked as being the most important climatic factors affecting management during the weaning to tupping period. Temperature was considered less important.

Thirteen of the farmers made an assessment of the likelihood of a dry summer in the September to November period. The most common means of assessment was the amount of spring - early summer rainfall (8), followed by "gut feeling", local knowledge and previous experience. One farmer listened to the advice of his neighbour who had been farming in the district for a long time and who was "usually correct." Only one farmer mentioned watching flowering dates for Kowhai and Cabbage trees. Two took notice of the long range forecast provided by the weather office.

General reaction when a dry summer was anticipated was to take more care with planning of summer feed and water management. Four farmers sold lambs earlier (as stores if necessary), one weaned lambs earlier and sold surplus cattle, and one planted an additional area of summer crop.

Surprisingly, nearly one third of the farmers who made an assessment that a dry summer was likely did not react to it. The major reason for this was the unpredictability of the Wairarapa climate. ("A normal season in the Wairarapa is rare," commented one farmer). Some farmers had made assessments in previous years and acted accordingly, but in hindsight these decisions had been expensive. (For example where the sale of a high proportion of lambs as stores in December was followed by good pasture growth in subsequent months). Others farmed for a dry summer regardless of the season.

Shelter

Three farmers mentioned management problems associated with poor shelter. In each case they consisted of wind damage to pastures and reduction of pasture growth through removal of water. One farmer expressed this problem as; "We are stuck with north-west faces which we cannot move." (Plate 3.3)

3.4 LIVESTOCK

3.4.1 STOCK NUMBERS WINTERED

A total of 168,870 sheep and 5,098 cattle were carried on the 30 farms at the end of June, 1982 (Table 3.14). Ewe flocks (two-tooth and mixed age (MA) ewes), ranged from 1,610 to 12,406 in number and beef breeding herds from 28 to 339 cows (13 farms had no breeding cows, 7 farms had no cattle).

Table 3.14 STOCK NUMBERS ON THE SURVEY FARMS AT 30 JUNE 1982

Farm	Total Ewes	Ewe Hoggets	Wether Hoggets	Rams and Others	Beef Cows	Heifers	Steers	Bulls
1	3700	1206	45	75	28	32	64	30
2	1610	305	146	30	0	0	0	0
3	3157	1197	600	118	0	0	0	0
4	3482	1332	117	168	129	105	120	3
5	7770	2908	77	348	138	81	72	3
6	3329	900	40	250	65	23	16	1
7	4000	1300	50	50	0	0	0	0
8	4002	1531	445	78	0	0	146	0
9	4682	1452	20	29	132	56	4	4
10	3614	1695	216	91	163	71	69	3
11	1620	615	10	35	0	35	142	0
12	2202	700	10	30	0	53	27	0
13	2560	1120	15	482	66	45	0	2
14	3232	832	15	85	0	0	0	0
15	4250	1280	230	85	88	65	13	2
16	6630	2200	50	132	310	111	10	10
17	1770	535	0	46	76	56	13	2
18	4629	1233	243	132	148	92	67	4
19	3200	1000	50	42	3	0	1	1
20	3200	450	100	60	0	0	64	0
21	5354	1971	96	1062	339	241	239	7
22	6500	2673	282	896	257	198	49	5
23	6220	1719	0	77	0	100	0	6
24	2422	785	114	36	0	1	3	0
25	2320	873	0	24	0	0	0	0
26	4622	1727	207	57	152	91	31	2
27	3630	1150	160	65	85	36	14	2
28	12406	3338	57	474	70	72	60	0
29	2789	478	29	30	0	0	0	0
30	2209	700	0	43	0	0	0	0
Totals	121111	39205	4424	4130	2249	1564	1224	61
Mean	4037	1306	147	137	75	52	41	2
SE	403	134	41	34	18	11	10	0.5

On 21 of the farms, sheep numbers had been increased during the previous three years, 2 had decreased in sheep numbers and 7 had been maintained at the same level. Cattle numbers had been increased on 6 farms and decreased on 6 farms during this period. Stock increases were mainly associated with the Livestock Incentive Scheme (LIS) and LDEL. Most farmers who had been involved in LIS were either completing or had one year remaining of the loan qualifying period. Although the LIS was not discussed in detail during the interview, several farmers mentioned that they were considering reducing stock numbers after completing the scheme's requirements mainly to provide more flexibility with grazing management.

3.4.2 WINTER STOCKING RATES

Stock numbers have been converted to a common standard, using a stock unit system, to enable between-farm comparisons. The stock unit conversion factors, originally derived by Coop (1965), express the various classes of stock farmed on the basis of the total amount of feed required per year, relative to the breeding ewe which has a value of one stock unit. The limitations of this system are that no account is taken of seasonal changes in pasture quality (Jagusch and Coop 1971), or of the timing of the changes in the animals physiological status with the pattern of pasture growth. A third criticism, that it fails to consider the various levels of performance of animals at different liveweights, have been taken into account in more recently published conversion factors (e.g. Rattray 1978, defined the standard stock unit as a 55 kg liveweight breeding ewe, weaning 100% of lambs, with an annual dry matter requirement of 550 kg). Despite these shortcomings, the stock unit system remains one of the few easily calculated comparisons between farms.

The stock unit conversion factors used in this study shown in Table 3.15, have been adjusted to take account of the higher quality of pasture required by young stock to obtain recommended target liveweights (Farquharson 1982, Smeaton 1981). In particular, the conversion factors for younger cattle have been increased compared to those used by other researchers (Stewart 1983, NZMWBES 1982), but are similar to those used by Clarkson (1974).

Table 3.15 STOCK UNIT CONVERSION FACTORS, BIDEFORD-WANGAEHU VALLEY SURVEY

SHEEP	Conversion Factor
2-tooth ewes	1.0
MA ewes	1.0
Ewe hoggets	0.7
Wether hoggets	0.7
Rams	0.8
Others	0.8
CATTLE	
Beef cows - 2 year and older	6.0
Mated 1 year - 2 year heifers	5.0
R 1 year heifers	4.0
R 1 year steers	4.0
R 2 year steers	5.0
2 year and older steers	5.0
Bulls - breeding	5.0
Bulls - non-breeding	5.0

The number of sheep and cattle SU (SSU and CSU respectively) run on each farm at 30 June 1982 is shown in Table 3.16. The average stocking rate was 11.3 SU/effective ha, with the highest and lowest stocking rates being 15.6 and 7.7 SU/eff ha respectively.

The sheep to cattle stock unit ratio varied from 1.8:1 to 15.6:1, on the farms which had more than 28 CSU (Table 3.16).

Table 3.16 STOCKING RATES (SU/EFF. HA) AT 30 JUNE 1982; SHEEP: CATTLE STOCK UNIT RATIOS AND STOCK UNITS PER LABOUR UNIT (SSU = SHEEP STOCK UNIT; CSU = CATTLE STOCK UNIT).

Farmer	SSU	CSU	Sheep: Cattle Ratio	Stocking Rate (SU/ eff/ha)	Labour Units	SU/Labour Unit
1	4636	743	6.2	12.0	3	1793
2	1950	0	-	12.3	1	1950
3	4509	0	-	12.6	1	4509
4	4630	1813	2.6	11.4	2	3222
5	10138	1457	7.0	12.1	3	3865
6	4187	556	7.5	11.4	1	4743
7	4985	0	-	8.8	1	4985
8	5448	730	7.5	12.8	2	3089
9	5736	1078	5.3	12.3	2	3407
10	5025	1623	3.1	12.5	2	3324
11	2086	840	2.5	12.1	1	2926
12	2723	366	7.4	12.2	1	3089
13	3740	621	6.0	10.8	2	2181
14	3893	0	-	11.3	1	3893
15	5375	866	6.2	7.7	1	6241
16	8311	2445	3.4	8.3	4	2689
17	2181	768	2.8	8.2	2	1475
18	5768	1574	3.7	9.4	2	3671
19	3968	27	-	9.5	1	3995
20	3633	256	14.2	10.3	1	3889
21	7660	4178	1.8	11.6	5	2368
22	9285	2638	3.5	9.8	3	3974
23	7485	480	15.6	9.3	2	3983
24	3080	17	-	11.8	1	3097
25	2950	0	-	13.2	1	2950
26	6021	1442	4.2	11.1	2	3732
27	4599	741	6.2	12.4	1	5340
28	15162	1039	14.6	11.1	6	2700
29	3168	0	-	15.6	2	1584
30	2733	0	-	11.9	1	2733
$\bar{x} \pm$ SE	5168 512	877 176	6.3 0.9	11.3 0.4	1.8 0.3	3380 202

3.4.3 LIVESTOCK BREEDS

Sheep

The major sheep breed run on the survey farms was the Romney. There is a significant shift back towards the easy-care type of Romneys, mainly from Perendales, to improve wool production (Table 3.17).

Table 3.17 SHEEP BREEDS ON THE SURVEY FARMS

Breed	Number of Farms
Romney	7
Coopworth	5
Perendale	5
Change Perendale to Romney	7
Change Coopworth to Romney	2
Change Romney to Coopworth	1
Introducing one cross of Border Leicester	3

The easy-care open-faced Romney selected for fertility and fleeceweight was considered a better producing sheep than the traditional Romney and incorporated the advantages of Coopworths and Perendales, namely, minimal shepherding at lambing and higher fecundity. Also, the improvement of pastures and better subdivision on some of the harder hill country meant that the Perendale is no longer required to fulfil a development role.

Three farmers were in the process of introducing one cross of Border Leicester over Romney ewes to improve lambing percentages and to gain the benefits of hybrid vigour. This involved running separate mating groups but all three farmers expressed satisfaction with the results although they did not indicate they would be setting up a continuous cross-breeding programme (Wilson 1983).

The 13 farmers involved in a breed changing exercise is a high proportion and indicates a willingness on the part of farmers to change with market conditions and to make adjustments according to their farm's state of development. At least half of the farmers currently changing breeds were previously involved in changing to either Perendales or Coopworths during the late 1960's and early 1970's because lamb returns were high relative to wool at that time.

Four of the farmers were involved in ram breeding and used Sheeplan as a basis for recording and selection (Farms 13, 21 bred Romneys, farm 28, Coopworths and farm 22, Perendales).

Cattle

Although only details of sheep breeds were requested in the questionnaire, visual observation of cattle during farm inspection indicated that the major beef breeds were Aberdeen Angus and Hereford. There were a number of cross-bred herds, mainly of white faced Angus (Hereford x Aberdeen Angus) and Shorthorn. One farmer (11) ran dairy beef dry cattle, mainly Friesian and Friesian cross steers. There was one Aberdeen Angus stud (farm 1), but this was being scaled down, and replaced by a steer fattening policy.

3.4.4 REPLACEMENT AND LAMB SELLING POLICIES

On all farms ewe lambs were kept through for flock replacements and only one farmer (26) occasionally bought in some older MA ewes. Similarly, all of the 17 farmers running breeding cows bred their own replacements. However, in two cases, additional weaner heifers were bought to make up replacements numbers. The four farmers with dry cattle policies bought in stock ranging from weaners to 2 year and older (see Section 8.2.4 on Cattle Buying and Selling Policies).

Eight farmers operated essentially a store lamb policy with, on average, less than 25% of the lambs sold as prime (Table 3.18).

Table 3.18 LONG TERM PERCENTAGE OF LAMBS NORMALLY SOLD PRIME

Percentage of lambs sold prime	Number of Farms
≤ 25%	8
26 - 50%	9
> 50%	13

3.5 LIVESTOCK PERFORMANCE

3.5.1 LAMBING PERCENTAGES

The average lambing percentage on the survey farms for the three seasons prior to the survey was 95%. However there was a large range between the highest and lowest performing farms (67 to 130%) (Table 3.19).

Table 3.19 LAMBING PERCENTAGES 1980 - 1982 (%) AND DISTRICT (1 = Wangaehu, 2 = Ihuraua, 3 = Bideford).

Farm Code	Lambing Percentage				District Code
	1980	1981	1982	Average[1]	
1	112	92	120	108	1
2	93	73	105	90	1
3	101	96	102	100	1
4	92	97	100	96	1
5	88	100	103	97	1
6	106	77	96	93	1
7	110	82	104	99	1
8	107	84	106	99	1
9	110	92	101	101	1
10	92	97	89	93	2
11	106	96	119	107	2
12	104	91	109	115	2
13	111	114	119	115	2
14	87	80	93	87	2
15	85	75	92	84	3
16	104	92	100	99	3
17	87	71	93	84	3
18	84	75	83	81	3
19	86	51	82	73	3
20	-	52	89	70	3
21	133	123	135	130	2
22	118	97	100	105	3
23	75	75	85	78	3
24	100	93	103	99	3
25	106	90	108	101	3
26	88	90	96	91	3
27	91	81	95	89	3
28	108	87	115	103	1
29	75	60	66	67	3
30	0	0	106	106	2
$\bar{x} \pm SE$	98.5 2.8	85.6 3.0	100.5 2.5	95.0 2.7	

1. Average of the data available.

Further analysis of lambing percentages indicates that there were considerable differences between years and between districts (Table 3.20). Differences in lambing percentages between years were highly significant

(P < 0.01) as were differences between districts (P < 0.01), but year by district interactions were not significant. Lambing percentages were highest on average and were less variable between years, in the Ihuraua district. Average lambing percentages were the lowest in the Bideford district each year.

Table 3.20 DISTRICT BY YEAR ANALYSIS OF 1980-1982 AND AVERAGE LAMBING PERCENTAGES. ( ) NO. OF FARMS.

Year / District	Average Lambing Percentage (%)						Average	
	1980		1981		1982			
	$\bar{x}$ ±	SE	$\bar{x}$ ±	SE	$\bar{x}$ ±	SE	$\bar{x}$ ±	SE
Wangaehu (10)	102.7	2.7	88.0	2.8	105.2	2.3	98.6	1.6
Ihuraua (7)	105.5	6.6	100.2	6.4	110.0	6.0	105.5	3.6
Bideford (13)	91.6	3.7	77.1	4.3	91.7	3.0	86.0	3.4
Average	98.5	2.8	85.6	3.0	100.5	2.5	95.0	2.7

ANOVA of Year effects (P = 0.000)
ANOVA of District effects (P = 0.002)

The poorer overall average lambing percentage in 1981 can be attributed to the relatively dry autumn conditions of that year (see Appendix B) which affected flushing management, and the difficult conditions experienced during lambing mainly because of feed shortages (Parker and Lowe 1982). On the other hand, weather conditions over the lambing period in 1982 were exceptionally good (Table 3.1) ensuring a high survival of lambs dropped.

3.5.2 AUTUMN 1983 SHEEP LIVEWEIGHTS

Liveweight data was collected from 28 farms. The majority of liveweights were recorded within the period three weeks prior to tupping and in all cases except one, a sample of at least 50 animals was weighed. Two weighings were obtained about six weeks after the commencement of tupping and an estimate of tupping weight was made from these. Most sheep were weighed within six hours of being removed from pasture but it was not possible to standardise procedures between farms so that all animals were weighed with the same gutfill, nor was it possible to obtain an objective assessment of body condition for each group weighed.

Similarly, the ewe lamb liveweights represent a sample of ewe lambs on the farm at the time of weighing. On some farms the final selection of replacements had been made, while on others, virtually no lambs had been culled.

Eleven of the weighings were completed by the MAF who provided scales. The remainder were carried out by the farmers themselves.

The average liveweights were 52.8 ± 1.0 kg[1] for the MA ewes, 48.6 ± 1.1 kg for the two tooths and 30.2 ± 0.9 kg for the ewe hoggets (Table 3.21). A range of 26.8 kg, 23.9 kg and 21.3 kg in average liveweight between farms in the MA ewes, two tooths and ewe hoggets respectively was recorded. This variation is similar in magnitude to that reported by Kelly (1982), although the average ewe liveweights are lower.

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[1] Mean ± Standard error of the mean, n is always $\leq$ 30.

Table 3.21 AUTUMN 1983 SHEEP LIVEWEIGHTS ON THE SURVEY FARMS

Farm	Liveweight (kg)		
	MA Ewes	Two tooths	Ewe lambs
1	55.8	51.8	29.7
2	52.7	49.0	25.4
3	56.8	49.8	32.7
4	55.3	49.0	32.0
5	52.0	49.0	29.5
6	54.6	47.3	30.8
7	49.0	51.0	28.2
8	52.8	52.6	31.9
9	-	-	-
10	48.0	45.0	29.9
11	60.0	57.0	36.3
12	59.5	57.3	36.4
13	60.0	56.6	32.0
14	-	-	-
15	53.7	43.7	30.7
16	53.6	51.4	25.6
17	49.8	48.1	28.6
18	46.7	35.1	24.0
19	46.0	40.0	25.4
20	50.0	42.0	25.0
21	65.0	59.0	40.0
22	52.0	48.0	35.0
23	45.6	41.8	26.4
24	51.0	49.0	32.0
25	54.7	48.7	36.0
26	55.7	51.4	30.7
27	49.8	41.6	26.8
28	53.0	51.5	29.6
29	38.2	39.3	18.7
30	56.5	54.0	37.3
$\bar{x} \pm SE$	52.8 1.0	48.6 1.1	30.2 0.9

The MA ewe liveweights were surprisingly high considering the dry autumn conditions that had been experienced in most of the survey area. Two thirds of the farms had ewes which averaged 50 kg or better.

The 4 kg difference between the mean two-tooth liveweight and the MA ewe liveweight was the same as that recorded by Parker et al (1975). The two tooths were born in 1981, a year which provided some of the most difficult spring climatic conditions for farming experienced in the Wairarapa. This has probably depressed the two tooth liveweights compared to a normal year.

Ewe lamb liveweights indicated examples of replacements ranging from excellent to very poor, although the mean liveweight for the survey area was an acceptable April 1 target weight (McNeil 1982).

The correlation between ewe lamb and two tooth liveweight was 0.76, and 0.85 between two tooth and MA ewe liveweights. This indicates that farmers who rear good ewe lambs are likely to also have heavier ewes.

District differences in sheep liveweights, for all classes were highly significant ($P < 0.01$) (Table 3.22).

Table 3.22 DISTRICT AVERAGE AUTUMN LIVEWEIGHTS 1983 ( ) NO. OF FARMS

Class of Stock / District	MA Ewes $\bar{x}$	± SE	Two-tooth ewes $\bar{x}$	± SE	Ewe Lambs $\bar{x}$	± SE
Wangaehu (9)	53.6	0.8	50.1	0.6	30.0	0.8
Ihuraua (6)	58.2	2.3	54.5	2.1	35.3	1.5
Bideford (13)	49.8	1.3	44.6	1.4	28.1	1.3
Mean	52.3	1.0	48.6	1.1	30.3	0.9
ANOVA P	0.002		0.000		0.004	

The MANOVA of MA and two tooth ewe liveweights by district with 1982 winter stocking rate as a covariate indicated that, although overall the district liveweights still remained significantly different (Wilk's P = 0.003), this difference was due to a difference between Wangaehu and Bideford ewe liveweights (P = 0.003) rather than between Ihuraua and Wangaehu (P = 0.946).

3.6.3 CALVING PERCENTAGES

The three year average calving percentage on the 16 farms with more than 20 breeding cows was approximately 84.5% (Table 3.23). This over-estimates the actual percentage slightly because three farmers expressed the calving percentages as the number of calves docked as a percentage of the number of cows wintered, which excludes cows that have been pregnancy tested as being empty and subsequently sold.

Table 3.23 CALVING PERCENTAGES 1981 - 1982

Farm	Calving Percentage			Average
	1980	1981	1982	
1	80	80	80	80
2	-	-	-	-
3	-	-	-	-
4	82	80	70	77
5	88	83	87	86
6	76	87	87	83
7	-	-	-	-
8	-	-	-	-
9	93	97	90	93
10	91	91	79	87
11	-	-	-	-
12	-	-	-	-
13	84	76	96	85 *
14	-	-	-	-
15	85	66	82	78
16	90	91	92	92
17	91	93	87	89
18	85	80	85	83
19	-	-	-	-
20	-	-	-	-
21	89	85	90	88 *
22	85	84	92	87 *
23	-	-	74	74
24	-	-	-	-
25	-	-	-	-
26	-	90	87	89
27	92	90	95	82
28	-	-	-	-
29	-	-	-	-
30	-	-	-	-
$\bar{x} \pm$ SE	86.5 1.33	84.9 2.02	85.6 1.80	84.5 1.35

* Calving % = $\frac{\text{number of calves docked}}{\text{number of cows wintered}} \times \frac{100}{1}$

3.6 ANALYSIS OF DISTRICTS WITHIN THE SURVEY AREA

The analysis of the major soil types, lambing percentages and sheep liveweights supports the observations made during the inspection of survey farms and the comments of local farmers and advisors, that the Bideford, Wangaehu and Ihuraua districts are dissimilar. To determine whether other district differences existed, physical characteristics and management practices were compared (Table 3.24).

The ANOVA F-tests indicate that the districts were only significantly different in terms of performance variables (1982 lambing percentage and 1983 liveweights). There are, however, some trends of note in the district means Bideford accounted for 95% of the unimproved pastures (P = 0.06) and 75% of the non-grazeable land on the survey farms (Table 3.8). About 50% of the latter had potential for further development. The relatively recent changes in ownership of three of the Bideford farms is reflected in the lower average period of managing/ownership although the average farmer age for all districts was similar.

The MANOVA indicated that the districts were significantly different when performance variables were considered together (Wilk's P = 0.002). However, the analysis showed that the Wangaehu and Ihuraua districts were not significantly different (P = 0.631) in terms of sheep performance, but that Wangaehu and Bideford were, (P = 0.000). This result supports the observations made in the field.

Table 3.24 DISTRICT COMPARISON OF PERFORMANCE LEVELS, PHYSICAL CHARACTERISTICS AND MANAGEMENT PRACTICES (( ) NO. OF FARMS)

Characteristic	Wangaehu(10)		Ihuraua (7)		Bideford(13)		Average (30)		ANOVA
	$\bar{x}$ ±	SE	$\bar{x}$ ±	SE	$\bar{x}$ ±	SE	$\bar{x}$ ±	SE	Sign of F.
PHYSICAL									
Effective area (ha)	597.7	115.9	431.7	105.7	607.9	101.0	563.4	62.8	0.6362
Permanent pasture (ha)	595.7	115.9	428.3	106.2	572.2	94.8	546.4	60.8	0.5710
Unimproved pasture (ha)	2.0	2.0	3.4	3.4	35.8	14.8	11.0	7.0	0.0600
Number of main paddocks	40	6	28	3	32	3	34	3	0.2000
Average area of main paddock (ha)	13.9	1.3	14.3	2.3	19.4	3.0	16.4	1.5	0.2206
MANAGEMENT									
Fertiliser (normal kg P/SU)	2.04	0.23	2.30	0.13	1.78	0.17	1.99	0.11	0.2077
1982 Winter stocking rate (SU/ha)	11.79	0.43	11.77	0.22	10.55	0.64	11.25	0.33	0.2217
Cattle:Sheep SU Ratio (1982)	0.12	0.04	0.23	0.05	0.15	0.05	0.16	0.03	0.3570
Years ownership/managing	14.7	3.8	17.9	4.3	11.0	2.5	13.8	1.9	0.4324
Farmer age (years)	42.5	3.2	40.3	3.6	40.1	3.4	40.9	1.9	0.8570
Labour (SU/Labour unit)	3456	349	2930	220	3556	383	3377	208	0.3946
PERFORMANCE									
Average lambing % (1980-82)	98.6	1.6	105.5	3.6	86.0	3.4	95.0	2.7	0.2000
1983 autumn ewe live-weight (kg)	52.7	0.6	57.3	2.3	48.5	1.3	51.7	1.0	0.0010
1983 autumn ewe lamb liveweight (kg)	30.0	0.8	35.3	1.5	28.1	1.3	30.3	0.9	0.0040
1982 lambing percentage (%)	105.2	2.3	110.0	6.0	91.7	3.0	100.5	2.5	0.0010

If 1983 liveweight is treated as a covariate in a MANOVA of 1982 lambing percentage by districts, the district effects are no longer significant (P = 0.276). Thus differences in 1982 lambing performance appear due to differences in liveweight (P = 0.000). This analysis suggests firstly, that factors affecting liveweight should be further investigated. Because 1983 liveweight is highly correlated with 1982 lambing percentage (r = 0.90), factors which affect liveweight will also affect lambing percentage. These aspects are developed further in chapters 5, 7, 9, and 11. Secondly, the analysis indicates that the survey population is contiguous with the exception of liveweight differences between Ihuraua and Bideford.

3.7 REPRESENTATIVENESS OF THE SURVEY SAMPLE

It is useful to establish how widely the conclusions of the survey can be applied. Some results obviously will be specific to the survey farms and local region, but if the sample can be shown to be representative of a wider population some results may be extrapolated to these groups as well, making the findings much more useful.

The representativeness of the sample can be ascertained by comparing the survey results with those of other farm surveys. (This was one of the main reasons for including the same or similar questions from previous questionnaires). The values of variables common to a number of hill country surveys with those of the Wangaehu-Bideford survey, are shown in Table 3.25.

Comparative data was obtained from:

1. The NZMWBES North Island hard hill country (Class 3) and North Island hill country (Class 4) categories for the 1981-82 season (NZMWBES 1983);
2. A 1978 census survey of the 130 farm units in the Akitio County, Southern Hawkes Bay (approximately 80 km north of the Wangaehu-Bideford area) (Arthur-Worsop and Shepherd 1980). The county is predominantly moderate to steep hill country but is more remote and has not had as long a history of settlement as the Wangaehu-Bideford area.
3. A survey of 100 moderate to steep hill country sheep and beef farms in the Patangata County, Central Hawkes Bay (McClatchy 1966).
4. The 20 farms distributed throughout the Wairarapa region included in a 1974 survey of factors affecting lambing percentages (Clarkson 1974).
5. A random sample of 41 Wairarapa sheep and beef farms studied by Gould (1975) to investigate beef breed performance and management.
6. A study of hill country farm development in the Horowhenua County (Halford 1971).
7. A long term study, of hill country properties of north and north-west of Gisborne, of the effects of management inputs on production levels (Fitzharris 1982).

On average, stocking rates are likely to have increased on the farms surveyed prior to 1980 due to improvements made to management and the LIS and LDEL programmes (Donaldson 1982). The latter are also likely to have increased the effective grazing area on these farms. The differences in state of pasture development between Akitio County farms and those in the Wangaehu-Bideford area are therefore likely to be smaller than those shown in Table 3.26.

Table 3.25 SUMMARY OF SIMILAR FARM SURVEY RESULTS

Reference	Survey Region	No. of farms	Area (ha)	Eff. Area (ha)	SR/eff ha (SU/eff ha)	Average Lambing (%)	Average Calving %	Bdg Ewes/ L.U.
Arthur-Worsop Shepherd(1980)	Wangaehu-Bideford	30	602	562	11.25	95	84.5	3393
	Akitio County	130	640	624	8.80	96		1702
Gould (1975)	Wairarapa	41	583	-	6.95	-	84.2	-
Clarkson(1974)	Wairarapa	20	-	474	9.85	-	99.1	-
Halford (1971)[1]	Horowhenua	20	441	353	8.15	86	81	873
NZMWBES (1983)	North Island hard hill	76	810	668	8.70	84.8	75.7	2563
	hill	143	397	372	11.20	94.2	82.5	2384
McClatchy (1966)	Patangata County	100	-	452	-	-	-	2942
Fitzharris (1982)[2]	Gisborne	100			9.7	89	82	

1. Excluding two very large properties
2. 1980-81 season

Table 3.26 COMPARISON OF AVERAGE PASTURE DEVELOPMENT ON FARMS IN THE AKITIO COUNTY AND WANGAEHU-BIDEFORD SURVEYS

	Akitio (1978)	Wangaehu-Bideford (1983)
Average farm area	640 ha	602 ha
Area improved pasture	71%	91%
Area poor pasture	16%	-
Area unimproved pasture	10.5%	3%
Non-grazeable area	2.5%	6%

The comparisons presented suggest that the Wangaehu-Bideford area is not atypical of medium to hard hill country properties, particularly in the Southern North Island, in terms of area, stocking rate and stock performance. It should therefore be reasonable to extrapolate some of the conclusions of this study to similar hill country farms outside of the survey districts.

CHAPTER FOUR

PASTURE MANAGEMENT

4.0 INTRODUCTION AND CHAPTER OUTLINE

In most areas of New Zealand 60-80% of annual pasture growth occurs during a 3-4 month period in the spring and early summer (Campbell 1966, Rattray 1978). Matching pasture growth with the requirements of animals throughout the year is therefore a major problem (Hutton 1970, Rattray 1978). The seasonal distribution of pasture production and quality can be improved by grazing management which minimises reproductive development in the grasses (Campbell 1966, Tainton 1973, Jaqusch et al 1978, Korte and Sheath 1979, Holmes and McClenaghan 1979, Korte 1981, Baars et al 1981). This also encourages the production and persistence of clover in the sward (Sheath 1982, Baars et al 1981, Clarke et al 1982, Hay and Baxter 1983). The latter is desirable because of the higher nutritive value (Rae et al 1963, McLean et al 1965, Ulyatt et al 1976) and animal preference for legumes (Arnold 1964, Guy et al 1981).

Reproductive development in the grasses can be discouraged by avoiding lax grazing practices during late spring/ early summer and adopting carefully timed hard grazings when seedheads begin to form (Tainton 1973, Baars et al 1981, Korte 1982). Under hill country conditions with a mixed sward, reproductive development varies according to species, and seasonal factors such as daylength and temperature (Smetham 1983). Therefore several successive hard grazings may be required. If seedheads are not grazed when they are at an immature stage, palatability decreases and they will be rejected in preference to leaf material (Arnold 1962, Guy et al 1981).

Frequently, the development of reproductive tissue in hill country pastures occurs very rapidly (during a period of 1-2 weeks) and over a large proportion of the farm. The farmer therefore has to recognise the initiation of the reproductive phase - the technique suggested by Korte (1981) is appropriate - and develop and put into effect grazing management strategies within a very short period of time. This may be incompatible with the needs of other parts of the farming system; if for example temporary destocking is required because lambs need to be drafted so as to avoid overfat problems,or shearing/ crutching is necessary to prevent serious losses from fly-strike. There are also physical restrictions on stock management such as the seasonal requirement to keep male and female stock separate. In most years, grazing priorities must be established and if necessary loss of control on some parts of the farm accepted.

Maximum usage of differences in pasture production due to aspect (White 1973, review) and steepness (Sheath and Bircham 1983) should be made. Thus grazing pressure should initially be concentrated on the warmer northern slopes where reproductive development usually commences earlier. If necessary, paddocks can be temporarily retired from grazing to increase the stocking rate on the remainder of the farm. Sheath and Bircham (1983) suggest that these should comprise the easier and better developed pastures where control can most easily be regained. In addition, conservation for hay or silage or topping are possible alternatives on these areas to give a greater measure of pasture control and to redistribute pasture production (Dawson 1978, Dodd 1982, Holmes and McClenaghan 1979, McDonald 1983). Alternatively, and more expensively, chemicals such as paraquat (Palmer 1967, Taylor and Arnst 1968) or melfluidide (Smith 1983(a), review) may be used to encourage clover production and depress seedhead development.

The second means by which the match of animal requirements and pasture production can be improved is stock management. While there are limited opportunities under hill country conditions to adjust capital stock numbers, unless a buying and selling policy is operated, breeding policies do enable the effective stocking to be increased/decreased at certain times of the year. Through adjustments to calving/lambing and weaning dates and the sale of surplus natural increase, the pattern of feed requirements can be changed to match increases/decreases in pasture growth (Rattray 1978). Obviously higher lambing/calving percentages provide a greater range in total feed requirements and therefore greater flexibility.

Utilisation of the late spring/early summer pasture flush can be improved by increasing winter stocking rate (McMeekan 1961(a)). Corresponding increases in per animal and unit area productivity up to "critical" stocking rates are possible (McMeekan 1961(b), Suckling 1964, Hodgson 1975). These increases are greatest where associated changes in management - later lambing/calving, sale of more lambs as stores - are made so that shortfalls in feed supply at other times of the year are not exacerbated.

Set stocking or variations of set stocking during the late spring/early summer period are likely to give the greatest degree of seedhead control, except under high stocking rates (Lambourne 1956, Suckling 1959, Boswell et al 1974, During et al 1980, Clarke et al 1982). Rotational grazing may be used as a means of increasing herbage mass during spring (Sheath and Bircham 1983) but should probably be discontinued in preference for set stocking to maintain control once satisfactory feeding levels have been achieved (Thompson and MacEwen 1983, Smeaton 1983). If rotational grazing is adopted during periods of high pasture growth rates, rotation lengths should be decreased so that paddocks are grazed every 10-14 days. This will simulate the frequency of grazing of individual tillers under set stocking (Hodgson 1966, Morris 1969, McIvor and Watkin 1973, Curll and Wilkins 1982).

In this chapter, details of grazing management on the survey farms is discussed. This provides background information for subsequent chapters in which aspects of sheep and cattle management are described in greater detail.

4.1 PASTURE MANAGEMENT - SURVEY RESULTS

4.1.1 MOST DIFFICULT TIME OF THE YEAR TO MATCH PASTURE GROWTH AND LIVESTOCK REQUIREMENTS

Farmers surveyed believed the most difficult months for matching livestock demands with pasture growth were in the late winter/spring and summer/autumn periods (Table 4.1).

Table 4.1 MOST DIFFICULT MONTHS FOR MATCHING FEED SUPPLY/DEMAND

Period	Months	No. of Farms
(1) Late winter/spring	July - October	9
(2) Early summer	November - January	1
(3) Late summer/autumn	February - April	6
(4) Early winter	May - June	1
(5) Periods (1) and (4)	-	12
(6) None	-	1

Perceived difficulties related almost entirely to animal requirements being in excess of pasture growth, either because of climatic conditions or changes in animal physiological state. The control of peak pasture growth in spring/early summer and poor pasture quality in the summer were mentioned in only two instances as contributing to the feed supply/demand problem. The predominance of late winter/spring problems suggests that the feed position obtained at lambing is insufficient to carry-over until the onset of the spring flush. Opportunities to improve winter and spring pasture management therefore seems likely. These are discussed further in Chapters 5 and 11.

4.1.2 MANAGEMENT TO CONTROL SEEDHEAD EMERGENCE

Two thirds of the farmers attempted to control seedhead emergence in the late spring/early summer period (Table 4.2) because they believed this improved subsequent pasture quality. The farmers who did not deliberately attempt to control reproductive development were mainly concerned about reseeding of pastures.

Seedhead control was generally achieved through stock grazing management, by buying stock or getting-in grazers and closing up part of the farm (mentioned once and two times respectively). Essentially, stock grazing management prior to weaning involved shuffle set stocking to adjust individual paddock stocking rates as pasture growth exceeded stock requirements. As weaning approached, some paddocks were dropped out of the grazing area, effectively increasing the stocking rate on the remaining area.

Table 4.2 REASONS FOR CONTROLLING OR NOT CONTROLLING SEEDHEAD DEVELOPMENT IN LATE SPRING/EARLY SUMMER

	Reason		No. of Farmers
No control	Important to allow pastures to re-seed.	4	
	Cover in summer gives protection against sun and wind.	1	
	(both)	1	6
	Can clean up with cattle later		4
Controlled	Try to keep vegetative/grows better.	12	
	Results in better quality lamb feed.	4	
	(both)	2	18
Other	Never have a surplus until January		2

No details of the actual methods used to decide when to implement control measures were obtained, but a high proportion (17 out of 20) did so on the basis of observation of feed supply relative to demand or emergence of seedheads. Physical inspection of tillers as suggested by Korte (1981), was not mentioned by any of the farmers. If preventative management commenced after the seedhead was visible in the sward this would be too late to give effective control.

Examples of differences in the effectiveness of late spring/early summer pasture control can be seen in plates 4.1, 4.2, 4.3 and 4.5. Plates 4.4 and 4.6 indicate the poor pasture composition typical of the naturally low fertility soils and/or on areas receiving low rates of fertiliser in the survey area.

Plate 4.1 Differences in seedhead control between farms in the lower Wangaehu, still evident in mid-April. Although both farmers essentially used set stock grazing management throughout the year, the farm (1) in the foreground had a higher winter stocking rate. The Rangitumau Range can be seen in the background.

Plate 4.2 Differences in seedhead control between paddocks (mid-April) in Wangaehu. The paddock on the right will provide "rough feed for cattle during the winter " (Farm 6).

Plate 4.3 Differences in seedhead control between paddocks (late March) in east Bideford (Farm 18).

Plate 4.4 Manuka reversion problem in the Bideford district (Farm 17) on low natural fertility soils derived from sandstone.

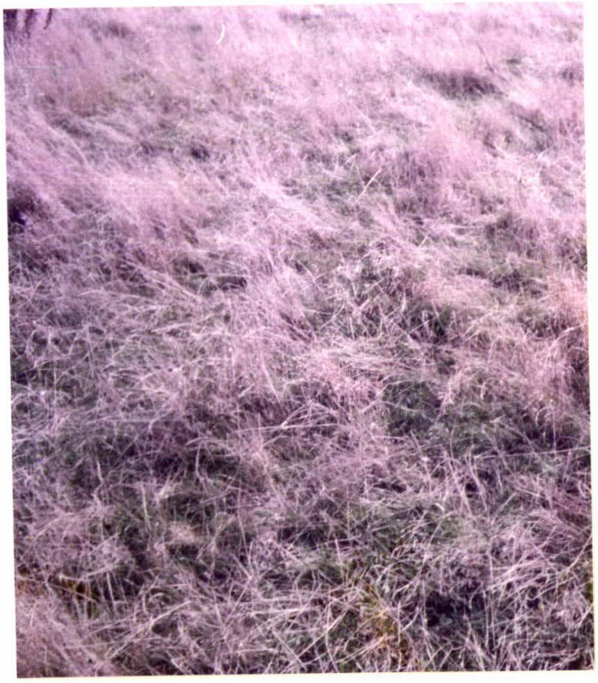

Plate 4.5 Rank growth in mid-April on pastures poorly controlled in late spring/early summer.

Plate 4.6 Browntop dominant sward ("native pasture") on an area with a history of no phosphate fertiliser. Primarily used for breeding cows at calving.

4.1.3 CONSERVATION, TOPPING AND SUPPLEMENTARY FEEDS

Conservation and topping played a minor role on the survey farms as a means of controlling pasture growth.

Two farmers (24 and 25) made silage in November and used this as a flushing feed. Capital costs on these farms were low because storage and feeding out equipment could be shared. Overall there did not appear to be much interest in the use of silage. This related to the lack of suitable land as well as the capital cost of equipment and facilities required for storage and feeding out.

Hay was made on 2 farms in the 1982/83 season. The use of hay was diminishing - all of the 7 farmers who bought in hay purchased 1000 bales or less in the 1982/83 season - and was being replaced with all-grass wintering systems and increased nitrogen usage. The major role of hay was to quieten cattle and to supplement breeding cows at calving.

Feed other than hay was bought in rarely - mainly during droughts.

Six farmers topped some pastures in 1982 but only relatively small areas (6 to 40 ha) were involved. One of the main reasons for topping was thistle control.

4.1.4 ADJUSTMENTS TO STOCK NUMBERS

Additional cattle were grazed during the October - April period in the 1982/83 season on 2 farms in order to control surplus growth but this was not a common practice on the survey farms. In general, surplus feed supplies in late spring/early summer meant that stock were usually unavailable for grazing purposes at this time.

4.1.5 CROPPING

Small areas, between 3 and 10 ha, of winter crop was grown on farms 3, 9, 15, 27 and 29 in 1982/83, mainly for hogget grazing in mid to late-winter.

A summer crop, primarily for finishing wether lambs and to a lesser extent, on one property as a safe area from ryegrass staggers, was planted on 6 farms (1, 12, 18, 27, 28 and 29) in 1982/83. The areas involved were less than 14 ha, except on farm 28 where 40 ha was planted.

Fodder crops were, therefore, relatively unimportant in the survey area. Winter crops which were commonly incorporated into a pasture renewal programme were declining, but summer crops will probably continue to be grown on a few farms in the drier parts of the survey area.

Although cash crops have been grown in Wangaehu and Bideford, none were planted in 1982/83.

4.1.6 CLOSING UP PASTURE

Sixteen of the farmers had closed up part of the farm during periods of good pasture growth to maintain control over the rest of the farm. With the exception of the farmers who made either hay or silage, generally poorly developed, less accessible pastures were closed up. Most were cleaned up during the following winter. No details of the area closed, or timing of closing were obtained. Of the farmers who closed up areas, 7 mentioned the importance of cattle for cleaning up and regaining control, and 4 stated that closed up areas were very difficult to get under control again by autumn or even during the winter. The latter can probably be explained by the area chosen, since the less developed areas and poorer pastures also tend to be the least intensely sub-divided, and therefore can only be stocked at relatively low rates even when mob-grazed during the winter.

The 14 farmers who did not close up for seedhead control either did not manage for seedhead control, preferred to obtain a measure of control in part of every paddock, liked to build-up as much feed reserves as possible, attempted to feed stock at maximum intakes or said that they did not find it necessary. A high lambing percentage, high stocking rates, flexible cattle policy and early weaning were mentioned as being important controlling factors by some of these farmers.

Generally farmers viewed closing up areas of the farm as being a last resort.

4.2 CONCLUSIONS

4.2.1 GENERAL ASPECTS OF PASTURE CONTROL MANAGEMENT

Maintaining pasture control during the period of high pasture growth rates was identified as being the most difficult time of the year to manage pastures on only two farms. This was consistent with the result which indicated that one third of the farmers did not consider seedhead control to be important and 18 of the farmers who considered that control could be obtained relatively easily.

An impression gained during the survey was that rank pasture growth was generally not regarded as a problem - being preferred to short controlled pastures in the event of dry conditions. In wetter summer seasons this could always be cleaned up during the winter when feed was short on a high proportion of the farms. Rank summer pasture growth was not mentioned as being associated with lower winter production by any of the farmers.

A question in the minds of many of the survey farmers was:

> "What alternatives do I have after having obtained a high degree of pasture control during the late spring and early summer if moisture is insufficient to promote regrowth during the summer?"

While the quality of transferred standing herbage may be low, most farmers considered it "better than nothing", and viewed it as being a source of cattle feed either during the summer if conditions became dry, or for winter.

This question should also be considered in relation to the effect of the seedhead on the micro-environment on exposed slopes. Although the seedhead was unpalatable to stock, some farmers thought that it provided protection from the elements for green herbage at a lower level in the pasture canopy. The reduced loss of moisture was considered particularly important.[1]

Among farmers who attempted to control pastures in late spring/early summer, there was no consistant method

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1. The author is unaware of any pasture management trials which have investigated these aspects on hill country especially on sites exposed to strong winds as is the situation in much of the Wairarapa.

of determining when management control should commence. The methods used appeared to have been developed through experience over a number of years. Nevertheless, some farmers are likely to benefit from having a more objective basis for decision making, such as that suggested by Korte (1981).

4.2.2 IMPROVEMENTS TO CLOSING UP MANAGEMENT

Closing up improved pastures which are well subdivided is likely to be superior to temporary retirement of extensively subdivided and poorly developed pastures. The former option enables much higher stock concentrations to get pastures back under control and theoretically, since differential growth rates between poorer and improved pasture are to be expected, a smaller area of the best pastures would need to be shut up. Ryegrass dominant pastures also appear to be easier to get back into production than browntop because stem material breaks down faster. (Most of the dry seedhead material remaining in the winter and following spring in hill country is browntop).[1] As well, in browntop dominant swards lax grazing or closing up during the late spring/early summer will encourage persistance of browntop and prevent the establishment of improved pasture species (White 1973).

Previously closed up areas should be grazed prior to the autumn. By January, initial reproductive development is finished (Korte 1982) and the best possible control on the areas given grazing priority will have been obtained. Transferring grazing pressure to the pastures where control was lost during the October-December period will prevent overgrazing of the "controlled" areas and enable rank areas to be brought back into production by the autumn. This will in turn ensure higher quality winter feed than mature herbage transferred as standing hay.

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[1] See Plates 4.2 and 4.5.

CHAPTER FIVE

AUTUMN AND SPRING SHEEP MANAGEMENT

5.0 CHAPTER OUTLINE

Mating management is of fundamental importance to profitable sheep farming, affecting the pattern of feed requirements in relation to pasture growth and the number of lambs born per ewe. In the first part of Chapter Five factors relevant to the questionnaire which affect mating management are reviewed and the practices adopted by the survey farmers are described.

The second part of the chapter is devoted to a discussion of spring management. This period of the year is increasingly being shown to have a large effect on ewe and lamb productivity. Although only a small section of the questionnaire related to management from lambing to weaning the results are important for understanding post-weaning management; discussed in Chapter 7.

5.1 MATING MANAGEMENT - LITERATURE REVIEW

5.1.1 EFFECT OF LIVEWEIGHT ON LAMBING PERFORMANCE

The relationship between liveweight and lambing performance has been well documented under experimental conditions (Clarkson 1974, review; Drew et al 1973, Allison and Kelly 1978, Rattray et al 1981) and in commercial farming situations (Parker et al 1975, Armstrong et al 1980, Kelly 1982, Kelly and Johnston, 1982).

The general consensus from New Zealand research is that for every 1 kg increase in mating liveweight the lambing percentage increases by 2 to 2.5%, and that for every 1 kg gain in the 3 weeks prior to mating, lambing percentages increase by a further 2 to 3% (Allison and Kelly 1978, Thompson 1983).

5.1.2 FLUSHING

Smith et al (1983) established that a minimum period of 3 weeks of high level feeding on pastures was necessary to obtain a flushing effect. This management was associated with a 3 week carry-over effect, hence flushing should commence 3 weeks prior to the introduction of rams.

Details of flushing feeds have recently been reviewed by Rattray et al (1983). If ewes are flushed on pasture, a clover dominant sward of at least 1000 kg green DM/ha is required. A utilisation of less than 50% per grazing is recommended.

5.1.3 TIMING OF MATING PERIOD

Investigations of the number of eggs shed by the ewe during the breeding season indicate that there is a period of maximum reproductive efficiency (McDonald and Ch'ang 1966, Black 1974, Knight and Hight 1976, Knight et al 1980). This is affected by a number of factors including breed (Allison and Kelly 1979), age (Quinlivan and Martin 1971), latitude (Kelly and Knight 1979) and altitude (Quinlivan and Martin 1971).

These studies indicate that the optimum period of joining in the Wairarapa is between April 1 and April 15. At this time the maximum ovulation rate and a high first cycle conception rate is most likely. In addition, Quinlivan and Martin (1971) found that embryonic losses were greater in ewes mated early in the breeding season.

The timing of mating is also important because it determines how well the increase in ewe feed requirements after lambing coincide with the increase in pasture growth rates in the spring. If lambing occurs early relative to the spring flush, under-feeding of ewes is likely unless saved pasture is available. Alternatively, very late lambing is likely to result in loss of pasture control.

5.1.4 LENGTH OF MATING PERIOD

The length of the mating period also has important implications for management in the subsequent spring. A prolonged mating period is more likely to result in a spread out lambing, decreasing the efficiency of labour utilisation and increasing the complexity of grazing management. A wider variation in lamb weight at weaning will tend to shift weaning dates later and therefore potentially disrupt summer pasture management.

A condensed lambing, however, can increase lamb losses if it coincides with a spell of bad weather but this is counteracted by the fact that a spread-out lambing is more likely to be affected by storms (Clarkson 1974).

The current recommendation is that mating should be restricted to 51 days (3 cycles), although there is a trend towards 34-day mating periods on more intensively farmed properties.

5.2 MATING MANAGEMENT ON THE SURVEY FARMS

5.2.1 FLUSHING MANAGEMENT

Information relating to management of ewes prior to mating was sought, to gain an understanding of how farmers approached this critical time of the year.

Twenty seven of the farmers indicated that flushing of ewes was a normal management practice. The three farmers who said they did not try to flush their ewes commented to the effect that "there is usually no feed available." One farmer suggested that flushing was not necessary if the ewes were maintained in good condition through the summer.

Details of the period of flushing in 1983 are shown in Table 5.1.

Table 5.1 LENGTH OF 1983 EWE FLUSHING PERIOD (WEEKS)

Period	Number of Farms
0 weeks	9
1 week	1
2 weeks	5
3 weeks	8
4 weeks	4
5 weeks	2
7 weeks	1

The high proportion of farmers who did not increase the level of feeding of ewes prior to mating reflects the dry summer and autumn conditions in 1983. Half of the farmers flushed their ewes for the minimum recommended period of three weeks or longer (Rattray *et al* 1983).

Seventeen farmers said that their ewes had gained weight, 5 were not sure, and 8 considered that ewes had either nil gain or lost weight over the flushing period. Despite the difficult seasonal conditions, 50% of the farmers expressed satisfaction with the condition of ewes at the time of mating (this is supported by the liveweight data).

As expected, the major problem experienced during flushing related to inadequate moisture for pasture growth. Only 7 farmers indicated that they had no problems most years in providing sufficient pasture for flushing. The pasture was mainly obtained through the management of southerly faces on mudstone soils, where pasture growth persists later into summer.

5.2.2 GRAZING MANAGEMENT DURING FLUSHING

Over the 1983 flushing period ewes were rotationally grazed on 21 farms, set stocked on 8 farms and supplemented with silage and rotationally grazed on one property. Rotational grazing versus set stocking of ewes just prior to and during mating was a topic of discussion amongst the farmers at the time of the survey. Half of the farmers indicated a preference for rotational grazing, six liked set stock management and the remaining nine changed management according to seasonal conditions.

The sample of comments listed below from each of these groups summarises the main points of view;

Rotational Grazing Preferred/Used

"Rotational grazing provides better management of ewes and pastures, easier control of stock and improved weight gains under normal conditions. Under dry conditions ewes appear to do better with regular changes of paddocks - ewes get used to shifts and shift themselves."

"Not much difference in ewe liveweight gains but rotational grazing is better for pasture control."

"Set stocking is probably more beneficial for ewes but causes major problems in setting up a winter rotation. Silage feeding restricts you to rotational grazing ."

"Rotational grazing increases ram contact with ewes and increases your chance of picking up a dud ram. Set stocking causes problems if you are using harnesses."

"See stock more often. With set stocking tend only to see good sheep, as ones doing poorly are hidden away."

Set Stocking Preferred

"Set stock ewes do better - less stress with less shifting. It is important to have a lot of water/shade with rotational grazing. Particularly set stock in a dry year."

"Set stock ewes are left alone and rams find their own territory."

"Set stocking is better for water, less ewe stress, less energy used moving about to get feed."

Either System

"Doesn't really matter - if ewes rotated you've got to be careful; can easily underfeed."

"Depends on the season - if you're short of feed, set stock."

"Both seem to work; if you have little feed, set stocking is best. Rotational grazing ewes have more contact with ram."

Perhaps the most surprising factor to emerge was the preference for set stocking in a dry season (although continuation of rotational grazing when feed supplies are very low is difficult). This can expose the farmer to a potentially more serious feed shortage than carefully controlling ewe intakes through rotational grazing up to the time of joining. By set stocking too early, feed reserves can be used up prior to flushing and although an initial weight gain may be achieved, the benefit of this is likely to be lost if liveweights then decrease prior to joining (Rattray et al 1983). In addition, using up all the available feed reserves during flushing and mating can jeopardise winter management.

The subsequent question was therefore asked: "If you set stocked ewes for flushing after rotational grazing over the summer, how did you determine when you should set stock?" This question was applicable to 8 farmers in the 1983 season. In four cases set stocking commenced when feed began to "run-out" or problems with water were experienced. The remaining farmers estimated the amount of feed available, how long it would last and set stocked accordingly. ("I know I need roughly six weeks of good feed from the date of tupping"). In each case this exercise was carried out subjectively using no formal feed budgeting procedures.

5.2.3 LIVEWEIGHT AND LAMBING PERFORMANCE

Survey data included information on average ewe liveweights in autumn 1983 and flock lambing percentage in spring 1982. Kelly's (1982) survey results indicate only small variations between years in mean ewe liveweight. Accordingly, the between farm correlation of 1982 lambing percentage with 1983 autumn ewe liveweights was calculated. The correlation for the sample farms was 0.90 and the regression of lambing percentage on weighted average ewe liveweight[1] estimates a 2.37%

1. Weighted average ewe liveweight = ((1983 MA ewe LWGT *3) + 1983 Two tooth LWGT) / 4

increase in lambing percentage for every 1 kg increase in mean MA ewe autumn liveweight. This result is consistent with those reported in the literature.

5.2.4 TIME OF MATING

A comparison of 1982 lambing percentage with commencement date of mating indicated that flocks mated after April 1 had significantly ($P < 0.05$) higher lambing percentages (Table 5.2). All of the flocks mated in February and March were located in the lower Bideford and Wangaehu Valleys where the spring flush is normally about two weeks earlier.

Table 5.2 THE EFFECT OF MATING DATE ON 1982 LAMBING PERCENTAGE

Mating Date	No. of Farms	Average lambing percentage (%)
Before April 1	9	92.8 ± 4.2
April 1 and later	21	103.8 ± 2.8

All except one farmer joined ewes with rams in the period 15 March to 12 April in 1982. The exception was a February 12 MA ewe mating which had been practiced for three years. On this farm two tooth ewes were mated on 20 March. The reasons given for this practice were: an early lamb draft at the end of October was possible which often captured a price premium (although it was acknowledged that this had decreased in recent years), more readily available works space and fewer interruptions because of strikes, increased flexibility with shearing dates and a more reliable feed supply for flushing.

A second farmer changed to an early February mating of MA ewes in 1983 in an attempt to improve lamb weaning weights. On the morning of the farm visit, a count by the farmer indicated that only about one third of the ewes had been marked by rams in the first 3 weeks of mating. The change in mating dates is therefore likely to result in a spring feed shortage and a wide range in lamb size by weaning (see Chapter 11).

Two tooths were joined with rams at the same time as MA ewes on 24 of the farms, and within 7 days of MA ewe joining on 4 farms. On two properties two tooth tupping dates were more than 7 days different. The primary reason for staggered mating dates was to spread labour requirements.

A "flying" flock was run on two farms (18 and 28). Older ewes and those not suitable for breeding replacements were, in both cases, joined with terminal sires 10 days earlier than the main flock.

5.2.5 EFFECT OF DURATION OF MATING PERIOD ON LAMBING PERFORMANCE

The duration of the 1982 mating period varied from 34 to 90 days, with a mean of 52 days. A comparison of mating period with the 1982 lambing performance indicates that farmers using mating periods of between 34 and 43 days were not disadvantaged in terms of the percentage of lambs docked ($P = 0.351$) (Table 5.3). All of the short duration matings commenced after April 1.

Table 5.3 COMPARISON OF 1982 LAMBING PERFORMANCE WITH DURATION OF PREVIOUS MATING

Mating Period	No. of Farms	1982 Lambing Percentage
34 - 42 days	5	108.4 ± 3.6
43 - 52 days	12	98.0 ± 4.7
53 - 90 days	13	99.7 ± 12.1

(ANOVA, P = 0.351)

5.2.6 IDENTIFICATION OF EWES AT MATING

Tupping crayons were used to identify the time of mating on 9 farms. Generally, crayons were introduced either for the second or third cycles and only one colour was used.

More than one colour change was made on two farms, with the most intensive use involving 3 changes at days 9, 17 and 34 of mating. In the latter case this was to conserve feed at lambing (by delaying set stocking of each group until 1-3 days before lambing) and at tupping (by restricting feed intakes of ewes already mated).

Other reasons for marking ewes at mating included identification of late or barren ewes for culling, better utilisation of labour in the spring, and to assist with recording of single-sire matings.

Several farmers mentioned short-comings of ram harnesses in hill country. The most frequent criticism was that with irregular checking of paddocks, a ram with a broken harness, worn-out crayon or physical disability due to rubbing under the brisket and front legs, was often not detected for several days. Catching rams to check and change crayons was very difficult and time-consuming where there were no holding paddocks or yards nearby.

Three farmers, all of whom had recently purchased their farms, indicated that they would like to use ram harnesses but the expense of fitting 20 to 40 rams was prohibitive.

5.2.7 HOGGET MATING

Ewe hoggets were mated on 6 farms in 1982, in 2 cases for the first time. A number of farmers indicated they had tried and discontinued the practice, because of poor returns, extra work or lower two tooth tupping weights.

5.2.8 CONCLUSIONS

The 1983 season posed serious problems on most of Wangaehu and Bideford district farms for flushing ewes, with 50% of the farmers expressing dissatisfaction with the flushing period. The 1983 lambing was likely to be worse than that recorded in 1981 because ewe liveweights were declining at the time of joining on most farms except those in the Ihuraua area. The broad principles of an increasing plane of nutrition and the importance of bodyweight at mating appeared to be understood by all farmers, but there were few instances in 1983 of management strategies to overcome the effects of dry conditions. For the majority of farmers, grazing management was the same as previous years except where a change was forced by a serious feed shortage or water supply problem. Twenty five farmers said that they did not intend to change flushing management in 1984. This is surprising considering that in many cases these systems appeared to fail in 1983.

Many of the problems of flushing management relate to inadequate research on the practical aspects of summer-autumn management. The work by Smith et al (1983) is of considerable importance because it provides some information on the minimum flushing period, length of carry-over effects and the feeding levels required. For example, commencing flushing at 3 weeks rather than 6 weeks prior to mating when green pasture is limited would, for a lesser amount of feed consumed, result in a higher lambing performance.

The research evidence, the pattern of mating obtained on the farm which adopted a February mating in 1983, and the significant difference between flocks mated before and after April 1 in terms of their 1982 lambing percentage all indicate that the optimum time for joining ewes in the survey area is likely to be between April 1 and April 15. Mating at this time should result in a first cycle conception rate of at least 80% in ewes which are heavier than 45 kg at joining, fewer returns to service and a lower proportion of barren ewes (Armstrong et al 1980, Allison and Kelly 1978).

By obtaining a high conception rate in the first cycle, mating can be reduced to 42 days or less without affecting lambing percentage. It would provide considerable advantage to winter and spring grazing management and would reduce the variation in lamb size and age, providing greater flexibility in the choice of weaning dates.

Further increases in lambing percentages on all the farms surveyed could be expected if static ewe liveweights were increased, as only one of the farms approached the mean ewe liveweight where responses in ovulation rates in some experiments have been shown to taper off (Allison 1968, Allison and Kelly 1978, Rattray et al 1983).

5.3 SPRING MANAGEMENT

5.3.1 FEEDING LEVELS POST-LAMBING TO WEANING

The attainment of two-tooth mating weights of 50 - 55 kg on hill country properties is frequently hindered by low lamb growth rates from lambing until weaning (Desmond 1983). An inadequate level of herbage to sustain high levels of ewe milk production in the first six weeks of lactation and to meet the increasing requirements of lambs, can easily lead to lamb weaning liveweight differences of more than 5 kg (Milligan 1982). The pattern of pasture production, particularly in low summer rainfall areas, means that this liveweight is unlikely to be caught up by two tooth mating time.

Ewes should be provided high levels of feeding before peak milk production is reached (2-3 weeks after lambing) to maintain high lamb growth rates (Geenty 1983). A pre-grazing herbage level of 2000 kg DM/ha under rotational grazing has been suggested by Geenty (1983) in order to attain high lamb growth rates. On the other hand, McEwen et al (1983) achieved high lamb growth rates under set stocking at a mean herbage mass of 900 kg DM/ha.

Farmers often observe that lambs born up to a month after the commencement of lambing have weaned at similar or better weights than earlier born lambs. Three lambing dates; September 8 and 21 and October 6 were compared at

Woodlands in Southland (McEwen 1983). The corresponding RDM in the first 6 weeks of lactation were 401, 750 and 1180 kg DM/ha. Later born lambs grew significantly faster during the first six weeks of lactation and by weaning on January 5, no significant effect of date of lambing on lamb liveweight was evident. Rattray et al (1975) recorded higher lamb growth rates in the first month of lactation at an average lambing date of October 1 compared to September 1.

The level of pasture required to obtain high lamb growth rates has important implications for management subsequent to weaning. Lax grazing at the levels suggested by Geenty (1983) is likely to result in early loss of pasture control and an associated decline in herbage quality. The lower level reported by McEwen et al (1983) has greater practical application.

5.3.2 SURVEY RESULTS

Pasture Height at Lambing

Half of the survey farmers indicated that they usually lambed ewes onto pastures which were between 0 and 2.5 cm in length (400-650 kg DM/ha) (Table 5.3). Only four farmers had pasture levels at lambing that would provide for high lamb growth rates ($>$ 5.0 cm or approximately 1000 kg DM/ha). Although autumn ewe lamb liveweights were highest on the properties with the most feed on offer to ewes at lambing, insufficient information was obtained to enable the relative importance of pasture cover at lambing in 1982 to be established. Differences in winter stocking rate and commencement date of lambing between farms grouped according to pasture height were small.

Table 5.4 LENGTH OF PASTURES AT THE COMMENCEMENT OF LAMBING IN 1982

Average Pasture height (cm)	Est. pasture cover (kgDM/ha)	No. of Farms	Average Lambing Date	Average Winter SR (SU/ha)	Average Autumn ewe lamb wgt. (kg)
0 - 2.5	400 - 650	15	4 Sept.	11.0 ± 0.5	31.1±1.3(n=13)
3 - 5.0	700 - 1000	11	24 Aug.*	11.6 ± 0.6	28.0±1.5(n=10)
> 5.0	> 1000	4	4 Sept.	11.4 ± 1.0	33.1±2.2(n=4)

* Excludes February mating

Grazing Management Prior to Weaning

Three farmers rotationally grazed ewes and lambs prior to weaning in some years, and not always with the entire ewe flock involved. Each of the farmers concerned gave separate reasons for adopting this practice - pasture control, a MAF trial comparing set stocking and rotational grazing management, and provision of fresh pasture for ewes and lambs.

Docking

The late completion of docking, either because of a wide lambing spread, unsuitable weather or inadequate labour, can contribute to poor late spring/early summer management. This tends to occur because attention is focussed on completing stockwork rather than pasture control. For example, if ewes and lambs are mobbed together and docking is delayed for several days because of rain or some other reason, pasture cover can rapidly increase on the spelled paddocks, and pasture control may be lost from this point.

Docking was completed prior to October 15 on half the farms in 1982. Two farmers did not complete docking until November. Both these cases related to single labour unit properties with above average SU/labour unit.

In one instance, docking was completed later than in previous years. On the majority of farms docking was normally completed at a similar time to that of 1982.

It therefore seems unlikely that docking contributes to difficulties in controlling spring pasture growth in most years in the survey area, especially in view of the low average pasture cover on most of the farms at the commencement of lambing.

5.3.3 CONCLUSIONS

The major feature of spring management was the poor pasture cover at lambing on most of the survey farms. This is of concern because of its likely effect on lamb growth rates up to the time of weaning. Although few details were collected, the results suggest that winter and spring management fails to make sufficient provision for feed during the critical first six weeks of lactation. A follow-up mail questionnaire seeking more detailed information about winter and spring management was therefore sent out in August 1983 (See Chapter 11).

CHAPTER SIX

SHEEP MANAGEMENT

6.0 CHAPTER OUTLINE

Parts of the questionnaire were designed to provide an overall view of management practices and problems rather than information related to specific classes of stock. The information presented in this chapter falls into the former category and provides background material for the ensuing chapter in which the management of respective age groups of sheep are discussed in detail.

The frequency of stock weighing and its application to management is discussed in the opening section. The philosophy of monitoring as part of the management control process outlined in Section 1.2.1 is expounded further in relation to weighing and condition scoring.

Prior to the survey, a Wairarapa farm management consultant suggested that sheep diseases such as salmonella and ryegrass staggers were potentially serious problems affecting management during the weaning to tupping period. The results of a series of questions to quantify the seriousness and frequency of sheep and cattle diseases in the survey area make up the second section of this chapter.

This is followed by details of the survey farmers' drenching programmes. Most drenching on sheep farms occurs during the weaning to tupping period. Incorrect drenching procedures during this time can affect animal productivity (Sykes and Poppi 1982, Thompson et al 1982), and increase expenditure unnecessarily. The drenching practices on the survey farms are compared with published recommendations, and methods by which drenching could be made more effective are suggested.

In the following section shearing practices during the 1982/83 season are outlined. Alternative shearing arrangements which could improve the pattern of labour/ feed requirements are presented.

The concluding section presents a description of sheep selling policies during the weaning-tupping period for the 1982/83 season.

6.1 STOCK WEIGHING

Details of the frequency of livestock weighing, classes weighed, awareness of target liveweights and management applications of liveweight information were obtained from the survey farmers. Farmers who did not weigh were asked to give their reasons for not doing so, and to explain their alternative method of assessing sheep liveweight. These results and a review of related literature is presented in this section.

6.1.1 LITERATURE REVIEW

Sheep Weighing

Weighing provides objective animal performance information, but short term changes in liveweight can give misleading impressions of actual carcass weight. For example, gut contents alone can constitute 12-23% of animal liveweight depending on the type of diet, water consumption, grazing duration and to a lesser extent age (Hughes 1976). Fasting prior to weighing can reduce this variation (Taylor 1954, Hughes 1976). A single weighing can provide similar accuracy to several weighings of the same animals over a number of days, particularly if the sample size is increased (Hughes 1976).

Other than the review article by Hughes (1976) there is a noticeable absence of New Zealand literature concerning the collection and application of liveweight data at a farm level. Considering the heavy emphasis placed on the importance of liveweight by agricultural extension services this is surprising. It seems likely that problems relating to variation in gut fill, changes in physiological status and sampling method, would be frequently encountered when weighing livestock under commercial farm conditions. A set of standardised procedures and correction factors could be of considerable use to farmers, as well as to researchers who rely on farm records as a source of data.

Condition Scoring of Sheep

Assessing the body condition or "the ratio of the amount of fat to the amount of non-fatty matter in the body of the living animal" (Murray 1919) is an alternative to weighing. In 1961 Jefferies developed a 0 to 5 scoring system (very thin to very fat) for Australian pastoral conditions. This was evaluated by Everitt (1962) and later tested in Britain (Russel et al 1969) where it became a widely recommended management aid. Milligan and Broadbent (1974) tested condition scoring as a prediction of lambing performance under New Zealand conditions and found that scores "generally reflected variations in liveweight."

Condition scoring is an easily acquired skill which requires no equipment (M.L.C. 1975). Problems with differences in size and skeletal shape of ewes are reduced and in circumstances where liveweights are difficult to interpret, such as in late pregnancy, the condition score system offers advantages. The main disadvantages are that it is subjective and based on discrete rather than continuous measurement although half-point differences can be detected (Jefferies 1961).

Condition scoring could therefore be used in conjunction with weighing as a guide to management and to reduce the number of weighings, particularly in mature stock. Thus, ewes could be weighed at weaning and mating only and at other times of the year a condition score could be recorded.

Discussion

Recording the condition score or liveweight of animals assists management control by providing information by which previous management decisions can be evaluated and future directions can be determined. Very few farmers are capable of consistently and accurately determining animal liveweights by eye appraisal. This is especially true of woolly sheep. Similarly, unless a ewe with more than 2.0 cm of wool is physically handled to determine body condition, eye appraisal alone is likely to be misleading.

The issue of weighing is sometimes confused by the fact that some farmers who do not weigh have sheep of similar or better weights than their counterparts. It is not clear whether these farmers could have had even heavier sheep by weighing or whether they could have reached their current sheep liveweights more rapidly through a programme of objective liveweight monitoring.

Monitoring liveweights/condition scores enables the current position of livestock relative to planned expectation and to previous seasons to be determined. More rational decisions on whether to change feeding priorities or selling dates of stock, for example, are then possible. This should ensure that management objectives have a greater chance of being realised. In general, this information is likely to be of greater value on properties where a high level of pasture utilisation is being achieved.

Liveweight or condition score information supports management decision making. Data should therefore be recorded at strategic intervals so that it can be used for forward planning as well as evaluation of past management strategies. The extent and the effectiveness of information usage will depend on the individual farm manager. It has already been noted that some farmers require no or minor amounts of objective information to obtain high levels of performance (See Section 1.2.1).

The benefits of weighing/condition scoring ultimately are measured by whether or not the additional information has improved financial returns. The costs are simpler to calculate and fall into two categories; labour and equipment. A break-even analysis for a hill country farmer using a moderately intensive weighing programme indicates that ewe liveweights would need to increase by only 0.29 kg, relative to no-weighing, to have met costs in 1983 (Table 6.1). Alternatively, weighing can benefit the farmer by preventing weight losses.

This discussion is equally applicable to the monitoring of pasture, soil fertility, rainfall and temperature, faecal worm burdens, financial transactions or any other part of the farming system.

Table 6.1 BREAK-EVEN ANALYSIS FOR SHEEP WEIGHING

ASSUMPTIONS

Farm: 300 ha moderate to steep hill country (291 ha eff)
Labour: Owner operated.
Stock wintered: 2500 two tooth and MA ewes (2550 mated)
900 ewe hoggets
200 other sheep
50 R1 year steers
of 3490 SU (12.0 SU/eff ha).

Scales - purchase price $714.
Weighing procedure - 50 sheep per weighing. Coincide weighing with normal stock operations wherever possible (e.g. shearing, drenching, crutching).
Liveweight responses - For every 1 kg gain in mean static ewe liveweight at mating 2.5% higher lambing is achieved, of which 97% survive to sale (See Section 5.1.1). If hoggets are selected by liveweight, greasy fleeceweight production can be expected to increase by 0.2 kg/ewe/year for every 1 kg increase in ewe static liveweight (Blair 1984 pers. comm.)

Livestock returns - $17.50 net/lamb and $2.90 kg/wool (net).

COSTS

1. Equipment

(a) Opportunity cost of money invested in scales at 10% interest rate	$71.40
(b) Depreciation (10%)	71.40
(c) Repairs and maintenance	20.00

2. Labour

Ewe lambs - 6 weighings @ 1 hour/weighing
Two tooths - 5 weighings @ 1.5 hours/weighing
MA ewes - 4 weighings @ 1.5 hours/weighing

Total labour required = 19.5 hours @ $10/hour	$195.00
	$357.80

BENEFITS - for 1 kg increase in ewe static liveweight.

1. Extra lambs sold - 2550 ewes x 2.5% x 97% = 62 lambs; 62 lambs @ $17.50	$1085.00
2. Extra wool 2500 ewes x 0.02 kg/ewe x $2.90/kg	145.00
	$1230.00

NET BENEFIT

For every 1 kg increase in ewe liveweight $ 872.20

Alternatively; - a 0.29 kg increase in ewe liveweight is required to break even;
Or - the farmer could afford to pay $54.73/hour for labour.

6.1.2 SURVEY RESULTS

Number of Farmers Weighing and Frequency of Weighing

In the 1981/82 season, 18 of the survey farmers weighed ewes and lambs, while 1 farmer weighed two tooths only. The majority of these farmers used their own set of scales (10), but some relied on MAF (5) or shared equipment with neighbours(4).

Generally, weighing was infrequent with 6 farmers weighing ewes once annually at tupping. Weighing at intervals of between one and two months was practised by 5 farmers, while the remainder weighed at intervals lying between these two extremes. As expected, farmers with their own scales weighed more frequently than those who had to cooperate with the MAF or neighbours.

Awareness of Liveweight Targets

Awareness of autumn liveweight targets was considerably greater than spring targets (Table 6.2). This reflects the emphasis which has tended to be placed on flushing and mating management. A low proportion of farmers were able to specify a target ewe lamb weaning weight. Similarly, only half of the farmers identified a target weaning weight for MA ewes.

Generally, farmers with heavier MA ewes tended to have higher target weights for younger classes of stock. No information was collected to determine whether these had been revised upwards as sheep performance improved. In the instances where target liveweights were specified for each age group, a realistic pattern of liveweight gain between target weighings was possible. This could be expected, since farmers that are aware of the various age target weights, are also likely to know the levels of

Table 6.2 SHEEP TARGET LIVEWEIGHTS ON THE SURVEY FARMS

Liveweight	Ewe Lambs		Ewe hgts/Two tooths		Ewes	
(kg)	Weaning	April 1	Spring Shearing	Mating	Weaning	Mating
20	1					
21						
22	1					
23						
24						
25	2					
26						
27						
28	2					
29						
30		1				
31						
32						
33		3				
34						
35		6				
36						
37		2				
38		2				
39						
40			2			
41						
42			1			
43						
44			1		1	
45			6			
46						
47						
48					1	
49						
50				2	5	
51						
52					1	
53						
54						
55				11		7
56				1		
57						
58						1
59						
60				2	1	6
60+						1
No. of farmers	6	14	10	16	9	15

liveweight gains which are possible at different times of the year.

Usefulness of Weighing

All of the farmers weighing sheep agreed that it was a useful management aid. A sample of farmer comments reflects how the liveweight data was used:

"Over a period of years you know whether you are improving or not."

"Gives something to aim at; enables comparisons - only way of really knowing what is happening."

"Guide to progress. Confirms eye appraisal. Very important for a young farmer starting off. Makes you 'toe-the-line' and become more aware. Set more targets which you try to achieve."

"Management check; indicates need for action if behind target."

The common theme was that weighing provided an objective assessment of management progress, a standard against which farm performance could be compared. If weights improved over time or were attained, management decisions were confirmed. The failure to reach target liveweights indicated that there was room for improvement. It was generally agreed that visual assessment was inadequate and was often misleading:

"You can get trapped into believing sheep are doing well, where in fact sheep are losing body weight, but this is masked by wool growth."

One farmer weighing for the first time in 1983 commented: "Weighing has shown that visual assessment is not as good as I thought."

Farmers not Weighing Sheep

Sheep were not weighed on 11 of the survey farms. The alternative method used was to assess liveweight by eye; in 2 cases this was supplemented with additional information gained by hand assessment of condition when sheep were yarded for operations such as drenching and shearing.

Except for 2 farmers who considered their sheep could not be fed better anyway - a fair comment in one case - reasons for not weighing ranged from "having a better alternative" to "not keen enough."

Non-weighing farmers' comments are essentially reflected in the following:

"Ewes are shifted often - if you can't see your ewes going forwards/backwards in condition something is wrong. If there was a 10% gain in lambing I would do it."

"There are higher priorities than weighing. I assess condition by feel at crutching and shearing."

Weighing of Cattle

Cattle were weighed on 4 properties. In one instance weighing provided the basis for the spring selling policy, but in the other cases cattle were weighed occasionally mainly for interest.

6.1.3 CONCLUSIONS

The proportion of farmers weighing sheep was surprisingly high and may be due in part to the long term and wide influence of the Wairarapa Farm Improvement Club and MAF farm advisory officers in the survey area. Weighing as a management aid therefore had a high level of acceptance in the survey farming community. However the generally poor knowledge of target liveweights, particularly for the spring period, and the low frequency of weighing suggests that a continued extension effort is required if weighing is to usefully contribute to management rather than simply being a means of satisfying curiosity. In particular, heavy emphasis should be placed on gaining liveweight information for hoggets at spring shearing and ewes and lambs at weaning. This will provide sufficient time for management adjustments to be made and hence improve the chances of reaching target autumn liveweights. Single autumn or unplanned occasional weighing primarily indicates whether or not management decisions were correct, but provide little opportunity for adjustment.

Some farmers not weighing had a misconception of the role of weighing in management, either by directly linking it to an increase in performance or to the amount of pasture sheep consume. Both of these factors may be altered as an indirect result of weighing - liveweights by themselves only provide objective information which can be incorporated into management decision-making. Again, farmer education on the use of liveweight data is required.

A large number of weighing systems were used. As discussed in Section 6.1.1, standardisation of procedures both within and between farms would likely increase the usefulness of liveweight data for management purposes.

6.2 ANIMAL HEALTH

6.2.1 SHEEP DISEASES

Survey respondents were asked to rank a prescribed list of sheep diseases according to seriousness and frequency of occurrence during the weaning to tupping period (Table 6.3). Internal parasite problems in sheep were considered as a separate topic (see Section 6.3).

The most serious and frequent sheep health problem encountered was flystrike. This mainly occurred in lambs during late October to January. The problem became more serious if warm humid weather was experienced. Treatment and/or prevention was by early shearing, fly crutching or to a lesser extent dipping. On some farms, lambs were treated for flystrike at docking to provide protection through to shearing.

Footrot received a high seriousness ranking and frequency ranking. The traditional practice of paring hooves, now relatively uncommon on the survey farms, has been replaced by the use of footbaths and heavy culling of affected sheep. Loss of liveweight in affected sheep was mentioned as being the most serious symptom of the disease during the weaning to tupping period.

Ryegrass staggers caused serious disruption to grazing management by breaking rotations on 12 properties. Farms in the lower Wangaehu and Bideford were most seriously affected. There were basically two approaches to treating the disease. One was to set stock those worst affected, generally lambs, in paddocks with no streams, steep broken slopes or other potential death traps. The second approach was to put the stock on a

Table 6.3 SHEEP DISEASE PROBLEMS AND FREQUENCY OF OCCURRENCE IN THE SURVEY AREA

Disease	Seriousness			Frequency of Occurrence			
	Mean Score	Ranking	Ranked Very serious (no. of farmers	Every Year	Every Other Year	Every Two Years Plus	No Problem
Footrot	3.8	3	0	21	2	2	5
Scabby mouth	4.3	6	1	4	4	7	15
Ryegrass staggers	3.8	3	1	13	5	3	9
Facial eczema	5.0	8	0	-	-	5	25
Fly strike	3.3	1	2	27	1	1	1
Teeth health	4.0	5	2	15	1	1	13
Salmonella	3.7	2	2	7	2	10	11
Pink eye	4.3	6	0	7	3	9	11

quick rotation when the symptoms were first noted.[1] Several farmers had observed that sheep were more seriously affected in some paddocks than others and attempted to graze these preferentially. One farmer used a summer crop as a safe area for grazing lambs.

Pinkeye, while not ranked highly for seriousness affected rotational grazing management, particularly if pastures were rank and conditions were dusty. The usual remedy was to stop rotating the affected class of stock and set stock until the infection cleared.

Salmonella was ranked the second most serious sheep disease. The major difficulty was that very high losses could quickly occur before preventative vaccinations could be administered. The first reaction to an outbreak was usually to spread out those stock that had been on a rotation. This could seriously disrupt grazing management and result in the depletion of saved pasture. Thirteen farmers vaccinated two tooths for salmonella annually. Other precautions included minimising yarding of sheep and maintaining as clean a water supply as possible.

There is widespread interest in teeth wear problems in the Wairarapa stemming from local research work

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1. The endophyte neurotoxins in ryegrass which causes ryegrass staggers are primarily associated with the leaf sheath (Keogh 1983). Therefore grazing management which avoids grazing this portion of the plant, such as a fast rotation to leave a high residual, should be adopted. The encouragement of white clover to lessen ryegrass dominance during the summer months will also assist. Both these recommendations are compatible with the principles of good summer management (Keogh 1983) (See Section 4.0)

(Bruere et al 1979, Bruere and West, 1983). One of the Wangaehu survey farms had been used as a case study. Teeth problems were ranked as being very serious by two farmers. In both cases stocking rates were higher than the district averages and close grazing of pastures occurred during most of the year.

Salmonella, ryegrass staggers and pink eye therefore posed the most serious threats to management during the weaning to tupping period, particularly if sheep were in large mobs for rotational grazing purposes during the summer. However, few farmers regarded sheep health problems as being very serious and most had taken some steps to prevent outbreaks occurring through extra care with management or vaccinating.

6.2.2 CATTLE DISEASES

This section of the questionnaire was completed by 20 farmers. In general, health problems with cattle were minor and most of the listed diseases received a low seriousness and frequency rating for the October to April period (Table 6.4).

Ryegrass staggers was the most serious cattle health problem, but worms were the most common problem. Four of the five farmers experiencing annual outbreaks of grass staggers were located in the Wangaehu-Bideford districts. Treatment mainly involved minimal disturbance of stock.

None of the farmers identified any disease effects on cattle management during the October to April period.

Table 6.4 FREQUENCY OF OCCURRENCE AND SERIOUSNESS OF CATTLE DISEASES

Disease	Seriousness			Frequency			
	No. of Farmers	Mean Score	Rank-ing	Every Year	Every Two Years	Every Three Years	No Prob-lem
Facial eczema	20	5.00	4	-	-	5	15
Grass staggers	20	3.55	1	5	-	7	8
Bloat	20	4.95	3	-	-	6	14
Worms	20	4.10	2	12	-	-	8
Other: Cancerous eye Pinkeye Lice	20	-	5	3	-	-	17

6.3 DRENCHING PRACTICES

In this section the 1982/83 weaning-tupping drenching programmes of the survey farmers are outlined. These are compared with published recommendations (Brunsdon and Adam 1975, Ross 1982) and conclusions are drawn as to the scope for improving drenching regimes on the survey farms. The literature review is restricted to a discussion of faecal egg counting as a means of improving internal parasite control. Other references consulted are listed in Appendix A.

6.3.1 LITERATURE REVIEW

Monitoring Worm Burdens

Monitoring the level of internal parasite infection provides two potential advantages. First, the optimum time and frequency of drenching can be determined and secondly, the effectiveness of control measures already taken can be evaluated. There is evidence on commercial farms that "good drench can be thrown after bad," despite recommended drenching programmes being followed (Bruere 1984 pers. comm.)

The level of infestation in sheep, especially in young animals, can be estimated by faecal egg counts (Whitlock 1959, Kingsbury 1965, McKenna 1981), but in cattle the correlation between faecal egg counts and size of worm burden is poor (McKenna 1981). An indication of parasite contamination can also be obtained from herbage samples (Black 1959).

McKenna (1981) concluded that, provided sufficient samples were analysed and the results were interpreted according to the concept of "low" "moderate" and "high" levels of infection, "useful and reasonable deduction" could be made about the "level and likely pathogenicity of the worm infections in the flock." Any diagnosis should always be considered in relation to the previous management of the flock and any clinical signs of infections.

6.3.2 DRENCHING PROGRAMMES ON THE SURVEY FARMS

Lambs

Post-weaning lamb drenching programmes in the 1982/83 season are summarised in Table 6.5. The 5 drench preventative programme (Brunsdon and Vlassoff 1982) and variations of this were most common.

Table 6.5 POST-WEANING LAMB DRENCHING PROGRAMMES 1982/83

Programme	No. of Farms
(1) Every 3 weeks	1
(2) Every month	10
(3) Every 6 weeks	5
(4) 3 x 21 days plus 2 x 28 days (5 drench)	8
(5) Other - 2 x 21 days plus monthly	2
- 1 x 2 weeks plus 2 x 6 weeks	1
- 3 x 21 days plus 2 autumn drenches	1
- wether lambs 2 autumn drenches; ewe lambs 1 May drench	1
- 2 weeks after weaning then every 4-5 weeks	1

The lamb drenching programme was changed in 1982/83 from previous years on 16 properties. Nine of the changes involved more frequent drenching and most commonly involved the 5 drench programme or a variation of it. The small sample size prevents definitive conclusions being drawn on ewe lamb liveweights or carcass weights relative to drenching programmes.

Ewes

The number of farmers drenching ewes at weaning and/or pre-tupping is summarised in Table 6.6. Eight farmers drenched ewes between weaning and tupping, but in all but one instance, this only involved a proportion of the flock such as low-condition or older ewes.

Table 6.6 EWE DRENCHING AT WEANING AND PRE-TUPPING IN 1982/83

		Drench prior to tupping No	Yes	
Drench at weaning	No	16	7	23
	Yes	2	5	7
		18	12	30

The ewe drenching programme was different from previous years for 8 farms during the 1982/83 season. In 6 instances this involved more frequent drenching.

The emphasis in ewe drenching programmes was in two main areas; to improve ewe condition and to prevent accumulation of dags. No details on the grazing management practices associated with ewe drenching, or the information upon which farmers based their decisions on whether to drench were collected.

Cattle

All but one of the 17 farmers with breeding cows drenched calves at weaning in 1983. Bought-in weaners were drenched by 5 farmers. No other cattle were drenched during the October-April period.

6.3.3 DISCUSSION

The wide range of drenching practices on the 30 farms surveyed is in agreement with the larger scale surveys of Brunsdon (1982) and Kettle *et al* (1981). This is demonstrated by the variations of the 5 drench preventative programme for lambs (Brunsdon and Vlassoff 1982), and the different drenching practices used prior to weaning.[1] In a number of cases, divergences from the recommended drenching programmes were evident. In particular the uncoordinated time intervals between drenches and the treatment of only a proportion of stock which are subsequently grazed together, is likely to reduce the effectiveness of drenching (Thompson et al 1982, McAnulty et al 1982).

Differences in management practices and farm development, such as sheep to cattle ratio, level of subdivision or use of integrated versus preventative approaches to control, mean that a standard drenching programme between farms is unlikely to exist. However, a common philosophy on the reasons why a particular type of drench is used and its pattern of administration, could be expected. The differences (and in some cases confusion) amongst farmers may be related to alternative recommendations provided by advisors/consultants, neighbours or may have developed from personal experience (Kettle et al 1981), or the failure of researchers to understand the practicalities of day to day farm management.

The latter is well illustrated by the recommendation on the preparation of "safe" pastures for use in an integrated control programme (Nicol and Thompson 1982). Only 8 of the survey farms had some "safe" pastures prepared by hoggets and/or cattle for lambs by weaning (Section 7.4.3). Although Jagger (1982) suggests that many farmers do not want to understand the principles of "safe" pasture preparation, the problem is complex where subdivision is limited and other pasture management objectives, such as pasture control, warrant higher priority. Also, on many properties such as those with

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[1] Prior to weaning lambs were drenched once on 12 farms and twice on 3 farms. With the exception of 2 cases this involved all lambs.

low or zero cattle numbers, the ratio of "more resistant" to "susceptable" classes of stock is insufficient for preparation of "safe" pastures.

The survey farmers had exhibited a willingness to change drenching regimes. Thus 50% of the lamb drenching programmes in 1982/83 were different to those of previous years. Similarly, 44% of the farmers drenching ewes had made changes. However, it was evident from the interviews that the reasons for adopting a particular drenching programme, or the incorporation of this into the overall management of the farm, were generally not well understood. For example, drenching of only some animals within a group on the basis of the amount of dags present or condition is unwise when stock are immediately run together again on contaminated pastures (Sykes 1982), even before considering the appropriateness of dags or stock condition as indicators of the need for drenching.

There are risks in adopting recipe-type recommendations. For example, the 5 drench programme will not necessarily reduce internal parasite problems on some farms (Bruere 1984 pers. comm.) and in other situations this number of drenches may simply not be required.

It is therefore recommended that the sheep drenching programme on individual farms be based on objective measurements, such as faecal egg counts. A faecal egg counting service is currently available to farmers through their local veterinarian (the faecal samples can be collected by the farmer). Samples should be collected prior to the due drenching date because up to a week could elapse between collection and the return of results, even if procedures are well organised (McKenna, 1984 pers. comm.)

Over time, farmers could learn to analyse faecal samples and interpret the results, in much the same manner as spore counting for faecal eczema control. This would initially require close liaison between the farmer and his veterinarian, but the cost of equipment (basically a microscope and a McMaster slide) is minimal relative to annual expenditure on drench.

The regular collection of faecal samples from the various classes of stock will enable worm burdens to be monitored and the drenching programme to be adjusted accordingly. In a dry summer this is likely to mean considerably less drenching than in wetter years, and will enable positive decisions to be made as to whether an economic response to treatment is likely (e.g. pre-tup drenching of ewes).

6.4 SHEARING POLICIES - OCTOBER TO APRIL

Shearing can be expected to have some effects on the subsequent production of sheep because the shearing process is a very stressful event involving strange environments and handling pressures (Kilgour and de Langden 1970) and because removal of the fleece causes extensive physiological changes (Wodzicka-Tomaszewska 1963). The physical and physiological responses of a sheep to shearing have been reviewed by Livingston (1983). The following literature review is therefore restricted to aspects of shearing relevant to the October to April period.

6.4.1 LITERATURE REVIEW

Ewe Shearing in Relation to Weaning Date

Although ewe shearing three to four weeks prior to weaning is likely to have only a small positive effect on weaning weights of ewes and lambs (Wickham 1984 pers. comm.), this practice does increase the flexibility of cull ewe sale dates and enables a pre-tup second shearing policy to be implemented. These advantages need to be weighed against the extra work involved in shearing ewes with relatively young lambs at foot.

The Effect of Shearing on Lamb/Hogget Production

No large or consistent benefit to various times of lamb shearing have been recorded (Wallace, cited by Wodzicka-Tomaszewska 1963, Wright et al 1982, Sumner 1984). Similarly autumn hogget shearing trials (Sumner and Dobbie 1981, Sumner et al 1982) have in general only shown short-term liveweight gains but no carry-over effects at subsequent shearings.

Lamb shearing in November/December can provide practical advantages where flystrike is a problem and weeds such as biddi-biddi occur. These must be weighed against any price discount for the shorter wool staple of early shorn lambs.

Effects of Shearing on Reproductive Performance

Pre-tup shearing of two tooths enhances flushing responses (Smeaton et al 1982) and lambing performance (McClure 1960, Wodzicka-Tomaszewska 1963, Wodzicka-Tomaszewska and Dobbie 1967). However, where there is insufficient green herbage for flushing, pre-tup shearing will depress ovulation rates (Smeaton 1983). McMillan and Knight (1982) suggest that shearing should occur 4 weeks prior to joining to obtain an increase in ewe fertility. Other trials also indicate that shearing ewes within one week of joining or during mating can depress ovulation rates (Welsh et al 1979, Sumner et al 1982). Although the latter evidence is not entirely consistent, shearing two tooths, especially, just prior to, or during, mating is probably an unwise practice.

6.4.2 SHEARING POLICIES ON THE SURVEY FARMS

Shearing Policies

Full wool (once a year) shearing policies were the most common, with only 2 farmers second shearing and 2 using eight monthly policies (Table 6.7)

Table 6.7 SHEARING POLICIES, 1980-1982 (NUMBER OF FARMS)

Class of Sheep	Shearing Policy	1980	1981	1982
MA ewes	Full wool	25	25	26
	Eight monthly	1	2	2
	Second shear	2	2	2
Two tooths	Second shear	25	26	25
(Autumn)	Not shorn	3	3	5
Number of valid farms		28	29	30

The farmers in general, were very aware of shearing costs and were looking for means of reducing them. This was the main reason why 5 farmers did not second shear maiden two tooths in autumn 1982. In each case Perendale or Perendale x Romney ewes were farmed. Their generally lower wool production (Dalton and Ackerley 1974) means that the shearing interval can be increased to 15-16 months, without encountering problems such as lower fleece quality or wool blindness.

On 24 farms, all lambs present at the time of shearing were shorn (some lambs had been sold prior to shearing on 14 farms). On the remaining 6 farms, lamb shearing policies ranged from shearing only replacement ewe lambs to shearing all lambs except late or short-woolled lambs.

Shearing Dates

Hogget, two tooth and ewe and lamb shearing dates for the 1982 year are summarised in Figures 6.1 and 6.2. Most ewe hoggets were shorn by mid-October, and again as two tooths in late February/early March. The majority of ewes were shorn in a six-week period beginning in the first week of November. Lamb shearing was concentrated in a three-week period for late November to mid-December.

Ewes were shorn more than two weeks before weaning on 12 farms - including farmers who pre-tup second shore ewes and one farmer with an eight-months shearing policy (Figure 6.3).[1] Ewes from these flocks, were no heavier on average in autumn 1983, than ewes from other flocks which were shorn closer to or after weaning (52.7 ± 2.4 kg vs 52.8 ± 0.8 kg). Advantages of early shearing of ewes mentioned by farmers included reduction in the amount of ewe dagging, fewer labour problems and increased flexibility with cull ewe selling dates.

Lambs were shorn within three or four days of weaning on the majority of farms (Figure 6.4). November shearing of lambs was practised on 7 farms mainly to reduce fly-strike problems.

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[1] Farm 20 is not shown in Figures 6.2 and 6.3. Ewes were shorn on 13/8/82 (eight monthly) and lambs on 15/11/82 at weaning.

Figure 6.1 EWE HOGGET AND TWO TOOTH SHEARING DATES 1982

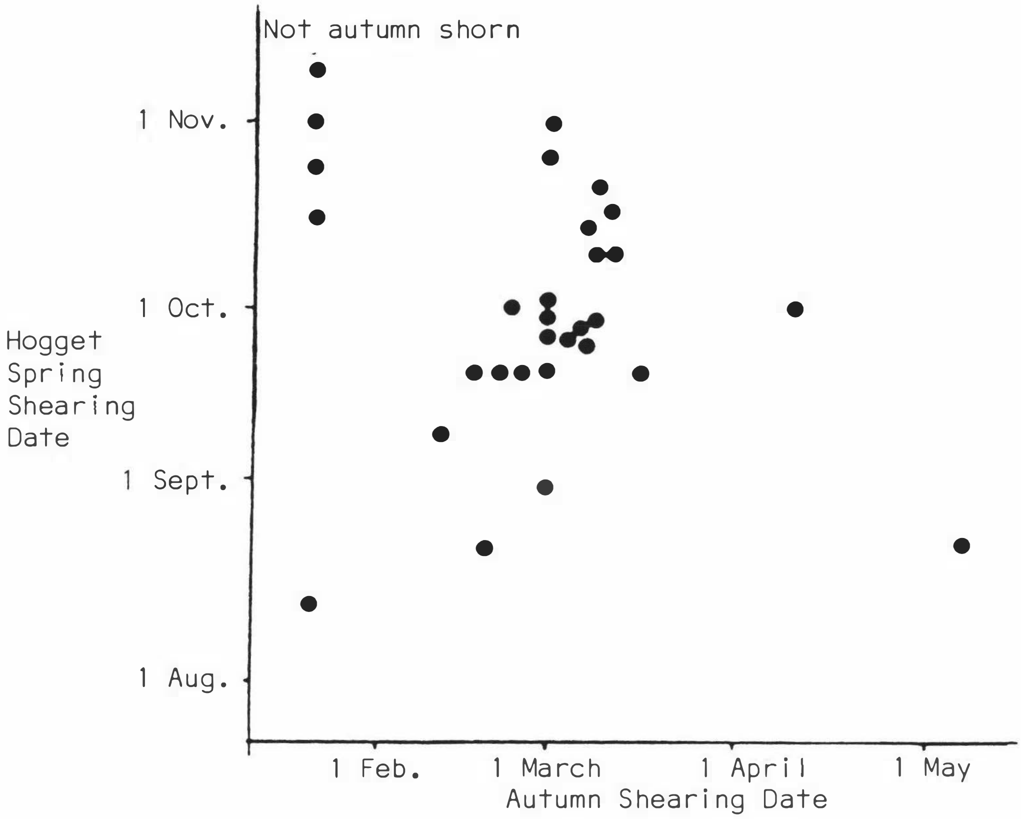


Figure 6.2 EWE AND LAMB SHEARING DATES 1982/83[1] (● = Full Wool, ○ = Second Shear, ◆ = Eight monthly).

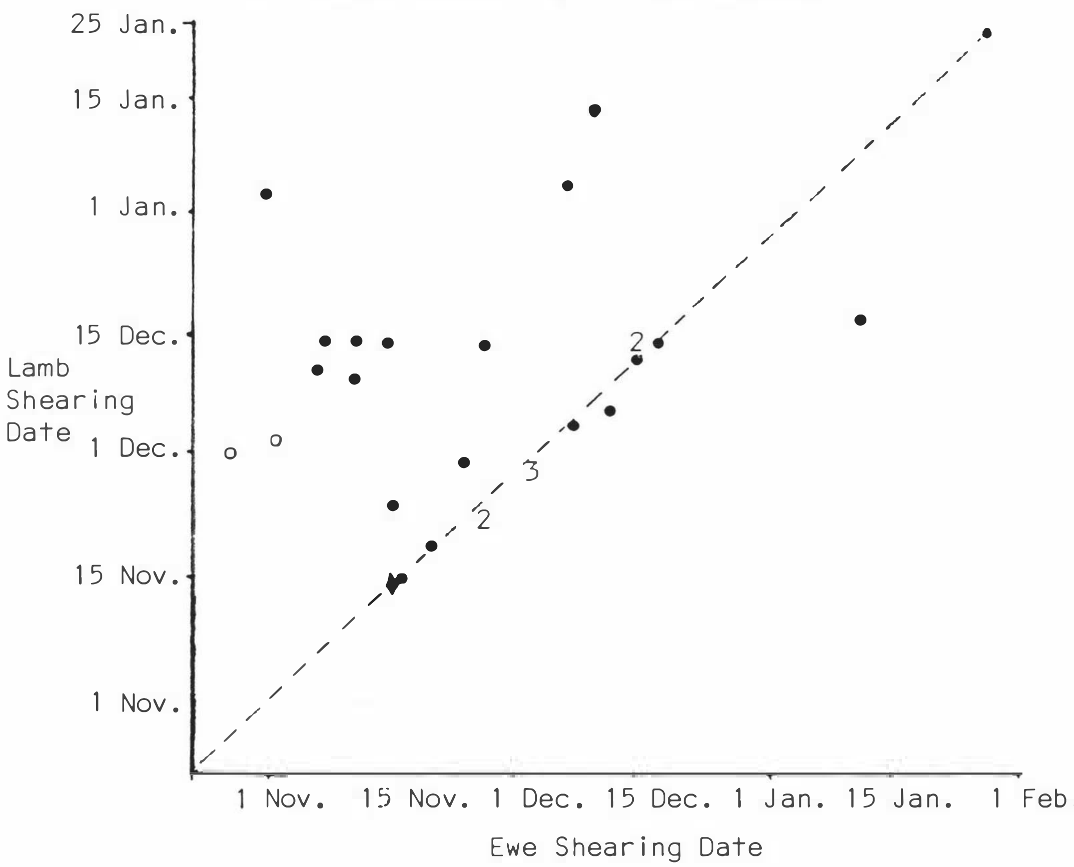


Figure 6.3 EWE SHEARING AND LAMB WEANING DATES 1982/83 (● = Full Wool, ○ = Second Shear, ◆ = Eight monthly).

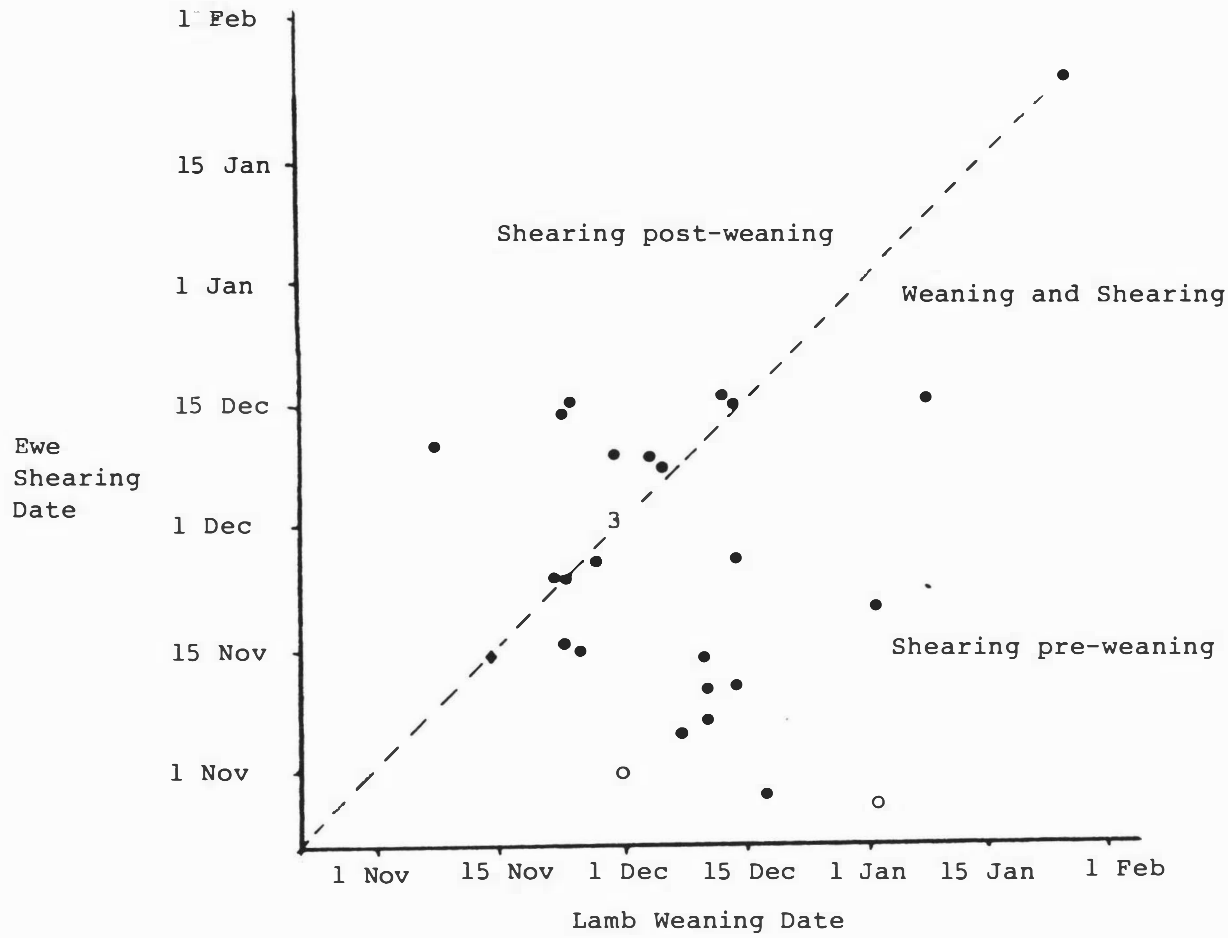
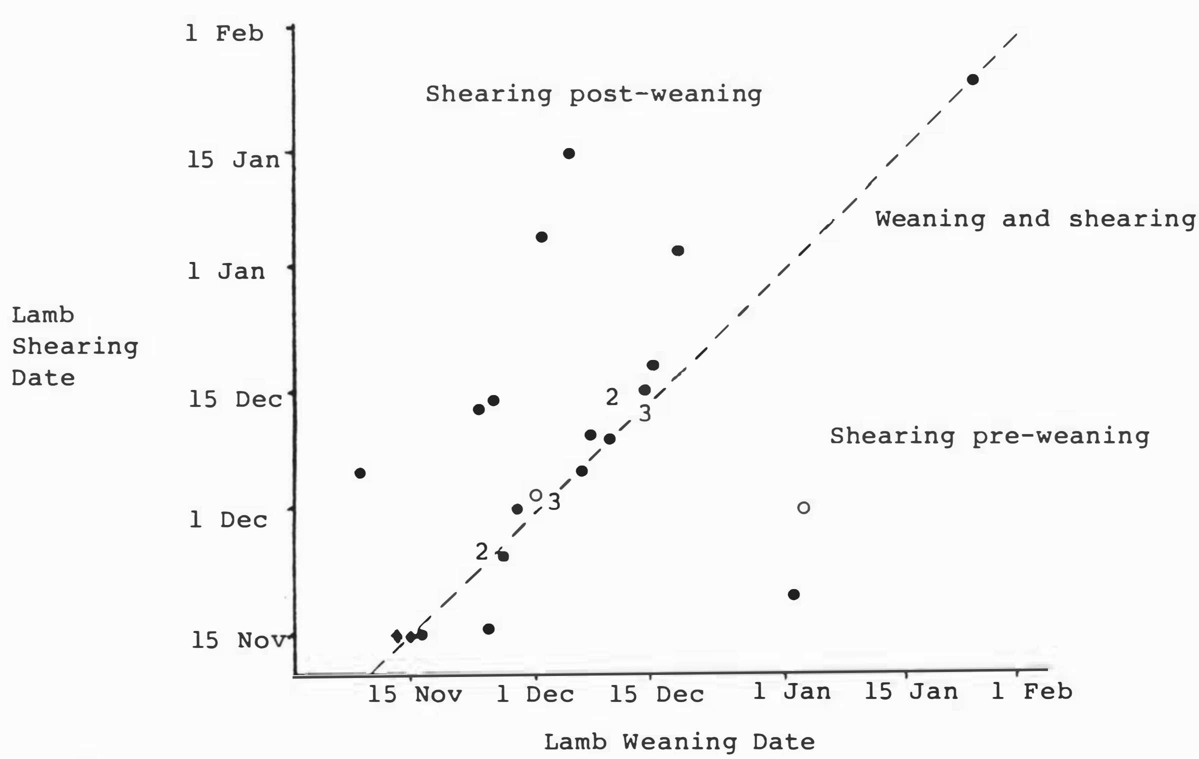


Figure 6.4 LAMB SHEARING AND WEANING DATES 1982/83



6.4.3 DISCUSSION

Reports in the literature indicate possible advantages pertaining to spring shearing of ewes as being: improved pasture control, higher wool quality and small increases in ewe liveweights and lamb growth rates. These have to be weighed against the practical difficulties associated with ewe shearing prior to lamb weaning.

A compromise system of shearing ewes when lambs are weaned at 8 to 10 weeks of age could therefore be worthwhile. Lamb shearing could be delayed until later in the summer, spreading the workload and improving wool staple length. However, fly-crutching and dipping for flystrike protection at weaning would be necessary on most of the survey properties if this policy was adopted.

The survey results indicated that all except 2 of the farmers shore two tooths at a time which is likely to give maximum responses in fertility. On the 5 farms where two tooths were not shorn, no disadvantage in the 1983 season is likely to have occurred because of the dry conditions and absence of flushing feed. Providing there are no financial restrictions, such 15 month two tooth shearing policies (hogget to main shear) are likely to offer advantages in dry summers by conserving feed, as well as reducing shearing costs. Shorter wool stapled breeds such as Perendales would be particularly well suited to this policy. Alternatively, replacement ewe lambs could be first shorn in April/May and subsequently at the same time as older full wool ewes. This policy would also eliminate pre-tup shearing of two tooths.

6.5 SHEEP SELLING POLICIES

6.5.1 INTRODUCTION

Stock selling policies are an important determinant of total animal feed demand. Thus the timing of stock sales can be expected to influence overall productivity, especially where competition for feed exists.

The impact of alternative lamb and ewe selling policies on average pasture cover during the weaning to tupping period were investigated using a simple feed budgeting model. Riverside, was used as a case farm (Parker 1983). Three alternatives were compared:

1. Actual sales and monthly stock numbers from October to April for the 1982/83 season.
2. Sale of all cull ewes by the end of January.
3. Sale of all except 200 wether lambs as stores on December 1 and all cull ewes by the end of January.

Stock numbers for the base situation are summarised in Table 6.8. Except for the changes specified, stock numbers and feed requirements remained the same for each option. The average monthly pasture growth rates for Riverside presented in Table 3.4 were used. It was assumed that pasture growth could be transferred over any period of time without deterioration in quality. Animal feed requirements, based on data summarised by Milligan (1981), are shown in Table 6.8. Lambs were weaned on December 1.

The feed budgets indicated that selling all cull ewes by January 31 rather than mid-April increased average pasture cover during the summer by a small amount. Average pasture cover changes for alternatives 1 and 2 were therefore similar, reaching a peak of 2500 kg DM/ha in December and declining to 700-800 kg DM/ha by May.

Table 6.8 SIMPLE FEED BUDGET: BASE STOCK NUMBERS AND FEED REQUIREMENTS

Month	Ewes			Hoggets/2 Tooths			Others			Ewe Lambs			Wether Lambs [3.]		
	No.[1.]	Feed Req.[2.]	Sales	No.	Feed Req.	Sales	No.	Feed Req.	Sales	No.	Feed Req.	Sales	No.	Feed Req.	Sales
October	7878	2.59	353	2493	2.0	240	225	1.5							
November	7467	3.11	200	2244	2.0		225	2.0							
December	7238	1.85		2240	2.0		223	2.0		3169	1.4	337	5437	1.4	874
January	6527	1.85	400	2240	2.0		223	2.0	43	2815	1.4		4551	1.4	1107
February	6518	0.99	76	2240	1.8	25	174	1.8	43	2815	1.6	631	3441	1.6	1954
March	6518	1.42		2214	1.8		124	1.8		2177	1.6		1483	1.6	819
April	6490	1.86	221	2213	1.8		116	1.8		2174	1.6		656	1.6	365

1. Number at beginning of month less sales and deaths.
2. Cull ewes feed at 0.99 kg DM/ewe/day from January 1.
3. Includes terminal-sired ewe lambs.

Disposal of virtually all wether lambs as stores in December resulted in pasture cover peaking at 2800 kg DM/ha in January and declining to 1700 kg DM/ha by May. In addition, but not accounted for, non-replacement lambs require high quality pasture and compete directly with replacement ewe lambs for feed. Ewes, on the other hand, can be fed at maintenance levels on poorer quality pasture if necessary.

The pattern of pasture production at Riverside is similar to that of the survey area (Section 3.1.5). Although simplistic, the feed budgets illustrate that the survey farmers could make the greatest impact on summer feed supplies by adjusting the timing of lamb sales to suit seasonal conditions. Selling cull ewes prior to the drier summer months will assist to a lesser extent, but nevertheless has considerable management advantages.

In this section details of sheep selling policies on the survey farms during the 1982/83 season are presented.

6.5.2 SHEEP SELLING POLICIES ON THE SURVEY FARMS

<u>Lamb Sales</u>

Data was collected for lamb sales made during the October to April period for the 1982/83 season only. This information is summarised in Table 6.9.

Of the estimated 128,119 lambs born on the survey farms in 1982, 55,808 (43.6%) had been sold by March 31st. Approximately 39,955 ewe and 4,500 wether lambs were to be wintered (using the same proportions as the previous season). After allowing for lamb losses (4%) it was estimated that about 18% (22,731) of the lambs born in 1982 would be sold in the period from April to June.

Table 6.9 LAMB SALES, OCTOBER TO APRIL, 1982/83 SEASON

(a) WORKS LAMBS

Month	No. of Farmers Selling	Total No. of Lambs Sold	Average Carcass Weight(kg)	Average farm Nett Price ($) *
October	1	229	14.60	21.00
November	4	3857	13.00	17.57
December	10	5491	12.82	17.81
January	16	6481	12.69	18.21
February	19	8722	12.34	17.97
March	11	4510	12.23	18.68

(b) STORE LAMBS

Month	No. of Farmers Selling	Total No. of Lambs Sold	Average farm nett Price ($) *
November	6	5878	12.37
December	8	7442	13.63
January	10	8593	13.69
February	2	1195	11.78
March	6	3410	15.61

* Average price = (average farm price/no. of farms selling). It is not a true weighted average for all lambs sold.

Lamb selling policies ranged from selling all surplus lambs as stores in November at weaning, to fattening all lambs and selling mainly on the winter and spring market. Sixteen farmers indicated that 1982/83 lamb sales were different to previous years. These differences were mostly attributable to the seasonal conditions. Thus several farmers had sold lambs, which would otherwise have been fattened, as stores in December because they thought that a dry summer was likely. Financial circumstances constrained lamb selling policies on only 4 farms.

Very few farms achieved drafts in which carcass weights averaged more than 13.0 kg; most appeared to be drafting to an average carcass weight of 12.0 - 12.5 kg. Drafting generally commenced at weaning.

Store prices were lower on average than works price, although the difference was probably greater than normal due to the depression in the store lamb market caused by the difficulties encountered nationally in selling export lamb, as well as dry summer conditions. A corresponding adjustment in schedule prices was protected by SMP payments.

Two Tooth Sales

Maiden two tooths were sold in January/February by 12 farmers. The number sold ranged from 6.7% to 35.4% of the ewe hoggets wintered (average 17.7%). These proportions indicate that two tooth sales represent a "specialist" policy on some farms and an opportunity to sell late culls or surplus breeding stock on others. There was no significant difference in average autumn liveweight on the properties where two tooths were sold (51.4 ± 1.6 kg) or were not sold (46.7 ± 1.4 kg). No information relating to spring sales of ewe hoggets was collected but at least 2 farmers had such a policy.

Ewe Sales

Barren, wet dry and/or late-lambing ewes were sold prior to weaning on 22 farms. At weaning, 7 farmers sold cull/old ewes - 4 of these shore their ewes 3-4 weeks prior to weaning. Thus cull ewes could be identified at shearing and by weaning were ready to be drafted for sale The main disadvantage of early culling is that the farm is being destocked at a time when maximum numbers are required to control pasture growth.

Cast-for-age (c.f.a.) ewes were sold on 22 farms. Most were sold at local ewe fairs in January and February (Table 6.10). Two farmers sold c.f.a. ewes during the winter because there was usually a price premium at this time.

Table 6.10 SELLING MONTHS FOR C.F.A. EWES 1982/83 SEASON

Month	No. of Farms
January	12
February	8
April-June	7
July-September	7

Cull ewes were sold by 26 farmers. Four farmers essentially sold surplus/cull ewes as c.f.a., and killed the very poor culls for dog meat. The 1982/83 season for cull ewes was difficult and a large number of farmers still had cull ewes on hand in April/May. Most sold 1-2 months later than normal (Table 6.11).

Table 6.11 EWE SALES: ACTUAL AND PREFERRED SELLING MONTHS FOR SURPLUS EWES 1982/83

	Main Sale Month 1982/83	Preferred Month of Sale
November	2	4
December	-	8
January	6	13
February	12	3
March	4	1
April-June	6	1

The preferred selling months indicate that 16 farmers would like to sell in January-February. Traditionally this has been the time when c.f.a. and cull ewes are identified. Twelve farmers would like to sell culls earlier, although the disadvantages of this policy - additional work during the busy weaning period, time of shearing relative to sale date and getting out of phase with sales/purchases of the rest of the farming community - were recognised.

The single most important factor preventing sale of cull ewes at the preferred time was unavailability of works space (26 farmers). Low prices and no alternative markets were cited by 3 farmers. Only one farmer who sold all surplus ewes as c.f.a. experienced no problems.

6.5.3 DISCUSSION

Almost all the farmers experienced difficulty selling cull ewes in the 1982/83 season at the desired time, primarily because of lack of killing space. However, a simple feed budget analysis has indicated that timing of ewe sales is likely to have a relatively small effect on pasture cover compared to the timing of lamb sales. It is therefore important to make a decision in December/early January concerning the number of lambs which can be carried through to heavy weights. Selling stores or at lighter weights may be necessary if there are indications there will be a dry summer.

The high proportion of wether lambs still on many of the farms in April, appeared to be primarily related to the inability to achieve satisfactory carcass weights (12.5 kg) earlier in the season. These animals therefore compete for scarce high quality feed with replacement lambs and heifers and ewes (especially at flushing), and contribute to a reduced pasture cover going into the winter, as shown in the Riverside feed budgets (Section 6.5.1). This problem could be decreased by achieving heavier weights earlier in the season especially through improved feeding levels during the lambing to weaning period (Section 5.3.2).

On some properties it was noticeable, particularly where lambing percentages were low, that lambs to be sold received highest grazing priority throughout the summer. This is an understandable reaction since the lower number of animals available for sale must realise a higher average price. However, such a policy is likely to result in the continuation of the problem of low lambing percentages while only partially alleviating financial difficulties. Taylor (1982) alluded to this problem and made some suggestions as to how productivity could be improved on properties of this type.

Two strategies are suggested as a means of reducing the cull ewe problem. The first is to create a "flying" flock of ewes which will become culls the following season, and mate these to a terminal sire earlier than the main flock. Cull ewes may then be sold correspondingly earlier the following spring. Labour requirements are also spread for operations such as lambing, docking and weaning. These advantages have to be weighed against the management requirements of an extra ewe mob.

An alternative strategy is to farm a flock of a younger average age and to sell surplus ewes as c.f.a. as practised on 4 of the survey farms. This system fits into the existing infra-structure of the sheep industry. Prices tend to fluctuate with expensions/contractions within the industry but, in general, price differences between age classes are maintained.

A wide range of sheep selling policies were operated on the survey farms. Some farmers had adopted a very flexible approach to lamb sales, being prepared to sell large numbers early as stores rather than carry through to heavier weights if summer feed shortages were likely. Although reduced lamb returns for that season were likely, longer-term overall productivity (and returns) was protected by ensuring that replacement ewe lambs received the best possible chance to reach high liveweights by the autumn.

CHAPTER SEVEN

SHEEP GRAZING MANAGEMENT

7.0 CHAPTER OUTLINE

Lamb weaning management practices, and the grazing management of ewe lambs, two tooths and MA ewes during the weaning to tupping period on the survey farms are presented and discussed in this chapter. In additions the farmers' objectives for the various stock classes are presented and these are compared with the management practices adopted. Conclusions are drawn, as to how management of the various classes of sheep could be improved.

The material in this chapter provides most of the background information to Chapter 9 in which the combined effects management of individual stock classes are considered from the point of view of overall system performance.

7.1 WEANING MANAGEMENT

7.1.1 INTRODUCTION

The choice of weaning date has important implications for sheep farmers because of its effects on pasture and stock performance. Prior to the survey, the author had monitored the effects of early weaning (average age of 8-9 weeks) at Riverside farm in 1981 when both pasture cover and ewe liveweights were very low. Lamb growth rates were poor compared to previous years and in many cases lambs had already weaned themselves onto pasture.

After weaning, ewe liveweights quickly recovered and by tupping were similar to that of previous years. Mixed age ewe wool weights at second shearing the following May were the highest recorded. Replacement ewe lambs were lighter at weaning and in mid-winter than in previous years but reached an average of 50kg by early January 1983. This experience indicated that weaning date was a powerful management tool which could be used to improve pasture management and ewe liveweights at no expense to lamb growth rates.

In this section, literature relating to weaning management is reviewed and the management practices adopted by the Wangaehu-Bideford farmers described.

7.1.2 LAMB WEANING DATE

Age at Weaning[1].

The lactating ewe influences lamb growth mainly through

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1. The distinction between the age of individual lambs and the average age of lambs at weaning is important. For the purposes of this study, the average lamb age at weaning is defined as the number of days elapsing between the mid-point of lambing and the date of weaning. The mid-point of lambing is primarily a function of mating management in the previous autumn. In particular, the date of joining rams, relative to the onset of the breeding season in the ewe, influences the distribution of lamb birth dates (See Section 5.1.3). Unless the birth date of each individual lamb is recorded it is impossible to accurately calculate the average age of lambs at weaning. The duration of the mating period (and hence the potential lambing spread) does not necessarily reflect the frequency distribution of ewes lambing over time, since the same proportion of ewes may be mated in the first 30 days for flocks which have different mating periods. Mating crayons changed at frequent intervals (6-10 days) can provide an indication of the likely pattern of lambing on a commercial farm.

the provision of milk for the lamb and through competition for high quality pasture. The choice of how early a lamb can be weaned is dependent on the age that it is able to digest pasture, its weight and its capacity to consume sufficient herbage to compensate for the loss of milk from its mother.

The physical development of the lamb's rumen and the production of microbial end-products reaches adult levels 3 to 8 weeks after birth (Hodge 1966). Although lambs are capable of digesting herbage at near maximal rates before 8 weeks of age, herbage quality must be high to compensate for digestable protein and energy otherwise obtained from milk.

A large number of experiments have been conducted comparing different ages of lambs of numerous breeds at weaning in New Zealand (Clarke 1954, Barnicoat et al 1957, Scales et al 1968, Jagusch et al 1970, Joyce 1971, Geenty 1980, Geenty and Sykes 1981, Munro and Geenty 1983) and overseas (Brown 1964, review; Furnival and Corbett 1976). These trials have shown that lambs can be weaned as young as 14 days of age and still reach slaughter weights at 5-6 months of age, providing a high quality diet is made available. Early weaning, or the withdrawal of the ewe's milk supply before the time when weaning would normally occur, may be associated with a post-weaning depression in weight gains lasting 1 to 4 weeks depending on pasture quality, stage of rumen development and liveweight at weaning (Furnival and Corbett 1976, Rattray et al 1975, Geenty 1980, Geenty and Sykes 1981), although this may be caught up by a later date (Brown 1964, Furnival and Corbett 1976).

Where lambs are weaned early onto pasture, an immature leafy highly digestable herbage or special purpose pasture such as lucerne will result in better liveweight gains than pastures which have commenced flowering (Wardrop et al 1960, Scales et al 1968, Jagusch et al 1970).

The carcass characteristics (including grading) of early weaned lambs are similar to those of lambs weaned at 12 weeks and older, except where weaning occurs at very young ages (less than 6 weeks) (Wardrop et al 1960, Cameron and Hamilton 1961, Jagusch et al 1970). Weaning at an average age of 8-9 weeks can be expected to have no adverse effects on export lamb production (Geenty 1980).

Weight at Weaning

It is usual to describe lamb weaning date in terms of age. The concept of defining weaning date in terms of liveweight may be more useful. Where early weaning onto pastures is to occur, most researchers have defined a minimum liveweight as well as age (Bronsma and Eugela 1941, Barnicoat et al 1957, Wardrop et al 1960, Corbett 1968). Furnival and Corbett (1976) recommended a minimum liveweight of 10.6 kg at weaning while Geenty (1980) suggests 12 kg. Thus an average weaning weight of about 20 kg is necessary to avoid a significant proportion of lambs suffering a post-weaning growth check.

Weaning weight is related to lamb age by the equation:

$$WWT = ADG(T) - WT_B \qquad \text{(Equation 7.1)}$$

Where WWT = Weaning weight (kg)
ADG = Average daily weight gain (kg)
T = (Average) lamb age (days)
WT_B = Birth weight (kg)

Equation 7.1, in conjunction with a target liveweight at weaning, highlights the need to consider factors affecting ADG of lambs in addition to average age at weaning, when evaluating weaning management. Thus, assuming a birth weight of 4.3 kg and an average age of 8-9 weeks at weaning, an average weaning weight of about 20 kg requires average daily liveweight gains of 250-280 g/day from birth.

Effect of Weaning Date on Ewe Performance

1. Wool Production: Over the lactation period, ewes rearing a single lamb produce between 0.2 and 0.3 kg less wool than a ewe which has reared no lamb (Corbett and Furnival 1976). A similar difference in wool production between ewes rearing single and twin lambs also occurs (Stevens and Wright 1951, Seebeck and Tribe 1963, Ray and Sidwell 1964).

Weaning lambs at an average age of 8-9 weeks compared to 12-14 weeks, where the ewe is well fed from the time of parturition, is likely to have only a small positive effect on wool production (Smeaton *et al* 1983(a), Corbett 1968) but where ewes are on a reduced plane of nutrition this difference will be greater (Corbett and Furnival 1976, Smeaton *et al* 1983(a)).

2. Liveweight: Corbett and Furnival (1976) showed that the shorter the preceding lactation, the greater the liveweight at joining and the higher the proportion of Merino and Corriedale ewes that mated and lambed. Early weaning provided the greatest advantages where ewes were on a very low plane of nutrition, (unlikely to be approached under New Zealand conditions except following a serious drought and poor spring pasture growth).

Romney ewes weaned at 8 weeks were 2.1 kg heavier at mating than their counterparts weaned at 14 weeks but did not have a higher ovulation rate (Smeaton *et al* 1983(a)). A 7% increase in multiple ovulation could have been expected on the basis of previously measured liveweight/ovulation rate relationships.

3. Milk Production: The ewe lactation curve usually peaks 1 to 3 weeks after parturition and steadily declines from this point to a level which is between 20 and

40 percent of peak production after 8 weeks (Bronsma and Eugela 1941, Barnicoat et al 1949, 1957; Owen 1957, Peart 1967, Scales 1968, Treacher 1970, Gibb and Treacher 1980).

The correlation between lamb growth rates and milk production in the first four weeks after parturition is very high (r = 0.90) (Owen 1957, review), and declines as lactation progresses and the lamb begins to consume an increasing amount of herbage.

Wardrop and Tribe (1959) estimated that the lamb would need to consume about 1.3 kg DM/day of high quality herbage to compensate for milk if weaned at 8 weeks of age. This would need to increase to 3.2 kg/day if the herbage was mature and of low digestibility - an amount which the lamb is unlikely to be able to consume. This emphasises the importance of making high quality leafy pasture available to lambs after early weaning to compensate for loss of milk as a dietry source (Wardrop et al 1960, Hodge 1966, Scales et al 1968, Furnival and Corbett 1976, Joyce and Rattray 1970).

7.1.3 DISCUSSION

Weaning of lambs at an average age of 8-9 weeks (requiring average daily gains of 250-280 g/day from birth) can provide considerable management advantages compared to the more traditional age of 12 to 14 weeks in areas prone to dry summer conditions. Ewes and lambs can be managed separately enabling the allocation of high quality immature herbage (preferably with a high legume content) to lambs, and more mature pasture of lower digestibility to ewes. Grazing pressures can also be adjusted between the two classes of stock. Lambs that are at a minimum liveweight of around 12 kg at weaning should suffer no disadvantage in liveweight gain or wool production at later stages of life. A lower level of worm infestation is possible in early weaned lambs (Corbett 1968, Brown 1964), and carcasses are likely to be leaner at similar weights than those of late or unweaned lambs.

A reduced lactation period increases the opportunity for the ewe to regain condition. This is especially an advantage in dry summer areas where pasture quality and availability can rapidly decline from January until the autumn. As well, a small increase in ewe wool production can be obtained.

The overall efficiency of energy utilisation is increased by weaning lambs at younger ages. Thus Clarke (1954) estimated the efficiency of converting grass to milk to meat was only about 9%, while the efficiency of direct conversion of grass to meat was in the vicinity of 30%. Bronsma and Eugela (1941) and Geenty and Sykes (1981) have reported similar increases in efficiency of energy usage due to early weaning.

If lambs are weaned on the basis of an average target weaning liveweight, average lamb age and weaning date will be dependent on the average daily liveweight gains of lambs from birth (equation 7.1). Factors which influence lamb growth rates are therefore of vital interest to management, and may be classified as being controllable (for example lambing date relative to the onset of spring pasture growth, pasture cover at lambing, stocking rate and genetic merit) and uncontrollable, such as climate. Weaning date will therefore vary according to seasonal conditions and the management system imposed.

7.2 WEANING MANAGEMENT - SURVEY RESULTS

7.2.1 LAMB AGE AT WEANING IN 1982

The distribution of the age of the oldest lamb at weaning for the survey farms in 1982/83 is presented in Figure 7.1. The average age of the oldest lamb at weaning was estimated from the MA mating and weaning dates as being about 100 days. The average weaning age could therefore be expected to be 10-15 days less than this, i.e. 85-90 days. This reconciles reasonably well with the "preferred" average weaning age of 83 days given by the survey farmers (Table 7.1).

Figure 7.1 LAMBING DATE, WEANING DATE AND AGE OF OLDEST LAMB AT WEANING 1982/83

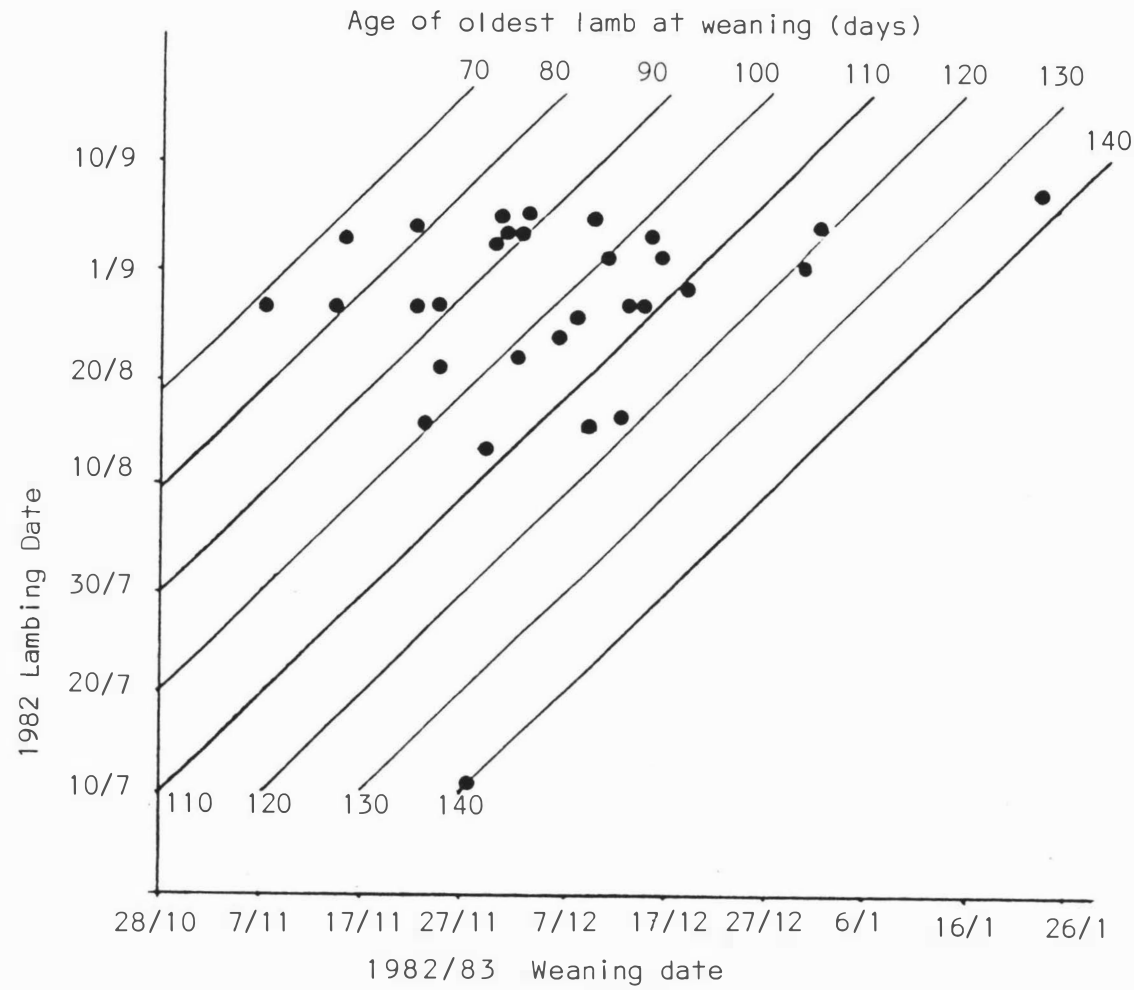

Table 7.1 PREFERRED AGE OF WEANING, AND MINIMUM AGE AT WHICH FARMERS WERE PREPARED TO WEAN

Weaning Age	Preferred Average Age (No. of Farmers)	Minimum Weaning Age (No. of Farmers)
42-70 days (6-10 weeks)	2	14
70 days	8	7
77 days	4	
84 days	8	7
91 days	3	
98 days	2	
112 days	3	2
Mean	83 days (11.8 weeks)	

Two tooth weaning dates were within one or two days of those for MA ewes. Hogget lambs were weaned between December 20 and January 20.

There was a willingness to wean lambs at younger ages, and some farmers mentioned that they would be prepared to wean at ages as young as 42 days.

In a year when pasture cover was low in late spring, 13 farmers would wean earlier, 3 later and 14 would not change from their normal practice. The willingness to change weaning dates needs to be considered in relation to the factors determining weaning dates.

7.2.2 FACTORS INFLUENCING CHOICE OF WEANING DATE

Farmers were asked to rank six listed factors according to their influence on choice of weaning date (Table 7.2).

Table 7.2 FACTORS INFLUENCING CHOICE OF LAMB WEANING DATE

	Average Score	Ranked Most Important (No. of Farmers)	Not Important (No. of Farmers)
Availability of shearers	2.78	8	2
Feed position	2.79	5	6
Lambs ready to draft	3.21	2	4
Lamb condition	3.69	11	4
Other - store lamb sale	6.50	1	27
ram sales		1	

Availability of shearers was a major factor influencing the choice of weaning date and was unimportant on only two properties. The high ranking of this factor can be related to the high SU: labour unit ratio on the survey farmers (Table 3.16). Where lamb shearing and weaning operations are combined, any delay in shearing (due to weather, availability of shearers etc) may have important implications for pasture control.

The second highest ranked factor influencing choice of lamb weaning date was the feed position. This corresponds to the stated willingness of 13 farmers to change weaning date if feed was short. The impression gained during the survey was that if weaning date was altered because of the feed position,it would be only 5-10 days different from normal practice and would be constrained by the other factors influencing the time of weaning.

7.2.3 CHANGES IN WEANING DATE

A total of 6 farmers had changed weaning date since 1980.

In the cases of earlier weaning, 3 farmers changed from late December-early January to the first two weeks of December, and 2 moved weaning forward to November when lambs were 8-10 weeks of age. All the farmers weaning earlier were pleased with the results and in general found that ewe liveweights were improved, management was simplified, and with one exception, that the proportion of lambs drafted was similar or better than under the previous management system.

Weaning was 4 weeks later (January 20) on one farm in 1982 because of the unavailability of shearers in late December. More lambs were drafted prime at weaning, but retained lambs grew poorly in February and March. Better pasture control was obtained than in previous seasons but this could have been due to a number of factors, including the increased lambing percentage and dry late spring conditions. The farmer was unsure whether he would continue with late January weaning in 1984.

7.2.4 EARLY WEANING ON THE SURVEY FARMS

Four farmers weaned lambs at average ages between 8 and 9 weeks in 1982 - (the oldest lambs were 70-80 days of age at weaning, Figure 7.1). Figure 7.1 shows that these four farmers lambed slightly later and weaned at an earlier date than the average for the survey farms. The situation on each of these four farms is briefly reviewed.

Case 1 (Farm 19). Usually weans at an average age of 8-9 weeks because farm is prone to summer feed shortages. Weaning at this time enables advantage to be taken of the premium available in most years at the early store lamb sale.(All lambs sold store).

Case 2 (Farm 20). Weaned at an average age of approximately 9 weeks in 1982 because of a feed shortage. Farm is exposed to winds and dries out quickly in the summer months. In 1983 will wean about one week earlier to coincide with the first store lamb sale at Masterton.

Case 3 (Farm 28). Weaning at an average age of 8 weeks has been practised for two seasons. Ewes have put on more weight before dry summer conditions and can be used for pasture control earlier. No disadvantage recorded in lambs.

Case 4 (Farm 30). Spring pasture cover was very low in 1982. This was partly the result of 300 ewes being mated 3 weeks earlier than planned when the neighbour's ram hoggets escaped. Ewe condition was poor and "lambs were not doing well." Lambs were weaned at an average age of 8 weeks, to provide more time for ewes to regain liveweight and to make better quality pasture available to lambs. The best wether lambs were drafted at weaning. In hindsight these lambs should not have been sold as early, nor should pastures have been closed up 3 weeks prior to weaning; these rapidly got out of control and were unsuitable for lamb feed after about 3 weeks.

Each of the farmers was satisfied that early weaning had not disadvantaged lambs and had enabled ewes to regain weight lost over the winter and spring, before the summer. On Farm 19, there was the possibility that weaning in 1983 would be delayed to an average age of 10 weeks to achieve better seedhead control in the pastures. However,this decision would depend on how well the lambs have grown, store lamb prices and climatic conditions. On Farm 30

(Case 4) the farmer was in his first year of ownership and was not sure whether the policy would be repeated. He hoped to improve spring pasture cover through changes to winter management (made possible by considerably increased subdivision) and later lambing.

7.2.5 FARMER COMMENTS ON LAMB WEANING AGE

In previous sections, details of factors influencing choice of weaning date and weaning ages have been discussed. A sample of farmer comments further explains why current weaning policies have been adopted.

"I am tempted to wean earlier - I would like to combine weaning with ewe shearing on 10th November. (Early ewe shearing reduces the amount of dagging). This would reduce stock work but I am not sure lambs are big enough."

"I wouldn't be averse to weaning earlier but I have a few questions about lamb growth rates."

"Lambs seem to wean themselves often. Late lambers always seem to do better than early lambers. I don't think there is any advantage in weaning early."

"I would like to wean early (10 weeks) - I did in 1981, but this year the shearers were late."

"The convenience of shearing and selling 90% of the wether lambs store off the ewes at the same time is an advantage (on December 1st usually). I am considering weaning earlier to improve ewe liveweights going into the summer."

7.2.6 CONCLUSIONS - WEANING MANAGEMENT

The main feature to emerge was that farmers take a number of factors into consideration when choosing a weaning date, and that practical management considerations such as minimising work load have a major influence. Most farmers were willing to change weaning date if it contributed to improved stock performance and/or simplified management. The trend in the survey area was towards weaning at younger ages and a number of farmers are closely watching the outcomes on farms where weaning is at an average age of 8-9 weeks.

The observations of the farmers who had weaned lambs at average ages of 8-9 weeks support those recorded under experimental conditions. This evidence indicates that early weaning would be a useful management strategy in those parts of the survey area which are prone to dry summer conditions (e.g. lower Bideford) and in years when spring pasture cover has been low, such as in 1982. Improved ewe liveweights and greater flexibility in grazing management could be expected. However there were no significant differences between districts in the average weaning age of the oldest lambs in the 1982/83 season. (Wangaehu 98.1 ± 4.5 days, Bideford 103.5 ± 5.5 days, and Ihuraua 98.1 ± 5.6 days).

None of the farmers weaned on the basis of lambs having reached a target liveweight, although most indicated, indirectly, that they were conscious of the importance of weaning weights because of subsequent effects on lamb performance and lamb selling policies. There are some practical difficulties in using this approach on hill country farms (for example, determining average liveweights of various mobs and the need to fit in with shearing contractors), but in future it is likely that farmers, particularly those weaning on the basis of the proportion of lambs that are ready to draft, will be forced by market requirements to be more aware of liveweights and associated levels of fatness.

7.3 LAMB GRAZING MANAGEMENT

7.3.1 LITERATURE REVIEW

Post-Weaning - Summer Period

High post-weaning lamb growth rates are associated with generous pasture allowances and low levels of utilisation (Jagusch *et al* 1979, Thompson *et al* 1980). If possible, an immature pasture with a high legume content (Rae *et al* 1963, McLean *et al* 1965, Grimes *et al* 1967, Rattray and Joyce 1970) and which is "short" (<5 cm) rather than "long" (>5 cm) should be made available (Lewis and Cullen 1973, Clarke 1954).

There is little conclusive evidence whether lambs should be set stocked or rotationally grazed. Geenty (1980) measured higher liveweight gains in lambs which had been set stocked, compared to those shifted at weekly intervals, although both groups were fed ad-libitum (i.e. a pasture utilisation of about 30%). A higher proportion of the gain in set stocked lambs was fat; 54% were graded overfat, compared with 11% in the rotationally grazed group. The results of Irish trials on a ryegrass/white clover pasture showed that liveweight gains in set stocked lambs were initially high but declined over a 6-10 week period (Nolan 1975). Over the same period the clover content decreased from 14% to 4%. This may have contributed to the pattern of liveweight gain and it was surmised that rotational grazing may have enabled a more uniform white clover sward to be maintained.

A grazing system where lambs are set stocked at relatively low rates and shifted every 3-4 weeks may be the most effective management practice. Regardless of the frequency of shifts, it is clear that lamb grazing management needs to be integrated with that of other classes of stock to maintain pasture control.

Late Summer-Autumn

Late summer-autumn lamb grazing management studies indicate that weight gains are more dependent on the quantity of herbage per hectare than allowance per sheep (During et al 1980, Jagusch et al 1979). Thus, during dry summers when only low allowances are possible, set stocking at low rates is suggested; but where higher feeding levels are possible (RDM > 1200 kg DM/ha), rotational grazing can be superior (During et al 1980).

Hight and Sinclair's (1965) late summer-winter trials indicated that lamb growth rates were higher on long pastures (5-12 cm) than short pastures (2.5 - 5.0 cm). This was attributed to the higher clover content in the longer pastures. Results reported by During et al (1980) support this conclusion.

The recommended target average liveweights for replacement ewe lambs (McNeil 1982), of 20 kg at weaning and 35 kg by May, require average growth rates of about 0.65 kg/week over the summer-autumn period. In practice, lamb growth rates are frequently lower than could be expected from the feeding levels provided (During et al 1980, Severinson 1983, Duckworth 1983). This is usually referred to as ill-thrift. Probable causal factors, reviewed by Scott et al (1976), include pasture quality (stage of maturity and composition), facial eczema, ryegrass staggers, parasites and temperature and water stress. Often poor lamb growth rates attributed to ill-thrift, are in fact due to incorrect management, especially grazing and drenching (McNeil 1982).

Effect of Ewe Lamb Autumn Liveweight on Subsequent Performance

The early attainment of puberty in ewe lambs has a positive effect on lambing percentage over and above that which can be attributed to differences in mating liveweights as two tooths (Hight and Jury 1976, Meyer 1981, Moore and Hockey 1982, Davis et al 1983, review). There is limited evidence that this effect carries over to subsequent lambings (Moore and Hockey 1982). Selection of flock replacements on the basis of hogget oestrus is therefore recommended (Clarke and Binnie 1981). Consequently, management practices which facilitate high liveweight gains in lambs between weaning and late autumn are desirable, since well grown ewe lambs have greater opportunity to reach heavier two tooth mating weights and are also more likely to exhibit oestrus in their first breeding season (Meyer 1981).

7.3.2 DISCUSSION

To obtain high lamb growth rates during the weaning to April period, lax grazing of high quality immature pasture is necessary. It is important, especially in low summer rainfall areas, that high liveweight gains are achieved in early summer, so that lower pasture growth rates during February-March, when pasture quality is often poor and its availability is decreasing, can be withstood. Recommended early summer management of lambs then will quickly result in a deterioration of pasture quality. Consequently, lamb management must be closely integrated with that of other classes of stock.

7.4 LAMB MANAGEMENT FROM WEANING TO APRIL - SURVEY RESULTS

7.4.1 LAMB MOBS FORMED AFTER WEANING

The post-weaning period provides the opportunity to differentially manage lambs. There may be a variety of purposes for this management: it may involve the preferential feeding of a particular group of stock or the grazing of ewe and wether lambs separately. In most cases this will require stock to be put into mobs. Details of the various lamb mobs formed at weaning were therefore obtained from the survey farmers.

A common practice after weaning on the survey farms was to run all lambs together after weaning (Table 7.3). This system avoided mix-ups between different lamb classes in the initial period after weaning when lambs were unsettled, and simplified grazing management. Lambs were usually separated into different groups 3-4 weeks later at the next drench, shearing or drafting date. The adoption of this system means that priority cannot be given to any one class of lambs immediately after weaning.

Table 7.3 LAMB MOBS FORMED AFTER WEANING

	Post-weaning lamb mobs	No. of Farms
1 Mob:	All lambs grazed together	11
2 Mobs:	Separate ewe and wether lamb mobs	12
3 Mobs:	Ewe lambs, wether lambs plus other lambs (late lambs, crossbreds, etc)	7

The remaining farmers usually formed 2 or 3 mobs of lambs after weaning and grazed these separately.

7.4.2 LAMB GRAZING MANAGEMENT

Defining Lamb Grazing Systems

The following system was used to differentiate between rotational grazing and set stocking of lambs:

> Rotational grazers included farmers who shifted lambs regularly at up to 10 day intervals. In the majority of cases lambs were shifted every 7 days or less.
>
> Set stockers included farmers who grazed paddocks with lambs for 10 day or longer intervals. All except one farmer, who set stocked the same area throughout the summer, shifted lambs at 2-4 weekly intervals.

However, some farmers switched between systems and in one case both systems were operated at the same time with different mobs. In later summer months, management practices were increasingly determined by the availability of water.

Rotational Grazing

Lambs were rotationally grazed on 12 farms after weaning. The usual system involved grazing one paddock at a time, although on one property up to five paddocks per shift were sometimes allocated.

Rotational grazing was preferred by 8 of these farmers because lambs could be provided with fresh pasture at each shift and more effective worm control was thought to be obtained as a result. The ability to preferentially feed lambs was mentioned in three cases and one farmer thought that with regular shifts lambs were checked more frequently and any problems were likely to be noticed earlier.

Lambs were rotationally grazed in mob sizes ranging from 550 to 3100 lambs with a mean mob size of 623 lambs. Mob sizes were determined by convenience (e.g. all the ewe lambs or all the wether lambs or the number of lambs on the farm at weaning), and were not considered to be a factor limiting lamb growth.

For the 10 farms with liveweight data and on which lambs were rotationally grazed, autumn ewe lamb liveweight and mob size were not negatively correlated.

Set Stocking

Lambs were set stocked after weaning on 19 farms[1] at stocking rates varying from 2 to 25 lambs/ha (although only one farm had a stocking rate higher than 10 lambs/ha).

Set stock management was preferred mainly because lambs were considered to grow faster (10 farmers) and because lambs knew where water, shelter and shade could be found (6 farmers). One farmer set stocked lambs because of ryegrass staggers, while two farmers considered they had insufficient subdivision to allow rotational grazing.

1. The overlap in total survey farms occurs because on one property wether lambs were rotationally grazed and ewe lambs set stocked.

7.4.3 PREPARATION OF PASTURES FOR LAMBS POST-WEANING

All but one farmer surveyed took positive steps to prepare pastures for lambs at weaning. A number of different methods were used, with the most frequent being spelling paddocks from grazing by ewes and lambs prior to weaning (Table 7.4).

Table 7.4 METHOD OF PREPARING PASTURES FOR LAMBS AFTER WEANING

Prepared by	No. of Farms
(1) Closing up 2-5 weeks before weaning	15
(2) Closing up 1-2 weeks before weaning	5
(3) Closing up 1-6 days before weaning	2
(4) Grazing with cattle	2
(5) Grazing by hoggets	3
(6) Grazing by cattle and hoggets	1
(7) Combination of (3), (4) and (5)	2

Four farmers indicated that they were unable to prepare sufficient area for lamb weaning. In three instances this was because "there never seems to be any surplus feed prior to weaning," and in one case, where a large scale development programme was being implemented, autumn sown pastures were not available for regular grazings until early summer, creating a spring feed shortage since increased stock numbers were wintered in anticipation of higher levels of pasture production.

The proportion of total grazeable area prepared for lamb weaning varied from 1% to 27%, with a mean of 8.3% (This is probably an important factor in maintaining pasture control on most of the survey farms and was discussed in Section 4.1.6).

The average height of pasture which farmers preferred (i.e. would like) to wean lambs onto reflects the closing up policy (Table 7.5).

Table 7.5 AVERAGE HEIGHT OF PASTURE PREFERRED FOR FRESHLY WEANED LAMBS

Preferred Height of Pasture	No. of Farms
0 - 2.5 cm	0
3.0 - 5.0 cm	8
5.0 - 7.5 cm	14
8.0 cm +	8

A summer crop (rape) was available at weaning on one farm, although crops were used on four farms later in the summer for lamb fattening.

7.4.4 REPLACEMENT EWE LAMB MANAGEMENT

Grazing Priorities

A series of questions were asked to determine how farmers allocated pastures between different classes of stock during the weaning to tupping period, in order to examine whether this had any effect on performance variables such as lambing percentage and hogget liveweight.

In the first month after weaning, highest priority was given to replacement ewe lambs on 12 farms; 11 farmers were unable to establish priorities because all lambs were grazed together; and 7 farmers preferred to feed lambs that were to be sold in the next month as well as possible.

Analysis of lamb management priorities in the first month after weaning indicated that farmers who gave highest priority to ewe lambs during this period did not have significantly (P > 0.05) higher average lambing performance or autumn ewe lamb liveweights (Table 7.6). This suggests that there is sufficient high quality lamb feed available in the first month after weaning to obtain high growth rates in all groups of lambs. Although there were only small differences in mean autumn liveweight, the variability of both autumn liveweight and lambing percentage is lower in the group which gave highest priority to ewe lambs.

Table 7.6 COMPARISON OF PERFORMANCE VARIABLES WITH LAMB MANAGEMENT IN THE FIRST MONTH AFTER WEANING. ( ) NO. OF FARMS WITH LIVEWEIGHT DATA

	Highest Lamb Grazing Priority			
	Replacement Ewe lambs (10)	Works Lambs (7)	All Lambs Equal (11)	Significance of F
1980-1982 Average lambing %	97.57 ± 1.59	96.57 ± 4.59	95.10 ± 5.26	0.77
Average autumn ewe lamb liveweight (kg)	30.01 ± 0.75	31.60 ± 1.70	30.08 ± 1.57	0.46

Objectives for Ewe Lamb Replacements

All survey farmers wished to grow ewe lambs as well as possible but only 8 farmers specifically mentioned an autumn liveweight target (35 kg + by April 1). The ewe lambs on these farms were significantly heavier (34.13 ± 1.54 kg vs 28.68 ± 0.88 kg, P < 0.01), than those on farms where a specific weight was not mentioned.

Fifteen farmers used sample weighting to assess whether their objectives were being met, 14 used a subjective assessment based on overall appearance and one farmer combined visual appraisal with the killing weights of wether lambs to estimate liveweight gains. Ewe lambs were 3.76 kg heavier on the farms where weighing was practised (31.98 ± 1.10 kg vs 28.22 ± 1.24 kg). This difference was significant at the 5% level (P = 0.033). More than half of the farmers (17) were dissatisfied with their replacement lambs on (or near) April 1 1983. Inability to sell surplus stock, primarily cull ewes, because of the freezing works situation in the 1982/83 season, was blamed most frequently as the cause of poor replacements (Table 7.7).

Table 7.7 FACTORS PREVENTING THE ATTAINMENT OF SATISFACTORY EWE LAMB SIZE/WEIGHT BY APRIL 1, 1983

Preventing factor	No. of Farms
Unable to sell surplus stock	8
Poor summer pasture growth	6
Water problems, shortage of pasture	3

Poor summer pasture growth and water supply problems were also mentioned as reasons why ewe lambs had not grown as well as expected.

Ten farmers indicated that the problem was specific to the 1982/83 season, but 7 farmers stated that they regularly encountered problems rearing ewe lambs. Six of the farmers with regular problems were located in the Bideford area, which generally experiences drier summer conditions and has lower natural soil fertility. This suggests that environmental factors could be the main cause of consistent poor performance in ewe lambs (See Section 3.6).

7.4.5 CONCLUSIONS - LAMB MANAGEMENT

The preparation of lamb weaning pastures is of particular interest and raises several important issues. The first is that closing up paddocks may help maintain pasture control on the rest of the farm by increasing the stocking rate on this area. Secondly, where pastures are closed up automatically each year at a certain period before weaning, ewe and lamb liveweight gains could be disadvantaged through restriction of feed intakes, particularly in a slow pasture growth spring. Thirdly, closing up feed for more than one week in November and early December is likely to result in pasture which is too long for optimum lamb growth (Lewis and Cullen 1973). If lambs are set stocked at low rates onto these saved areas, a situation of rank and largely unpalatable pastures will soon be reached because of the selective grazing behaviour of young sheep. Fourthly, relatively few farmers are able to use cattle or hoggets to prepare pastures for lamb weaning. This means that a preventative rather than an integrated drenching programme needs to be adopted (See Section 6.3). There is therefore probably no disadvantage in weaning lambs directly back into paddocks previously grazed by ewes and lambs, at low stocking rates. After 3-4 days, pastures will have grown to provide high quality herbage and by this time lambs will have settled and regained their appetites. This practice was successfully used by several of the survey farmers in the 1982/83 season.

The survey data shows that decisions on whether lambs should be rotationally grazed or set stocked can be based on individual farm circumstances such as water supply, level of subdivision and labour, because, although ewe lambs which had been set stocked on the survey farms were on average heavier than those rotationally grazed, by the autumn this difference was not significant (31.1 ± 1.0 kg vs 29.4 ± 2.0). The main requirements for obtaining recommended lamb growth rates are high herbage allowances and high herbage quality. These can both be achieved under a low stocking rate semi-set stock system, with lambs being shifted every 2-4 weeks. This pattern of shifts should ensure a higher proportion of clover in the sward than longer term set stocking and fits in with a preventative drenching programme.

The survey results suggest that environmental factors are important determinants of high lamb liveweights but also that some farmers are "better" lamb managers, being able to consistently rear good ewe hoggets each year despite wide climatic variations between seasons. In particular, the farmers who set a liveweight target for ewe lambs, and/or used weighing to determine whether the objective of increasing liveweight was being met, were more successful in obtaining heavy ewe lamb liveweights. Other factors which affect autumn liveweight in ewe lambs will be discussed in more detail in Chapter 9.

7.5 TWO TOOTH MANAGEMENT FROM OCTOBER TO APRIL

7.5.1 LITERATURE REVIEW

Very high liveweight gains (>130 gms/day) during the late spring-early summer period are possible if hoggets are fed to leave residuals of 1000-1200 kg DM/ha (During et al 1980). For example, a liveweight gain of 17 kg between mid-September and the New Year, with a rapid rotational grazing plan (1-3 days/paddock) leaving a residual of 1000 kg DM/ha, was obtained at Riverside in 1982. Gains of 2.1 kg/week during this period were measured under a similar system with Coopworth hoggets at Keeble farm in the Manawatu (Morris 1984 pers. comm.)

Drew et al (1973) found rapid compensatory growth occurred in Romney hoggets during spring-summer after a period of low winter gain, and by the time of two tooth mating no significant effects of previous winter feeding levels were evident. However, if two tooth mating weights of 55 kg are to be reached in dry summer areas a target liveweight of 40 kg off the shears in October is recommended (McNeil 1982).

Set stocking of hoggets during October and November was found by During et al (1980) to give better control of spring growth and higher quality pastures than rotationally grazing on hill country. Under either system, a residual of 1200 kg DM/ha was recommended during this period. However, on many hill country farms, sufficient area to set stock ewe hoggets so as to maintain these residuals is not available until early November and rotational grazing provides greater opportunity to maintain a consistently high level of feeding on a restricted area during this period (Milligan 1982). Providing the rotation length is adjusted according to the rate of pasture growth, similar control to that obtained under set stocking can be obtained.

A two tooth liveweight of 50 kg at New Year is recommended by advisors in low summer rainfall areas (Milligan 1982), because pasture availability and quality often decline rapidly from January to March and only small liveweight gains (1-5 kg) over these months may be achieved. Green leafy pasture, which has higher nutritive value and palatability than either stem or dead material (Guy et al 1981), should be made available during the summer months if possible.

Hogget-two tooth management must therefore take full advantage of high quality late spring-early summer pasture growth. Hoggets should be fed ad lib as early as possible in the spring, without jeopardising pasture intakes of ewes and lambs. As pasture growth begins to decline, and the amount of high quality pasture diminishes, two tooths should take second priority to replacement ewe lambs. Failure to obtain satisfactory liveweights in two tooths by New Year will normally create unnecessary competition between two tooths and ewe lambs over the summer months.

7.6 TWO TOOTH MANAGEMENT - SURVEY RESULTS

7.6.1 TWO TOOTH MANAGEMENT OBJECTIVES

The most important objective for two tooth management over the weaning to tupping period was to increase liveweight. Six farmers identified a target liveweight in the autumn and one aimed to reach tupping weight by Christmas. Only two farmers did not mention increasing liveweight as an objective. They specified objectives of maintaining pasture control and "to keep shifting two tooths onto fresh grass" respectively.

Sixteen farmers used sample weighing of livestock to assess whether two tooth liveweight objectives were being met while the remaining fourteen farmers used only visual assessment of stock condition. The average autumn two tooth liveweights on farms where weighing occurred were almost identical to those which did not weigh (48.7 ± 1.5 kg versus 48.4 ± 1.6 kg respectively). However, insufficient information was obtained to determine the importance of weighing in the attainment of two tooth objectives.

7.6.2 TWO TOOTH GRAZING MANAGEMENT SYSTEMS

The 1982/83 two tooth management systems over the October-April period could be classified into five groups:

A. Set stocked from October to April (6 farms)
B. Set stocked from October to December then rotationally grazed until April (6 farms)
C. Rotationally grazed from October to April (12 farms)
D. Rotationally grazed from October to December or January then set stocked until April (4 farms)
E. Rotationally grazed from October to January then grazed with MA ewes from January (2 farms).

These management systems were initially compared in terms of autumn liveweights and stocking rate by ANOVA (Table 7.8) There were no significant differences between groups. MANOVA was then used to compare autumn ewe lamb and two tooth liveweights with the grazing management systems, using stocking rate as a covariate. No significant differences between groups were evident (MANOVA P = 0.295).

This result indicates that the method of grazing two tooths over the October-April period was unimportant in relation to autumn liveweight in the 1982/83 season. What is important is that feeding levels are such that high liveweight gains are achieved. It is likely then that some of the systems will realise this objective more easily and consistently than others on individual properties. There may also be conflict between two tooth management and that of other classes of stock (e.g. if two tooth liveweight gains result in deterioration in the pasture sward or affect ewe lamb liveweight gains). Grazing maiden two tooths with MA ewes when summer conditions are dry is a case in point because while management is simplified by reducing the number of mobs and releasing extra paddocks for lamb grazing, feeding priorities between two tooths and MA ewes cannot be established.

Table 7.8 TWO TOOTH GRAZING MANAGEMENT SUMMARY

Grazing Management System Two tooth ewes		No. of Farms	Autumn Liveweights 1983 Ewe Lambs		Two Tooths		MA Ewes		Stocking Rates (SU/eff/ha)	
	Group		$\bar{x}$	SE	$\bar{x}$	SE	$\bar{x}$	SE	$\bar{x}$	SE
Set stock October-April	A	6	28.0	0.8	48.2	1.7	51.5	1.4	10.9	0.7
Set stock October-December than rotational graze	B	6	33.6	2.1	52.3	1.6	55.8	1.9	11.2	0.8
Rotational graze October-April (10 cases with LW data)	C	12	32.6	1.6	50.5	1.8	54.4	1.6	11.1	0.6
Rotational graze October-December/January then set stock	D	4	29.4	1.8	45.7	3.6	52.0	2.0	10.9	0.5
Run with MA ewes from January	E	2	25.9	0.9	41.8	0.2	49.9	0.1	11.4	1.1
Significance*			0.167		0.182		0.590		0.968	

* Significance of F calculated by ANOVA

7.6.3 SIZE OF TWO TOOTHS AT MATING

Seventeen farmers were pleased with the size/appearance of the two tooths mated in 1983 (Table 7.9). (It could be expected that these two tooths would be lighter than in previous years because of the difficult 1981 spring and dry conditions during the 1983 summer). Nine of the 13 farmers who were not pleased with their two tooths were also dissatisfied with their ewe lambs. However, only three of the seven farmers who had previously indicated that they regularly had problems rearing ewe lambs (see Section 7.4.4) were dissatisfied with their 1983 two tooths. This may indicate that high priority is given to two tooths during their second summer on these farms, enabling satisfactory two tooths weights to be attained.

Table 7.9 COMPARISON OF SATISFACTION WITH SIZE/APPEARANCE OF EWE LAMBS AND TWO TOOTHS, AUTUMN 1983

Two Tooths	Ewe Lambs Not Satisfied	Ewe Lambs Satisfied	Row Total
Not satisfied	9	4	13
Satisfied	8	9	17
Column total	17	13	30
	χ^2 = 0.7101	P = 0.3994	

Two tooths of the farmers who were satisfied in 1983 were not significantly heavier than those of farmers who were dissatisfied (49.5 ± 1.7 kg vs 47.3 ± 1.4 kg).

Survey farmers identified a number of factors contributing to the poor two tooths, the most frequent being the dry summer conditions (Table 7.10). Only two farmers related the size of the two tooths to the rearing of ewe lambs.

Table 7.10 REASONS WHY TWO TOOTHS WERE NOT AS WELL GROWN AS PREFERRED IN 1982/83

Reason	No. of Farms
Drought, low pasture growth rates	5
Ran with MA ewes/dry conditions	2
Poor lambs/wintered too many	2
Poor feeding during September-December	2
Not sure	2

7.6.4 TWO TOOTH LIVEWEIGHT GAINS DURING THE PERIOD JANUARY TO MATING

Twelve farmers indicated that they normally had problems putting liveweight on two tooths between New Year and mating (including 9 of the farmers who were unhappy with their 1983 two tooths). Poor liveweight gains during the January-tupping period were most commonly attributed to insufficient pasture and/or low pasture quality because of the dry windy conditions experienced during the October-April period.

7.6.5 MANAGEMENT CHANGES WHICH COULD HAVE IMPROVED 1983 TWO TOOTHS

Eleven of the farmers who were unhappy with their 1983 two tooths responded to the question whether they could, in hindsight, have improved two tooth management (Table 7.11).

Table 7.11 MANAGEMENT CHANGES WHICH IN HINDSIGHT COULD HAVE IMPROVED 1983 TWO TOOTHS

Management Change	No. of Farmers
Better feeding during the September-December period	3
Reduced number of ewe hoggets wintered	1
Sold other lambs earlier	4
No possible changes	3

All except three farmers felt that they could have improved management through changes such as better feeding or earlier sale of lambs. The "no change group" included one farmer who was limited by the state of farm development. He felt that pasture composition (and hence pasture quality) would need to improve before he could expect heavier two tooths at mating. A second farmer, who set stocked his two tooths over the October-April period, considered that no improvements could have been made because of the seasonal conditions.

Some of the comments made in response to this question are of interest:
"Hoggets were held too long in the same paddock at shearing in October and this knocked their progress."
"We could have bought more cattle earlier to help with pasture control. This would have resulted in more vegetative pasture, but we were worried if there was going to be a really dry summer."
"I tried to fatten lambs rather than sell stores this year. I am not sure how much this cost in terms of two tooth and MA ewe liveweights."
"Put on more fertiliser? I am in a development situation and there is not much room to cull ewe lambs." (Average lambing percentage - 84).

7.6.6 CONCLUSIONS - TWO TOOTH MANAGEMENT

The main feature of two tooth management to emerge was the importance of ewe lamb nutrition up to 8-10 months of age, since the farmers with heavy two tooths also had, on average, heavier lambs and higher lambing percentages. This agrees with the research evidence reviewed (Section 5.1.1) showing the importance of ewe liveweight on lambing percentage. Highest priority must therefore be given to replacement ewe lambs rather than two tooths during the weaning to tupping period if lambing percentages (and two tooth joining weights) are to be increased. It was apparent that more emphasis was placed on two tooth management than that of the replacement ewe lambs on some farms. This is a lost cause if two tooths are already well behind target liveweights and high quality feed is scarce. The longer term effects of management of young sheep therefore did not appear to be appreciated by some of the survey farmers. (This is further demonstrated by the lack of knowledge of target liveweights as discussed in Section 6.1.2).

The lambing to weaning period deserves high priority for ewe hogget/two tooth management and maximum advantage of potential liveweight gains should be taken. Set stocking during this period has been shown to provide at least as good, if not better, liveweight gains than other management systems and is superior for maintaining pasture control (During et al 1980). However, in view of the apparent low pasture cover at lambing on at least half the survey farms, it is unlikely that there would be sufficient feed to allow set stocking in October on a number of farms. In these cases a rotational grazing system providing a uniform pattern of intake should be adopted until pasture cover has increased to a level which will allow a set stocking system to be sustained. The improved implementation of winter management systems will also affect hogget liveweight gains in spring because average pasture cover should be higher.

A liveweight of 50 kg by New Year should be the target in the survey districts to minimise competition with ewe lambs during the period of dry conditions and lower quality herbage growth. This requires a minimum post-shearing liveweight of 35-37 kg in early October.

7.7 EWE MANAGEMENT FROM WEANING TO TUPPING

7.7.1 LITERATURE REVIEW

Traditionally, ewes on most hill country farms have been mob-grazed after weaning to either develop pastures or prepare lamb feed. This has usually involved grazing pastures down to low RDM's (Halford 1971). The adoption of hard grazing of ewes in late November-December is likely to compound pasture control problems because ewe intakes are being restricted. Furthermore, ewe liveweights are likely to decrease from that at weaning, placing a heavy reliance on unreliable autumn flushing feed.

Alternative ewe management systems between weaning and tupping have been described by Rattray and Jagusch (1978), Milligan (1982), Sheath and Bircham (1983), Smeaton and Rattray (1982), and Smeaton (1983). Basically these fall into two categories. The first is to graze ewes relatively hard after weaning (RDM = 600-750 kg DM/ha). This gives a high level of pasture control over a small area of the farm which then provides some high quality pasture for flushing ewes and feeding replacement ewe lambs. Ewe liveweights at weaning are likely to be maintained or decrease over the summer and high allowances of high quality feed at flushing for at least 3 weeks are required to achieve satisfactory ovulation rates (Smith et al 1983).

The second approach is to graze ewes after weaning to achieve near maximum intakes (grazing down to 1000-1200 kg DM/ha). This will result in a poorer level of pasture control over a much larger area, but higher ewe liveweights. It is essential that this liveweight be maintained through to mating (Rattray et al 1983). This management system places less reliance on flushing because ewe liveweights are higher, but it may also generate less high quality feed in March/April than the former options (Smeaton et al 1983(a)). In addition, ewe wool production will be higher because wool growth is sensitive to feeding levels over the summer months (Sumner and Rattray 1980).

7.8 EWE MANAGEMENT - SURVEY RESULTS

7.8.1 EWE MOBS FORMED AT WEANING

A main mob of MA ewes, ranging in size from 900 to 5500 ewes (mean size 2719) was formed at weaning on 28 farms for the purposes of rotational grazing. On the larger farms with more than 5500 ewes, two or more large mobs were usually formed. Mobs of between 200 and 1200 ewes consisting of either c.f.a. ewes to be sold in January/February, works or cull ewes, dry dry and wet dry ewes, recorded ewes or "light" (low condition) ewes were run separately after sorting up either at weaning, the main shear, or in January (Table 7.12).

Table 7.12 NUMBER OF MA EWE MOBS FORMED AT WEANING

Number of Mobs	Number of farms
One	11
Two	9
Three	8
Four	2

Two farmers ran maiden two tooth and MA ewes together over the summer. However, one farmer did not regard this as being successful in 1983 because of the dry conditions.

7.8.2 EWE CONDITION AT WEANING

Ewe condition at weaning in 1982 was better than that of 1981, when a very poor spring was experienced. Seven farmers rated their ewes as being heavy, 22 as medium and one as light at weaning in 1982, compared with 6, 11 and 12 respectively for 1981.[1] This indicates that a considerable variation in ewe condition between years occurs at weaning and that most farmers would need to improve ewe condition by tupping. The weaning to mid-January period in areas prone to dry summer conditions is generally the only time of the year when there is opportunity to significantly increase ewe liveweights/condition without affecting production of other classes of stock. This is because pasture growth rates are normally sufficiently high to allow all stock to be fed ad lib. Furthermore, any pasture intake above that required for maintenance is available for liveweight gain rather than for milk production or to support foetal growth.

[1] 1981 information was available for 29 of the survey farms.

7.8.3 MIXED AGE EWE OBJECTIVES

The farmers were asked to specify their objective(s) for the MA ewes over the weaning to tupping period. The most common aim was to increase ewe liveweight (16 farmers). Eight farmers preferred to have a small increase or maintain ewe liveweight after weaning and to concentrate on flushing ewes prior to mating. Using ewes for pasture control was the most important objective for 3 farmers, while a combination of pasture control and increasing ewe liveweights was cited by 3 farmers (Table 7.13).

7.8.4 RESIDUAL HEIGHT OF PASTURES GRAZED BY EWES IN THE SIX WEEK PERIOD AFTER WEANING

One third of the farmers grazed pastures down to less than 2.5 cm with ewes after weaning. (This corresponds to 500-600 kg DM/ha). Two farmers adopted a lax grazing system, usually leaving residuals of more than 8.0 cm (1600 kg DM/ha) during the initial 6 weeks post-weaning. The compatability of MA ewe objectives and the height of pasture remaining after grazing by ewes is shown by cross tabulation in Table 7.13.

Table 7.13 CROSS TABULATION OF MA EWE OBJECTIVES BY RESIDUAL HEIGHT OF GRAZING AFTER WEANING

MA Ewe Objective	Residual Height of Grazing				Total
	0 - 2.5 cm	3.0 - 5.0 cm	5.5 - 7.5 cm	8.0 cm	
Put on liveweight	1	8	5	2	16
Control pastures	2	0	1	0	3
Put on liveweight/ control pastures	2	1	0	0	3
Maintain liveweight/ small LW increase	5	3	0	0	8
Total	10	12	6	2	30

For the majority of farmers, ewe grazing management is consistent with their objectives. The group which has the most difficulty are those who believe pasture control is achieved by hard grazing and who wish to increase liveweight at the same time.

Reasons for Adopting a Particular Ewe Residual Grazing Height

Farmers were asked why they grazed pastures down to specified residual pasture heights with MA ewes. While most of the reasons are compatable with the ewe objectives mentioned in the previous section some differences did show up (Table 7.14).

Five farmers indicated that reduction of milk production after weaning was important. This was mainly achieved by hard grazing.

The farmers aiming to put on liveweight tended to graze pastures more laxly than those who wished to control or develop the pastures.

Table 7.14 REASONS FOR ADOPTING A PARTICULAR RESIDUAL GRAZING HEIGHT WITH MA EWES IN THE POST-WEANING PERIOD.

Reason	Residual Pasture Height (cm)				Total
	0 - 2.5	3.0-5.0	5.5-7.5	8.0 +	
(1) Increase ewe liveweight	0	2	2	2	6
(2) Control/develop pastures	5	3	1	0	9
(3) Combination (1) & (2)	2	6	2	0	10
(4) Decrease milk production	1	0	0	0	1
(5) Combination (1), (2) and (4)	2	1	1	0	4
Total	10	12	6	2	30

7.8.5 EWE GRAZING SYSTEMS

Rotational Grazing

Ewes were rotationally grazed in the 6-week post-weaning period on 28 of the properties. Ewe rotation lengths varied from 14 to 65 days, with a mean length of 32 days during the 1982/83 season (Table 7.15)[1]

Table 7.15 LENGTH OF EWE ROTATION BY RESIDUAL GRAZING HEIGHT

Rotation Length	Residual Height 0 - 2.5 cm	3.0-5.0 cm	5.5 cm+	Row Total
14 - 25 days	2	3	3	8
30 - 37 days	3	5	1	9
42 - 45 days	0	2	0	2
50 + days	5	2	2	9
Column Total	10	12	6	28

The cross tabulation of residual grazing height and rotation length for ewes shows that longer rotations (≥ 50 days) tended to result in harder grazing by ewes (of pastures) when compared with fast rotations (≤ 25 days). This is because on a slow rotation, paddock grazing durations are generally longer, and ewes are forced to graze closer. Therefore, lower ewe

[1] The rotation length represents the period of time elapsing between grazings of the same paddock by ewes. This question was misinterpreted by some respondents. While most of the replies were discussed with the farmers during the interview, in a few cases other classes of stock graze paddocks before the ewes return.

liveweight gains under this system would be expected. In two instances farmers were attempting to increase liveweight by grazing ewes hard (0 - 2.5 cm) on a rotation which was more than 42 days long. Other than these exceptions, the reasons for adopting a particular rotation length, residual grazing height and MA ewe objectives, were compatible.

Three different approaches to pasture control were evident. One group of farmers believed that a relatively fast rotation (≤ 25 days) was the best means of obtaining control, while the second group had adopted a slower rotation (> 50 days). The third group adopted rotations which were intermediate in length. It is difficult to draw conclusions as to which is the most effective without also considering lamb and cattle grazing management. However, if a long rotation results in the transfer of large amounts of feed into the drier summer months, this is likely to be of low quality and unpalatable to sheep (Guy *et al* 1981). Reduced late summer-autumn pasture production on the areas concerned could be expected (Korte 1981).

Farmer decisions about rotation lengths were made by reference to factors ranging from the rate of pasture growth to the number of paddocks available (Table 7.16).

Table 7.16 FACTORS DETERMINING THE LENGTH OF THE EWE ROTATION

Rotation Length \ Reason	Pasture Growth Rates	Leaves a high residual promoting regrowth	Number of paddocks available	Builds up feed reserves	Time taken to clean out a paddock	Row Total
14 - 25 days	5	0	3	0	0	8
30 - 37 days	3	2	1	1	2	9
42 - 43 days	1	0	1	0	0	2
50 + days	2	2	2	3	0	9
Column Total	11	4	7	4	2	28

As expected, farmers whose decision was related to the rate of pasture growth tended to have faster rotations than those who attempted to build-up a feed reserve. The latter reason is a surprising one for the early summer months and reflects a precautionary policy of transferring feed through into the summer as an insurance against dry conditions. This policy was associated with a longer rotation.

Set Stocking

Two farmers continued set stocking ewes after weaning, although several farmers who had initially rotated, switched to set stocking from late January when pasture conditions became drier.

The reasons given for set stocking were:

"Set stocking gives better weight gains. It doesn't matter if pastures go clumpy - these can be cleaned up during the winter."
"Water (problems) and paddock numbers - I couldn't see any advantage in a rotation this year. The two separate blocks making up the farm means set stocking is more practical."

7.8.6 EFFECTS OF POST-WEANING EWE MANAGEMENT ON PERFORMANCE

The average autumn MA ewe liveweight of the 16 farmers whose primary objective was to put liveweight on ewes in the first 6 weeks after weaning was compared with the group of 8 farmers who wished to maintain or have a small increase in liveweight. The ewes in the former group averaged 54.8 ± 1.2 kg compared with 52.2 ± 1.3 kg in the latter group ($P = 0.523$).

Similarly there was no significant difference ($P = 0.303$) in the 1983 autumn MA ewe liveweights of the farmers who weighed (53.9 ± 1.1 kg) and those who did not (51.1 ± 1.9 kg). Thus farmers who were apparently more concerned with liveweight, on average had heavier sheep, suggesting that this awareness may contribute in part to higher autumn liveweights.

A comparison was also made between farms where either "hard" (< 2.5 cm residual) or "lax" (> 2.5 cm residual) grazing of ewes was adopted after weaning (Table 7.17). On the farms where ewes were laxly grazed after weaning, two tooth liveweights were heavier, and the 1982 lambing percentage and winter stocking rate was higher. This suggests that productivity is higher on these farms. Post-weaning grazing management of ewes could be a factor contributing to this.

Over all the variables there was no significant difference between the two groups ($P = 0.301$).

Table 7.17 COMPARISON OF FARMS WHERE EWES ARE GRAZED EITHER "HARD" OR "LAXLY" IN THE SIX WEEK POST-WEANING PERIOD. ( )NO. OF FARMERS WITH LIVEWEIGHT DATA

Variable Grazing pressure	Group 1 (9) Hard $\bar{x}$	 ± SE	Group 2 (19) Lax $\bar{x}$	 ± SE	Univariate F-test Significance
1983 autumn ewe liveweight (kg)	50.8	1.2	53.7	1.3	0.179
1983 autumn two tooth LW (kg)	45.5	1.9	50.0	1.3	0.054
1983 autumn ewe lamb LW (kg)	28.3	1.1	31.1	1.2	0.139
1982 lambing percentage(%)	93.2	2.6	104.3	3.4	0.048
1982 winter stocking rate (SU/ha)	10.27	0.8	11.66	0.3	0.062
Average size of largest ewe mob post-weaning	2984	387	2601	347	0.510
Number of main paddocks	29	2.7	37	3.8	0.182
			MANOVA	F	0.301

7.8.7 CONCLUSIONS - EWE MANAGEMENT

No overall major conclusion can be drawn from the comparison of ewe management systems either between or within farms although on individual farms some modifications could be made. These include:

1. the adoption of a faster rotation or more lax grazing to obtain ewe liveweight gains and pasture control, rather than hard grazing. There is no advantage in adopting a slow rotation to build-up feed reserves for the summer as most of this will eventually decay rather than be consumed. Green herbage production during the later summer months is also likely to be depressed (See Section 4.0).
2. discontinuing hard grazing management designed to reduce milk production after weaning as in nearly all cases ewe milk production will be only 10-20% of peak production 10 weeks after parturition (See Section 7.1.2).

CHAPTER EIGHT

BEEF CATTLE MANAGEMENT

8.0 INTRODUCTION AND CHAPTER OUTLINE

The position of beef cattle on New Zealand hill country farms has been dominated by two characteristics - the wide fluctuations in market demands for beef and, almost without exception, the lower returns per SU than sheep. Nevertheless, cattle perform an important function on hill country farms in roles such as developing areas of scrub, fern and other rough plant species into improved pasture, cleaning-up low quality pasture not eaten by sheep and providing a diversifying enterprise requiring relatively low labour inputs.

In this chapter, details of cattle management during the October to April period on the survey properties are presented. This includes a description of the use of cattle in grazing management, mating practices, calving performance and buying and selling policies. A comparison is also made between farms with and without cattle in terms of their physical characteristics and production levels. The survey results are then considered in relation to published research. (The literature review presented is restricted to two topics - calf weaning age and sheep:cattle ratios. Other references consulted are listed in Appendix A). Suggestions are made on this basis as to how cattle might be used more effectively in pasture control, as well as ways of improving the efficiency of other aspects of cattle management.

8.1 LITERATURE REVIEW

8.1.1 CALF WEANING AGE

Under New Zealand hill country farming conditions most beef calves are weaned at six months or more of age (Hanly and Mossman 1977, Halford 1971, Scales and Stevenson 1976). Subsequent to weaning, cows are used to clean up rank summer pasture growth or control secondary growth and weeds on new development areas. This weaning age was seen as being inefficient as early as 1955 when Walker commented:

> "If a dairy calf needs only 8 weeks milk feeding to grow into a normal weight 2 year old, surely a beef calf does not need supporting 8 months or thereabouts before he can become self-supporting."

Despite this, only one New Zealand trial on the effects of early weaning has been formally reported (Hight 1968(a) (b)).

Herbage intake increasingly supplements milk in the calf's diet after about 3 months of age (Brumby et al 1962, Barton 1970) However, trials conducted under dry summer conditions have shown a strong association between milk production 5-6 months after calving and growth rate (Anderson 1977, review). In effect the reduction in pasture quantity and quality is being buffered by the dam's milk production. Thus in Hight's (1968(a), (b)) comparative weaning date trial, cows which were weaned at 14 weeks and used for roughage and fern control were heavier than those weaned at 26 weeks and grazed on better quality pasture.

Calf weaning age trials in New Zealand (Hight 1968(b)) and Australia (Bailey 1973) have shown that calves weaned at 3-4 months of age are lighter at 12 months of age than those weaned at 6 months and older. However the difference was considerably reduced by providing "reasonable post-weaning conditions" (Hight 1968(b)) and was smaller in dry seasons (Bailey 1973). In a trial at Massey University, calves weaned at 120 days (January 10) and 180 days of age (March 10) were no different in average liveweight at 18 months of age (Morris 1984 pers. comm.)

Early weaning, defined as weaning before 6 months of age by Hughes and Acland (1970), offers several management advantages. First, as summer conditions become increasingly drier, limited high quality pasture can be allocated to priority classes of stock - ewe lambs and calves - and breeding cows can be restricted to lower levels of nutrition on poorer quality pastures two to three months earlier than is normal practice. Pastures which have gone to seed during the early summer and are unpalatable for sheep and not suitable for high liveweight gains in young cattle, can be returned to a state likely to promote maximum regrowth prior to the autumn, rather than during the winter (Korte 1981). Secondly, weaning early avoids the conflict, in dry autumns, between flushing of ewes and feeding freshly weaned calves high quality pasture. The later weaning system requires that some paddocks be saved from sheep grazing at a time when the maximum possible amount of high quality pasture needs to be available for ewes.

The research results of Hight (1968(a)) and Morris (1984, pers. comm.), (and some experience under commercial farming conditions) indicates that there are unlikely to be disadvantages associated with weaning calves at 3 to 4 months of age. It is also possible to wean calves at considerably lighter weights than those recommended by Barton (1964) of 204 kg for heifer calves and 227 kg for steer calves, providing they are subsequently grazed on high quality pasture.

8.1.2 SHEEP:CATTLE RATIOS

The grazing behaviour, plant preferences and patterns of defoliation of sheep and cattle are different (Calder 1970, Madden 1962, Suckling 1964, Hamilton 1976). Thus under commercial farming conditions, on steep hill country receiving no fertiliser, Madden (1962) observed that continuous grazing with sheep resulted in increased levels of less palatable pasture species and weeds while increasing the cattle:sheep ratio improved pasture composition. Similarly under experimental farmlet conditions, Suckling (1964) noted that paddocks grazed by sheep only tended to develop a "dense mat of unpalatable rank herbage particularly at lower stocking rates." In a more recent farmlet trial at Invermay, (Monteath et al 1977), mixed grass - white clover swards grazed by sheep, at stocking rates varying from 17.3 to 27.2 ewes per ha., remained ryegrass dominant, whereas under cattle grazing (5.4 yearling/ha) cocksfoot became increasingly dominant. Composition changes under separate sheep (up to 12 ewes/ha) and cattle grazing (up to 2 cows/ha) on low to moderate southern North Island hill country were also noted by Clarke et al (1982).

Increases in pasture production of 28% and 41% respectively with sheep only over cattle only grazing were recorded by Monteath et al (1977) and Scott (1977) respectively. Clarke et al (1982) found over a period of 5 years that winter, spring and annual herbage accumulation rates were decreased by cattle grazing.

The lower total production in cattle pastures appears to be primarily due to lower grass production, as clover production has either remained at similar levels under both treatments (Monteath et al 1977, Scott 1977) or increased with cattle only (Boswell and Cranshaw 1977, Clarke et al 1982). Cattle pastures tend to become "progressively" more open than those stocked by sheep only. Thus Scott (1977) recorded 30% bare ground in cattle grazed pastures in February compared with 16% in sheep pastures. A detailed discussion of why differences in pasture production and changes in composition occur may be found in Monteath et al (1977) and Scott (1977).

Animal production on irrigated pastures was found to be superior under mixed rather than separate grazing of sheep and cattle at Winchmore (Winchmore Irrigation Station Annual Report 1962), with total meat production per hectare and lambing percentages both being higher under combined grazing conditions. Suckling (1964) compared separate and mixed grazing of sheep and cattle at stocking rates ranging from 7.41 to 16 ewes/ha on hill country. Essentially cattle numbers were adjusted to control roughage and surplus herbage. Ewe liveweights, lamb weaning weights, lambing percentage, wool production, teeth wear and incidence of footrot were generally superior under conditions of mixed grazing although all treatments showed a decline in ewe productivity at higher stocking rates.

At Invermay, Boswell and Cranshaw (1977) compared four ratios of sheep:cattle (0, 33%, 66% and 100%), under either simultaneous grazing or a "cattle leader and sheep follower" management systems. The benefits of mixed grazing showed up in sheep rather than cattle. Sheep grazed with cattle gained weight at twice the rate as those grazed as followers after cattle, or sheep grazed alone. The largest weight gains were made at the 66% ratio for sheep and the 33% ratio for cattle. Unfortunately, no data of the reverse system - "cattle following sheep" were collected.

The "cattle-follower" system is recommended by Sheath and Bircham (1983). Cattle should follow sheep with a 1-2 day overlap in rotations in the period of high pasture growth rates to reduce the level of competition between sheep and cattle for preferred species, especially clovers. Cattle are therfore forced to eat longer pasture, especially the stem portion, and species unpalatable to sheep. Where sheep are set stocked after weaning, cattle should be rotated through paddocks as material rejected by sheep begins to accummulate. In the late summer and autumn, the sheep leader system should be continued and cattle used to remove rank pasture from paddocks not previously controlled. Sheath and Bircham (1983) acknowledge that cattle performance will be lower but overall farm productivity would increase with this form of grazing management. This conclusion is supported by Boswell and Cranshaw's (1977) findings at Invermay.

8.2 SURVEY RESULTS

8.2.1 INTRODUCTION

Of the 21 farms which wintered cattle in 1982, 16 had breeding herds. A further herd purchased with a new property in late 1982 gave a total of 17 farms from which analysis of breeding herd information could be made.[1] Details of grazing management, weaning management and buying/selling policies were also analysed for dry cattle systems.

Farmers with all-sheep policies were questioned on their experiences and a comparison of production variables on these properties is made with those running cattle.

8.2.2 MATING POLICIES

Within the survey area there was a trend towards

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[1] Information concerning numbers, ratios with sheep, breed and calving percentages are presented in sections 3.4.2 and 3.5.3

later calving. In the majority of cases this was a reaction to early spring (July-September) problems with acidosis and hypomagnesaemia. In one herd, for example, bulls were not introduced until January 20 to give a late October commencement of calving (Table 8.1).

Table 8.1 JOINING MONTH OF BEEF BREEDING HERDS

Month bull introduced	No. of farms
October	2
November 1 - 15	8
November 16 - 30	0
December	6
January	1

Bulls were joined with heifers within one or two days or at the same time as mixed age cows on 14 farms, later on 2 properties by about two weeks and 16 days earlier in one herd. Four farmers (30%) mated heifers at 15 months, which is similar to the overall average of the East Coast region (Hansen 1983).

The mating period varied from 43 to 174 days, with a mean of 82 days (Table 8.2). Calving percentage was not depressed by condensed mating periods (Table 8.2). It is apparent that bulls are left out with the herd on some properties until the cows are mustered for weaning, pregnancy testing or tuberculosis testing, as a means of saving labour. No details of calving spread were obtained.

Table 8.2 LENGTH OF MATING PERIOD AND THE 1980-82 AVERAGE CALVING PERCENTAGE

Mating Period	< 80%	80-85%	86-90%	> 90%	Total
43 - 63 days	1	1	2	1	5
65 - 88 days	1	2	3	1	7
100 plus days	2	0	1	1	4
Total	4	3	6	3	16

8.2.3 CALF WEANING

Most calves were weaned in April, although two farmers weaned earlier than normal (in February) in 1983 because of the dry conditions (Table 8.3). Weaning was 2-4 weeks later than usual in 1983 on three properties. Most calves were therefore 6 months of age and older at weaning.

The reasons for choosing a particular weaning date, as with lamb weaning dates, reflect the importance placed on ease of management and convenience (Table 8.3). Weaner sale dates were therefore a major influencing factor as was the need to fit in with other operations such as culling, and tuberculosis (TB) testing.

Table 8.3 MONTH OF CALF WEANING AND REASONS FOR CHOICE OF WEANING DATE

Reason for Weaning Date / Month weaned	Weaner Sale Date	Availability of pasture	Fits in with other operations	Cow/calf condition	Total
February	0	1	0	1	2
April	6	1	4	0	11
May	1	0	1	0	2
June	0	0	0	1	1
Total	7	2	5	2	16

Comments by farmers weaning in April included:

"Weaning at this time is convenient and can be combined with weaner sale, TB testing, and maybe there is some pasture growth to wean onto."

"Less mud before winter, usually brand as well. No other reason."

"Weaned one month before May sale (in 1982) but calves went back, so this year will wean nearer to sale date."

"Coincide with weaner sales and TB testing. My neighbour weans in January but this requires extra paddocks and water is very important."

The farmers who weaned in February commented:

"I saved a paddock for calves earlier. There was little grass for calves while on cows. Calves have done well."

"Because of the dry season the cows were starting to dry up. Wanted to use cows to clean-up pastures and calves do better off the cow. Best thing I ever did - calves have done well and quietened down."

Farmers selling weaners were reluctant to wean early because of a price discount on these calves. However very few indicated what the price difference was. One suggested \$15. Paradoxically the same farmers would prefer to buy calves which had been weaned for several weeks prior to sale if they were in reasonable condition, rather than calves weaned the day prior to the sale. In some parts of the Wairarapa a policy of weaning heifer calves only in January-February is adopted during a dry season. Steer calves are then weaned at the usual time in April or May.

Calf weaning date was altered according to seasonal pasture growth by 8 farmers. The 7 farmers who weaned according to sale date were relatively inflexible. Generally then, the most flexible weaning policies were associated with policies of retaining calves through to older ages before sale.

All except one of the farmers attempted to prepare pastures by spelling of paddocks for weaning. Surprisingly, 14 farmers (82%) indicated that they experienced no conflict between this practice and the provision of feed for flushing ewes. This may be because weaning in most cases occurs after tupping has commenced and autumn rains have boosted pasture growth rates.

8.2.4 CATTLE SELLING POLICIES

Cattle selling policies were based on a number of factors but almost half of the farmers based their decision on when to sell on three or four main indicators (Table 8.4). Pregnancy test information was also used by one farmer and the cash flow situation was considered by another.

Table 8.4 FACTORS INFLUENCING DECISION WHEN TO SELL CATTLE (ALL CLASSES)

	Reasons for selling	No. of Farmers
(1)	Sale prices	1
(2)	Availability of feed	1
(3)	Schedule price	2
(4)	Annual cattle fairs	4
(5)	Combination of 2, 3 and 4	13

Eleven of the 17 farmers with breeding cows sold weaners in the autumn (Table 8.5). This corresponds to the large weaner fairs which are held in the major farm trading centres from late March to May. There was a trend towards reduced cows numbers and wintering more weaner steers to sell the following spring or to rear to older ages.

There were two main selling times for 13 month to 2 year old cattle. The first occurred from September to November. This is referred to as the "grass market" because demand for stock increases as pasture growth begins to exceed animal requirements. These cattle are therefore predominantly changing between farms rather than being slaughtered. The second popular sale time is in the autumn at 18-20 months of age when animals are at killable weights and stock numbers are being reduced prior to the winter months to make way for replacements.

Table 8.5 SALE PATTERNS FOR DIFFERENT CLASSES OF CATTLE 1982/83. (FIGURES REPRESENT THE NUMBER OF FARMERS SELLING IN A PARTICULAR MONTH)

Month	Weaners	13 month-2 year old	2 year +	Breeding Cows
January			2	1
February			2	
March		2	3	
April	6	1	3	6
May	3	1	2	3
June	2		1	
July			2	
August			1	
September		3		
October		1	1	
November		3	2	3
December		1	1	

There was no definite trend in 2 year and older cattle sales although slightly more farmers sold during the autumn months. Cattle of this age group are generally at killable weights and may be disposed of at virtually any time to assist with cash flow or to reduce feed demand.

Breeding cows were generally sold either at the end of calving, when dry cows or cows which lost calves can be identified, and in the autumn after weaning. Thus cows sold in the autumn include cows culled for age or some production fault (e.g. negative pregnancy test) or a physical fault such as bad feet.

Problems experienced with selling cattle were minor. Five farmers were sometimes unable to get works space as required and one farmer in a TB restricted selling area had to test before sale which was a nuisance.

8.2.5 CATTLE BUYING POLICIES

Of the 5 farmers who purchased cattle in most years, 4 had no breeding cows. In general cattle were purchased either as weaners in March to April at the weaner sales or at 15-18 months of age between October and January. All except one of the farmers purchased cattle of traditional beef breeds (i.e. Angus and Hereford). Farmers were flexible in the age of cattle purchased. Thus both weaners and 18 month cattle might be purchased within the one season.

Purchases in the late spring-early summer were made essentially to assist in the control of the spring pasture flush. These cattle could be sold again as early as January-February if conditions began to get dry, or alternatively, numbers were gradually decreased over the winter months depending on the feed situation and prices. Although profitability was important, the role of controlling rank growth and preparing pastures suitable for lambs was given a high priority.

Two farmers based their cattle buying policy on the store or schedule price, attempting to purchase when the price was low and selling when it was high. These farmers had the most flexible policy. Buying and selling on the same market and assuming that the margin between sale and purchase price are similar even if price variations are quite large between years, was adopted by one farmer.

The other two buying policies were in between these extremes.

8.2.6 CATTLE GRAZING MANAGEMENT

Eleven farmers described their breeding cow grazing management between October and April as set stocking. Essentially, this involved allocating cows to paddocks which required seedhead or roughage control. Shifts between paddocks occurred after the required control was achieved rather than in terms of a pre-defined plan. On the other 5 farms, cows were shifted every 1 to 4 weeks depending on paddock size and feed position. Shifts tended to be more frequent in the period December to February, but essentially a semi-set stock system was retained.

Grazing management of other classes of cattle was similar, with 8 farmers "set stocking" replacements and steers. Shifts every 2-4 weeks were used on 4 properties while 1-2 week paddock grazing durations were adopted by 4 farmers.

On the farms with dry cattle policies, two set stocked and two shifted every 3-4 days in conjunction with the ewes and lambs.

In general cattle grazing management was very flexible requiring low labour inputs. The primary purpose of management in early summer was to prepare lamb feed by controlling seedhead, but later in the summer the emphasis was shifted towards restoring pastures to a state that would encourage autumn growth.

Importance of Cattle for Pasture Management

Cattle were considered to be important or very important for controlling pasture growth on 18 of the 21 farms with cattle. Only 3 farmers thought that they were of limited value for this purpose.

Five farmers would have preferred to have had more cattle in most years to control pastures even though the sheep:cattle ratio on these farms was already quite low (5.6:1 ± 0.9 versus survey average of 6.3:1 ± 0.9 for the 21 farms with cattle): the reasons for not having more cattle were not determined. However these farmers had larger areas of unimproved pastures which may have been more suitable for cattle grazing.

Five farmers considered that there would be no change in pastures if all cattle were sold (Table 8.6). Some comments included:

"I have tried no cattle and there is very little difference."

"There would not be a great deal of change, but may have to work sheep harder which would decrease wool."

"Debatable - sheep could do the job just as well except in a year of exceptional growth. Small paddocks are required for cattle to clean up a paddock otherwise it is too hard on them."

Cattle however were regarded as being superior to sheep for cleaning up rough pastures (7 farmers), grazing seedhead (6) and preparing lamb feed (6) (Table 8.6).

Table 8.6 COMPARISON OF EFFECT ON PASTURES IF ALL CATTLE WERE SOLD AND ADVANTAGES OF CATTLE OVER SHEEP FOR GRAZING PURPOSES.

Advantage of Cattle for grazing purposes	Effect on pastures if all cattle sold			
	No Change	Pastures would deteriorate/More rushes and rough species	Don't Know	Total
None	0	1	1	2
Cleaning up rough pasture	2	5	0	7
Grazing seedhead	3	1	2	6
Preparing lamb feed/breaking worm cycle/grazing rough pasture	0	5	1	6
Total	5	12	4	21

The comments of farmers who were not prepared to farm without cattle included:

"I have tried no cattle and the feed gets away and loses quality later on."

"Pastures deteriorate, clovers go and lambs don't do."

"I hate to think! 'No cattle' doesn't work in our district. Pastures would go rank, sour and grass grub would establish. Sheep don't clean out a big paddock unless grazed very hard, and they will not eat dry stalky material."

"Pastures would be overgrazed and more importantly sheep performance would deteriorate."

Although there were contrasting points of view concerning the effects of a no-cattle policy, most farmers agreed that an increased level of subdivision was necessary if such a system was to be implemented successfully.

8.2.7 FARMS WITH ALL-SHEEP POLICIES

Experiences of Farmers without Cattle

Nine farms wintered less than 28 C.S.U. in 1982. In all cases it was at least the second season out of cattle (Table 8.7).

Table 8.7 NUMBER OF YEARS WITH NO CATTLE

No. of Years	No. of Farms
2	3
3	1
5	2
6	2
11	1

Decreased profitability of cattle was given as the main reason for going out of cattle by only one farmer. Disease and metabolic disorders, pugging of pastures and high capital requirements were also given as important reasons (Table 8.8). The latter reason was mentioned by two farmers who had recently purchased their properties.

Table 8.8 MAIN REASON FOR GOING-OUT OF OR DECREASING CATTLE

Reason	No. of Farms
Unprofitable	1
Disease/metabolic disorders	2
High capital requirements	1
Combination of above plus pasture damage/water problems	5

Five of the nine farmers indicated that they were definitely going to remain out of cattle. The remainder were watching prices and hoped to buy in dry cattle, at some stage. In three cases this was primarily because they enjoyed farming cattle.

Reduced cattle numbers were replaced by proportional increases in all classes of sheep on 5 farms, 2 farmers increased ewes only, 3 farmers wintered more ewe hoggets and 1 farmer carried additional wether hoggets into the spring.

Grazing management remained the same as with cattle on 4 of the farms; increased use of rotational grazing was made on the other properties. This was associated with increased subdivision in one case. The reduced need to transfer autumn and winter pasture through into the spring for calving was mentioned several times as being an advantage of an all-sheep system.

Grazing management under an all-sheep policy was rated as being more effective than with cattle by 6 farmers. Two farmers considered that there was little difference and only one suggested that grazing was less effective. These responses are confirmed by the fact that 4 farmers missed nothing from having no-cattle. Three farmers sometimes experienced difficulty in controlling pastures during the summer especially in wetter years, and cattle were missed on one property where they had been useful for grazing rough grasses, rushes and sedge.

It therefore appears that the transition from a mixed sheep and cattle farming system to one of an all-sheep policy can be completed with very little effect on pastures. The main reason for wanting to change back to a mixed system was the pleasure obtained from farming cattle, rather than any management difficulties which had been encountered.

Comparison of Farms With and Without Cattle

The survey farms were divided into two groups on the basis of wintering more or less than 28 C.S.U. in 1982. The no-cattle and cattle groups formed included 8 and 20 farmers respectively for which there was sufficient data for analysis.[1] These were compared in terms of physical characteristics and performance variables (Table 8.9) to determine whether all-sheep systems' performance was poorer than on properties where mixed grazing occurred.

Multivariate analysis (MANOVA) indicated that the two groups were not significantly different (P = 0.2750) (Table 8.9 (a)). Of the variables included in this analysis only AREA was significantly different between the two groups. Amongst the four variables tested, at the univariate level only significant differences in the size of post-weaning ewe mob characteristics and average main paddock area existed (Table 8.9 (b)). (The latter could be expected because of the large difference in effective grazing area but similar number of main paddocks between the groups).

These results suggest that, on average, the no-cattle farms were managed more intensively. The main reason for this is probably their smaller size. Thus on a smaller farm, higher returns per hectare must be generated to achieve an economic standard of living comparable to a larger farm. The historically greater profitability of sheep over beef cattle (Taylor 1984), especially breeding cow systems, means that higher income can be more easily achieved with an all-sheep system.

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[1] Two farms, one from each group were excluded because 1983 autumn sheep liveweights were not available.

Table 8.9 MULTIVARIATE COMPARISON OF FARMS WITH AND WITHOUT CATTLE. ( ) NO. OF FARMS.

(a) Variables in the Multivariate Analysis

Variable Description	Cattle(20) $\bar{x}$	± SE	No Cattle (8) $\bar{x}$	± SE	Univariate Test Significance of F
1983 autumn ewe liveweight (kg)*	52.47	1.13	49.86	2.05	0.2470
1983 autumn ewe lamb liveweight (kg)	30.54	0.92	29.46	2.20	0.5918
1982 lambing percentage (%)	102.20	3.04	97.00	5.28	0.3824
1982 winter stocking rate (SU/eff ha)	10.89	0.37	12.01	0.76	0.1514
Effective grazing area (ha)	679	80	303	48	0.0083
Number of main paddocks	36.0	3.7	30.0	3.6	0.3333
Percentage farm in unimproved pastures (%)	18.25	9.47	12.50	12.49	0.7376
Normal phosphate application (kg P. SU)	1.99	0.17	1.97	0.07	0.9526
Years of ownership/managing (years)	15.65	2.43	8.13	3.26	0.0979
Labour (SU/LU in 1982)	3405	266	3238	421	0.7414

MANOVA F = 0.2750

* LW =((MA ewe LW * 3) + two tooth LW)/4)

(b) Variables not included in the multivariate analysis[1]

	Cattle(21)		No Cattle (9)		t-test
Average lamb carcass weight to March 1983 (kg)	12.40	0.20	12.80	0.20	N.S.
Average main paddock area (ha)	18.98	1.91	9.98	1.36	**
Number of ewes in largest post-weaning mob	2983	315	2435	269	**
Average main paddock stocking rate with largest post-weaning mob (ewes/ha)	177	19	255	24	**

[1] Either because they would be a linear combination of one or more of the variables already in the analysis or the data was not easily computed to include on file.

** Indicates significance at 1% level.

The smaller average main paddock area meant that higher grazing pressures were being exerted on the no-cattle farms in the post-weaning period. This confirms the comments of farmers who stated that sheep grazing could be as effective as mixed sheep and cattle grazing, if subdivision was more intensive.

Although the levels of productive performance favour the cattle group, the differences were not significant, supporting the view of all except one of the farmers in the no-cattle group that grazing management and hence performance was just as effective as with cattle. Five of the farmers with cattle expressed the same opinion. Although this result is contrary to some reported in the literature (see Section 8.1.2) it should be remembered that performance data relates to one season only and there are a wide range of circumstances within each group.

8.3 CONCLUSIONS

The impression gained during the survey was that cattle receive more emphasis in management than sheep on most properties despite their lower profitability. This was evident by practices such as saving feed for calving but not necessarily for lambing, use of hay and nitrogen-boosted pasture as supplements and the adoption of break fencing to ration feed intakes over the winter and spring period. On some farms a block of land was maintained in its native state by not topdressing, specifically for calving purposes. Generally, cattle did not fulfil a major role in cleaning up and developing pastures - most farmers preferred instead to use large mobs of ewes for hard grazing purposes.

Considerably greater use of cattle for grazing management over the late spring-early summer period could be made on nearly all of the farms. Rather than set stocking cattle at relatively low rates, especially after lamb weaning, larger mobs should be formed and grazed in a manner that overlaps that of sheep as outlined by Sheath and Bircham (1983). The common system of maintaining a low cattle paddock stocking rate means that they have almost no impact in controlling reproductive growth because readily available leafy material is eaten in preference (Heady 1964).

The trend towards later calving will provide worthwhile benefits. These include improving the fit of cow and calf feed requirements with the pattern of pasture growth, reducing metabolic problems at calving (Shortridge 1960, Young et al 1981), allowing autumn and winter feed to be transferred for lambing rather than calving, improving the utilisation of spring labour by separating calving and lambing periods and ensuring a high level of nutrition post-calving to minimise the anoestrus interval (Morris 1976, review). The pasture growth rate data (Section 3.1.5) and the experience of some of the survey farmers indicates that a mid-October commencement of calving would be successful in the survey districts.

Most farmers would probably benefit from shortening the mating period. Although the length of the mating period does not necessarily reflect the calving spread, a wide range in calf ages is only possible with long mating durations. It is suggested that a change to a 63-day period be progressively made with both cows and heifers being introduced to bulls at the same time. A long term aim is to have all cows calving in 42 days (Morris 1976, Mossman and Hanley 1977). The advantages of this breeding policy include reduction in variability of calf age and size at weaning (without affecting calving percentages) and simplified grazing management because larger numbers of cows can be treated as a single mob at the required feeding levels

(Burns 1967; Morris 1980, 1982).

The research evidence indicates that mating at 15 months can be successfully adopted on hill country properties (Carter et al 1980, Smeaton 1981, Smeaton and Winn 1981, Hansen 1983, review). The grazing management systems adopted by the survey farmers probably do not encourage maximum liveweight gains in young cattle except during the period November to January in most years. The low spring pasture cover grazed by ewes at lambing suggests that winter and spring growth rates in young cattle are low. Mating at 27 months also means that less emphasis needs to be placed on achieving high liveweight gains in the first 15 months. Halford (1971) observed similar management of young cattle in Horowhenua hill country.

Weaning calves at 3 to 4 months of age would increase management flexibility especially of pastures. The advantages of earlier weaning of calves has already been discussed in Section 8.1.1. The main reasons why this policy is not adopted appears to be tradition and concern about the effects of a post-weaning check in growth rates.

The cattle buying and selling policies are typical of other farms in the Wairarapa (Gould 1975) but the declining number of breeding cows has long term implications. In some instances a change in farming policy has been made with a higher proportion of calves being wintered in place of cows. Gould (1975) recorded the same trend towards sale of heavier cattle.

In other cases breeding cows are being replaced by a dry-cattle policy. The reduced availability of weaner calves of traditional breeds means that dry cattle policies will increasingly be based on dairy beef. At the time of the survey only one farmer was regularly buying animals of this type. Although the bias against dairy breeds is diminishing it will be some time before they are treated as "equals" to beef breeds.

The analysis of the cattle and no-cattle farms pointed to insignificant differences in performance between the two groups in the 1982/83 season. A major reason for farming cattle is that they provide enjoyment. This means that providing cattle are affordable, they will be farmed irrespective of comparative economic returns or efficiency of grazing management.

CHAPTER NINE

INTEGRATION

9.0 INTRODUCTION

In Chapters 5 to 8, details of sheep and cattle management practices and surveyed farmer objectives have been analysed, primarily within a univariate or bivariate context. The large number of interrelationships between variables in a farming system mean, however, that an attempt should be made to integrate different aspects of management to estimate their relative effects on farm performance (output). As discussed in Section 2.6, it is possible, for example, for a variable to appear significant at the univariate level but not significant within a multivariate context, and vice versa.

One possible approach to integration is through systems modelling. The effects of various management strategies can be evaluated taking account of interrelationships between the various components of the production system. Given a systems model of hill country sheep/beef production, it would have been possible to analyse alternative management strategies for the survey farms. Such an approach was not feasible as part of this study.

An alternative approach to integration is to use statistical techniques to estimate the impact of management and state variables on system performance. A recent example of the use of multiple regression to aid analysis of management strategies affecting profitability of hill country production is the work of Fitzharris (1982). The application of statistical estimation techniques such as multiple regression to farm survey data is fraught with difficulties;

including measurement problems, number of potential explanatory variables relative to number of survey farms, and appropriate mathematical form of estimating equations. Farm production systems are usually characterised by multiple outputs and where the objective of the study is to investigate their interrelationships, multivariate analysis techniques are required (See Section 2.6).

The objective of this research was to investigate the interrelationships between management strategies and systems performance on a number of survey farms. An attempt has therefore been made to disaggregate overall systems performance in an effort to gain a greater understanding of the effect of various management strategies on the components of performance for the survey farms.

The reviews of literature undertaken as part of this study and analyses of survey data presented in earlier chapters have highlighted the importance of sheep liveweights in affecting overall farm performance. In particular, the liveweight of MA ewes at tupping is of crucial importance in determining lambing performance. Average liveweight of MA ewes is likely to be dependent to some extent on liveweights attained as two-tooths, and two-tooth average liveweight in turn is likely to be dependent to some extent on liveweights attained as hoggets. However, these classes of livestock may compete for available feed, at least at some times of the year. Thus management strategies designed to enhance liveweight gain of lambs from weaning to April may be competitive with those designed to increase liveweight gain of maiden two tooths over the same period. The analysis presented in this chapter is designed to investigate these interrelationships.

9.1 AUTUMN LIVEWEIGHTS OF EWE LAMBS AND MAIDEN TWO TOOTHS

The correlation between 1983 autumn average liveweights of a sample of ewe lambs and two tooth ewes on the survey farms was 0.76 . The corresponding correlation for sample average two tooth and MA ewe liveweights was 0.85. The correlation between 1983 autumn average liveweight of a sample of MA ewes and 1982 lambing percentage on the survey farms was 0.93 (Section 5.2.3).[1]

This pattern of liveweight relationships between stock classes, and the close relationship between autumn ewe liveweight and lambing percentage, has been reported in other farm surveys and experimental studies (see review, Section 5.1.1). The magnitude of the sample correlation coefficients between the stock class average liveweights is an indication that, in general, management strategies that result in high average autumn ewe lamb liveweights do not have a negative effect on two tooth or MA ewe mating weights, at least on the survey farms.

A basic objective of sheep farmers with breeding flocks, therefore, should be to implement management strategies so that replacement ewe lambs reach pre-winter liveweights of 35 kg or more. There is every indication that there are management strategies consistent with achieving target mating liveweights of 55 kg and 60 kg for two tooth and MA ewes respectively. An integrated analysis of management strategies in relation to autumn replacement ewe lamb and two-tooth liveweights is therefore likely to be of interest to farmers. Earlier studies have indicated relatively little opportunity to increase mature ewe liveweight (size rather than condition) beyond that achieved at two tooth mating (Parker et al 1975, Armstrong et al 1980). The high correlation observed between two tooth and MA ewe autumn liveweights on the survey farms (0.85) provides some confirmation of these earlier studies.

[1] r = 0.90 when two tooth liveweights are taken into account.

The following sections present the results of multivariate regression analysis of management practices and farm physical characteristics on 1983 autumn ewe lamb and two tooth liveweights for the survey farms. The dependent variables (ewe lamb and two tooth autumn average liveweights) are multivariate since both are hypothesised to depend on management and farm characteristic variables while, as has already been shown, there is a high correlation between them. For the purpose of analysing the effect of management factors on the dependent variables it is necessary to exclude each dependent variable from the equation attempting to explain variation in the other. Only the reduced form equations for each dependent variable are therefore estimated:

$$Y \text{ (lamb lwt.)} = f_1 \text{ (Management variables, state variables)} + e_1$$

$$Y \text{ (2th lwt.)} = f_2 \text{ (Management variables, state variables)} + e_2$$

Any residual relationship between the dependent variables will be indicated by the correlation between the estimated errors for each predictor equation. A close examination of the estimated errors for the survey farms, when combined with knowledge of management practices not quantified as explanatory variables in the predictor equations, may indicate useful avenues for further farm management research.

Given the limited nature of the survey data (only data from 28 farms was available for this stage of the analysis) the results presented in the following sections must be regarded with caution and as expository.

9.2 MULTIVARIATE REGRESSION ANALYSIS

9.2.1 METHODOLOGY

The simplest multivariate regression model may be written:

$$Y_{1i} = \alpha_o + \alpha_1 X_i + e_{1i}$$
$$Y_{2i} = \beta_o + \beta_1 X_i + e_{2i}$$

where,

e_{1i} are N I D (o, σ_1^2)

e_{2i} are N I D (o, σ_2^2)

$E(e_{1i}\ e_{2j}) = \sigma_{12}$ for $i = j$

$= o$ otherwise

Under these error assumptions and where the explanatory variable (X) is common to each model, then ordinary least squares (OLS) applied to each equation gives estimates of regression coefficients and their variances with desirable properties (Huang 1970). However, where $\sigma_{12} \neq o$, it is better to use a joint forecast region to accompany the point forecasts of the equations than to use individual forecast intervals. (In this study we are not concerned with forecast regions for multivariate performance variables, though such forecasts may well be of interest in other research contexts).

The multivariate regression model is restrictive in terms of (a) the set of independent or explanatory variables is common to each equation, (b) the observations on the independent variables are identical for each equation, and (c) the error assumptions.

In farm management analysis where we observe values for a number of dependent and independent variables on each of a number of farms, the multivariate regression model assumptions (a) and (b) are not restrictive, at least in a general sense. However, with a limited number of observations (farms) relative to the number of independent (management and state) variables, it may be desirable to consider the situation where the set of independent variables differs between equations. This situation has been described by Huang (1970) as the 'sets of regression equations analysis.' The analysis of sets of regression equations is most efficiently carried out using Aitkens Generalised Least Squares, rather than OLS applied to each equation (Aitken 1935).

The sets of regression equations in this study start out with the same set of independent variables and observations (i.e. multivariate regression assumptions (a) and (b) are met). OLS is applied initially to each equation and the estimates obtained have desirable properties. However, the SPSS New Regression programme was then used to build an estimating equation for each dependent variable by backward elimination (Hull and Nie 1981). In this procedure, variables are removed one at a time; with the variable removed being the one with the smallest student's t-value (ratio of estimated regression coefficient to estimated standard error).

A number of criteria can be used to halt the elimination procedure, i.e. select the 'best' predictor equation. The standard procedure is to cease elimination when all remaining explanatory variables are significant at some predetermined level (e.g. 10% or less). An alternative criterion is to cease elimination at the stage where the explanatory power (adjusted R^2 value) of the predictor equation is maximum. A disadvantage of this latter criterion is that some regression coefficients remaining in the equation may not be significantly different from zero at commonly accepted significance levels.

Given the small sample size (28 observations) and the exploratory nature of this analysis, the decision was made to select the predictor equation with the maximum adjusted R^2 value.

When implemented, the stepwise procedure will generally give estimating equations where the sets of independent variables remaining in the final stage differ between equations. Since the variables deleted in each equation are not significant at the specified level (10% in this study), the resulting estimates should be reasonably close to those that would have been obtained from application of Aitken's Generalised Least Squares. This hypothesis has been checked empirically by taking the independent variable set at the final stage for each equation, and then creating an enlarged independent variable set common to both. OLS was then applied to each equation using this common independent variable set, thus obtaining the Aitken's Generalised Least Squares estimators. In the cases tested, the estimated regression coefficients and standard errors were very close to those obtained for the variables remaining at the final stage of the backward stepwise regression procedure. This is the expected result unless pairs of independent variables exhibit a high degree of multicollinearity, and in this situation it is not possible to obtain efficient estimates of the regression coefficients for these variables.

In this study it has been assumed that the values of performance variables are uncorrelated between farms, (i.e. the multivariate regression error assumptions hold true). This assumption is difficult to test without time-series data on each farm, but because between-district differences might be expected, district dummy variables have been included in the analysis.

9.2.2 POSSIBLE EXPLANATORY VARIABLES

The set of possible explanatory variables may be categorised as either State or Management variables. State variables are those whose values are not under direct management control (at least in the short term) while the values of management variables are subject to farmer decision. It is recognised that the following list of variables used in this analysis may be incomplete, and at a subsequent stage in the analysis an attempt is made to examine this question.

State Variables

Symbol	Description
AREA	- Effective grazing area of farm (ha).
STEEP	- A measure of farm topography. Proportion of farm area that is non-cultivatable.
MANAGE	- Number of years experience farmer has had as farm owner or manager.
D8	- Dummy variable for Ihuraua district.
D9	- Dummy variable for Bideford district. (The coefficients on these dummy variables estimate the difference between these districts and the Wangaehu district).

Management Variables

LAMB82	- Date lambing commenced in 1982 (July 11 = 1)
OLDEST	- Age of oldest lamb at weaning 1982 (days).
SR	- Stock units wintered per effective ha, 30 June 1982.
RATIO	- Ratio of cattle:sheep SU wintered June 1982.
P.SU	- Kilograms of phosphate per SU normally applied.

PDKMAIN - Number of main paddocks.

LAMBFEED - Proportion of grazeable area closed for lambs prior to weaning.

LAB.SU - Number of SU per labour unit, June 1982.

D1 - Dummy variable for farms with no summer water problems.

D2 - Dummy variable for farms where replacement ewe lambs were given grazing priority over other lambs during the first month post-weaning.

D3 - Dummy variable for farms where lambs were rotationally grazed versus set stocked post-weaning.

D4 - Dummy variable for farms weighing lambs and replacement ewe hoggets.

D5 - Dummy variable for farms where grazing management of MA ewes during 6-week period post-weaning resulted in residual pasture heights (RH) of > 2.5 cm RH.

D6 - Dummy variable for farms where replacement two tooth selection was undertaken in January rather than pre-winter as ewe hoggets, (i.e. female stock surplus to replacement requirements were sold in January as two tooths).

D7 - Dummy variable for farms where management strategies were implemented in an effort to provide flushing feed for ewes prior to mating.

Dummy variables take the value one for the situation or management strategy described, and zero otherwise. Simple correlation coefficient values between the dependent variables and candidate explanatory variables that can be measured quantitatively are presented in Table 9.1.

Table 9.1 SIMPLE CORRELATION COEFFICIENTS (r) BETWEEN DEPENDENT AND EXPLANATORY VARIABLES

Explanatory Variable	Dependent Variables	
	Ewe Lamb Lwt. (ELLWGT)	Two Tooth Lwt (TWOTLWGT)
AREA	- 0.003	0.013
STEEP	0.283	0.223
MANAGE	- 0.050	0.166
LAMB82	0.335	0.176
OLDEST	- 0.217	- 0.109
SR	0.120	0.157
RATIO	0.327	0.268
P.SU	0.155	0.302
PDKMAIN	0.146	0.202
LAMBFEED	0.157	- 0.011
LAB.SU	0.000	- 0.332

9.2.3 RESULTS

Estimated regression coefficient values for the equations that maximised adjusted R^2 values for each dependent variable are presented in Table 9.2 Figures in brackets are Student's t-values.

Table 9.2 EWE LAMB AND TWO TOOTH AUTUMN LIVEWEIGHT ESTIMATING EQUATIONS (ORDINARY LEAST SQUARES)

Explanatory Variable	Dependent Variable: ELLWGT	TWOTLWGT
Constant	23.496 (10.54)	50.457 (10.70)
MANAGE	-0.219 (3.51)	-0.197 (1.89)
D8 (Ihuraua)	5.759 (3.25)	7.156 (3.38)
D9 (Bideford)	-2.200 (1.61)	-3.002 (1.90)
OLDEST		0.063 (1.46)
RATIO	5.848 (1.36)	
PDKMAIN	0.092 (1.86)	0.112 (1.44)
LAMBFEED	0.103 (1.90)	
LAB.SU		-0.002 (2.96)
D1 (Summer water)	3.236 (2.68)	
D2 (Grazing Priority)		-4.427 (2.82)
D3 (Rotational grazing)		-2.288 (1.36)
D4 (Weighing)	1.733 (1.38)	6.780 (3.68)
D5 (MA ewe grazing)		-3.314 (1.81)
D6 (Jan. sale 2 tooths)	1.522 (1.17)	3.882 (2.39)
Adjusted R^2 value	0.670	0.737
Residual Mean Square (df)	7.300 (18)	9.010 (15)

Note: Figures in brackets are Student's t-values.

Discussion

Regression analysis results indicate that farms in the Ihuraua district are better suited to high levels of livestock performance (as indicated by autumn ewe lamb and two tooth liveweights) than the Bideford and Wangaehu districts.

These results also indicate a negative relationship between years of management experience and livestock performance. It might be expected that a young farmer, especially with low equity, would place heavy emphasis on improving liveweights to increase production and hence profitability. However, there are a number of other possible explanations for this interesting result that could warrant further study. It is worth noting here that the simple correlation coefficients between MANAGE and liveweights of ewe lambs and two tooths, unadjusted for the effects of other variables, do not provide the same strength of evidence for this negative relationship. This is an example of where simple univariate analyses may give misleading results.

There is evidence to suggest that farmers running a higher proportion of cattle to sheep, closing a greater proportion of farm grazeable area for lamb grazing subsequent to weaning, on farms without summer water problems and a greater number of main paddocks, produce ewe lambs of higher liveweights in autumn.

Farms with higher stock numbers per labour unit, where grazing priority is given to replacement ewe lambs and where lambs are rotationally grazed post-weaning, and where MA ewes graze pastures laxly after weaning, produce two tooths with lower autumn liveweights.

Farmers, who weigh livestock and sell two tooth ewes surplus to replacement requirements in January, produce ewe lambs and two tooth ewes with higher autumn liveweights. There is also some evidence that higher autumn two tooth liveweights are associated with the practice of weaning lambs at older ages.

The appropriateness of the regression equation coefficients can be partially established by comparing the values with experimental results and field observations. In terms of the ewe lamb equation the following comments can be made:

1. The benefits of high cattle numbers to sheep performance is in agreement with the literature reviewed (Section 8.1.2). However, the optimum cattle:sheep ratio for pasture management purposes and high financial returns, generally do not coincide (Harris 1979).

2. The practice of closing areas for lamb feed prior to weaning increases the grazing pressure on the remainder of the farm and is likely to improve seed-head control, thereby enhancing summer pasture production and quality (Section 4.0). The benefit of closing up lamb feed then,may not only be due to the availability of feed reserves at weaning but also to improved summer feeding.

3. Where water is not readily available,inadequate water consumption can limit lamb growth (Squires 1970). Alternatively, long walking distances may result in reduced pasture intakes because of overgrazing near the water source. There is limited evidence that inferior water quality depresses lamb performance (Section 3.3.3). In addition, access to open dams is generally difficult for lambs during hot dry summer weather, especially when grazed with cattle (Plate 3.11).

4. Fitzharris (1982) showed that increased subdivision was associated with higher productivity. More paddocks are likely to improve the efficiency of hill country pasture management (Section 4.0). This will be reflected in pasture quality and feed allocation, both of which are important in lamb management. (This also applies to two tooth management).

There is less published evidence upon which the two tooth equation coefficient values can be substantiated. The coefficients could be rationalised as follows:

1. The positive effect of older lamb ages at weaning may be related to two tooth feeding levels up to weaning. For example, if older lamb ages are associated with later weaning (Figure 7.1),two tooths may be fed at

higher levels for longer periods because lambs are competing with ewes (rather than two tooths) for feed.

2. The negative effect of high stock numbers per labour unit may indicate that two tooths are not receiving the same level of management attention as on properties with more labour. For example, short term underfeeding resulting from delayed paddock shifts because of the pressure of other competing activities is cumulative.

3. The practice of not giving ewe lambs highest priority immediately after weaning may benefit two tooth summer and autumn growth rates because destocking through lamb sales occurs earlier on these properties.

4. The negative effect of rotational grazing ewe lambs after weaning suggests that competition between ewe lambs and two tooths for pasture may exist under this form of management. If two tooths, for example, follow ewe lambs in a grazing sequence determined by feeding priorities, the quality of pasture offered to two tooths will be lower where there is a poor recovery of pasture between grazings.

5. Weighing will improve sheep liveweights if the information is used by management as discussed in Sections 1.2.1 and 6.1.1.

6. Later culling, through a policy of selling two tooths, can improve the efficiency of selecting flock replacements if the additional information about performance (fleeceweights, liveweights) is used as a basis for culling decisions. Also sheep, which will be small as adults are obvious at this stage because mature liveweights are almost fully expressed at 16-17 months of age. It is likely, given the range of lambing percentages on the survey properties that later culling is improving phenotypic rather than genetic performance

(Butler 1983).

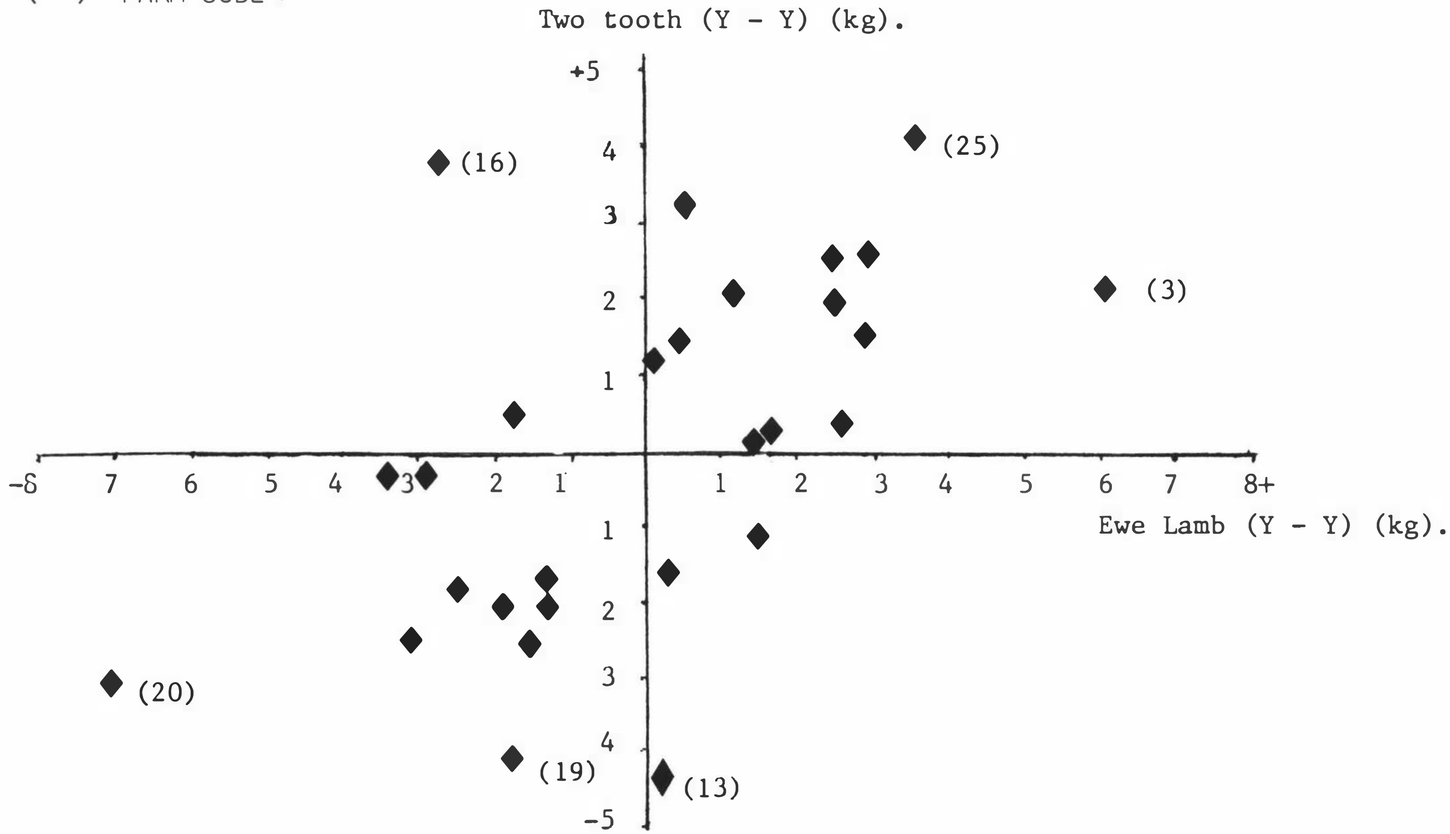
7. The reason why lax grazing of older ewes after weaning should depress two tooth liveweights is not clear. It could indicate that less pasture is being offered to two tooths because of the high pasture allocation to ewes.

Interpretation of the multivariate analysis relative to reported experimental evidence is made difficult by the fact that most research results derive from experiments designed to investigate specific management practices, whereas survey farm data represent the combined effects of a number of management strategies. Although the multivariate analysis results are generally consistent with those reported in the research literature, there are a number of issues raised in relation to farm production management strategies which can only be satisfactorily investigated using an approach that allows for interaction between systems components.

9.2.4 ANALYSIS OF ESTIMATED RESIDUALS

The estimated residuals ($Y_i - \hat{Y}_i$) for the regression equations presented in Table 9.2, are plotted in Figure 9.1. Positive values for estimated residuals are obtained where actual liveweight is greater than predicted from the estimated equation, and vice versa. These situations may simply be due to random variation about the expected liveweight value, or represent the effect of factors other than those included in the estimated equation. A close examination of farms with large positive or negative estimated residuals may uncover important management practices or state variables not previously included in the analysis.

Figure 9.1 PLOT OF ESTIMATED RESIDUALS FOR THE EWE LAMB AND TWO TOOTH AUTUMN LIVEWEIGHT REGRESSION EQUATIONS
( ) FARM CODE .



Where we have two simultaneously determined variables, the joint distribution of the estimated residuals (as presented in Figure 9.1), may lead to additional insights in the analysis of management practices. Where both errors of prediction are positive (or negative) overall management may be classified as especially successful (or unsuccessful). Where one prediction error is positive and the other negative, attention should focus on factors leading to undue competition between stock classes.

An examination of Figure 9.1 indicates the following:

1. Both ewe lamb and two tooth autumn liveweights are higher than predicted on farms 3 and 25.

2. Liveweights of both stock classes are lower than predicted for Farm 20.

3. While ewe lamb liveweights are close to predicted values for farms 13 and 19, two tooth liveweights are lower than predicted.

4. There is some suggestion that management strategies leading to higher than expected two tooth liveweights on Farm 16, may be competitive with those that would otherwise be expected to produce better grown ewe lambs.

Although time did not permit a more detailed follow-up case study of each of the farms identified as interesting in terms of the "gaps" between actual and estimated performance levels, the farm survey visits enabled the following subjective comments on factors which might be associated with the results obtained.

Farm 3: The farmer purchased his lower Wangaehu Valley farm in 1974 after a career in banking. He began upgrading the Perendale ewe flock to Romney using rams selected on Sheeplan Index in 1977. Some effects of heterosis are therefore still being realised.

A flexible winter stocking rate is possible because wether lambs are carried through to the winter/spring and sold according to the feed supply. Ewe condition is maintained at a high level throughout the year, but sheep are not weighed. No cattle are farmed, but grazers are available from the neighbouring property if required. A small area of summer crop is grown for lambs.

The overall impression from the farm visit was that the farmer had a well planned programme. When he commenced farming, time was spent visiting above-average local properties, attending field days and reading widely.

Farm 25: The enthusiastic young owner (27 years old), qualified with a Dip. Ag., took over half of the family farm in southern Bideford in 1982. A regular monitoring programme of pastures (farm feed budgets every 7-14 days) and sheep liveweights (monthly) is carried out. No cattle are run, but silage is made on the easier topography and some pastures are also topped. Ewe lamb management is given high priority, and less attention is paid to two tooths once they attain 52-55 kg. This may be as early as November.

The Perendale flock is being upgraded to Romneys using rams selected on Sheeplan Index (same ram source as Farm 3).

Weaning is at an average age of 8 weeks. Pre-weaning lamb growth rates are high. This can be attributed to carefully planned winter management to control feed supply at lambing and intensive use of tupping crayons, both to ration feed at lambing and to conserve feed going into the winter.

The farmer has the ability to use objective measurement to identify potential management problems and then to take remedial actions.

Farm 19: This 500 ha farm, located on the lower fertility soils of south-east Bideford, is very exposed to winds and experiences dry summers in most years. The farmer, 35 years old and qualified with a Dip. Ag., had 6 years experience on a dairy farm and worked on a high performing Wairarapa sheep farm before purchasing his property in 1979. In 1981 a small block was purchased for the purpose of rearing bigger two tooths, but this combined with low stock performance has increased debt servicing to high levels. The disappearance of 300 two tooths in winter 1982 (rustlers?) did not help. The development of scrub areas, as well as intensification of existing improved pastures, is therefore tightly constrained by finance.

No cattle are run, but grazers are normally available if required. Perendale ewes are run and rams are selected on the basis of their Sheeplan index. Early weaning (average age 8 weeks) is practised to enable ewe weights to be increased before the summer. All non-replacement lambs are sold as stores in mid-November.

Well grown two tooths (55 kg) have been reared on the small southern Bideford block indicating that some local factor is probably the main cause of poor young stock performance.

Farm 20: This property adjoins Farm 19. The 26 year old farmer purchased the farm in 1981 after a background in Marlborough high country. No cattle are run because of limited capital. Lambing performance in his first spring was very poor (51%) but improved to 89% in 1982. No selection of two tooths was therefore possible. Ewes have been in low condition since 1981, and the dry windy conditions during the 1982/83 summer has resulted in a continuation of this problem. Two difficult years, in conjunction with tight financial constraints, have blunted the farmer's enthusiasm. In addition, his inexperience on the farm has contributed to "knowing where I've gone wrong after the event, rather than during or before the problem." As with Farm 19, the poor performance is also likely to be due to local environmental factors.

Farm 13: This well established 411 ha Ihuraua property is fully developed with improvements maintained in immaculate order. The farm is very exposed to north-westerly winds. Pastures have reasonably high levels of brown-top, probably due to the farmer's desire to feed stock at high levels all year round. A special trace element fertiliser with lime has been applied since 1982.

The very good sheep performance (115% average lambing) is associated with running a recorded Romney flock of 800 ewes.

There are two likely reasons for the poorer than expected two tooths. Firstly, pasture quality during the summer is probably poor because of browntop dominance. Secondly, day to day management is complicated by the increased number of mobs due to sheep recording, which possibly results in non-recorded sheep being treated less well in some years.

Farm 16: Since 1976 this large northern Bideford farm (1417 ha) has been undergoing a large scale development programme (60-80 ha/year) in association with the LIS and LDEL schemes. This has had two major effects. First, additional stock are wintered in anticipation of increased pasture production from autumn sown pastures the following spring and summer. Secondly, paddock sizes are still large (up to 60 ha) on most of the improved areas which considerably reduces flexibility of stock management (35 main paddocks in total on two separate blocks). However, newly sown pastures tend to be clover dominant in the subsequent spring and is probably the main reason for better than expected two tooth autumn liveweights. In addition to the dry windy conditions during the 1982-83 summer the farmer considered that store lambs were retained too long, which disadvantaged replacement ewe lambs.

This subjective analysis of farm management practices on farms identified as interesting by analysis of the prediction errors, generates several hypotheses that might be worthy of further study. The inherent dangers of an over extended farm development programme and the potential advantages of a management system involving close monitoring of farm performance, are but two examples.

9.2 CONCLUSIONS

In this chapter a procedure for integrating farm physical characteristics and management practices using multivariate regression analysis has been outlined.

Although constrained by the nature of the data set and sample size, possible effects of various management practices on production levels (autumn liveweight) were identified. These results indicate ways in which management could be changed in order to increase production.

The analysis indicates the potential advantage of combining survey research with a systems model of farm production. This approach would avoid the restrictions forced by existing multivariate statistical procedures (mathematical form, limited number of equations). Nevertheless, the preceding analysis suggests that analytical techniques, such as multivariate regression do have advantages in the task of integrating survey data, beyond that which can be achieved by simple univariate or bivariate analyses of factors affecting farm productivity.

CHAPTER TEN

FARMER REACTIONS

10.0 CHAPTER OUTLINE

In the final section of the questionnaire the farmer's opinions on the current state of knowledge about management during the weaning to tupping period were sought and aspects of farming during this period of time for which additional information was required identified. The responses to these questions are presented in the first part of this chapter.

The remainder of the chapter is a record of the meeting held with the survey farmers at the Bideford Hall in July 1983. A decision was made at the beginning of the survey to make every attempt to return results as quickly as possible to the farmers involved and to obtain their reaction to proposals for improvements to their farming systems. A description of the latter aspect is included in Section 10.2.2 and the origin of the winter-spring management survey, discussed in Chapter 11, is explained.

10.1 THE CURRENT STATE OF KNOWLEDGE OF THE WEANING TO TUPPING PERIOD

10.1.1 FARMER OPINIONS

The majority of farmers indicated that the current level of knowledge[1] about management during the weaning to

[1] Knowledge was defined as "that which is known," and essentially referred to published research results or information made available through extension (e.g. field days, discussion groups).

tupping period was either adequate or good (Table 10.1) It was noticeable however that when farmers were asked to specify areas in which they would like additional information very broad topics rather than specific examples were cited. More detailed description of areas of concern were obtained after prompting.

Table 10.1 FARMER OPINION OF CURRENT STATE OF KNOWLEDGE ABOUT MANAGEMENT DURING THE WEANING TO TUPPING PERIOD

State of knowledge is:,	Frequency
Very good	1
Good	11
Adequate	14
Poor	4

The topic areas in which farmers felt knowledge was inadequate are summarised in Table 10.2. A sample of farmer's comments, for each of the topic areas, gives an indication of the areas of concern on individual properties.

Table 10.2 FARMING TOPICS FOR WHICH MORE INFORMATION IS REQUIRED

General Topic Area	No. of Farmers
(1) Pastures/grazing management	7
(2) Fertiliser/lime	3
(3) Stock performance	7
(4) Animal health	3
(5) Stock selling policies	3
(6) Combination 1, 2 and 3	2
(7) Combination 1, 3 and 5	3
(8) Pasture pests	1

Farmer Comments on Topic Areas

1. Pastures/Grazing Management:

   "Methods of grazing stock during prolonged dry or drought conditions and the virtues of set stocking and rotational grazing these periods."

   "Increasing pasture production and pasture quality on hill country, without having to put on DAP."

   "The effects of late spring management on subsequent management, especially pasture management, e.g. spring rotation lengths, early weaning and nitrogen."

2. Stock Performance:

   "Advantage of good feeding of ewes immediately after weaning confirmed."

   "Eight month versus second shearing policies with respect to stock performance health and wool prices."

   "Relative importance of static versus dynamic liveweight."

   "Improved definition of flushing management."

   "Is it better to spread the stress on lambs by shearing and weaning at different times?"

3. Stock Health:

   "Lamb drenching programmes and the necessity of drenching ewes."

   "Grass staggers and pnuemonia in young stock and means of minimising dag and flystrike problems."

4. Stock Selling Policies:

   "Effect of drafting top ewe lambs on flock performance."

   "Effect of a store versus fat lamb selling policy on ewe weights."

5. Fertilisers:
   "What are the effects of copper and selenium on stock performance and how can they be detected?"

   "Optimum fertiliser rates, application rates and effect of trace elements."

6. Other:
   "Best method to develop out of manuka on sandstone country."

   "Accurate long range weather forecasting."

10.1.2 ADDITIONAL QUESTIONS

During the final stages of the interview, two supplementary questions were asked. The first related to the establishment of a Wairarapa hill country research station (Donaldson 1982).

About one third of the farmers did not consider that a research station was necessary. They argued that information from other research centres could be adapted to the Wairarapa situation, but there was a need for personnel to translate experimental results to local conditions at the farm level. Of the farmers who supported the concept of a Wairarapa research station, some were unsure of the type of experimental work that needed to be carried out, but felt that its local presence would be of benefit to the farming community. Several farmers indicated that if the station was set up, it would be most useful if the environmental conditions were similar to that of their own farms.(This was a major criticism of the usefulness of Riverside farm). The need to run trials under conditions representative of those on commercial properties was heavily stressed, suggesting that a hill country demonstration farm may be more applicable than a research station for many farmers.

In the second supplementary question, farmers were asked to identify the "top" local farmers. One of three farmers was commonly given. It was clear that "top" farmers were identified for different reasons. In some cases the level of performance achieved - lambing percentages, wool weights - was the main criteria used. Others considered the level of inputs (e.g. fertiliser and labour) relative to the level of production achieved to be more important. The number of years farming, willingness to adopt new technology and ideas and lifestyle were also used as indicators.

The "top" farmers had an important influence in the Wangaehu-Bideford area through setting possible production levels and refining farming methods. Locals frequently looked to these farmers to provide a lead and inspiration for improvement rather to outside organisations, even though the information flow from these properties was usually by word-of-mouth and often second-hand.

10.1.3 DISCUSSION

The responses to the questions in the last section of the questionnaire clearly indicated the importance of an effective extension service, both between research organisations and farmers and also between farmers themselves[1].

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[1] Warren (1914) made the often quoted statement: "Every farm is an experiment station and every farmer a director thereof."

In a number of instances, where a need for information had been identified, farmers were unaware of experimental work already completed relevant to their situation or had obtained a limited knowledge of research findings but were uncertain as to how these results could be practically applied. The diversity of drenching regimes and the bases on which these were adopted is a case-in-point (Section 6.3.3).

Some farmers made a greater effort to keep abreast with new developments than others. In general these farmers made wider use of local advisory services, attempted to attend as many field days as possible and were members of the local farm improvement club or MAF discussion group.

Greater use of the "top" farmers could be made to provide information for the wider farming community. These farmers have already obtained the respect of most locals and their methods have a high degree of acceptance. If the farming systems on these properties were monitored to provide more detailed objective information (on some of the farms this would only require improvements to the collation of data) for field days or discussion groups, these properties could be effectively used to convey information about improved/alternative management and production systems.

10.2 THE BIDEFORD HALL MEETING

10.2.1 INTRODUCTION

During each farm visit the farmer was told of a meeting, planned for July, at which a progress report and initial results would be presented. It was hoped this would assist in maintaining farmer interest in the project and was seen as a means of compensating for the time given up by the farmers for the survey. Of equal importance was the opportunity to get farmer reaction to initial conclusions and proposals arising from the results.

Farmers were advised by letter of an afternoon meeting at the Bideford Hall on July 28, 1983. A copy of the results to be discussed were posted with the letter.

The meeting was attended by 25 of the 30 farmers surveyed. (two were away on holiday, one phoned an apology, leaving two unexplained absences). Two members from the local MAF office and a consultant from the Wairarapa Farm Improvement Club who had helped with the selection of the survey area and pre-testing of the questionnaire were also in attendance.

During the meeting six aspects of management relating to survey results were discussed. These are described in the next section.

10.2.2 TOPICS OF DISCUSSION

Late Spring/Early Summer Grazing Management

The importance of maintaining pasture control when pasture growth rates exceed animal requirements during the late spring/early summer was briefly reviewed and a semi set-stock system or fast rotational grazing system, as discussed in Section 4.2 was proposed. Farmers appreciated the need to obtain high animal intakes at this time of the year but some questioned whether the semi-set stock system would result in the deterioration of pastures in paddocks which were less well developed. The wide variability between most years was seen as a problem and it was considered particularly important to be able to determine when animal intakes should be reduced so as to ensure adequate feed supply through to the autumn. It was agreed that increased ewe liveweights post-weaning, and the maintenance of these through the summer, was the correct objective where flushing feed was unreliable.

The management implications and the survey farm results of closing up part of the farm (Section 4.2.2) were presented. It was suggested that the improved and more intensively subdivided pastures should be closed up in preference to areas with poorer pastures and large paddocks, and that pre-autumn grazing of these improved paddocks should be adopted. In general there was a reluctance to accept a system of temporary pasture retirement because of problems associated with regaining control and maintaining pasture composition. A preference for improved stock management and better utilisation of sunny and shady faces with different pasture growth characteristics was indicated.

Lamb Management

1. Lamb Management prior to weaning: The autumn ewe lamb liveweights for the survey farms suggested that one of the problem areas in ewe lamb management could be poor weaning weights. The farmers agreed that weaning weights were generally low. Pasture quantity and quality were thought to be the most important factors affecting lamb weaning weights, but availability of water, lamb birth size, wind, ewe milking ability and genetic potential for growth rate were also mentioned.

There was a varied reaction to the results for the 1983 feed position at lambing (Section 5.3.2), indicating that 50% of the farmers lambed onto pastures of 2.5 cm or less in height. Some farmers argued that it was impossible to achieve longer pastures at higher stocking rates in the survey area before the end of September, especially where there is a browntop dominant sward. Others were worried that if pastures were longer at lambing a much greater problem controlling pastures in November would result. There was also a concern that longer pastures at lambing would increase the incidence of bearings and other lambing problems. The discussion indicated that many farmers were having problems with management during the lambing to weaning period and it was proposed that this should be investigated further.

2. Lamb Weaning Dates: The advantages of a flexible weaning date, particularly earlier weaning in a dry summer environment, were presented with the survey farms' weaning data (Sections 7.1.2 and 7.2.4). One farmer pointed out that it was important to establish a routine in farming so that weaning was always carried out at about the same time to work in shearing and other aspects of running a farm. Other concerns with earlier weaning were the effects on lamb drafting and variation in lamb size. Weaning at 8-10 weeks would result in less lambs achieving a carcass weight of 12.5 kg or more and therefore an extra or larger mob of wether lambs would have to be run. There was also a reluctance to wean relatively young lambs when both the ewe and lamb appeared to be doing well.

3. Post-Weaning Grazing Management: The likelihood that a high proportion of the farmers were weaning onto pastures which were too long for optimal lamb growth rates (Section 7.3.1 and Section 7.4.4) was discussed. Longer pastures were preferred by one farmer because they tended to have a higher clover content. Another claimed that satisfactory lamb growth rates were obtained on short pastures which

had not been spelled from sheep grazing prior to weaning. Again, a number of farmers indicated that water availability and quality, hours of sunshine and wind had an important influence on lamb liveweight gains. It was suggested that there was a big difference between the type of pasture required for lambs before and after Christmas, with longer pasture and greater chance for selection being more suitable in the latter period. This view is supported by research results (Section 7.3.1)

Cattle Policies

1. Age of Heifers at First Mating: Farmers mating heifers at 27 months rather than 15 months of age were asked why this policy was continued when research work (Carter *et al* 1980, Smeaton 1981) indicated economic advantages to yearling mating. The following reasons were given:

(i) Heifers can be used as dry cattle for pasture management enabling grazing preference to be given to sheep. This is not possible if you are trying to achieve yearling target mating weights.

(ii) It is difficult to achieve heifers of satisfactory size by 15 months with low quality pastures. This situation will continue while fertiliser inputs are low.

(iii) Two year olds have poor calves and there are more problems remating, so earlier mating is not worthwhile.

It did not seem likely that the survey farmers involved would change their present practices.

2. Calf Weaning Dates: The potential advantages of earlier weaning of beef calves (Section 8.1.1) were outlined

and the two farmers who had weaned in February 1983 were asked to describe their experiences. It was generally considered that early weaned calves were discounted by $30 - $40 per head at the weaner sales, mainly because they did not have the same "finish" as freshly weaned calves and sometimes tended to be pot-bellied. However, the same farmers were prepared to buy calves which had been weaned 1-2 months prior to the sale in preference to more recently weaned stock providing they were of a similar size.

Most of the farmers were unsure whether a beef calf could be weaned at 10-12 weeks of age without affecting subsequent production, and thought a wet summer would be necessary for it to be successful. Some concern was expressed that more cows could be affected by mastitis because of early weaning.

It was pointed out that an early weaner sale for heifer calves was sometimes held in February during dry seasons in the Wairarapa, indicating that this policy was already accepted by a number of farmers.

The impression gained from the meeting was that most farmers would adopt earlier weaning if seasonal conditions were dry.

Weighing of Sheep

Following the presentation of the results of farmer awareness of target liveweights for various classes of sheep (Section 6.1.2), farmers were asked whether a knowledge of these was important; particularly at weaning. This was a busy time of the year for the farmers and there was often not time to carry out additional work. However, the majority considered that the effort to collect ewe and lamb weaning weights would be well worthwhile. One farmer thought that there was little point in collecting weaning weights because nothing could be done to alter these during the spring period.

It was generally agreed that more frequent weighings were more useful than an annual weight collected at tupping. A minimum weighing programme in spring (hogget shearing or weaning) and autumn (mating or May 1) was suggested.

Sheep Sales

The 1982/83 season was particularly difficult for selling cull ewes (Section 6.5.2) and two alternative selling policies - adopting a younger average aged flock and selling mainly c.f.a. ewes, or adopting a "flying" flock (Section 6.5.3) were presented. There were few criticisms of these suggestions other than the increased number of c.f.a. ewes could depress prices. There was some hope that the cull ewe problem would be reduced in future years by the revised Meat Board grading system and schedule.

10.2.3 DISCUSSION OF FOLLOW-UP WORK

The last part of the meeting was devoted to a discussion of the release of further results from the initial survey and the possibility of carrying out a follow-up study. Initial results indicated that autumn liveweights were critical to sheep performance and the poor performance of replacement ewe lambs on a number of the farms had emerged as a particular concern. Few details of pre-weaning management were collected in the initial survey but the estimated height of pasture at lambing in 1982, the very wide range in autumn ewe lamb liveweights (Table 3.21) and reports in the literature (Section 5.3.1) all pointed to the need to investigate aspects of winter and spring management. Of special interest were the factors which affected ewe and lamb weaning weights. It would also be possible to follow through the management of 1982 born ewe lambs if a sample were weighed at the spring shearing. The combination of all liveweights recorded would then give an approximate profile of growth from weaning through to the adult stage for most of the farms.

All the farmers indicated a willingness to complete a follow-up survey related to this period of the year. The MAF agreed to provide scales and labour on the same basis as the first survey.

10.2.4 CONCLUSIONS

The meeting with the survey farmers was most worthwhile, both as a public relations exercise and as a means of obtaining reactions to the suggestions made for improving management. The farmers raised a number of issues relating to the recommendations which could be investigated further. Interest in the work was high as indicated by the willingness to participate in follow-up work. The return of some results within two to three months of the survey was appreciated.

CHAPTER ELEVEN

THE WINTER-SPRING MANAGEMENT SURVEY

11.0 INTRODUCTION

Spring and early summer liveweights of sheep can be expected to be closely related to autumn liveweights. Consequently, management practices which influence early season liveweights also contribute to subsequent performance.

Lamb weaning weights are a function of average daily gain from birth and age at weaning (Section 7.1.2). Hence, factors which affect pre-weaning growth rates are important; particularly those which can be altered by management. Lamb growth rates are sensitive to post-lambing feeding levels of ewes (Section 5.3.1). High levels of feeding of ewes in the last six weeks of gestation has neglible effects on lamb birth weights (Read 1982 review, Owens 1984) but is likely to jeopardise lamb performance through reduced post-partum feeding levels (Smeaton et al 1983(b)). There is evidence, however, that feeding ewes so as to loose more than 100 gms/day during the first 100 days of pregnancy influences lamb birthweight through reduced placental development, particularly in flocks of high fecundity (Owens 1984). The greatest impact of underfeeding in early pregnancy is on lamb survival (Bennet et al 1964, Rohloff 1984), although low birthweights (< 3.5 kg) may also influence lamb growth rates (Blair 1981).

Similarly, the practices which affect the weight of ewes at weaning are of interest, because if these are high, less emphasis on improving ewe liveweights over the summer is necessary, releasing pasture to improve the performance of other classes of stock. Likewise, hogget liveweights, which are at or above target levels at spring shearing, increase the chances of achieving two tooths of 55 kg or more at mating.

Feed intake has the largest influence on ewe and hogget liveweight (Sections 7.5 and 7.7). The seasonal pattern of pasture production in the Wairarapa, however, means that unless stocking rates are very low, pasture growth during the winter and spring is insufficient to allow all stock to be fully fed. Competition between stock classes for pasture therefore exists.

Adjusting lambing (and calving) to coincide with the increase in spring pasture growth rates can ensure, within the limits of seasonal variations, that changes in the breeding animals' physiological status, and hence feed requirements, are matched. Thus, in the absence of other management changes, farms with higher stocking rates and/or performance should lamb later. In practice lambing dates are constrained by the need to coincide tupping with the autumn pasture flush and the natural breeding season of most sheep breeds (Section 5.1.3), and to achieve reasonable (> 28 kg) lamb weights prior to the decline in pasture production and quality during the summer. Lambing on most farms, therefore commences prior to the spring pasture flush, creating a potential feed shortage.

The management options to meet this pasture deficit, essentially involve one or a combination of the following: creating a pasture reserve either in the form of pasture <u>in situ</u> or supplements; increasing pasture production through the application of nitrogen; decreasing stock numbers or restricting the feed intakes of lower priority stock.

Under hill country conditions a heavy reliance on supplements and nitrogen is expensive, and although some flexibility can be provided by wintering additional non-replacement stock, creating a pasture reserve *in situ* and manipulating animal intakes remains a relatively inexpensive means of meeting the pasture deficit. Clearly the amount of pasture cover (reserve) required depends on factors such as pasture growth rates, stocking rate, lambing date, and the proportions of various stock classes, as well as the condition of breeding animals and the liveweights of replacements.

Spring pasture cover is increased by transferring feed from other periods. Following the first cycle of tupping, ewe allowances can be gradually reduced and sub-maintenance feeding during mid-pregnancy, with the loss of up to 10% of the tupping liveweight, is not detrimental if pasture cover needs to be increased or additional feed is required for other classes of stock (Owens 1984). Since ewe feeding levels need only increase slowly prior to lambing to meet the requirements of placental growth, it is preferable, if ewes are to be set stocked, that intakes be controlled for as long as possible up to the commencement of lambing (Smeaton *et al* 1983(b)). Additional pasture can be conserved for the post-lambing period if ewes are set stocked in groups according to the date of tupping.

The winter feeding levels of replacement hoggets is dependent on the liveweight reached by May 1. Where this is below target (35 kg), appropriately higher feeding levels are required to ensure the attainment of the spring target liveweight (Milligan 1981).

If insufficient pasture cover can be created during the winter months, careful attention to cover at the commencement of winter is necessary. For this to be manipulated to the level required, planning should commence in February with particular emphasis being given to the sale of non-replacement stock (Parker and Lowe 1982).

Rotational grazing provides the opportunity to adjust animal intakes by changing the height to which pastures are grazed and the interval between paddock grazings (Milligan 1981). In addition, planning and monitoring of grazing management is necessary to ensure that animals are offered the correct allowances, and that the desired average pasture cover is realised.

In this chapter the distribution, collection and analysis of information from the follow-up winter and spring management survey is discussed. Spring 1983 liveweight data and lambing performances are presented and discussed in relation to results obtained from the initial weaning-tupping survey.

11.1 PREPARATION OF THE WINTER-SPRING MANAGEMENT SURVEY

11.1.1 INTRODUCTION

The five original survey farmers who were not present at the Bideford Hall meeting were contacted either by letter or phone to get their reaction to a follow-up survey of winter and spring management. Although no negative replies were received, one farmer subsequently indicated that he wished to withdraw. The winter-spring survey therefore involved 29 farmers. Because there was insufficient time to revisit all the farmers during the lambing period (August and September), a decision was made to use the mail survey method.

11.1.2 FORMULATION OF THE QUESTIONNAIRE

A similar procedure to that used for the weaning-tupping questionnaire was followed for the preparation of the new survey forms. Changes were made where previous experience had indicated short-comings in the original design (Section 2.5.3). The questionnaire was kept as brief as possible and was restricted to five sections. (A copy of the winter-spring management survey is available on request from the Agricutural Economics and Farm Management Department).

In the first section of the questionnaire, stock numbers present on the farm on June 30 1983 were collected. This data would enable the subsequent questions on grazing management to be related to stocking rate. Tupping dates were collected for the 1983 mating to allow the calculation of lambing dates and the estimated average age of lambs at weaning (and hence an estimation of average daily lamb growth rates for each farm).

The second section was designed to collect details of the management systems used at lambing and the amount of pasture present on the farm at this time. The preparation of questions to obtain pasture cover data posed problems, since few farmers were familiar with the use of dry matter measurements (e.g. kg DM/ha) and even those that were, were unlikely to be similarly calibrated. (An interview survey incorporating a farm inspection would have been of considerable benefit in this regard). The amount of pasture present at lambing was therefore estimated by getting the farmers to indicate the proportions of the farm pastures which fell within defined height intervals. The height categories used were similar to those in the weaning-tupping survey, except the 0 - 2.5 cm option was divided into two categories;

0 - 1.25 cm and 1.25 - 2.5 cm. This change was based on a farmer's comment at the Bideford Hall meeting that "there is big difference in having pastures at one inch (2.5 cm) and half an inch (1.25 cm) at lambing."

Similarly, problems were encountered designing questions to determine paddock stocking rates at lambing because of the periodic adjustments made to paddock stock numbers after lambing had commenced. Section II therefore relied heavily on the judgement of the farmers, but the approach could be used with some confidence following the personal interview survey and the Bideford Hall meeting.

Aspects of winter management were examined in the third section. For the farmers who set stocked during the winter period (i.e. May 1 to September 1), this section required only one question to be answered as the remaining questions related to the system of rotational grazing adopted.

In the fourth section, farmers were asked to describe the planning of winter management, including the type of information used and the period for which the plan, if any, extended.

The final section (V) sought information on the use of supplements and nitrogen. Particular attention was paid to the timing and rate of nitrogen application, as this was also relevant to trial work being conducted at Riverside.

The total length of the questionnaire was 5 pages. To reduce the time required to answer the questionnaire and to simplify coding and analysis, most of the questions were of the multiple-choice type or required prepared spaces to be completed.

Pre-testing copies of the questionnaire were distributed to: a MAF farm advisory officer, a MAF sheep and beef advisor, and a private farm consultant from the Wairarapa, two farm managers in the Manawatu and two members of the Agricultural Economics and Farm Management Department at Massey University.

A number of modifications to Section II were suggested. Pasture cover data up to 2 weeks after the commencement of lambing corresponding to at least the mid-point of lambing, was included to indicate feeding allowances as ewe milk production approached maximum levels (Section 7.1.2.). Respondents were also asked to identify preferred pasture heights at, and 3 weeks after, the commencement of lambing. Increased space for additional comments was provided.

Two copies per respondent of the final questionnaire were then printed to ensure a copy was available for a follow-up letter if required. Each farmer was posted a copy of the questionnaire and a stamped addressed return envelope on August 18. An accompanying letter outlined the procedure for weighing ewe hoggets at shearing and ewes and lambs at weaning, and the collection of lambing percentage data. Farmers were asked to return the completed questionnaires by the end of September to ensure that the questions were answered close to the time at which events occurred on the farm. This was crucial for the collection of pasture height data.

11.1.3 MAIL RESPONSE RATE

With the questionnaire posted at one of the busiest times of the sheep farming year it was not surprising that only half of the forms had been returned by the end of

September.

A reminder letter, with a second copy of the questionnaire and stamped return-addressed envelope was posted on October 12. All but 5 of the questionnaires were returned by the end of October. The remaining farmers were contacted by telephone in early November and given a third reminder. The final questionnaire eventually arrived in mid-December.

The response rate was disappointing considering the population had all been contacted previously and had indicated a willingness to participate. Although the questionnaire was relatively short, some difficulties may have been encountered answering the second section.

11.1.4 COLLECTION OF LIVEWEIGHT AND LAMBING PERFORMANCE DATA

About one third of the farmers returned lambing percentage figures with their questionnaires, but in some cases final docking tallies were not available until mid-November. On the majority of farms, separate lambing percentages for two tooth and MA ewes were not available. The remaining lambing percentage figures were collected when the farmers were phoned in November to obtain ewe hogget liveweights. The latter was obtained for 26 of the farms. These were adjusted to a common October 1 shorn weight, with the assistance of the local FAO.

Weaning weights of a random sample of 50 ewes and 50 lambs were collected from 24 farms by early January 1984.

11.1.5 CODING AND ANALYSIS

Code sheets were prepared in the same manner as for the weaning-tupping survey (See Section 2.5.2) except dates were separated into day and month variables, rather than being grouped together. Thus a MA ewe mating date of 5 April was entered as:

Variable name	Variable Value
MAMDATE	5
MAMMTH	4

The data was entered into a separate SPSS system file, and then combined with the original weaning-tupping survey data. The combined variables for the two surveys gave a total of 578 variables for each of the farms involved in the winter-spring management survey. Combining results from the two surveys allowed, for example, the 1983 autumn ewe liveweights to be plotted against the 1983 lambing percentage, and pasture height at lambing in 1982 and 1983 to be compared.

11.1.6 RETURN OF RESULTS TO THE FARMERS

A 10-page summary of the results of simple analyses (e.g. frequencies and two-way cross-tabulations) and raw-data (e.g. ewe hogget liveweights) for the winter-spring survey was posted to each of the farmers on November 29. The farmers were advised of a second Bideford Hall meeting to be held in February, at which further results from both surveys would be discussed. This also provided an opportunity to remind those farmers who had not weaned, to collect a sample of lamb and ewe liveweights.

11.2 FARM PHYSICAL AND PERFORMANCE DATA FOR THE 1983 YEAR

11.2.1 STOCK NUMBERS WINTERED

Stock numbers for the 1983 season were slightly down on those of the previous year (Table 11.1). This can be attributed to the sale of capital stock on some properties because of the drought and possibly the reduction of stock numbers on some farms which had completed the qualifying period for the L.I.S. Thus the average effective stocking rate was 11.1 SU/eff ha compared with 11.2 SU/eff ha in 1982 for the same 29 farms (Table 3.16).

11.2.2 MATING DATES

Mating commenced on February 10 on one farm, March 1 and 2 on two farms, and between March 26 and April 16 on the remaining 26 farms.

Two tooth matings generally commenced either on the same day or within two or three days of the MA ewes. The same exceptions as discussed previously (Section 5.2.4) applied.

A "flying flock" with non-replacement breeding ewes mated approximately 3 weeks earlier than the main flock was operated by two farmers. Hoggets were joined in early May on 5 properties.

Table 11.1 1983 STOCK NUMBERS WINTERED, STOCKING RATE AND LAMBING PERCENTAGE

	Breeding Ewes	Ewe Hoggets	Other Sheep	Breeding Cows	Heifers	Steers	Bulls	Total SU	Stocking Rate/eff ha.	Sheep: Cattle Ratio	1983 Lambing Percentage
1	3700	1206	139	37	32	41	20	5321	11.9	6.9	104
2	1601	342	282	0	0	0	0	2041	12.8	0	88
3	3008	974	956	0	0	0	0	4382	12.2	0	104
4	3506	1557	423	129	89	96	1	6524	11.5	3.0	94
5	7942	2930	458	158	62	68	4	11842	12.3	6.9	99
6	3229	975	120	60	51	38	1	4746	11.4	5.4	85
7	4200	2050	45	120	0	106	0	6921	12.2	4.5	90
8	4000	1919	384	0	0	158	0	6407	13.3	7.1	100
9	3856	1540	72	121	60	12	4	6054	10.9	4.7	94
10	3698	1621	479	151	74	68	2	6732	12.7	3.3	91
11	1820	750	55	0	22	109	0	2994	12.4	3.9	121
12	2200	650	33	9	39	21	0	3026	11.9	7.8	115
13	2602	1102	546	81	21	2	5	4413	10.9	6.3	129
14	3250	1300	435	0	0	0	0	4473	13.0	0	92
15	3700	1250	230	80	66	14	2	5601	6.9	5.6	85
16	7200	2300	340	270	88	0	9	11124	8.6	4.4	91
17	1857	630	36	79	44	6	2	3027	8.5	3.3	91
18	4859	1331	895	154	86	79	4	8072	10.3	3.9	78
19	3250	900	110	3	0	3	1	3999	9.5	0	83
20	2600	900	175	0	0	0	0	3365	8.9	0	70
21	5325	2010	1158	323	253	142	7	11321	11.1	2.1	135
22	7200	1900	740	242	116	27	8	11229	9.2	4.3	100
23	5250	1395	188	0	148	92	7	7414	8.6	6.1	85
24	2334	988	50	0	4	0	0	3080	11.7	0	95
25	2238	847	46	0	0	0	0	2865	12.8	0	106
26	4816	1760	307	151	79	38	3	7692	11.5	4.4	88
27	3470	1008	213	89	39	16	2	5125	11.9	5.5	87
28+	5845	4271	459	80	36	42	1	9990	10.0	0	115
30	2210	680	75	1	2	1	1	2767	12.0	0	106
$\bar{x}$ *	3820	1417	326	81	49	41	3	5950	11.1	3.4	97.3

* for all farms

\+ applies to part of property

11.2.3 LAMBING PERFORMANCE

The mean 1983 lambing percentage of 97.3% (Table 11.1) was 4.3% less than that of 1982 (Table 3.19). This was a surprisingly good performance given the dry conditions at flushing and less favourable weather during lambing compared with the previous season. Lambing percentages were lower on average in the Wangaehu (97.3 ± 2.8%, n = 10) and Bideford (88.0 ± 3.0%, n = 12) districts, which were more seriously affected by the dry autumn conditions than the Ihuraua area (112.8 ± 6.5%, n = 7).

On the 10 farms where separate two tooth and MA ewe lambing percentages were available, there was a 11.3% difference between the two groups (i.e. 89.0 ± 3.5% for two tooths versus 100.3 ± 5.6% for MA ewes).

<u>Relationship between Autumn Liveweight and Lambing Percentage</u>

The least squares estimate of the linear relationship between lambing percentage and pre-tup ewe liveweight[1] (Figure 11.1) for the 1983 year was:

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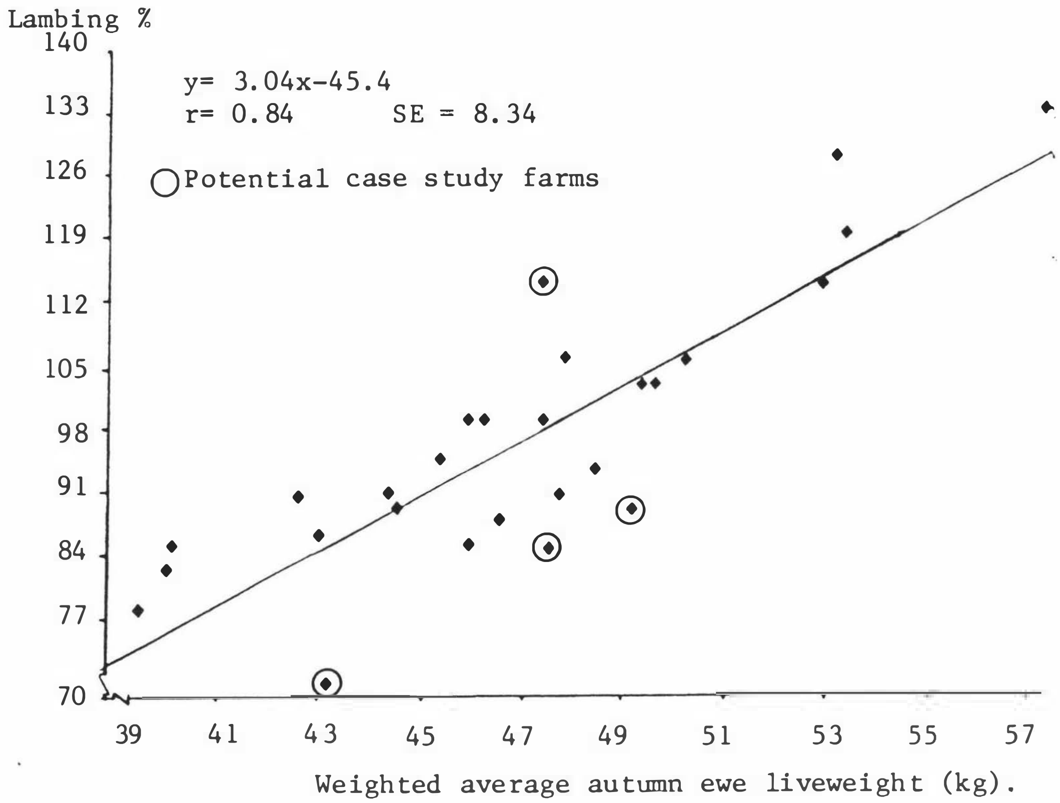
[1] The lambing percentage is expressed as a proportion of lambs docked to total ewes mated. Separate weighings of two tooths and MA ewes in the autumn were recorded (Section 3.5.2). The average weight of all ewes introduced to the ram was therefore calculated by assuming 25% of the ewes mated were two tooths by the equation:

$$\widehat{LW} = \frac{((3 * \text{MA ewe LW}) + \text{two tooth LW})}{4}$$

Figure 11.1 1983 LAMBING PERCENTAGE VERSUS AVERAGE AUTUMN LIVEWEIGHT OF EWES MATED



$\hat{y} = 3.04x - 45.4 \quad r = 0.84 \quad SE = 8.34$

where $\hat{y}$ = predicted lambing percentage

x = weighted average pre-tup ewe liveweight.

Thus, an estimated 3.04% increase in lambing percentage was obtained for every kilogram increase in autumn liveweight. This is at the upper end of the range of results obtained from other studies reviewed in Section 5.1.7.

Of note is the wide divergence in lambing percentage for flocks which had similar liveweights at the time of mating (See marked examples (◯) in Figure 11.1). This variation may be due to differences in genotype (Gibson and Craig 1980), environment, management practices or incorrect liveweight assessment due to gut fill, operator error, or incorrect adjustment for the proportion of two tooths entering the flock. (The exact proportion could not be calculated because ewe hogget sales and deaths were not known).

11.3 WINTER MANAGEMENT STRATEGIES

11.3.1 EWE GRAZING MANAGEMENT

Difficulties in obtaining precise descriptions of grazing management have been discussed previously in Section 2.5.3. Given the decision to use the mail survey method to collect information relating to the winter-spring period, questions relating to winter grazing were restricted to paddock grazing durations by ewes and rotation length (period of time between paddock grazings). Management practices adopted by the survey farmers are summarised in Table 11.2.

Table 11.2 WINTER GRAZING MANAGEMENT - INTERVAL BETWEEN PADDOCK GRAZINGS BY FREQUENCY OF EWE SHIFTS (28 RESPONSES)

Paddock Spelling Interval (days)	Frequency of Ewe Shifts (days) Set Stocked	1-3	4-7	8-15	Total
Set Stocked	2				2
20 - 30		1	4	1	6
31 - 40		5	1	1	7
41 - 50		2	2		4
51 - 70		3	1		4
80 +		4	1		5
Total	2	15	9	2	28

It is possible to achieve various grazing rotation lengths while maintaining a constant paddock grazing duration, by varying the number of paddocks used. The proportion of the farm used for grazing ewes and the grazing management strategies adopted for other stock classes will combine to affect pasture cover at lambing. As indicated above, it was not considered feasible to obtain full details of winter grazing management strategies adopted by the survey farmers. In general, shorter rotation lengths allow high ewe intakes in early winter (subject to pasture cover limitations). Pasture cover decreases once average daily pasture growth rates are less than total animal feed requirements and ewe intakes are progressively reduced as each round of the rotation is completed. A situation of low average pasture cover with low feed reserves and declining ewe condition at lambing is likely to be associated with short winter grazing rotation lengths.

11.3.2 SET STOCKING FOR LAMBING

Twenty two of the 29 farmers surveyed broke the winter rotation and set stocked ewes within 10 days of the commencement of lambing. In 9 cases set stocking occurred 5 days or less prior to the start of lambing.

Ewe condition, pasture management and simplification of management were cited as the main reasons for set stocking at this time (Table 11.3)

Table 11.3 FREQUENCY OF REASONS STATED FOR BREAKING EWE WINTER ROTATION TO SET STOCK PRIOR TO LAMBING

Reason for set stocking	No. of Farmers
Ewe condition, time to settle for lambing and find lambing sites	8
Some ewes starting to lamb	5
Pastures; even-up paddock pasture covers, or to save feed for lambing	7
Simplify management, weather conditions were suitable	2
As late as practical	4

These reasons indicate that most of the farmers appreciated the importance of saving pasture for ewes to lamb onto, and of having a short time interval between breaking the winter rotation and the commencement of lambing.

11.3.3 PLANNING FOR WINTER MANAGEMENT

Successfully implementing a long winter rotation is made more difficult if average pasture cover is low at the start of winter. Therefore initial planning for the winter period should commence two to three months earlier, particularly in a dry summer, to allow time for pasture cover to be manipulated to the required level. The winter plan, which should be modified as time passes, should cover the period from when ewes are restricted during tupping until the commencement of lambing (i.e. normally a period of between 114 and 133 days)

Commencement of Planning

One third of the 27 farmers who completed the planning section of the questionnaire, started planning in either April or May (Table 11.4). Three used the same system as in previous years and therefore presumably did not replan, while the remainder began planning in March or earlier.

Table 11.4 MONTH IN WHICH PLANNING FOR THE 1983 WINTER ROTATION COMMENCED

Month	No. of Farmers
Before February	6
February - March	9
April	5
May	4
Same system as in previous years	3

Planning Methods

A formal feed budgeting approach was used by 5 farmers to calculate the pattern of stock shifts during the winter. The remaining 22 respondents completed a mental plan and relied heavily on previous experience to derive this. This is shown by the responses to the subsequent question which asked the farmers to identify planning aids (Table 11.5). A high proportion of farmers used animal feed requirements and pasture growth rate data for planning. However the source of this information was not identified and responses to later questions suggest that these are primarily derived from practical experience. A lower percentage of farmers used the RDM technique or a specified number of days per paddock to plan winter management.

Table 11.5 AIDS USED FOR PLANNING WINTER MANAGEMENT

Aid	Used	
	Yes	No
Animal feed requirements	15	12
Pasture growth rates	14	13
Residual dry matters (RDM)	8	19
Days per paddock	11	16
Previous experience	19	8
Other	6	21

When deriving the winter plan, 50% of the farmers did not estimate the amount of pasture which was likely to grow between grazings. This may be one reason why a high proportion of the farmers implemented a fast (less than 50 days) ewe rotation in the 1983 winter. None of the farmers who estimated pasture growth between grazings,used the very limited published data available (See Section 3.1.5) and instead made assessments based on previous experience and current weather conditions.

Length of Planning Period

Information concerning the period over which the winter plan extended was obtained from 22 farmers. Most plans were for 60 days or more (Table 11.6). Five farmers indicated that they planned for periods of 180 days or more. Because an "in my head; previous experience" approach to planning was used by each of the farmers in this latter group, it is difficult to draw conclusions about the level of detail in these cases.

Table 11.6 LENGTH OF WINTER MANAGEMENT PLANNING PERIOD

Plan Length	Number of Farms
Less than 7 days	2
60 - 100 days	7
100 - 150 days	8
180 plus days	5

Conclusions

It can be concluded that a low proportion of the Wangaehu-Bideford farmers formerly plan the winter rotation, with the majority relying heavily on previous experience to put together a mental plan. The latter approach may be efficient in situations where a successful plan has been derived over a number of years and the farmer is able to recognise what adjustments have to be made because of differences in seasonal conditions, stocking rate or state of development.

A more objective approach to feed budgeting is severely restricted by the absence of reliable pasture growth rate data. Regular farm feed budgets can help to overcome this problem, but reasonably accurate planning is almost impossible without some reliable estimates of pasture growth. It is recommended that priority be given by MAF to the collection of pasture growth rate data at a number of representative sites in the Wairarapa.

11.4 MANAGEMENT DURING LAMBING

11.4.1 GRAZING SYSTEMS AT LAMBING

All except one farmer set stocked all pregnant ewes during the lambing period. The remaining farmer shedded-out ewes as they lambed so that only those ewes which had lambed were set stocked. Of the farmers using a fixed paddock set stocking system, two set stocked groups of ewes at different dates according to expected lamb birthdate using autumn tupping crayon markings, and one differentially set stocked early and later lambing ewes on the basis of udder development.

11.4.2 PADDOCK STOCKING RATES

There was a wide range in paddock stocking rates within farms of 1 to 25 ewes/ha during lambing. Between farms, average paddock stocking rates varied from 7 to 22 ewes/ha. These differences can be explained by the factors taken into account when determining paddock stocking rates (Table 11.7). The most common factor influencing farmers was the amount of pasture present, but pasture quality, stage of development, stock condition, lamb traps and whether or not nitrogen had been applied were also considered. Although most respondents gave only one reason for deciding a particular paddock stocking rate, it is likely that many of the other factors listed would have been taken into account. (For example, previous experience has a relatively low ranking).

Table 11.7 MAJOR FACTORS CONSIDERED WHEN DETERMINING PADDOCK SET STOCKING RATES AT LAMBING (26 RESPONSES)

Factor	No. of Farmers
1. Amount of pasture present	10
2. Paddock characteristics including stage of development, size, aspect, lamb traps	2
3. Previous experience	1
4. Pasture quality, quantity and previous paddock performance	7
5. Stock condition, age	4
6. Nitrogen fertiliser application	1
7. Shedding out system used	1

11.5 PASTURE COVER AT LAMBING

11.5.1 AVERAGE PASTURE COVER SCORE

An average pasture cover score for each property was derived from the proportion of the effective farm area, estimated by the farmer, which fell within the specified pasture height categories at the commencement of lambing. No objective account of differences in pasture sward density, species content or quality were taken, although several farmers did comment on these aspects.

The pasture cover score was calculated by the equation:

$$\bar{Y} = \sum_{i=1}^{s} a_i X_i$$

where $\bar{Y}$ = average farm pasture cover score

X_i = proportion of effective farm area at each height category

a_i = estimated kg DM/ha for height category

The values for a_i were based on data collected at Riverside farm, to calibrate pasture mass and height. The values used were:

a_i		height category	pasture score
a_1	=	0 - 1.25 cm	400 kg DM/ha
a_2	=	1.25 - 2.50 cm	650 kg DM/ha
a_3	=	2.50 - 5.00 cm	1000 kg DM/ha
a_4	=	5.00 - 7.50 cm	1250 kg DM/ha
a_5	=	> 8.00 cm	1600 kg DM/ha

The pasture cover scores shown in Table 11.8 indicate that 15 of the survey farmers had pasture scores of 800 units or less. Experienced advisers estimate that a score in the region of 800 - 1000 units would represent a situation of adequate feed supplies for ewes and hoggets at this time of the year, although this is dependent upon lambing date and stocking rate.

Farmers who delayed set stocking until just prior

(1-5 days) to lambing generally had higher pasture scores at lambing than those who set stocked earlier (Table 11.8).

Table 11.8 AVERAGE PASTURE COVER SCORE AT LAMBING AND THE TIME OF SET STOCKING OF EWES PRIOR TO LAMBING

Average pasture score at lambing	Number of days ewes set stocked prior to lambing				
	1-5 days	6-14 days	15-30 days	Set stocked	
< 600	1	5	0	1	7
600 - 800	0	4	3	1	8
801 - 1000	4	3	1	0	8
> 1000	4	2	0	0	6
	9	14	4	2	29

Although a direct comparison between the average height of pasture grazed by ewes 2 weeks into lambing, and estimated mean pasture score, is not possible because ewes do not graze all the farm area at lambing, a relationship between the two variables could be expected. The cross-tabulation (Table 11.9) indicates that, on farms with low mean pasture scores, ewes grazed relatively short pastures 2 weeks into lambing, while ewes grazing longer pastures were generally on properties with higher pasture cover scores.

Table 11.9 COMPARISON BETWEEN FARM MEAN PASTURE COVER SCORE AND AVERAGE HEIGHT OF PASTURE GRAZED BY EWES 2 WEEKS INTO LAMBING

Average height of pasture grazed by ewes	Estimated farm mean pasture cover score				
	390-650	651-750	751-1000	1000+	
0 - 1.25 cm	4	0	0	0	4
1.25 - 2.50 cm	5	2	3	2	12
2.50 + cm	0	1	8	4	13
	9	3	11	6	29

These results suggest that the use of average pasture height and proportion of farm areas at each of the specified levels can provide some indications of the overall farm feed situation. This is particularly useful where pasture growth rate data is unavailable or the farmer population concerned is unfamiliar with terminology such as kg DM/ha. The major difficulty is to define suitable height categories.

11.5.2 COMPARISON OF AVERAGE PASTURE HEIGHT AT THE 1982 AND 1983 LAMBINGS

The average height of pasture grazed by ewes at the commencement of lambing in 1982, was compared on the same farms, with the pasture height grazed by ewes two weeks after the start of lambing in 1983[1] (Table 11.10). Twelve of the 14 farmers grazing ewes on pastures of 0 - 2.5 cm in 1982 were in the same situation in 1983. Of the 14 properties with pastures averaging more than 2.5 cm in 1982, only 4 were in a worse situation in 1983.

Table 11.10 BETWEEN-YEAR COMPARISON OF AVERAGE HEIGHT OF PASTURE GRAZED BY EWES AT LAMBING (28 FARMS)

1982 Pasture Height	1983 0 - 2.50 cm	2.51 - 7.5 cm	
0 - 2.50 cm	12	4	16
2.51 - 7.50 cm	2	10	12
	14	14	28

χ^2 = 7.146 with a d.f P = 0.0075)

[1] Data for a comparison at the same time was not available. Average pasture height could be expected to be shorter at the time of estimation in 1983.

The significant relationship between years gives some indication that low pasture cover tends to be repeated between years.

11.5.3 PREFERRED AND ACTUAL PASTURE HEIGHTS AT LAMBING

Farmers were asked to specify the height of pasture which they would have preferred ewes to be grazing at the commencement, and three weeks after, the start of lambing. The comparison between actual and preferred pasture heights (Table 11.11) indicates that most farmers had less feed than desired in spring 1983. This suggests that there is an awareness of the pasture conditions necessary to obtain high ewe and lamb performance in the spring but that there are management and/or uncontrollable factors (e.g. weather) preventing achievement of targets.

Table 11.11 COMPARISON OF PREFERRED AND ACTUAL PASTURE HEIGHTS AT THE COMMENCEMENT OF LAMBING

Actual pasture heights after 2 weeks of lambing (cm)	Preferred Average Pasture Height (cm)				
	0 - 1.25	1.25 - 2.50	2.50 - 5.00	5.50 - 7.50	
0 - 1.25	0	1	3	0	4
1.25 - 2.50	1	4	6	1	12
2.50+	0	0	8	5	13
	1	5	17	6	29

Most farmers preferred average pasture height to increase as lambing progressed, (this probably relates to bearing problems and other lambing difficulties which are often associated with excessive pasture at the start of lambing). To achieve such an increase in pasture cover, lambing needs to coincide closely with the onset of the spring pasture flush.

Only one farmer indicated that he preferred ewes to be set stocked onto very short pastures (i.e. 0 - 1.25 cm) at the start of lambing. This is probably to minimise bearing problems.

11.6 SUPPLEMENTS

The main feature to emerge from this section of the questionnaire was the high use of nitrogeneous fertilisers during 1983 and the declining importance of the traditional winter feed supplements of hay and crops (Table 11.12).

Table 11.12 SUPPLEMENTS USED DURING THE 1983 WINTER PERIOD

Supplement	No. of Farmers
Hay	4
Nitrogen	15
Hay and Nitrogen	4
Hay, crop and nitrogen	1
Silage and nitrogen	1
None	4

Hay was used on a total of 9 farms. The combination of hay and nitrogen supplements on 5 of these properties suggests that the latter is replacing hay as a supplement. This could be expected as nitrogen provides a higher quality feed, requires less labour for its distribution and is cheaper than hay if responses exceed about 10 kg pasture DM per kg N applied.

Nitrogen was used on 21 (75%) of the survey farms. The most common form of nitrogen used was DAP (20 farms). Urea was used on 3 properties. The high tonnages of DAP applied and the proportion of the farm area treated indicates that DAP is becoming an increasingly important source of phosphate on several of the farms (Table 11.13; Section 3.3.4). DAP was applied to an average of 38.1 ± 7.0% of the effective area. Urea was applied to 2% of the effective area in 2 instances, and 76% of the effective area in the third case.

Table 11.13 PROPORTION OF EFFECTIVE AREA TREATED WITH NITROGEN FERTILISER IN 1983

% of Effective Area Treated	No. of Farms
0	8
1 - 25	10
25 - 50	4
50 - 75	1
75 - 100	6

The average application rate for DAP was 113 ± 5 kg/ha (range 75 to 160 kg/ha), while that for urea was 119 ± 11 kg/ha (range 98 to 133 kg/ha). The application rate for DAP would meet the phosphate requirements of most farms, as well as applying 15 - 32 kg N/ha. However, the application rate of urea was surprisingly high. The reasons for this are not known.

Nitrogen was applied in April on only one property (Table 11.14). A higher number of farmers may have been expected to apply DAP at this time considering the low pasture cover following the dry summer and good rains in mid-April. This would have boosted pasture growth prior to winter while soil temperatures were still above 7°C at 10 cm (Parker 1983). A low response to nitrogen in June is likely because of low soil temperatures even though moisture levels are usually high (Table 3.1). It is likely that many of the farmers applied nitrogen when a feed shortage was evident instead of predicting when the shortage was likely to occur and then applying nitrogen to remedy this situation. The latter approach requires more detailed planning as discussed in Section 11.4

Table 11.14 MONTH OF NITROGEN APPLICATION

Month	No. of Farms
April	1
June	3
July	7
August	10*

* Includes 3 properties applying urea

11.7 SPRING 1983 HOGGET LIVEWEIGHTS

The ewe hogget liveweights collected from 26 farms were corrected for variations in liveweight, due to time of weighing and wool length, to a common October 1 shorn weight.

The average October 1 ewe hogget liveweight was 36.9 ± 0.9 kg (Table 11.15). The "off-the-shears" October target liveweight of 40 kg recommended by McNeil (1983) was exceeded on 9 of the farms but 9 of the ewe hogget mobs were still below the May liveweight target of 35 kg. The farmers in the latter group would have difficulty reaching average two tooth liveweights of 50 kg by the end of December (Section 7.5.1), as indicated by the daily growth rates required between October 1 and December 31 in Table 11.15. Poorer or no liveweight gains can be expected between New Year and mating due to normally dry conditions.

Figure 11.2 SCATTERPLOT OF 1983 AUTUMN AND SPRING HOGGET LIVEWEIGHTS

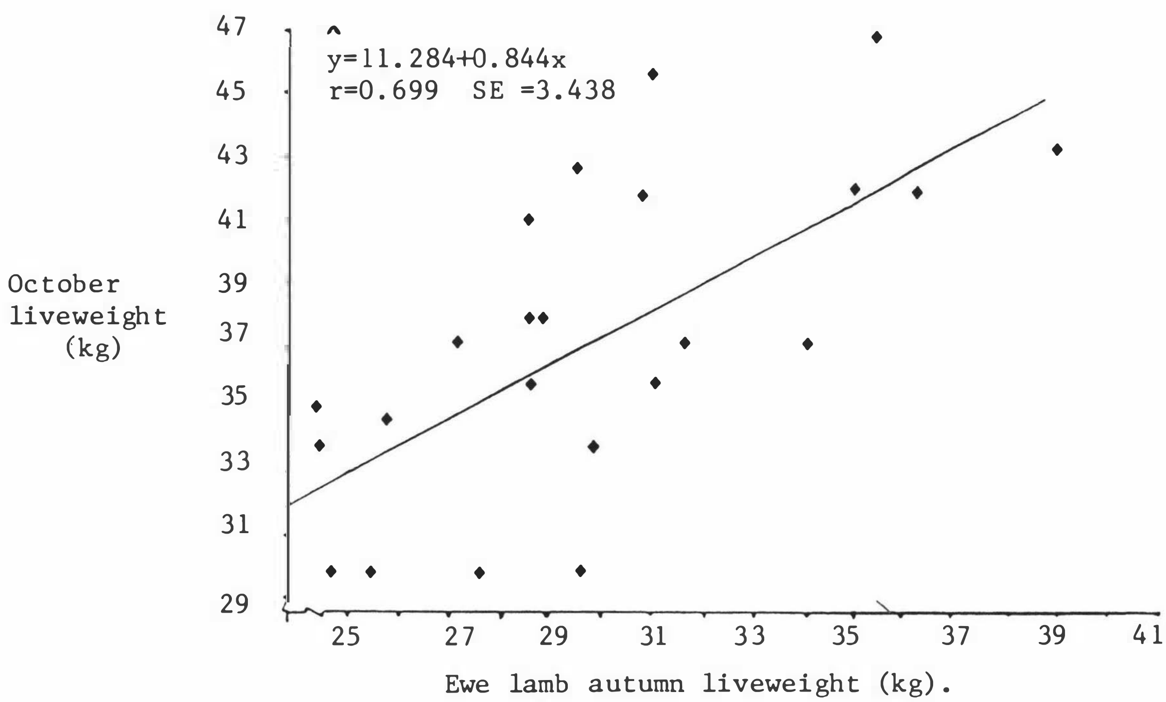


Table 11.15 HOGGET LIVEWEIGHTS (KG) AND AVERAGE DAILY GAINS (ADG)

Farm	Hogget Liveweights (kg) April 1st	October 1	ADG (April 1 to Oct. 1) (gms/day)	ADG required from October 1st to reach 50 kg by 31st December (gms/day)
1	29.7	36.0	34	143
2	25.4	35.0	52	165
3	32.7	37.0	23	143
4	32.0	41.0	49	99
5	29.5	38.0	46	132
6	30.8	33.9	17	177
7	28.2	37.0	48	143
8	31.9	42.0	55	88
9	-	33.5	-	181
10	29.9	38.0	44	132
12	36.4	46.5	55	38
13	32.0	41.1	50	98
14	-	29.5	-	225
15	30.7	30.0	-4	220
16	25.6	29.8	23	222
17	28.6	30.0	8	220
19	25.4	34.0	47	176
21	40.0	43.0	16	77
22	35.0	37.0	11	143
23	26.4	30.0	20	220
24	32.0	36.0	22	154
25	36.0	42.0	33	88
26	30.7	42.5	64	82
27	26.8	34.5	42	170
28	29.6	41.0	62	99
30	37.3	42.0	26	88
$\bar{x} \pm$ SE	30.9 ± 0.8	36.9 ± 0.9	35 ± 4	143 ± 10

The relationship between autumn and spring ewe hogget liveweights is shown in Figure 11.2. This indicates that some hoggets increased average weights significantly over the winter period while others barely maintained or lost weight. On average, ewe hoggets grew at 35 ± 4 gms/day over the period April 1 to October 1 (Table 11.15 and Figure 11.2). This represents an average total gain of about 6.0 kg in liveweight. Providing liveweights are around 35 kg by May, this represents a satisfactory rate of gain for the winter period (McNeil 1982).

These results emphasize the importance of the periods from birth to autumn and from late September until mating. On many of the farms these periods of hogget growth can be considerably shortened by dry conditions. Therefore, in the first and second years of a ewe's life, maximum liveweight gains must be achieved during the September to December period.

11.8 LIVEWEIGHTS AT WEANING

A random sample of a minimum of 50 ewe and lamb liveweights were collected from 22 and 24 of the survey farms respectively within 2-3 days of weaning. In this section these results are discussed in relation to spring management and information collected during the initial weaning - tupping survey.

11.8.1 EWE LIVEWEIGHTS

The average shorn weaning weight of ewes was 52.2 ± 1.2 kg (Table 11.16). The range in average liveweight between the heaviest and lightest flocks was just over 22 kg.

As expected, ewe weaning weights were highly correlated ($r = 0.89$) with the two tooth and MA ewe liveweights collected prior to mating in the previous autumn (Figure 11.3). The mean liveweight at tupping for the 21 flocks for which data was available for both periods was 53.0 ± 1.1 kg. On 7 farms ewe liveweights were 1-4 kg heavier at weaning than at tupping. On the remaining farms ewe weights were up to 5 kg lighter.

Table 11.16 1983 WEANING WEIGHTS, AVERAGE DAILY GAINS IN LAMBS FROM BIRTH, LAMB WEANING AGE, LAMBING PERCENTAGE AND AVERAGE PASTURE COVER SCORE AT LAMBING

Farm	Weaning Weights (kg) Ewes	Lambs	ADG from birth to weaning (gms/day)	Estimated average age at weaning (days)	1983 Lambing (%)	Average Pasture cover score at lambing
1	55.1	26.2	223	98	104	396
2	48.7	24.0	176	112	88	535
3	57.1	24.3	241	83	104	990
4	52.0	23.1	211	89	94	858
6	-	26.2	255	86	84	770
7	48.0	20.0	191	82	90	1050
8	48.0	19.2	213	70	100	1043
11	59.2	23.4	242	79	121	1053
12	57.8	23.2	274	69	115	885
13	60.0	26.5	231	96	129	535
14	52.0	23.1	254	94	92	396
16	49.0	24.0	266	74	92	480
18	39.9	20.0	160	98	78	738
19	-	21.0	199	88	83	850
20	43.0	20.0	178	88	70	675
21	62.5	26.0	265	82	135	770
22	55.0	31.0	262	102	100	620
23	47.5	21.2	217	78	85	463
24	51.0	19.0	171	86	95	905
25	53.0	22.0	295	60	106	1040
26	56.0	23.6	153	126	88	1172
27	50.4	24.9	226	91	87	713
28	48.0	19.0	258	57	115	1150
30	56.0	25.6	300	71	106	990
$\bar{x}$ ± SE	52.2 ± 1.2	23.2 ± 0.6	228 ± 8.5	86 ± 3	98.4 ± 3.3	776 ± 48

Figure 11.3 SCATTERPLOT OF 1983 EWE MATING AND WEANING WEIGHTS

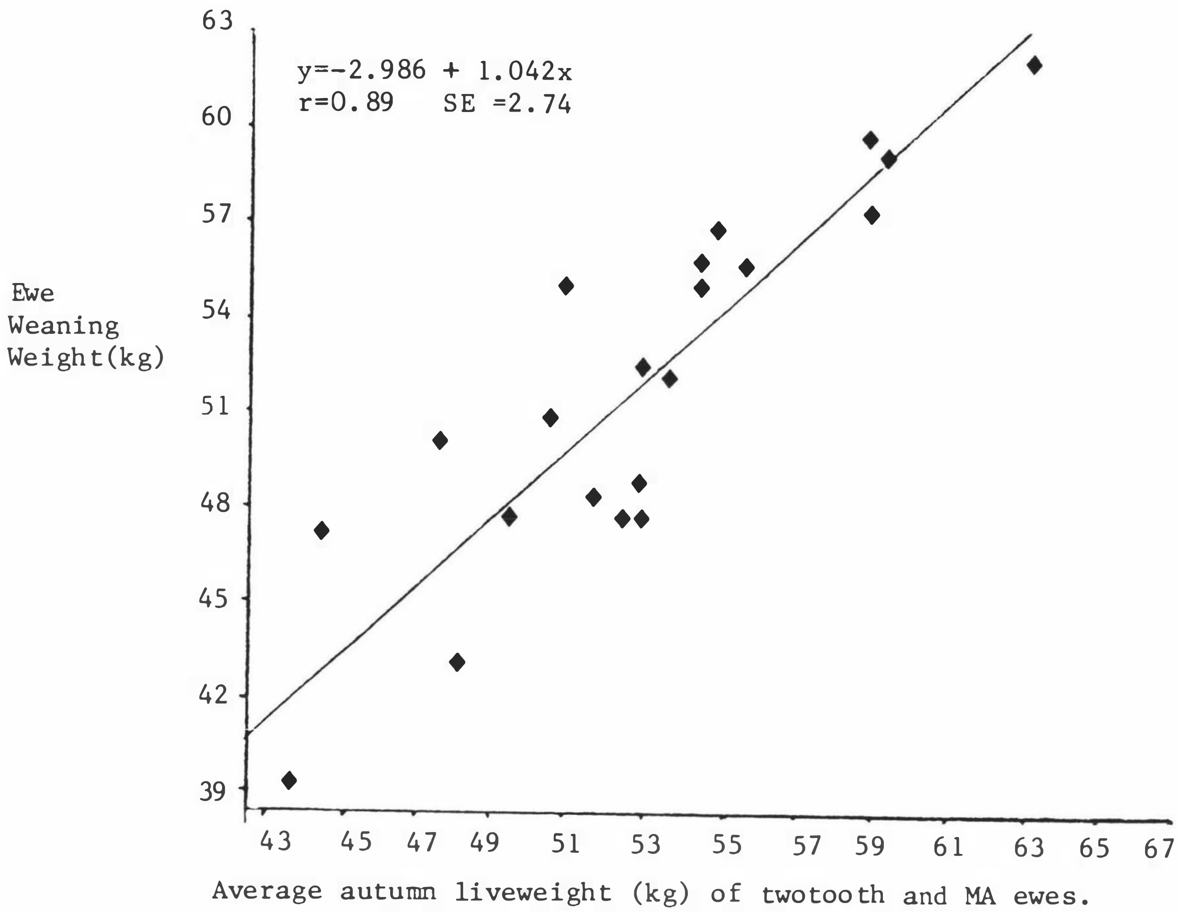
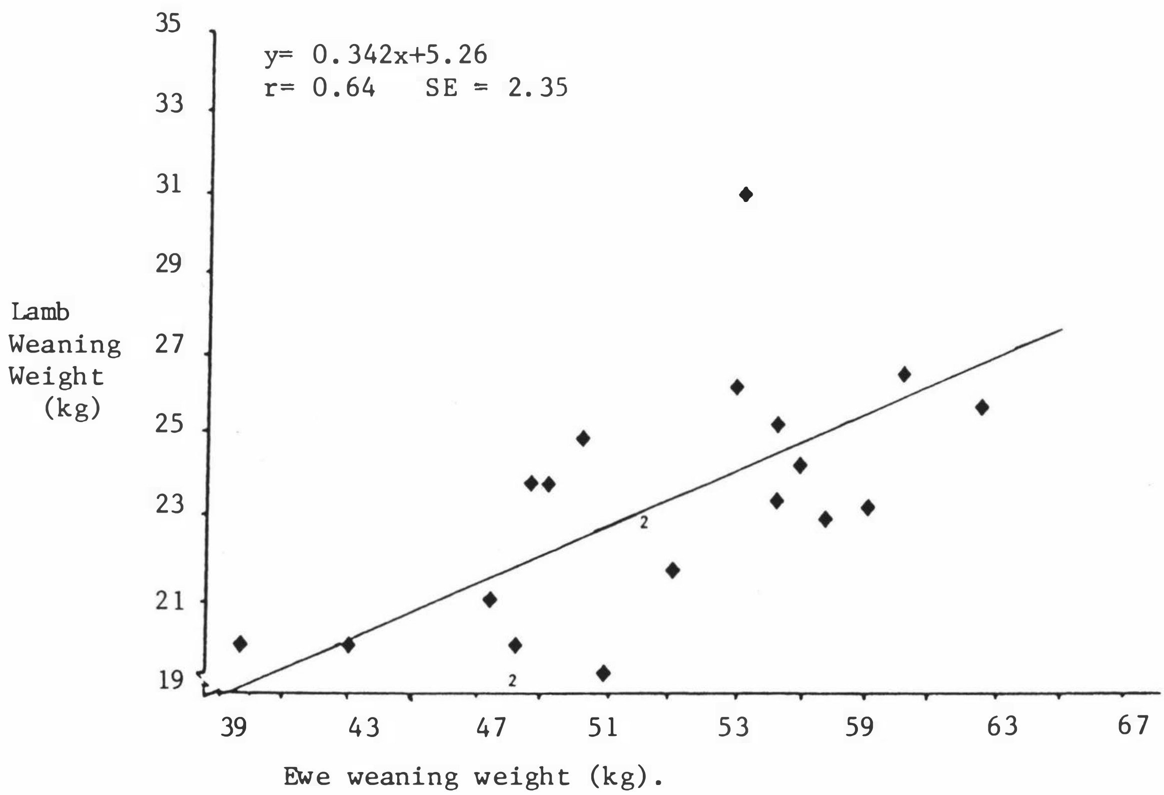


Figure 11.4 SCATTERPLOT OF 1983 LAMB AND EWE WEANING WEIGHTS



11.8.2 LAMB WEANING WEIGHTS

The average lamb weaning weight (woolly) of 23.2 kg ± 0.6 kg at an estimated average age of 86 days (Table 11.16) compares favourably with results presented by Everest and Scales (1983), Rattray *et al* (1978), Clarke (1980) and Newman *et al* (1983).

Lamb weaning weights were positively and significantly correlated ($r = 0.64$, $P = 0.0006$) with ewe weaning weights. The regression equation which best explained this relationship was:

$$y = 0.342x + 5.26, \text{ (Figure 11.4) } SE = 2.35$$

where y = predicted lamb weaning weight (kg)
x = ewe weaning weight (kg).

11.8.3 AVERAGE LAMB GROWTH RATES FROM BIRTH UNTIL WEANING

Only two pieces of information, date of commencement of lambing and weaning weight, were available to calculate average lamb growth rates. Growth rates were estimated after correcting the data for age at weaning and birth weight.

The average age of lambs at weaning (days from the mid-way point of lambing to weaning) was calculated by subtracting the estimated days from the commencement of lambing to mid-way point of lambing from the days between commencement of lambing and weaning. The time from the commencement through to the mid-way point of lambing was estimated at 10 days for flocks starting lambing after 20 August and 14 days for flocks commencing lambing prior to this date[1].

[1] These corrections were based on discussions with the survey farmers at the February 1984 Bideford Hall meeting.

These corrections accounted for the greater spread in lambing which normally occurs in flocks mated in February or early March (Black 1974, Armstrong et al 1980) and approximately represented the mid-way point of lambing for most flocks.

Insufficient information was available to make an accurate correction for differences in lamb weaning weight due to ewe liveweight at birth (Wallace 1948) or birthweight differences due to breed (Rattray et al 1978, Hight and Jury 1970, Dalton and Ackerley 1974), sex (Hight and Jury 1970), or birth rank (Duff 1981, review). However these studies indicate that differences due to these factors for a randomly selected mixed sex/birth rank sample would be relatively small (i.e. less than 1.0 kg). For the purposes of calculating average lamb growth rates a common birth weight of 4.3 kg was assumed.

The average lamb growth rates (Table 11.16) for the survey farms are therefore estimates only. Notwithstanding this, those farms which have either very high or very low average lamb growth rates from birth to weaning are of interest as the conclusion has already been drawn (Section 10.2.2) that poor growth rates during this period are one reason for the May 1 target weight of 35 kg for replacement ewe lambs not being achieved.

To investigate factors influencing lamb growth rates, estimated ADG values were used to calculate a common 13-week lamb weaning weight for each of the farms: 4.3 kg + (ADG X 91) = WWT. The analysis of this performance variable is described in the following section.

11.9 MULTIVARIATE REGRESSION ANALYSIS

11.9.1 HOGGET SPRING LIVEWEIGHTS AND WEANING WEIGHTS

The multiple regression procedure described in Section 9.2.1, was used to investigate the effect of management and state variables on the liveweights of hoggets (shorn) and ewes (shorn) and lambs adjusted to a common age between farms (12 months and 13 weeks post-partum respectively).

The possible explanatory variables included in the analysis were:

Symbol	Description
State Variables	
AREA	Effective grazing area of farm (ha).
STEEP	Proportion of farm area that is non-cultivatable.
MANAGE	Number of years experience farmer has had as owner/manager.
D8	Dummy variable for Ihuraua district
D9	Dummy variable for Bideford district
Management Variables	
LAMBDAY	Date lambing commenced in 1983 (July 12 = 1)
SSLBG	Number of days ewes set stocked prior to lambing.
COV.SU	Average pasture cover score per SU wintered (kg DM/SU).
SR	Stock units wintered per effective ha, 30 June 1983.
N.SU	Kilograms of nitrogen per SU applied during winter-spring 1983
R1	Ratio breeding cow SU:total SU wintered 1983
R2	Ratio other cattle SU (steers and unmated heifers):total SU wintered 1983
R3	Ratio of hogget SU (ewes, wethers and rams): total SU wintered 1983

Complete data sets were available from 24 farms for the analysis of hogget weight and 22 farms for weaning weights.

Performance variables have been excluded from the set of possible explanatory variables included in the regression analyses. Lambing percentage, for example, may well influence lamb weaning weights through average birth weight and competition for available feed. However, lambing percentage is positively related to ewe liveweights generally and nothing is gained by allowing lambing percentage to 'explain' ewe liveweights. The approach adopted in this study is to examine the residual relationships between performance variables after allowing for the effect of state and management variables.

Results

Estimated regression coefficient values for the equation that maximised adjusted R^2 values for each dependent variable are shown in Table 11.17. Figures in brackets are Student's t-values.

Discussion

Farmers in the Ihuraua district, as in the analysis of autumn liveweights, are shown to have obtained higher hogget liveweights and ewe weaning weights than those in either Bideford of Wangaehu. Possible environment effects contributing to district differences have been described in Section 3.6.

Increasing steepness disadvantages hogget and ewe liveweights. This is probably related to pasture production, since there is generally a higher proportion of cooler shady faces on steeper properties. Pasture growth is lower on these areas especially during the winter and spring (White 1973). Interestingly, steepness was positively correlated to autumn liveweight (Table 9.1) indicating that the moister southerley aspects are an advantage during the summer.

Table 11.17 REGRESSION COEFFICIENT VALUES FOR 13-WEEK EWE AND LAMB WEANING WEIGHTS AND EWE HOGGET LIVEWEIGHTS AT 12 MONTHS OF AGE

	Dependent Variable		
	Weaning Weights		Spring Weight
Explanatory Variable	Ewes	Lambs	Hoggets
CONSTANT	60.388 (17.533)	28.389 (6.073)	5.040 (0.717)
AREA			0.006 (2.362)
STEEP	-0.127 (3.235)		-0.037 (1.207)
MANAGE		0.098 (1.441)	-0.204 (2.358)
D8	7.665 (3.816)		7.989 (4.438)
D9	-5.083 (2.518)		
LAMBDAY		0.178 (4.382)	
SSLBG			0.099 (2.061)
COV.SU		0.059 (1.867)	0.070 (1.901)
N.SU	2.733 (3.046)	1.945 (2.884)	
R1		-11.339 (1.142)	
R2	-19.368 (1.315)	-40.639 (3.052)	
R3		-40.340 (1.927)	43.759 (2.061)
SR			1.472 (3.205)
Adjusted R^2 value	0.626	0.629	0.596
Residual Mean Square (d.f)	11.795 (16)	5.575 (12)	7.614 (15)

Greater farmer experience is shown to have benefited lamb weaning weights but not hogget spring weights. A longer period of farm ownership managing increases the opportunity to fine-tune spring management, particularly of paddock set stocking rates for lambing. The reasons for the larger farms' advantage in terms of hogget liveweight is not clear.

The management explanatory variables included in the equations suggest that each of the age groups, but especially lambs, are sensitive to spring feeding levels. Thus later lambing, higher cover per ewe at lambing, and the application of nitrogen - all of which can be expected to increase ewe feeding levels - result in improved lamb production. Ewes probably compensate for low feeding levels during the early stages of lactation when pasture cover increases later in the spring (Peart 1970), although the effects of initially underfeeding the ewe has a large effect on milk production and hence lamb growth rates (Barnicoat et al 1957). Ewe weaning weights benefited from the application of nitrogen during the winter-spring. This may reduce loss of ewe condition prior to and during lambing by increasing pasture production. High body condition (liveweight) buffers pasture deficits to some extent, especially in flocks with a high proportion of multiple births (Wallace 1948, Peart 1967).

Similarly, liveweights are shown to be affected by the ratios of other stock classes. Lamb weaning weights are depressed by increasing proportions of breeding cows, other cattle and hoggets. As the proportion of breeding cows increases, a corresponding increase - dependent on calving date - in the amount of pasture allocated to cows, is required to minimise metabolic disorders (Gould 1975).

In situations where farmers are attempting to grow young cattle over the winter, especially rising one year animals, either for the spring market or to reach target mating liveweights, competition for pasture will be higher than if there were an equivalent number of cow or ewe stock units. The latter classes may be fed so as to maintain, and if necessary lose some liveweight during the winter (Anderson 1977, Owens 1984).

The ratios of other cattle and hoggets to total winter SU provide a measure of flexibility to either reduce winter stocking rates during the July-September period and/or to temporarily decrease feed intakes. This is likely to be the main reason for the positive coefficients for hogget ratio and stocking rate in the hogget liveweight equation. Stocking rate may also be an indicator of the state of farm development; particularly winter pasture production.

Ewe hogget liveweights are also improved by higher levels of pasture cover at lambing. As cover increases there is a corresponding increased opportunity to feed stock at higher levels prior to the spring flush. Earlier set stocking for lambing, however, will generally depress pasture cover at lambing because feed intakes cannot be controlled. In this example the simple correlation coefficient is negative (as expected) while the regression coefficient is positive. The biological explanation for this is not clear.

Despite the limitation of the small number of farms, the regression equations provide some insights into the factors influencing spring hogget and weaning liveweights. In particular, a sensitivity to feeding levels is shown. Average pasture cover at lambing is a measure of the amount of feed available to livestock during the important first few weeks of lactation. In the next section average pasture cover is examined within a multiple regression framework.

11.9.2 AVERAGE PASTURE COVER AT LAMBING

Data from 28 farms was suitable for the analysis of the average pasture cover score (Section 11.5). This was investigated as pasture cover per stock unit wintered (kg DM/SU), rather than on a per hectare basis, to provide a measure of the amount of pasture available to each stock unit. (As stocking rates increase we might expect farmers to implement management strategies to increase average pasture cover per hectare at lambing, ceteris paribus). The interval between paddock grazings during winter (ROTLGTHA) was included to describe winter grazing management. Otherwise, the explanatory variables were the same as those used in the liveweight prediction equations.

The results of the cover per SU prediction equation are presented in Table 11.18.

Table 11.18 ESTIMATED AVERAGE COVER PER SU AT LAMBING 1983, REGRESSION EQUATION COEFFICIENTS. (STUDENT'S t-VALUES ARE SHOWN IN BRACKETS).

Explanatory Variable		
CONSTANT	120.949	(4.002)
AREA	-0.034	(2.429)
LAMBDAY	-0.407	(1.891)
ROTLGTHA	0.465	(4.057)
R2	184.354	(2.797)
R3	132.809	(1.713)
SR	-6.489	(2.921)
N.SU	5.346	(1.397)
Adjusted R^2	0.435	
Residual Mean Square (d.f).	226.301	(20)

Discussion

Longer winter rotations, later lambing, application of nitrogen and high proportions of potentially saleable stock can be seen to increase the amount of pasture available at lambing (kg DM/SU).

A longer winter ewe rotation allows more autumn and winter pasture growth to be transferred through to the spring because intakes are normally restricted more than under a faster winter rotation (at least during early winter when pasture growth rates are relatively high). Furthermore, under a long winter rotation, a higher proportion of the farm will have been spelled from grazing at lambing.

A lower pasture cover per SU is necessary at the commencement of lambing if lambing date coincides with the onset of the spring pasture flush and feed requirements can be met by fresh pasture growth. Hence, the amount of pasture cover per SU should increase with earlier lambing, to make up the deficit between pasture growth and animal requirements.

Pasture cover per SU can be maintained during the winter and spring by progressively decreasing stocking rates. This form of management, which is common in the Wairarapa, requires a readily saleable group of buffer stock, such as non-replacement cattle and hoggets. Thus the regression coefficients for higher proportions of other cattle and hoggets are positive. The stocking rate coefficient is negative, indicating that, *ceteris paribus*, farmers with higher stocking rates make less provision for pasture reserves per SU at lambing compared with farmers at lower stocking rates. This situation may be attributable in part to extension advice referring to target pasture covers at lambing in per hectare rather than per SU terms.

Pasture cover per SU at lambing can be increased by applying nitrogen. This is a common practice on the survey farms (Section 11.6).

The negative coefficient for effective area may reflect the more extensive form of management normally adopted by larger properties.

This analysis suggests that the most important change that can be made to winter management to improve pasture cover per SU at lambing on the survey farms is to increase the length of the ewe winter rotation. This is likely to require a more carefully planned approach to management than is currently occurring in most of the farms (Parker and Lowe 1982).

11.9.3 ANALYSIS OF ESTIMATED RESIDUALS

The estimated residuals ($Y_i - \hat{Y}_i$) for each of the regression equations may be interpreted within the context outlined in Section 9.2.4. The correlation matrix between the residuals of the predicting equations are shown in Table 11.19. Outliers expressed as coded values of the standardised residual deviation rather than as graphical plots, are presented in Table 11.20. The features of seven farms,whose 12-month ewe hogget liveweights and/or lamb weaning weights are worse/better than expected,are discussed in this section. It should be noted that a similar procedure for each of the farms with outlying values could be followed and if necessary, and with time permitting, a follow-up survey seeking more detailed information about management practices on these properties could be carried out.

Table 11.19 CORRELATION MATRIX FOR ESTIMATING REGRESSION EQUATIONS RESIDUAL VALUES

	Dependent Variable			
	Ewe weaning Weight	Lamb Weaning Weight	Hogget Weight	Cover at Lambing
Ewe weaning weight	1.000	0.488	-0.025	0.046
Lamb weaning weight		1.000	0.172	0.209
Hogget weight			1.000	0.270
Cover at lambing				1.000

Table 11.20 STANDARDISED RESIDUAL VALUES FOR ESTIMATING REGRESSION EQUATIONS. (Z Residuals coded; 0.00 - 0.74 = 0, 0.75 - 0.99 = +, 1.00 - 1.49 = ++, 1.50 = +++ for positive residuals and vice versa for negative values. N/A = Not Applicable)

	Farm Code	Ewe Weaning Weight	Lamb Weaning Weight	Hogget Weight	Cover at Lambing	Remarks
	1	++	0	0	0	
	2	0	0	0	--	Early lambing
	3	+++	0	0	+++	
*	4	--	--	++	0	
	5	N/A	N/A	0	0	
	6	N/A	N/A	0	0	
	7	0	-	0	0	
	8	0	0	0	0	
	9	N/A	N/A	N/A	0	
	10	N/A	N/A	--	+	
	11	0	0	N/A	0	
*	12	0	+++	+	0	
	13	++	0	0	---	
	14	-	--	N/A	-	
	15	N/A	N/A	0	0	
*	16	0	+	--	0	
	17	N/A	N/A	0	0	
	18	---	0	N/A	+	
	19	N/A	N/A	0	0	
	20	0	--	N/A	0	
	21	0	0	0	N/A	
*	22	0	-	++	0	
	23	0	0	0	--	
	24	+	0	--	++	Early lambing
*	25	+++	+++	+++	0	
	26	0	0	++	+++	Early lambing
*	27	0	-	--	0	
*	28	-	+	+++	+++	
	30	-	0	0	0	

* Indicates "outlier" farm.

Farm 25: Characteristics of this farm have been presented previously in Section 9.2.4. The intensive use of tupping crayons enables ewes to be set stocked for lambing 3-5 days before the due date of each colour group. An 80-day interval between grazings was achieved during the winter. Ewes with twins are shedded out two weeks after lambing and grazed separately. Rotational grazing of some ewes and lambs may be adopted if pasture cover is low. The farmer is very conscious of presenting high quality pasture to stock at all times of the year.

Farm 12: The 33 year old farmer, from a city background, purchased his Ihuraua property in 1977. Lambing percentages have increased from 65% in 1977 to 115% in 1983. A single cross of Border Leicester over Romney ewes was adopted, with the progeny being mated to Romney rams selected on Sheeplan Index. He does not belong to a discussion group or use MAF regularly but watches and listens to "top" local farmers. Highest priority is given to young stock ("They don't grow when they're older"). The farm has a good balance of flats and hills and some areas of soils on papa ensure reasonably reliable summer pasture production.

Farm 28: This large property (1496 ha) comprises three farms in the lower Wangaehu. Coopworths have been farmed for 20 years and a flock is recorded on Sheeplan. No cattle were run for several years until a small herd (70 cows) was purchased with the third property in 1981. Lambs are weaned at an average age of 8 weeks. This older farmer, a progressive and original thinker, is a member of the Wairarapa Farm Improvement Club.

The hogget and lamb liveweight analyses are restricted to the 1000 ha main block, where all the ewe hoggets are wintered (Table 11.1). The lower stocking rate on this area (10 SU/ha) and the application of DAP over 45% of the farm in August contributes to a relatively high average pasture score (1150) at lambing. Lambing performance is high (115% in 1983) despite medium ewe liveweights (50-53 kg at tupping), indicating the genetic merit of the flock (Gibson and Craig 1980). Early performance of replacements however, is usually very good.

Farm 22: Ownership of this well established 1255 ha Bideford farm was transferred to the son in 1981. A flock of 1200 Perendale ewes is recorded on Sheeplan. The sheep:cattle ratio wintered in 1983 was 4.3:1. Although additional land was purchased in 1978, stocking rates have steadily increased in the past 10 years. Paddocks are still relatively big (43 main paddocks). No phosphate was applied in 1982, but both DAP and urea was used during the 1983 winter-spring.

A 35-day interval between paddock grazings was achieved during winter 1983. Ewes were set stocked 21 days prior to lambing because their condition was low and to allow time for lambing sites to be established. These circumstances, which are seasonal, are probably the main reasons for the lower than predicted lamb weaning weights. Ewe hoggets, born in 1983, however were well grown (35 kg by April 1) and had reached a shorn liveweight of 37 kg by October 1.

Farm 4: This 586 ha lower Wangaehu property has a history of being farmed by managers. The current manager took over from his father in 1977. About half the farm has been cultivated and regrassed and the water supply is of a high standard. A relatively high sheep: cattle ratio (3:1) is run. The management system is "traditional" with set stocking being favoured. This may have contributed to the better than expected ewe hogget performance, especially during the winter and spring period, but at the expense of ewe and lamb weaning weights.

Farm 16: Details of this property have been presented in Section 9.2.4. The average pasture cover score at lambing of 480 kg DM/ha, is a reflection of the large scale development programme. Spelling intervals between winter grazings of only 20 days are achieved. The low winter and spring pasture cover, following the dry 1983 summer, restricted hogget liveweight gains. However, autumn sown pastures provide high quality clover dominant feed from mid-October onwards, and this is likely to be reflected in the lamb weaning weights.

Farm 27: The 32 year old farmer purchased the family farm in 1978. A large development programme of scrub to pasture, mainly by root raking, and fencing (the number of paddocks has been quadrupled) has been undertaken in the last 5 years. Ewe numbers have increased by 45% in this period. Installation of reticulated water and dams has been less rapid and water is a major management limitation during dry summers. A small area of barley and summer fodder crop is normally grown (for lamb fattening). Lambing date has been shifted later by 3 weeks since 1980 and a breed change from Coopworths to Romneys is being made.

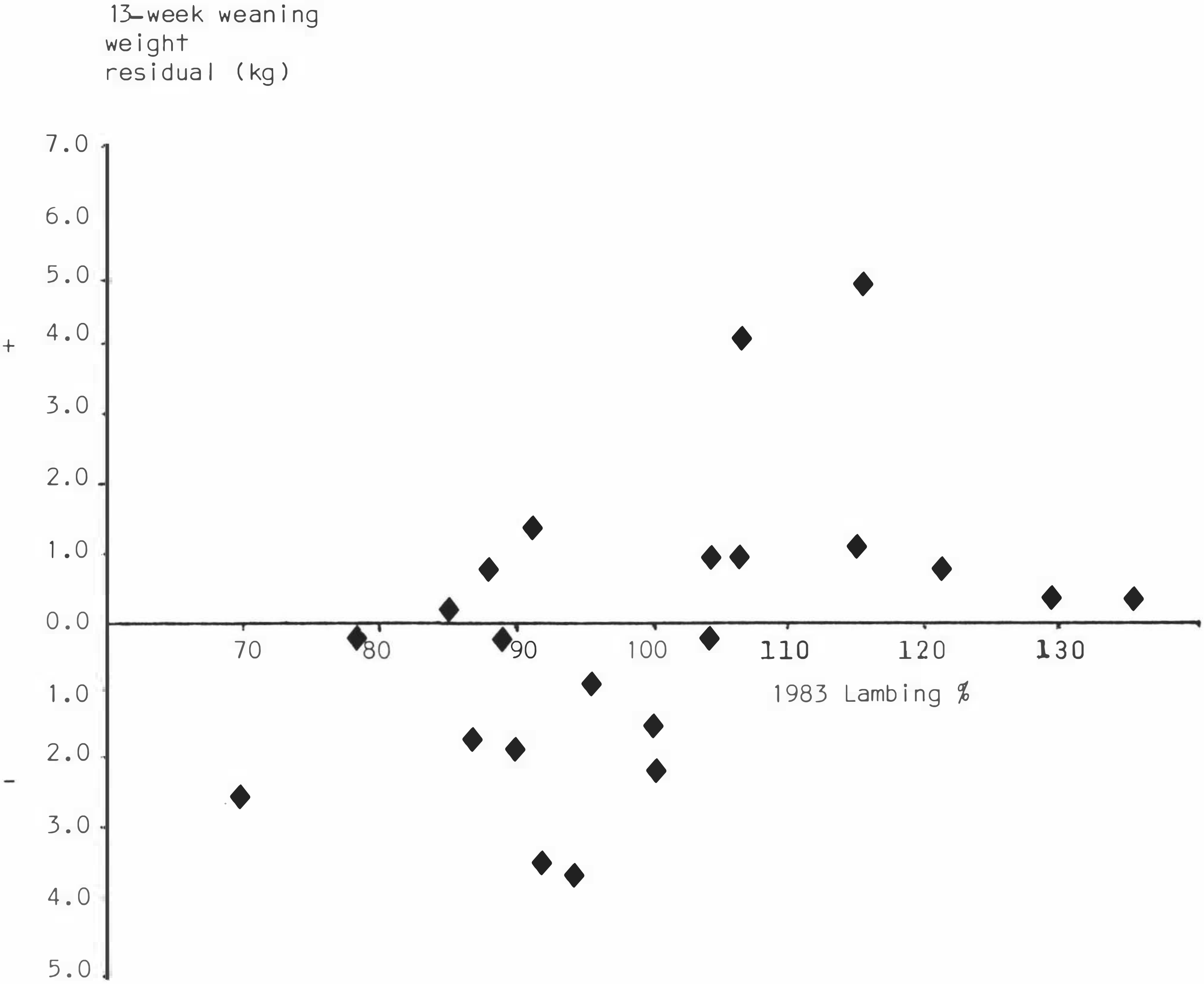
Poor lamb growth rates have traditionally been a problem. Pneumonia and grass staggers is common. The farmer considers that non-replacement lambs were held too long in 1983. This contributed to the low winter pasture cover, estimated to be 700 kg DM/ha during the farm inspection in April. Consequently there was little opportunity to increase ewe hogget liveweights over the winter period.

Further examination of Residuals

Further examination of residuals may prove useful in judging adequacy of the linear multiple regression model or to indicate other areas of management requiring closer study. For example, there may be a suspicion that farms with a higher than average lambing percentage might have 13-week lamb weaning weights less than predicted (negative residuals) due perhaps to the method used to estimate 13—week weaning weights, or due to management factors. Such an examination might focus attention on farmers who are apparently 'successfully' managing high lambing percentage flocks.

The plot of 13-week lamb weaning weight residuals versus 1983 lambing percentage is presented in Figure 11.5. The positive correlation between these variables (r = 0.461) indicates that, in general for the survey farms, higher than average lambing percentage is associated with better than predicted 13-week lamb weaning weights. This may be due in part to the higher average ewe liveweight of high lambing percentage flocks, and hence better ability of these ewes to milk well in spite of any feed shortages over the lambing to weaning period. Management practices on the farms with higher or lower than predicted weaning weights have been discussed in the previous section.

Figure 11.5 1983 LAMBING PERCENTAGE VERSUS 13-WEEK LAMB WEANING WEIGHT REGRESSION EQUATION RESIDUAL VALUES.



11.10 CONCLUSIONS

The winter-spring management survey was carried out in response to a number of questions raised by the weaning-tupping study. The results indicate, as could be expected, that some of the problems experienced during the October to April period are closely related to the management practices adopted during the winter and spring. This information, combined with pasture growth rate data (Tables 3.3 and 3.4) confirmed the pre-survey belief that underfeeding during the important first 6 weeks of lactation was common, and that this restricted both hogget and lamb performance.

There are a number of ways in which the survey farmers could increase ewe feeding levels after lambing. These include:

1. Later lambing so that the increase in ewe feed requirements for lactation coincide with the onset of the spring pasture flush. Unless stocking rates are very low it is suggested that lambing be delayed until September in the survey area. This would also provide advantages to autumn management, would be likely to increase lambing percentages (Section 5.2.4) and would probably condense the lambing period (Section 5.2.5).

2. Increasing pasture cover at the commencement of lambing by extending the interval between grazings to 70-110 days, depending on stocking rate and state of pasture development, during the winter. Nitrogen applied in the autumn, rather than spring, is also likely to assist (Section 11.6) by enabling higher ewe feeding levels to be maintained during early pregnancy, while at the same time allowing pasture to be transferred forward into the spring.

3. Delaying set stocking of ewes until as close as possible to lambing. Differential set stocking, according to tupping crayon markings, can improve the efficiency of this operation, and in a dry autumn also enables pasture to be conserved if ewes which have already been tupped are drafted off and fed at a reduced level.

4. Rotational grazing of ewes and lambs for a period of 3-4 weeks after early docking if pasture cover is low (Section 5.3.1). This requires some saved paddocks (for example, those grazed last on the winter

rotation) in which the rotation can commence without restricting ewes, to build up pasture ahead of the mob.

5. Changing the management of other stock. For example, delaying calving (Section 8.3) and ewe hogget shearing (Section 6.4.3), to mid-October to spread the increased demand for pasture.

6. Culling all unnecessary stock as early as possible. Dry dry and late lambing ewes can be identified by mid-winter with harnessed rams (Knight et al 1979) and surplus ewe hoggets can be sold early if a spring feed shortage is likely.

Better feeding from lambing to weaning will improve ewe milk production, reduce ewe liveweight loss and increase lamb growth rates (Section 5.2.1). Weaning at younger ages (60-70 days average age), without lambs suffering a growth check will then be possible - as some of the survey farmers are already proving. This will provide greater opportunity to increase ewe liveweights and enable more efficient allocation of high quality feed to priority classes of stock (Sections 7.2.6, 7.4.5 and 7.6.6).

The spring liveweight data again emphasises that high bodyweights are fundamental to a high performance sheep farming system. High bodyweights at tupping, as well as leading to higher lambing percentages (Figure 11.1), enable short periods of pasture deficit to be buffered during the late winter-early spring. Similarly, if ewe lambs are 35 kg by May 1, only moderate liveweight gain (50 gm/day) is necessary over the winter period. Considerably less valuable winter and spring pasture is required under these circumstances compared with situations where a 10 kg autumn deficit needs to be made up over the winter. The starting point to obtaining an increased average flock liveweight then, is to improve ewe lamb liveweight gains in the first 8 months of their lives. The results of the winter-spring survey further illustrates the scope for improvements in terms of existing performance differences between survey farms and providesadditional pointers (See Sections 7.4 and 9.2.3 also) as to how farmers with poor ewe lamb replacements could increase liveweights.

CHAPTER TWELVE

CONCLUSIONS

12.0 CHAPTER OUTLINE

In the first section of this chapter the methodology used in this study is appraised and possible improvements are suggested. An overview of the achievements to date at Riverside, and the possible direction of the farm's future development, are discussed in the second section. This is followed by a summary of the opportunities identified in this study to improve management on the survey (and other similar) farms. Topics requiring further research are also outlined.

12.1 EVALUATION OF RESEARCH METHODOLOGY

The mail questionnaire-interview combination proved to be a successful method of collecting large and detailed amounts of information from farms. In particular this method:

- reduced the time required to fill in the questionnaire during the farm visit, leaving more time for farm inspection and free-ranging discussion;
- provided the farmer with the opportunity to consider questions at his own leisure, and to recall and record information over time prior to the interview.

The return of the results soon after the completion of the surveys and the opportunity to discuss these as a combined group maintained farmer interest and involvement. Some farmers feel, in many cases justifiably, that participation in surveys is a waste of time because they receive nothing in return. The willingness of 29 of the farmers to participate in the follow-up survey indicates that the study was viewed as being worthwhile. The meetings with farmers also provided the opportunity to renew acquaintances. This assisted with the collection of information by telephone.

The study highlights the problem of collecting sufficient information to describe farm management and system performance. Despite 578 variables for each farm being collected - and a large number of additional variables which could be created from these - a considerable amount of detail is still required to analyse some parts of the farming systems. Thus in some instances more questions have been raised than answers provided. The follow-up survey, however, indicates that once an information base on each farm has been established, more specific data on components of the farming systems can be collected quickly and simply. As a result, the survey farms have become a valuable resource for further hill country farm management research.

The analysis of results was in many cases hampered by the small sample size. This poses a dilemma because on the one hand a large amount of detailed information is required to understand the various farming systems - which restricts the number of farms which can be surveyed - while on the other, sufficient farms representative of particular types of management or levels of performance are required for meaningful analysis. Thus in this study trends in performance rather than significant differences in many cases were established.

Multivariate analysis provided an appreciation of the farming systems over and above that which was provided by univariate or bivariate statistical methods. In this study the questionnaires were designed without much consideration being given to multivariate analysis. If more detailed models of the farming systems, (or parts thereof) based on the literature and observations had been constructed initially, the questionnaires could have been designed so that the appropriate information could have been collected. As it was, approximations of some of the management practices had to be used.

The considerable advantages of large capacity computers, which enable full user interaction, compared with hand calculation or the use of earlier makes of computer, is demonstrated in this research. Simplification of data manipulation and analysis enabled more time to be spent investigating relationships within the data set.

A major limitation to the analysis of farm survey data is often the lack of objective information. In this study an attempt was made to quantify the effects of management by collecting sheep liveweights and asking farmers to specify grazing management in terms of pasture height. These measurements were at the centre of most of the analysis of survey farm performance. Further consideration should be given to the development of methods that will enable management and performance to be quantified more precisely. The estimation of a pasture cover score in spring 1983 is an example of such methods.

12.2 THE ROLE OF RIVERSIDE

The initial achievements at Riverside farm appeared to be well received by the survey farmers. Although only about one third of the farmers had visited Riverside during an Open Day or by some other arrangement, most had some knowledge of the type of farming system being developed and of the trial work undertaken.

The major criticism of Riverside was that the high proportion of flats made it atypical of Wairarapa hill country. Some farmers also thought that summer rainfall was higher and more evenly distributed. As a result the application of the management systems used at Riverside to hill country farms tended to be viewed sceptically, although the principles being promoted, such as planned winter grazing management and monitoring of system performance, were generally well received. In a few instances farmers had made changes to management based on Riverside results.

These observations plus comments made to the author by farmers outside the survey area suggest:

1. that the development of a high stocking rate, high performance sheep farming system should continue at Riverside Farm (Parker and Lowe 1980). To gain wider farmer acceptance, higher per animal performance rather than further increases in stocking rate is required, as most farmers seem to be more impressed by high lambing percentages and wool weights rather than high stocking rates with average levels of performance. Particular attention should be paid to developing management strategies to achieve high autumn ewe lamb liveweights;
2. that simple and reliable methods of monitoring system performance to aid the management process be developed;
3. that the investigation and demonstration of new technology which may assist farmers increase efficiency be continued;
4. that trials to investigate, in detail, components of farming systems which are of local interest (e.g. rates and timing of fertiliser application, alternative shearing policies) be maintained, providing such trials do not affect the development and implementation of the overall farming system;

5. that farmer interest be maintained by creating regular opportunities to inspect and discuss management on the farm and publishing results as they become available. The means by which some of the Riverside findings could be implemented in hill country situations should receive greater consideration.

The initial development of Riverside has met the wishes of the late Mr Sydney Campbell that the farm be used to "accumulate, expand, and disseminate knowledge about agriculture." This will continue in the future because of the annual allocation of farm surpluses to fund research activities. For this reason Riverside Farm and Massey University can be expected to make an increasing contribution to agriculture in the Wairarapa.

12.3 SUMMARY OF SUGGESTED IMPROVEMENTS TO MANAGEMENT AND POSSIBLE TOPICS FOR FUTURE RESEARCH

At the completion of his Wairarapa lambing percentage survey Clarkson (1974) stated:

> "...while there is much evidence to suggest that liveweights and liveweight changes at critical times of the year are major factors affecting lambing percentages, there is very little information on the way in which management practices affect liveweight... Liveweight information alone is of little use, unless the farmer knows how to control liveweight by management."

In addition to describing management practices and associated performance levels, this investigation has identified some of the ways in which management practices affect liveweight and lambing percentages. Consequently, the means by which farmers could change management in order to improve system performance can be specified. In the following section, a summary of recommendations to improve management on the survey (and other similar) farms (Section 3.7) is presented. Aspects of management which require further research are also identified.

12.3.1 SUMMARY OF RECOMMENDATIONS

Ewe Lamb Management

The major recommendation from this study is that increased emphasis should be placed on rearing ewe lambs so that they achieve liveweights of 35 kg or more by May 1. If this objective is realised, obtaining target mating liveweights in two tooths and MA ewes is considerably simplified (Section 9.1 and 11.7). Thus there are two periods of lamb management which require attention;

1. from birth to weaning: High weaning weights are fundamental to the attainment of heavy ewe lamb replacements by autumn, because low liveweight gains prior to weaning are unlikely to be compensated by high growth rates in the post-weaning period in areas with low summer rainfall.

   The early stages (first 6 weeks) of lactation appear to contribute most to poor weaning weights. Increasing the length of winter rotations according to the pattern of pasture growth and stocking rate will ensure that the required pasture cover at the commencement of lambing is achieved. However, the efficient allocation of this saved feed poses a number of practical problems on hill country. Investigation of alternative strategies for grazing ewes at lambing is required. Results of this study suggest that a simple method of reducing this problem is to lamb later.

2. from weaning to autumn: The major problem during this period in dry summer areas are shortages of, or low quality, pasture. The application of recommendations from recent grazing management studies, such as Sheath and Bircham (1983) (Section 4.0) should help hill country farmers improve summer pasture growth and quality.

   Monitoring of drenching programmes should be adopted so that drenches are administered as required rather than on the basis of some predefined pattern or visible evidence such as the accumulation of dags. Similarly, a greater degree of control over the pattern of liveweight gain can be obtained by weighing every 3-6 weeks during the summer. Such a programme requires regular, close inspection of lambs and, compared with eye appraisal, will enable problems to be detected earlier and more accurately.

   More information on the effects of water supply and quality on lamb growth rates is required.

Two tooth management

The major aim of two tooth management should be to reach tupping weight (55 kg) by New Year, so that diminishing high quality feed can subsequently be allocated to lambs, and to lessen the risk of poor liveweight gains, during the summer months. This requires an off-the-shears liveweight in October of 40 kg. Ad-libitum feeding of hoggets, through set stocking or rotational grazing at relatively high residuals (1000-1200 kg DM/ha) (Section 7.6.6) should be adopted as soon as spring pasture growth allows this to be achieved without depressing ewe and lamb intakes.

Ewe Management

Increased emphasis should be placed on improving ewe liveweights prior to dry summer conditions by adopting grazing systems which encourage high intakes immediately after weaning (Section 7.8), weaning lambs earlier to increase the time period for ewe liveweight gain (Section 7.2.6), and improving feeding levels up to the time of weaning (Section 11.5).

Less emphasis should be placed on flushing. In dry summer areas, sufficient flushing feed either cannot be grown or it is achieved either at the expense of other stock classes and/or pasture cover going into the winter. It is preferable that priority be given to increasing static ewe liveweights, both by ensuring replacement stock are well grown and by maintaining ewe liveweights at the highest possible level throughout the year.

Joining of rams in the period April 1-15, is likely to improve lambing performance (Section 5.2.4), avoid prolonged periods of underfeeding in the spring (Section 11.5) and increase the amount of pasture available for flushing (Section 3.1.5). An associated mating period of 51 days or less would reduce the variation in lamb age and weight at weaning and simplify spring pasture management (Section 5.1.4).

Tupping crayons can improve the efficiency of pasture allocation at lambing, but colour changes should be made according to the number of ewes marked (that is, convenient mob sizes for spring management) rather than at the end of oestrus cycles. Problems with ram soreness, due to harnesses (and hence more breakages) can be reduced by fitting harnesses 3-4 weeks prior to mating to enable time for the skin to harden. In addition, harnessed rams can be used to identify barren ewes and late lambers for sale on the normally buoyant late winter-spring market, and to avoid wastage of feed on unproductive animals.

Cattle Management

The demand for spring pasture growth can be spread by delaying calving until mid-October or later (Section 8.3). Saved pasture for calving should no longer be necessary, and the ability to feed cows at high levels in the immediate post-calving period will minimise the anoestrus interval, ensure high calf liveweight gains and improve conception rates (Section 8.3). A compressed calving interval, to reduce variation in calf weight and age at weaning, and to simplify grazing management, will be more easily achieved. Improved control of the spring pasture flush can also be expected because animal feed requirements will be more closely matched to the pattern of pasture growth.

In general, cattle could be used more effectively for pasture control by adopting a "sheep follower" grazing system as described by Sheath and Bircham (1983) (Section 8.1.2).

Weaning calves at 12 weeks of age rather than at 24 weeks or older, offers a number of potentially important advantages to the hill country farmer in relation to flexibility in pasture management, without jeopardising post-weaning performance of calves (Section 8.1.1).

Pasture Management

Identifying emerging seedheads before they are visible in the sward by Korte's (1981) technique will assist decision making in the late spring in relation to timing of "hard" grazings and establishing area grazing priorities (Section 4.0). Where insufficient stock numbers are available for seedhead control, steeper warmer slopes should initially receive the most grazing pressure. Grazing management systems which are likely to restrict animal intakes during the period of high pasture growth rates should be avoided. Set stocking is the simplest method of achieving this.

More attention should be paid to the amount of pasture on the farm going into the winter (May 1). Depletion of feed reserves during flushing and mating should be avoided, in order that ewe liveweights can be maintained during the first 100 days of pregnancy, rather than decreased so as to build up pasture for the winter rotation. Planning for the winter must therefore commence in February (Section 11.3.3). In particular the paddocks in which rotations are to commence should be identified, and surplus stock sold, if necessary, at this time.

Monitoring pasture cover at certain times of the year is therefore suggested to improve planning of pasture management. Pastures should simply be measured in terms of height, rather than kg DM to avoid confusion and problems with calibration. (Research publications should also indicate grazing allowances or residual DM in terms of pasture height, as this is the only standard understood by all farmers). Initially a minimum record of average pasture height at three times of the year is suggested:

1. Lambing; to indicate the effectiveness of winter management and to determine how ewes should be grazed during lambing;
2. February 15; to indicate what changes may be necessary in order to achieve desired pasture cover going into the winter. In particular this should ensure attention is focussed on the future of non-

replacement lambs still on the farm (Section 6.5).

3. May 1; to assist with planning of winter management so that the desired average pasture height at lambing can be realised.

Monitoring pastures every 2-3 weeks will yield a more detailed description of changes in pasture height, and would be of even greater use to pasture management. However, most farmers are unlikely to adopt such a programme immediately. The above recommendation is aimed at forcing an objective evaluation of the whole farm at critical times of the year. Over a number of years, the value of these measurements in evaluating and planning management strategies will become increasingly apparent, and hopefully a progression to more regular monitoring will occur.

Applications of nitrogen in March-May, providing there is sufficient moisture for pasture growth, rather than in June-July, are likely to give larger responses in pasture growth because of higher soil temperatures. Additional feed can be transferred through the winter by rotational grazing. Spring nitrogen applications can pose problems because there is insufficient time to spell pastures from grazing, encouragement of grass growth may reduce clover production which is desirable for high lamb liveweight gains, and the problem of controlling pasture growth in late spring may be increased. The decision when to apply nitrogen can be improved by keeping a daily record of rainfall and soil temperatures at 10 cm (Section 3.3.4 and 11.6).

Stock Weighing

Standard procedures for weighing should be adopted, e.g. time stock remain in the yards prior to weighing.

Ideally, recorded weights should be adjusted for wool growth (Section 6.1).

Weighing should occur at strategic intervals so that the information serves both as a measure of the effectiveness of previous management, and as an aid to planning (Section 6.1.3). A suggested minimum weighing programme is:

Ewe lambs: weaning, mid-summer, May 1.

Ewe hoggets/two tooths: spring shearing, January 1, pre-tup.

MA ewes: weaning, mid-summer, pre-tup.

In all cases, these weighings can coincide with normal stock operations. A sample of 50 animals should be weighed and the weights preferably recorded so that a frequency distribution is obtained and the average weight can be easily calculated.

12.3.2 CONCLUSIONS

The need to objectively measure aspects of farm performance has been stressed in these recommendations. Sheep farmers, unlike dairy farmers, do not receive a regular record of the effects of various management decisions, and when the information does become available (lambing percentages, carcass weights, wool weights), it is rarely useful for evaluating management practices which contributed to success or failure. The increased scale and steeper topography of most sheep farming operations, compared with those of dairying, discourages regular inspection of the whole farm, and differences in stock grazing management - particularly of not being able to see the same class of stock each day - means that sheep farmers, even if they are astute observers, are less able to record the effects of management decisions.

Consequently sheep farmers are at a considerable disadvantage compared to dairy farmers in terms of information for making and evaluating management decisions. Contrary to what a high proportion of sheep farmers appear to think, irregular visual inspection of stock and pastures does not provide adequate information to ensure that plans have been correctly implemented and are performing as desired.(The farmer comments on stock weighing, in Sections 6.1.2 and 10.2.2 support this conclusion). In practice some sheep farmers may see the "back" paddock two or three times a year. If hoggets are grazing this area they may only be seen when being shifted in and out of the paddock, or at distances of more than 50 metres. Problems involving small changes in liveweight therefore may simply not be detected.

Collection of objective information serves two functions. Firstly, it enables the effects of management to be quantified and secondly the measurement process forces the farmer to evaluate management. The two functions are of equal importance. Thus when ewe lambs are weighed in mid-summer, not only is the average weight determined, but the farmer will also physically handle the lambs. Hence one of the benefits of the "preventative" control drenching programme for lambs has been the inspection of all lambs at regular intervals. Similarly if a sheep farmer adopts the practice of recording pasture height in each paddock, it is likely to be one of the few times of the year when he inspects the whole farm in a single day and makes an assessment of the farm's overall feed position. The benefit in this case is not so much that an average height of pasture will be obtained but that an overall evaluation of grazing management, feed supplies and future stock shifts can be made.

Whether or not farmers are willing to collect additional information is another matter. Clarkson (1974) addressed the question of farmer indifference and suggested that in some cases farmers will only change management to improve productivity in order to maintain a reasonable standard of living. Improvements in equipment and design of sheep handling facilities in general, mean that weighing has now become a simple task requiring relatively little time (Section 6.1). Similarly, improved access and motorbike transport means that farm inspection is neither an onerous task or time-consuming. Collection of additional information must therefore be seen by farmers as a means of improving productivity and net returns. This study has shown that weighing had an important positive effect on autumn liveweights of ewe lambs and that farmers who weighed, frequently had the highest average levels of performance.

The second feature of suggested improvements to management is that relatively small and inexpensive changes are required. Later lambing for example does not have any associated capital costs and the purchase of scales is a relatively small item when compared with expenditure on drench, fertiliser or fencing. Management changes are mainly directed towards improving the efficiency of pasture utilisation, rather than increasing annual production. Thus neighbouring survey properties with similar physical characteristics had average lambing percentages which differed by up to 40%. Other than genetic differences, most of this variation must be attributable to feeding levels. The realisation of potential animal production, discussed in Section 1.1, in many respects only requires the education of low producing farmers on implementing and controlling grazing management. One of the ways in which farmers can effectively learn is to monitor and evaluate their decisions.

APPENDIX A

SUPPLEMENTARY BIBLIOGRAPHY

The bibliography in this appendix includes all the references reviewed in relation to survey research methodology, sheep drenching and beef cattle management. Other texts consulted but included in the main bibliography are listed in alphabetical order at the end of each section.

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APPENDIX B

SURVEY AREA RAINFALL RECORDS

Long term rainfall records for Wairere (Ihuraua) Hoereka (north Bideford) Rosebank (south Bideford) and Bagshot (lower Wangaehu) are presented in this appendix.

"WAIRERE" RAINFALL (mm)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1952								160	83	51	95	140	
1953	204	90	72	107	177	239	72	53	118	124	80	49	1385
1954	15	14	89	203	50	85	142	110	71	33	78	90	980
1955	21	58	58	136	79	109	296	157	104	88	64	40	1210
1956	92	52	69	84	99	166	251	73	58	152	72	128	1296
1957	23	20	99	49	142	143	138	46	147	89	116	69	1081
1958	20	57	49	69	192	58	65	79	25	118	27	186	945
1959	95	128	71	76	317	36	97	51	81	168	18	25	1163
1960	46	71	51	54	99	102	107	60	108	50	82	129	959
1961	117	41	61	73	196	134	181	207	267	16	70	21	1384
1962	124	55	62	185	75	122	118	86	85	94	68	85	1159
1963	57	45	31	63	32	140	175	95	78	13	112	50	891
1964	65	39	47	36	57	171	137	94	110	116	64	97	1033
1965	70	53	217	97	90	111	156	239	75	49	77	93	1327
1966	79	38	40	151	179	99	215	143	76	67	80	336	1503
1967	36	109	96	61	74	35	51	212	64	43	151	170	1102
1968	23	25	11	205	107	221	241	77	55	135	40	102	1242
1969	77	47	20	83	96	73	85	69	37	67	36	52	742
1970	26	44	115	23	137	110	85	102	176	82	20	24	944
1971	17	69	27	37	158	49	96	129	87	147	63	83	962
1972	41	44	84	73	109	75	85	72	49	52	24	17	725
1973	31	7	79	54	190	89	68	97	63	24	40	50	792
1974	44	70	61	223	54	130	187	119	172	141	9	61	1271
1975	67	51	42	38	115	165	102	144	49	63	86	41	963
1976	138	99	47	35	52	135	120	118	136	97	65	116	1158
1977	52	63	62	129	140	140	116	133	210	24	26	30	1125
1978	7	33	28	113	83	117	184	49	41	29	63	54	801
1979	30	41	129	48	107	64	57	126	119	152	66	164	1103
1980	102	37	143	130	33	126	118	105	60	64	95	154	1167
1981	8	21	15	36	157	153	106	136	62	76	49	52	871
1982	22	35	51	35	83	150	86	54	81	89	68	99	853
1983	31	21	56	80									
1953-'82 Average	60	54	70	93	120	122	136	112	99	85	66	92	1109

"HOROEKA" RAINFALL RECORDS (mm)

Year		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
1964		-	-	22	21	57	191	81	79	88	83	33	84	-
	Wet days	-	-	3	5	11	11	13	10	13	11	9	7	
1965		49	53	181	70	77	108	99	237	41	41	49	72	1077
	Wet days	9	9	13	9	8	12	10	18	5	7	7	6	113
1966		40	15	21	112	193	88	194	156	77	33	80	219	1228
	Wet days	3	3	2	5	17	12	9	10	14	5	11	10	101
1967		29	109	86	53	58	27	36	176	50	37	112	80	853
	Wet days	5	3	11	8	12	8	8	14	11	5	11	9	105
1968		34	15	12	211	128	224	241	80	48	94	21	100	1208
	Wet days	6	1	4	13	11	15	20	13	10	11	6	14	124
1969		56	75	14	99	97	74	90	86	40	63	68	71	833
	Wet days	8	9	3	9	13	12	11	10	9	13	8	13	118
1970		28	48	146	21	197	102	103	129	148	99	31	24	1076
	Wet days	5	8	13	7	20	16	16	15	12	12	5	8	137
1971		189	68	28	65	173	83	160	192	110	221	105	79	1473
	Wet days	13	12	2	9	15	10	23	17	17	18	12	6	154
1972		40	44	109	83	138	105	95	92	60	62	30	65	923
	Wet days	8	6	6	6	8	13	15	11	10	7	7	12	111
1973		32	19	99	51	212	113	111	142	84	46	79	82	1076
	Wet days	6	4	12	10	14	11	15	17	15	6	8	8	126
1974		45	98	115	311	127	200	253	159	254	169	18	44	1793
	Wet days	8	7	9	16	10	14	19	22	21	17	7	10	160
1975		70	68	115	22	76	197	89	131	61	71	108	39	1047
	Wet days	15	6	8	8	15	13	13	15	9	11	14	8	125
1976		180	107	37	56	64	143	149	142	201	111	76	132	1398
	Wet days	14	11	6	12	8	11	16	18	23	21	18	17	175
1977		68	50	6	188	146	176	165	217	251	39	35	58	1399
	Wet days	8	4	3	10	18	18	16	21	22	11	10	11	152
1978		66	45	23	171	112	178	238	60	64	48	52	66	1063
	Wet days	2	11	17	9	21	10	21	8	16	8	6	8	147
1979		13	53	255	45	112	81	70	168	156	138	104	149	1344
	Wet days	2	7	14	6	11	11	8	9	9	10	6	10	103
1980		73	65	178	208	33	122	150	123	33	62	81	207	1335
	Wet days	9	7	17	11	8	15	14	13	7	8	14	13	136
1981		10	33	31	40	244	255	159	261	68	143	76	51	1371
	Wet days	4	5	13	5	13	23	17	22	14	13	9	11	149
1982		16	68	89	111	102	202	98	40	69	89	49	66	999
	Wet days	5	7	9	20	13	14	15	7	14	14	9	13	140
1965-82 Average rainfall		54	57	86	106	127	138	139	144	101	87	65	89	1193
Average Wet Days		7	7	9	10	13	14	15	14	13	11	9	10	132

RAINFALL, BAGSHOT STATION (1970-1983) (MM)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1970	24	40	142	20	140	114	80	101	150	74	44	19	948
1971	162	47	20	45	132	66	123	140	96	166	80	82	1159
1972	28	66	84	49	134	102	55	76	55	65	32	37	783
1973	25	5	80	57	180	68	95	105	75	46	77	106	919
1974	24	64	82	229	111	130	196	155	207	160	18	67	1443
1975	154	64	63	36	129	172	103	107	61	53	113	70	1125
1976	117	105	42	41	49	140	186	136	176	99	53	119	1263
1977	72	57	71	140	141	193	170	195	279	43	34	50	1445
1978	5	30	30	150	109	165	234	61	55	38	53	62	992
1979	22	57	218	36	90	88	68	142	162	194	52	157	1286
1980	86	39	174	162	21	116	129	133	43	69	112	154	1238
1981	27	29	51	40	177	265	121	162	68	122	66	62	1190
1982	36	69	84	66	78	141	100	38	51	63	44	53	823
1983	13	26	45										
1921-1980													
Average	70	69	75	85	116	118	124	120	91	85	71	83	1107
High	184	269	271	297	298	296	280	250	291	194	206	306	1445
Low	5	4	6	20	21	31	30	46	21	12	5	13	757

RAINFALL, ROSEBANK STATION (1970-1983) (MM)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1970	33	42	129	31	142	110	86	117	148	83	14	10	945
1971	155	60	23	35	136	64	118	149	63	195	64	80	1142
1972	38	51	87	69	118	89	73	71	58	56	42	36	788
1973	18	2	78	39	153	78	79	106	61	42	74	60	790
1974	22	71	80	224	122	160	184	144	188	140	13	44	1392
1975	100	56	46	34	115	148	85	98	52	57	85	71	947
1976	130	88	34	42	47	141	174	111	161	91	47	121	1187
1977	67	44	54	150	138	157	165	161	224	30	30	60	1280
1978	8	19	21	148	93	156	188	52	49	39	43	75	891
1979	15	52	200	35	87	84	53	141	124	142	83	124	1140
1980	71	35	168	188	41	113	148	116	36	64	90	153	1223
1981	11	23	25	33	175	203	117	162	53	108	69	62	1041
1982	16	48	84	55	74	145	89	31	47	62	49	44	744
1983	11	23	41										
1962-1980													
Average	55	46	75	93	98	114	128	110	87	73	58	89	1026
High	155	103	246	224	171	181	211	201	224	195	110	244	1392
Low	8	2	13	24	30	33	31	52	32	4	13	10	764

Source: N.Z. Meteorological Service

APPENDIX C

The following table has been put together with information from the D.S.I.R. General Survey of the Soils of the North Island, New Zealand, Soil Bureau Bulletin 5. (1954) and the Ministry of Works Land Resource Inventory Sheet N158 and the associated extended legend (1978).

Soil Number	Name	Parent Material	Class	Site	Natural Fertility	Erosion
2	Ahikouka silt loam	Undifferentiated flood plain alluvium	Recent soils from alluvium	Slow draining flood plain built by periodic desposition of silty sediments	M - H	Slight streambank
25H	Waipatiki silt loam	Slightly calc. siltstone Banded mudstone and siltstone.	Intergrade YGE - YBE	Restricted drainage, rushes	H	Shallow slipping, slump. Heals readily.
28cH	Whakaroro hill soils	Mudstone and argillite	Central YBE		M - H	Shallow slip and earth flow
29e	Bideford loam	Alluvium	Central YBE	Imperfect by drained terraces consisting of wind blown and alluvial silts over gravels.	M	Nil
29H	Atua silt loam, hill soil	Mudstone	Intergrade YGE - YBE		M	Slight to moderate earth flow and soil slip.
29bH	Atua/Pirinoa hill soil		YGE - YBE			

Soil Number	Name	Parent Material	Class	Site	Natural Fertility	Erosion
29fH	Kumeroa sandy loam	Sandstone and silty fine sand-stone	Intergrade YBE - YGE		M - L	Slip, sheet.
31d, 31dH	Purimu silt loam	Close jointed mudstone and siltstone	YBE		M	Slips, sheet wind erosion, minor gullying.
31fH	Whetukura sandy loam, hill soil	Massive sand-stone and siltstone.	Intergrades YGE - YBE		M - L	Slight to moder-ate soil slip, which heal slowly.
32cH	Ngaumu fine sandy loam, hill soil.	Massive sand-stone. Banded sandstone.	Central YBE		L	Nil
32d	Te Wharau sandy loam	Alluvium from sandstone.			L - M	
35bH	Kaikouta, hill soil	Loess over gra-vels and sandstone	Central YBE		M - L	Slight soil slip, sheet and tunnel gully.
114	Whangaehu loam	Argillaceous sandstone and mudstones			M	Slips which heal slowly.
114a	Taihape silt loam	Mudstone	Steepland soils related to cen-tral YBE and YGE		H - M	Moderate to severe soil slip and gully. Slight to moderate sheet.

Soil Number	Name	Parent Material	Class	Site	Natural Fertility	Erosion
114b	Turakina silt loam	Calcareous mudstone	Steep and soils related to central YBE	Soft unstable, broken surface. Moderately well drained.	H	Shallow slump flow Slip and gully. Heals readily.
116b	Mangamahu silt loam	Mudstone and sandstone	Steepland soils related to central YBE		M - L	Moderate to severe soil slip. Slight gully.
119	Whareama silt loam	Argillite	Steepland soil related to central YBE	Often occurs as the result of fault line shattering	M	Gullying and slumps. Few slips.
124b	Pahaoa silt loam	Greywacke	Steepland soil related to central YBE	Low producing pasture. Manuka.	M - H	Slight to moderate sheet and scree. Slight soil slip.

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