SOME FARM MANAGEMENT IMPLICATIONS OF EXPORT HOGGET PRODUCTION ON LOWER NORTH ISLAND HILL COUNTRY SHEEP FARMS

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

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ABSTRACT

The purpose of this project was to investigate some of the farm management implications of export hogget production on lower North Island Hill country farms from the perspective of a Farm Advisory Officer (Economics) operating within the Advisory Services Division (ASD) of the New Zealand Ministry of Agriculture and Fisheries (MAF). To establish the context in which the study is set, a brief review of the responsibilities of the Economics Section of ASD is presented as a precursor to developing the institutional and industry requirements of farm management research performed by staff of the Economics Section of ASD.

Brief reviews of existing sheep meat production systems, management systems for producing lean meat, and the market requirements for export hogget, indicate limited potential for further expansion of hogget production for export under conditions of relative profitability. Simple feed budgeting/gross margins analysis procedures are used to synthesise and evaluate export hogget production strategies for a range of lower North Island hill country farm types. Schedule prices, for export hogget meat, sufficient to break-even with pre export hogget production strategies are established, and the sensitivity of these break-even schedule prices to a range of management, output, and product price variables is investigated.

A highlight of the research approach is an interactive component of the research process, developed from Kelly's (1965) Personal Construct Theory and Woog's (1982) Personal Interaction Model of Extension, in which previously developed models are used as a basis for interactive discussions with farmers.

ABSTRACT (contd)

Export hogget production is shown to be feasible, although not necessarily fully compatible with, or desirable under, all existing hill country sheep production systems investigated. Export hogget production appears to have greatest potential appeal to moderately intensive farming systems practised under conditions where summer pasture production is poor, relative to winter grass growth.

The over-riding conclusion is that, whilst hogget production may have merit as a means of producing larger, leaner, carcases for export, and whilst current production systems appear capable of producing limited amounts of export hogget, current schedule payments preclude any rational decision to produce hogget for export.

CHAPTER ONE

INTRODUCTION TO STUDY

1.1 OBJECTIVES OF THESIS

This study, which is set in the context of a Farm Advisory Officer (Economics) undertaking research to develop and evaluate a new farm management system, has bipartite objectives.

The first objective is concerned with investigating the farm management implications of export hogget production on lower North Island hill country sheep farms. The second objective is concerned with developing an interactive approach to farm management research, suitable to meet the institutional requirements of research carried out by staff of the Economics Section, Advisory Services Division, of the Ministry of Agriculture and Fisheries.

In this context, the specific farm management system under investigation, export hogget production, is used as an example to develop the second objective.

1.1.1 Export Hogget Production

Export hogget production refers to the production of hoggets for slaughter and sale on an export hogget schedule.

For meat production purposes, a hogget is defined as a sheep with no more than two permanent incisor teeth in wear (Davison, 1982). As lambs can be sold on an export lamb schedule from the period 1 October to 30 September, export hogget refers to yearling sheep killed after 1 October. The important farm management implication is that export hogget production involves over-wintering lambs to the hogget stage.

Traditionally, most hoggets on non-arable farms are retained as breeding ewe replacements. Most hill country sheep properties retain more ewe hoggets than are required for normal flock replacements. Ewe hoggets surplus to breeding requirements may be sold for local meat consumption, but are more usually carried through and sold as two-tooths to be used for breeding purposes in lowland flocks. Lesser numbers of wether lambs are also carried on North Island hill country sheep farms, usually for on-farm consumption.

Historically, very little hogget has been killed for export. Up to the 1982/83 killing season the export hogget kill has averaged around 3.5% of the total hogget kill, or around 0.06% of the total export sheep kill (lamb, mutton, hogget). (New Zealand Meat Producers Board, 1982; New Zealand Meat Producers Board Annual Reports.) The main impediment to the development of overseas markets for export hogget has been an inconsistent supply of suitable hoggets from New Zealand farms, due to uncertain and variable returns for export hogget to the New Zealand producer (New Zealand Meat Producers Board, 1982).

After an investigation into potential market opportunities for export hogget (Bryant, 1982) and export hogget production (Davison, 1982), the Meat Producers Board requested meat exporters to offer separate schedule payments for hogget for the meat exporting season beginning 1 October 1982.

At the time this study was initiated, it was known that the New Zealand Meat Producers Board was interested in expanding its operation in export hogget. However, it was not expected that schedule payments would begin until 1 October 1983 (L.I.Bryant pers.comm.), consequently a study of the farm management implications of export hogget production was considered important (New Zealand Meat Producers Board, 1982). Accordingly, this study was undertaken under the understanding that off-farm marketing opportunities for export hogget did exist.

1.1.2 Economics Section of the Advisory Services Division of the Ministry of Agriculture and Fisheries

The Economics Section comprises a small group of specialist advisers within the Advisory Services Division of the Ministry of Agriculture and Fisheries. The specialist officers are designated Advisory Officers (Economics). The designation is a misnomer as the main area of responsibility lies in the field of farm management. The Economics Section, which has staff based only in major offices, has four main areas of responsibility (Ritchie, 1983). Briefly these are (full discussion is presented in Chapter Two):

(a) Evaluation and development of improved (new) farm and horticultural production systems:

In this role, staff of the Economics Section have the responsibility for initiating and co-ordinating more detailed farm management research than that undertaken by general advisory officers.

(b) Staff Training and development:

This area of responsibility involves passing on to advisory officers new information on both the technology and methods of analysis, resulting from farm management research.

(c) Regional and industry development:

This role involves advice at both producer and industry levels as to how to achieve targets and realise market potential in identified growth areas.

(d) Policy guidance:

The Economics Section fulfils this role through monitoring on-farm and industry implications of policy decisions and reporting these to Central Government.

1.1.3 Interactive Approach to Farm Management Research

Miller (1982) used the term 'interaction', in a farm management research context, to refer to a research approach involving an interaction of modelling and physical field research in both development and testing of hypotheses.

This thesis also involves an interaction between modelling and 'field research'. However, in this study, the field research undertaken is not of a physical nature. Rather, the field work involves testing 'farmer reaction' to export hogget production systems using an approach based on Kelly's (1956) Personal Construct Theory and Woog's (1982) 'Personal Interaction Model of Extension'. It is from these models that the term 'interactive discussion' was developed by the author.

The principle of integrating complementary simulation modelling and field research used in this study is similar to that suggested by Hutton (1973), McRae (1975) and Miller (1982). The difference lies in the method by which systems modelling and field research is integrated. In this study, the interactive approach is used to involve farmers (and farm advisory officers) in interactive discussions as part of the farm management research process. This approach is likely to be well suited to meeting the special requirements of farm management research carried out by staff of the Economics Section in situations where it is difficult or impossible to integrate physical field research into the research process.

1.2 OUTLINE OF THESIS

Chapter Two expands on the role and function of the Economics Section of Advisory Services Division in farm management research. The chapter also outlines the research approach followed in this study.

Chapter Three expands on the market potential for export hogget and briefly discusses the potential supply of hoggets for export from the New Zealand flock. A brief introduction to the debate on export lamb carcase composition is presented, along with known management strategies for producing leaner, larger lamb. The chapter concludes by indicating a potential opportunity for export hogget as a means of producing larger, leaner, export meat carcases.

Chapter Four introduces export hogget production in a systems context, and discusses the system components and inter-relations of concern in the study.

Chapter Five describes the study method by which models of export hogget production systems are synthesized for a range of farm types, and briefly discusses the implications of export hogget production systems for pasture management.

Chapter Six discusses the financial and physical output implications of export hogget production under a range of production strategies. Sensitivity analyses are presented for a range of model assumptions, system assumptions and parameters used in the study.

Chapter Seven presents a theoretical basis for interactive discussion with farmers and discusses the approach used in this study, and the findings emanating from the discussions on export hogget production.

Chapter Eight presents and discusses the results and conclusions of export hogget production systems.

Chapter Nine evaluates the study from three perspectives; the suitability of the research approach to the research topic, the approach and methods used in the research process, and the extent to which the project achieved the study objectives.

CHAPTER TWO

STUDY CONTEXT AND APPROACH

2.1 INTRODUCTION

This chapter develops the context in which the study meets institutional (Advisory Services Division of the Ministry of Agriculture and Fisheries) and industry (on-farm, and to a lesser extent, off-farm) requirements arising from the identification of a new production opportunity (export hogget production).

The chapter also discusses the approach used in the study and relates the approach taken to the different, though related, institutional and industry requirements of a research project investigating a new production system.

2.2 THE ECONOMICS SECTION OF THE ADVISORY SERVICES DIVISION OF THE MINISTRY OF AGRICULTURE AND FISHERIES

The Economics Section of the Advisory Services Division comprises a small group of specialist Advisory Officers operating within the Advisory Services Division of the Ministry of Agriculture and Fisheries (MAF). In order to appreciate the role of the Economics Section in farm management research, it is helpful to consider briefly firstly the broad objectives of the MAF as a whole, and secondly the more specific objectives and functions of Advisory Services Division (ASD) as they relate to the overall MAF objectives.

(a) Ministry of Agriculture and Fisheries (MAF)

The Ministry of Agriculture and Fisheries has the objectives of 'helping farming, horticultural and fishing industries to identify and realise their potentials, to maintain and where possible improve New Zealand's animal, fish and plant health status, and to provide our customers with quality assurances that facilitate effective marketing of our products' (MAF Directorate, 1983 a).

To achieve these objectives, the MAF has four main "results areas" (MAF Directorate, 1983 a):

"(i) Increased productivity for farming, horticulture and fishing; by providing research, advisory and fisheries management services which assist in solving problems, improving productivity, and realising new opportunities in farming, horticulture and fishing.

(ii) Protection and enhancement of animal, fish and plant health by preventing the introduction of exotic animal fish and plant diseases and pests, so protecting New Zealand's status as an approved source of species or produce, and by improving animal, fish and plant health status within New Zealand.

(iii) Quality Assurance systems for primary product exports; by assuring overseas Government agencies, overseas customers, (and New Zealand consumers where required) of the consistent purity and safety of New Zealand food products, basing such quality assurance on monitoring quality control systems in industry.

(iv) Policy advice by advising Government and industry of policies which will promote growth and development of farming, horticulture and fishing and facilitate efficient processing and marketing, and which will maintain reasonable resources and enhance the New Zealand environment.":

(b) Advisory Services Division (ASD)

Advisory Services Division, which is one of ten divisions within the MAF, has four specific areas of responsibilty in:

(i) Advisory activities

(ii) Quality assurance of plants

(iii) Pest and disease control of plants and bees, and

(iv) Farm Training Institutes.

In 1982, the general objective of ASD was stated to be: "to promote the adoption by farmers and horticulturalists of agricultural and management practices which will result in increased efficiencies, quantities and quality of production for export (Hercus, 1982).

To fulfil these ASD responsibilities and achieve the ASD objective, ASD employs both advisory (Farm Advisory Officers, and Horticultural Advisory Officers) and technical staff. In general, advisory staff are involved mainly in (i) and (iv), whilst technical staff have the greatest involvement in (ii) and (iii). Staff numbers vary, but in mid 1982, ASD employed 148 Farm Advisory Officers (FAOs) and 53 Horticultural Advisory Officers (HAOs) as well as additional technical and administration staff (Ministry of Agriculture and Fisheries, 1982 a).

Within the general occupational group designated as Advisory Officers (FAO or HAO) further differentiation of responsibilities occurs. The main grouping comprises "general" Advisory Officers (FAO or HAO) who deal directly with farmers in an extension role. In this role "general" Advisory Officers are expected to provide a sound technical and management service to the primary producing industry to obtain rewards and improved production consistent with good land use. In addition to these extension functions, advisers also have an intelligence role in which they are expected to define district problems or opportunities requiring research, and to report to their Controlling Officer (Scott, 1980).

In contrast to "general" Advisory Officers, "specialist" officers of the Economics Section of ASD do not deal directly with farmers in an extension role. Rather, the 15 "specialist" officers of the Economics Section serve the MAF and ASD objectives through servicing the needs of general advisory officers and the ASD Directorate. The "specialist" officers of the Economics Section are designated FAO (Economics) or HAO (Economics). Ritchie (1983) defined four main areas of responsibility in which FAO (Economics) and HAO (Economics) are expected to operate. These are:

(i) Evaluation and development of improved (new) production and mangement systems

In this role, staff of the Economics Section have a specific responsibility for initiating and co-ordinating more detailed farm management research than that undertaken by general Advisory Officers.

(ii) Staff training and development

This area of responsibility involves passing on to Advisory Officers new information on both the technology and methods of analysis resulting from farm management research.

(iii) Regional and industry development

This role involves advice at both producer and industry levels as to how to achieve targets and realise market potential in identified growth areas.

(iv) Policy guidance

Staff of the Economics Section fulfil this role through monitoring on-farm and industry implications of policy decisions, and reporting these to Central Government.

This section has developed the context in which staff of the Economics Section are part of an ASD team whose main area of responsibility is in providing a sound technical and management advisory service to farmers. ASD is only one of ten divisions involved in achieving broader MAF objectives. The next section concentrates in greater detail on the responsibilities of the Economics Section in farm management research as applicable in this study.

2.2.1 Role of Economics Section in Farm Management Research

Many writers have presented definitions of farm management and farm management research. (Candler, 1962; Candler and Sargent, 1965; Davies, 1968; Nix, 1979; Dillon, 1980; Long, 1981). Though differing in terminology, the common thread running through the

definitions is that farm management is concerned with farmer manipulation of farming systems in an uncertain environment in order to achieve an objective or objectives. And, that in the broadest sense farm management research is concerned with understanding this process, usually with a view to improving specific aspects of the process.

The farm management process consists largely of the co-ordination of information from a range of sources and accordingly farm management research covers a wide subject area from purely technical to purely management research and from purely methodological to purely behavioural research. However, because of ASD's responsibility within the MAF, farm management research undertaken by staff of the Economics Section is necessarily more restricted in its perspective. Accordingly the prime objective of farm management research by staff of the Economic Section should be to facilitate the ASD responsibility of assisting farmers with the development of their capability to manage their farming systems.

Staff of the Economics Section are part of a larger "team" whose main area of responsibility is in providing an advisory service to farmers. In order to provide updated technical and management advice on new or improved management and production systems it is necessary for some member(s) of the team to be in a position to evaluate the findings of research, as well as develop and evaluate new systems. It is in this role that staff of the Economics Section have a major responsibility to the advisory function of ASD as a whole.

Economics Section staff are expected, in conjunction with other officers (both within and outside ASD), to "identify those farming systems which show greatest promise and develop them with key individual farmers. This process will consequently lead to the development of new or improved farming systems" (Ritchie, 1983). In addition to this on-farm development role the author believes that Economics Section staff also have a responsibility actively to undertake applied research into new production and management systems where potential opportunities have been identified, but where such systems do not currently exist.

Because of their role within an extension service, Economics Section staff have a responsibility to service the information requirements of Advisory Officers. This requires Economics Section staff to pass on research findings on new production and management systems, in addition to familiarising FAOs with the methods of analysis used in the research and how the findings were derived. In this respect, ASD Economics Section staff have a staff training role. A further requirement of members of the Economics Section is to supply regional planning or industry advice on situations where adoption of new farming systems has implications outside the farm gate.

It is in the context of a FAO (Economics) undertaking a specific research project as a member of ASD that this thesis is set. In this study a new farm production opportunity, export hogget, has been identified. The task is to evaluate the farm management implications of potential export hogget production systems. The research approach must be commensurate with the responsibilities of a FAO (Economics) in meeting the anticipated information requirements of farmers and the associated agricultural industry. If the practice is feasible and desirable, FAOs will require information to develop extension programmes to promote the practice. Conversely, if the system is not feasible or desirable, FAOs may still require information as to why the practice can not be recommended.

Similarly, industry representatives may require information suggesting how the proposal could be made attractive to farmers or, if it is attractive, what the expected response might be under given circumstances. Although it is outside the scope of this thesis, in practice if a new production system is desirable, FAO (Economics) could expect to be involved in both the development of an extension programme within ASD, to encourage adoption of the practice, as well as advising industry of the implications of the practice.

Because the primary goal of research activities performed by staff of the Economics Section is to carry out analyses which will facilitate the performance of ASD, research undertaken by FAO (Economics) has several requirements. In the author's opinion these are:

(a) That the research is able to be completed relatively quickly when responding to a newly identified problem or opportunity.

(b) That the research needs to be easily undertaken, but adequately comprehensive to meet technical, management and industry requirements. In the author's view, it is more important to undertake a less rigorous research programme to provide general ("ball-park" type) information quickly, rather than taking a longer time to produce more detailed information.

(c) That the research needs to identify areas of management control and sensitivity in the production sytem, and indicate the impact of management practices on the system's performance.

(d) That the research approach needs to be credible in the eyes of both FAOs and farmers. To this end interaction with farmers and/or advisers is valuable in providing a practical input to the research process.

(e) That the research is able to highlight any current knowledge deficiencies important to either researchers or extension workers. That is, to be able to identify those areas where further research is required, and/or identify areas where current farmer knowledge or beliefs are inadequate or incorrect.

(f) That the research is useful in assisting with the development of extension programmes to encourage adoption of worthwhile practices, or if necessary, discourage undesirable practices.

(g) That the research results in findings which can be usefully extrapolated to meet industry requirements. The industry requirements are discussed further in Section 2.3.

2.3 INDUSTRY REQUIREMENTS

The industry requirements which the author believes need to be considered by staff of the Economics Section when planning a research project are discussed in this section. The requirements are considered from two aspects:

(a) On-farm requirements; and

(b) Off-farm requirements.

2.3.1 On-Farm Requirements

When a new or changed management practice or production system becomes available to the farming sector, farmers seek information about the practice or system before making "adopt" or "non-adopt" decisions.

In the author's experience, farmers evaluating a new production system seek information in five main areas of concern:

(a) Is the system feasible (under existing conditions), and what changes will be required (to current practices)?

(b) Is the system profitable?

(c) Is the system compatible (with existing systems)?

(d) What are the risks (uncertainties) associated with the system?

(e) Management confidence to execute and control the system in order to achieve objective(s).

Farm management research, undertaken by members of the Economics Section must be capable of meeting these information needs and altering farmer beliefs (confidence) in their ability to implement successfully a management system to execute and control the production system.

The specific information required will vary according to the new production system under consideration. Accordingly, research undertaken by staff of the Economics Section must be capable of providing information over a range of detail, and also indicate how such information can be integrated into practical on-farm production systems. In this context, farm management research undertaken by Economics Section staff is as much development as it is research.

2.3.2 Off-Farm Requirements

The off-farm industry and/or regional requirements of new production systems can be broadly classified into implications for resource demand and/or product supply.

(a) Resource Demand

All but the most simple changes in on-farm production strategies will alter the resource requirements of a production system. A changed production system may, at a very basic level, require increased farm inputs such as fencing materials, fertiliser or, as in this study, drench. At a more dramatic level, irrigation planners will want to know the likelihood of water-demanding developments occurring and what these demands

may be. Similarly a new production system if widely adopted may, for example, alter seasonal labour demands with implications for regional planners considering the provision of facilities for a transient labour force.

(b) Product Supply

New or changed production systems may alter the level and/or product mix from a farm. Servicing and marketing sectors may want information on the likely impact for them of such changes to farm productivity. Similarly, processing and marketing sectors may require information as to how much to pay farmers or growers in order to achieve targets and realise market potential.

Although this thesis is largely unconcerned with off-farm considerations, such considerations are nevertheless an important responsibility of the Economics Section (Ritchie, 1983).

2.4 STUDY APPROACH

Traditionally, the three major broad perspective approaches to generating information for farm management research have been surveys and case studies, production experiments, and synthesis (modelling) (Davies, 1968). In recent years an interactive approach involving an interaction of modelling and physical field research has been suggested (Hutton, 1973) and used in farm management research (Miller, 1982).

For this particular study, surveys and case studies were not possible as the production system under consideration (export hogget production) did not exist. The production experiment approach was conceptually feasible but in practical terms was not considered to be a valid approach owing to the unavailability of farm research units on which to experiment and/or monitor export hogget production.

This left synthesis as the most feasible research approach to use in this study. And, because of the institutional and industry requirements of research performed by a FAO (Economics) an interactive approach was considered desirable; hence the evolution of a three-phase research approach (presented in Figure 2.1) used in this study.

FIGURE 2.1 Diagrammatic Representation of Research Approach Used in Study

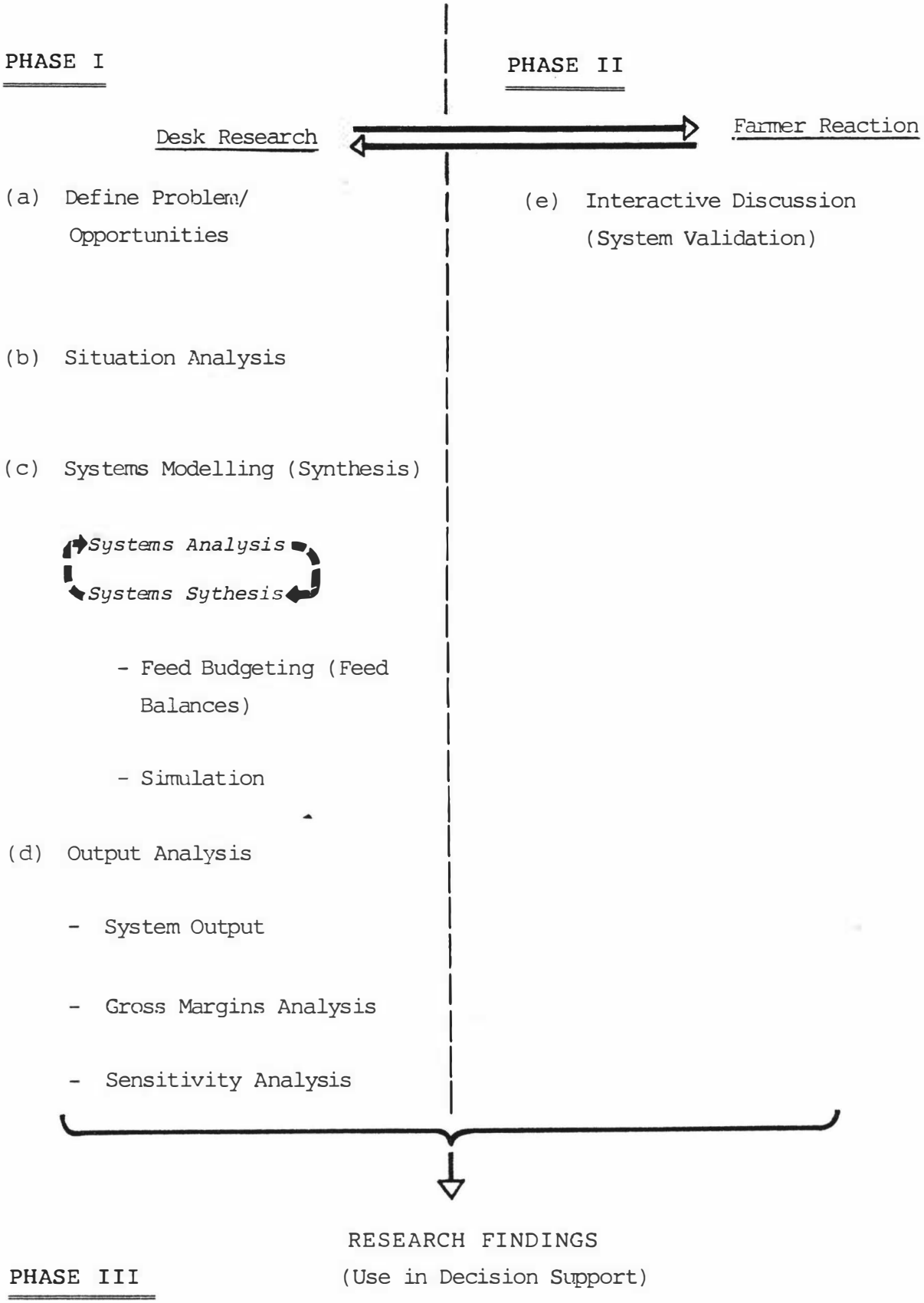


Figure 2.1 illustrates the essential nature of the research approach used in this study. It involved separate but integrated phases of desk research and farmer reaction, both of which contribute to the final research findings. The components of this research approach are now briefly discussed.

2.4.1 Problem/Opportunity Definition

In order to facilitate future research a clear understanding of the farm management issues under consideration are required.

In this study, the management issues under consideration are the feasibility, profitability and management implications of export production on lower North Island sheep and beef farms. Export hogget is defined as a 14 to 26 kg sheep carcase (ewe or wether) of low fat content slaughtered during the period 1 October to late December.

2.4.2 Situation Analysis

This part of a research project involves a more detailed investigation of the current situation with which the study is concerned. It is a period during which the feasibility of the proposed research project is established, and research ideas developed.

Reviews of literature showed that there was interest in the proposition of export hogget production (New Zealand Meat Producer, 1982; Bryant, 1982; Davison, 1982). The ability of hoggets to produce relatively large lean carcases at 15 to 18 months of age was also established (Kirton et al, 1974; Rattray et al, 1976; Kirton et al, 1982).

Discussion with the New Zealand Meat Producers Board (L.I.Bryant pers. comm.), New Zealand Meat and Wool Board's Economic Service (R.M.Davison pers. comm.) and the MAF (W.A. Royal, J.F.Scott and D.E.Wright pers. comm.), in early 1983, confirmed that a study of the farm management implications of export hogget production appeared to be warranted.

After discussion with MAF Farm Advisory Officers an initial survey of 22 farms in the lower North Island was undertaken as part of the situation analysis phase of the research programme. The intentions of this initial survey were to familiarise the author with lower North Island farming systems and to evaluate the potential supply of export hogget from these farming systems. Survey farms were selected by local Farm Advisory Officers on the basis of being representative of farms in the local area and having ewe hogget growth rate data from weaning to two-tooth mating. The survey briefly examined stock policies, management practices and stock performance with particular emphasis on lamb/hogget/two-tooth growth profiles. Farmers were also asked for their general reaction to an export schedule for hogget. (The full questionnaire is presented in Appendix One).

Survey farmers covered an area from Taihape to south of Masterton and involved farming systems ranging from intensive mixed cropping farms to extensive hill country farms. According to Candler (1965) the purpose of such a survey in the situation analysis phase is to "give a clear picture of what farmers are currently doing and then attempt to synthesise a picture of the appropriate production system and profitability of farming with the new product or practice". The survey confirmed the production potential for export hogget under conditions of relative profitability, existing management practices and known production technologies.

2.4.3 Systems Modelling

The primary objective of the desk research phase of the study was to synthesise desk models of export hogget production systems to be used as the basis for interactive discussions with farmers later in the study.

The first stage of systems modelling involves a study of the components and their relationships with the production system. The phase of component research has been referred to as Systems Analysis (Wright, 1971). The purpose of systems analysis is to provide an understanding of the production system, and to develop further knowledge about the system's components and relationships. The second phase of systems modelling involves the synthesis of a new/improved production system. This process is referred to as Systems Synthesis (Wright, 1971).

The modelling methods used in this study to develop export hogget production systems were a combination of a simulation programme, which could generate lamb and hogget feed requirements given the required annual liveweight growth profiles, and feed budgeting to evaluate the effect of export hogget production on pasture demand.

2.4.4 Output Analysis

In order to establish that a new or changed system is better at achieving a pre-specified goal or overcoming a problem than were existing systems, some form of output analysis is required. In farm management research output from a production system is usually measured in either financial or physical units.

In this study the financial implications of the desk models of export hogget production were evaluated by calculating gross margins. This involved preparing status quo gross margins for each status quo (pre export hogget) situation, and the appropriate post export hogget situation. From the difference it was possible to calculate a break-even schedule price for export hogget.

The effect of export hogget production on meat and wool output was estimated by comparing farm output for the pre and post export hogget situations.

The effects of changing various cost and return parameters, output parameters, and management factors on the break-even schedule for export hogget were also examined by gross margin analysis. This is referred to in this study as Sensitivity Analysis.

2.4.5 Farm Monitoring Scheme

The desk models of export hogget production systems are based on five synthetic representative farm models used by ASD in their farm monitoring scheme. Because of the importance of these ASD representative farm models in this study, a brief explanation of the scheme and the five status quo models used in the study is presented in this section.

Farm monitoring is undertaken by ASD as a formal means of observing and reporting significant happenings to Central Government as such happenings occur both on, and off, farms. The farm monitoring approach is based on separately collecting and reporting budgeted financial information for all of the major farm types in New Zealand.

Individual farm advisers each have a responsibility to monitor a number of farms, typical of the farm types in the region. At regular intervals each adviser submits to his regional farm monitoring controller anticipated physical and financial information for the next three months. Initially then, the financial information is based

on a series of cash forecasts, but at the end of each year actual data from farm accounts is collected and used as a basis for comparison with the budgeted information collected previously.

Each regional farm monitoring controller, who is generally a FAO (Economics), uses the information supplied by advisers to build a regional model for each significant farm type in the region. Every three months the regional model is updated physically and financially on the basis of information supplied by advisory officers. Regional monitoring controllers meet regularly and collate their information into national models in which information is weighted according to the national importance of each farm type.

In this manner information from individual farms and discussion groups is gradually built up into national models. The scheme, via the national models, forms a basis on which agricultural policy decisions can be based. Nationally, 13 different models of sheep and beef farms are prepared by ASD of MAF.

This study is based on five regional farm monitoring farming systems in the lower North Island. Brief descriptions of each model using November 1982 information follows, (for full details refer to Appendices Two to Six inclusive). These particular models were chosen to cover a range of farming systems in different regions, under varying climatic conditions and stages of development.

(a) Manawatu Small Hill (Model 1)

This model represents reasonably intensive hill country farms. The model farm is of 200 effective hectares wintering 1650 breeding ewes and replacement stock, and 80 dry cattle. Lambing performance is 103% and all stock are sold prime.

(b) Hawkes Bay/Wairarapa Good Hill (Model 2)

This model represents East Coast easy/good hill country in areas of better summer rainfall. The model farm is 340 effective hectares, wintering 2420 breeding ewes and replacement stock, and 168 dry cattle. Lambing percentage is 98% and all stock are sold prime.

(c) Manawatu/Taihape Hill Country (Model 3)

This model represents better West Coast hill country farms. The model farm is 300 effective hectares and winters 2420 breeding ewes and replacement stock, and 120 dry cattle. Lambing percentage is 95%. Approximately 70% of lambs are sold prime and 30% store. Cattle are sold fat.

(d) Hawkes Bay/Wairarapa Harder Hill (Model 4)

This model represents East Coast farming systems in areas where there is less summer rain. The model farm is 630 effective hectares and winters 3500 breeding ewes and replacements, and 175 cows and replacements. Lambing percentage is 90% and calving percentage is 78%. Half the lambs are sold prime and half are sold store. Cattle are sold mostly as weaners.

(e) Taihape/Wanganui Hard Hill (Model 5)

This model represents farming systems on harder West Coast hill country. The model farm is 390 hectares and winters 2360 breeding ewes and replacement stock, and 70 breeding cows and replacement stock. Lambing percentage is 84% and calving percentage is 84%. All stock are sold store.

2.4.6 Interactive Discussion

The second phase of the research approach involved an assessment of farmer reaction to export hogget production systems developed during phase one. The approach involved farmers in (controlled) interactive discussions during which the author attempted to match information gained during the desk research phase against current farmer knowledge, beliefs and attitudes associated with export hogget production. The theory behind the approach, and methods used in the discussions, are discussed in greater detail in Chapter Seven.

2.5 CHAPTER CONCLUSION

This chapter established the context in which the study is set, by developing the role and function of a FAO (Economics) within the Ministry of Agriculture and Fisheries.

The author's appreciation of the role of the Economics Section in farm management research was then developed. The argument was presented that the primary goal of farm management research performed by members of the Economics Section is to facilitate ASD performance, and that as a consequence of this goal, farm management research carried out by a FAO (Economics) has a number of requirements. These requirements were presented and discussed.

Possible approaches to farm management research were then briefly reviewed; and the research approach adopted in this thesis was introduced. A brief discussion of the study methodology was presented.

The chapter also briefly reviewed the potential for export hogget production on lower North Island hill country farming systems.

Chapter Three expands on the potential for export hogget production by firstly reviewing current sheep meat production, and then presenting an argument for a potential role of export hogget as a means of producing larger, leaner carcases for export.

CHAPTER THREE

A REVIEW OF SHEEP MEAT PRODUCTION SYSTEMS AND THE POTENTIAL OF EXPORT HOGGET FOR LEAN MEAT PRODUCTION

3.1 INTRODUCTION

This chapter presents a brief review of New Zealand sheep farming systems, with emphasis on hogget composition of flocks, and the potential ability of farming systems to supply hoggets for export. Product requirements and the potential market for export hogget are discussed. Later sections discuss New Zealand sheep meat production, lamb carcase composition and known management strategies for producing leaner lamb carcases. Finally, an argument is presented for a potential role of export hogget as a means of producing larger, leaner carcases for export.

3.2 SHEEP FARMING SYSTEMS IN NEW ZEALAND

The New Zealand Meat and Wool Board's Economic Service classifies New Zealand commercial sheep farming systems into eight farming sub-groups (Meat and Wool Board's Economic Service - Annual Sheep and Beef Farm Surveys). Estimates for the number of sheep farms and number of sheep for those farm types for the year ending 30 June 1981 (the latest year for which figures are available) are given in Table 3.1.

TABLE 3.1 Estimates of Number of Sheep Farms and Number of Sheep by Farm Type

Farm Type	Number of Farms	Number of Sheep (million)
South Island High Country	300	2.5
South Island Hill Country	900	5.1
North Island Hard Hill Country	1700	7.5
North Island Hill Country	5100	16.9
North Island Intensive Fattening	4400	9.3
South Island Fattening - Breeding	4100	13.1
South Island Intensive Fattening	3300	8.1
South Island Mixed Cropping and Fattening	1800	2.5
TOTAL 'COMMERCIAL'	22 000(1)	65.0(1)
Non Sheep Farms		4.9(2)
TOTAL FLOCK		69.88(3)

Source: New Zealand Meat and Wool Board's Economic Service 1980-81 Season Estimates

Note (1) Estimated from New Zealand Meat and Wool Board's Economic Service Annual Survey

(2) Farms which do not meet sampling unit criteria: viz
- (a) greater than 750 stock units
- (b) privately owned
- (c) 80% of income from sheep or cattle
- (d) not a stud or deer farm

(3) Total flock from Agricultural Statistics (MAF, 1983 c).

Table 3.1 shows the importance of North Island hill country sheep farms to the North Island sheep industry, particularly when consideration is given to lamb production from these farms (Table 3.2). Most of the later detail of this study relates directly to North Island Hard Hill, and North Island Hill Country farms.

TABLE 3.2 Farm Production by Farm Class(1) (1980/81 season)

	% of total Wool Production	% of total Meat Production(2)	% of total Lamb Production
S.I. High Country	2.7	1.8	0.89
S.I. Hill Country	6.7	6.0	4.8
N.I. Hard Hill Country	10.6	11.1	6.6
N.I. Hill Country	26.6	26.3	19.1
N.I. Intensive Fattening	14.7	17.2	18.1
S.I. Breeding/Fattening	21.0	19.0	21.7
S.I. Mixed Cropping and Fattening	4.0	4.6	7.5
Non Sheep Farmers(3)	13.7	14.0	21.3
NEW ZEALAND TOTAL	100%	100%	100%

Source: New Zealand Meat and Wool Board's Economic Service 1980/81 season estimates

Notes (1) Farm Production figures are net; adjusted for changes of stock, purchases and sales.

(2) Includes lamb, mutton and ram

(3) Farms which do not meet sampling criteria.

3.3 INTERDEPENDENCE OF FARM CLASSES

Although the farm classes presented in Tables 3.1 and 3.2 are shown as separate categories, there is in practice a significant degree of interdependence in the economies of these farm types.

Lowland farms often rely heavily on hill country farms to supply both store lambs for finishing and two-tooth ewes for flock replacements. Due to such interdependencies a financially attractive schedule for export hogget could be expected to have flow-on effects through the sheep farming sector. Consequently, it could be expected that a schedule for export hogget may reduce the supply of two-tooth ewes available from hill country farms as breeding replacements, with a subsequent increase in two-tooth ewe prices given their demand as replacements for lowland flocks. If this was to happen it would increase the opportunity cost of export hogget production on hill country farms, and, unless there was an increase in returns, reduce the profitability of lowland farms by increasing the cost of their flock replacements.

Although it is likely that such effects could occur, an investigation of the likely magnitude of these effects is beyond the scope of this study. Such an investigation is not, however, beyond the responsibilities of Economics Section staff.

3.4 HOGGET COMPOSITION OF FLOCKS

The New Zealand Meat and Wool Board's Economic Service Sheep and Beef Farm Survey shows that on the 'all classes average farm', hogget numbers vary between 22% and 24% of opening sheep numbers (Table 3.3). Of the total hoggets wintered, ewe hoggets make up between 85% and 87% and wether hoggets between 13% and 15%. Greater variation in the proportion of total hoggets wintered, to total sheep numbers, occurs on individual sheep farms as replacement rates and overall flock expansion (or contraction) rates vary according to specific farm conditions.

For example, during development or improvement phases when flock expansion occurs, hogget retention levels are higher when ewe hoggets are used to provide the basis for 'breeding up' stock numbers. But on farms where stock increases are small, or stock numbers are static, it is uncommon for all ewe hoggets wintered to enter the breeding flock as two-tooths.

The normal practice is for some proportion of ewe lambs reared to be used to maintain ewe flock numbers by introducing them to the flock as two-tooths (18-19 months of age). Generally less than 100% of ewe lambs weaned are required to replace mature ewes which have died, been culled or cast for age. The majority of farmers are therefore faced with options regarding the proportion of ewe lambs to winter as hoggets and the time of sale of those ewe hoggets surplus to replacement requirements. Current farm practice where replacements are bred from the ewe flock varies between wintering the minimum number of ewe hoggets, and selling the maximum number of maiden two-tooths in the January/February two-tooth fairs.

The annual ewe 'wastage rate' in a static ewe flock, and hence hogget replacement rate, is in the range of 30 to 34% of total ewes wintered. (Meat and Wool Board's Economic Service, All Classes Farm). However, Table 3.3 shows that the number of ewe hoggets wintered is in excess of two-tooth ewe numbers by between 13% to 15%, indicating that in a static flock these ewe hoggets are surplus to breeding requirements and are therefore available for sale. Table 3.3 also indicates that a small number (slightly in excess of 3.0%) of the total sheep wintered are wether hoggets. Even when allowance is made for the interdependence of farming systems and the number of South Island hill farms which run wethers for wool production, the combined total of ewe and wether hoggets wintered in New Zealand hill country sheep farms (Table 3.3) constitutes a potential supply of hoggets available for sale on an export schedule.

Flock composition does however vary between farm classes. This variation in composition may influence any potential supply of export hoggets from a farm class. Flock composition by farm type for 1980 (Table 3.4) indicates that hill country farms, of both islands, winter the highest proportion of hoggets (ewe and wether), and therefore currently constitutes the largest potential source of hoggets for an export market.

TABLE 3.3 All Clases Farm - Flock Structure - Winter Numbers

Season	Ewe Hoggets	Wether Hoggets	Total Hoggets	Two-Tooth Ewes	Mixed age Ewes	Total Sheep
1976/77	490	71	561	418	1373	2443
1977/78	533	85	618	461	1399	2569
1978/79	525	83	608	483	1407	2594
1979/80	577	95	672	499	1490	2754
1980/81	636	111	747	536	1539	2921

Source: New Zealand Meat and Wool Board's Economic Service-Supplements to Annual Sheep and Beef Farm Surveys. All Classes Sheep and Beef farm.

TABLE 3.4 Flock Composition Expressed in Percentage Terms by Farm Class as at 1 July 1980

Farm Class	Ewes	Ewe Hoggets	Wether Hoggets	Wethers	Rams
S.I. High Country	47.0	12.0	8.7	31.1	1.2
S.I. Hill Country	68.5	23.1	3.5	3.3	1.6
N.I. Hard Hill Country	67.5	25.4	4.4	1.2	1.5
N.I. Hill Country	69.5	24.3	3.8	0.9	1.5
N.I. Intensive Finishing	74.0	18.2	6.0	0.3	1.5
S.I. Finishing Breeding	72.6	22.7	2.7	0.6	1.4
S.I. Intensive Finishing	76.7	20.0	1.3	0.7	1.3
S.I. Mixed Finishing	76.5	17.7	4.4	0.2	1.2
'ALL CLASS AVERAGE'	71.0	21.8	3.8	2.0	1.4

Source: New Zealand Meat and Wool Board's Economic Service Supplement to Sheep and Beef Farm Survey 1980/81

3.5 POTENTIAL SUPPLY OF EXPORT HOGGET

The potential supply of hoggets for an export market is not entirely clear due to the interdependence of New Zealand sheep farming sytems. However, it is apparent that nationally there are essentially three farm types with the potential to supply significant numbers of 'surplus' breeding ewe hoggets to an export market. These are: South Island Hill Country (class 2) farms, North Island Hard Hill Country (class 3) farms and North Island Hill Country (class 4) farms. In addition, South Island Finishing-Breeding (class 6) farms may also have limited potential to supply surplus ewe hoggets. In this context, the term 'surplus' refers to the difference in the number of opening ewe hoggets on hand on July 1st and the number of closing two-tooths on hand a year later at June 30th. Apart from a normal death rate the difference in the number of opening and closing stock indicates the number of 'surplus' breeding stock sold annually. It is therefore possible to use flock composition numbers for each farm type, and the numbers of farms in each type, to estimate the number of 'surplus' breeding ewe hoggets or two-tooths sold nationally. These stock are a potential source of supply to an export hogget market.

Together, it would appear that the four farm types above have the potential to supply between 1.5 million to 2.0 million 'surplus' breeding ewe hoggets to an export market (New Zealand Meat and Wool Board's Economic Service Supplements to Annual Sheep and Beef Farm Surveys 1976/77 to 1980/81). However, because of the interdependence of New Zealand sheep farming systems, the majority of ewe hoggets 'surplus' to breeding requirements on hill country farms are sold to lowland farms to form the basis of lowland flock replacement policies. Consequently, the potential ability of existing farm production systems to supply an export hogget market, based on a national 'surplus' of ewe hogget replacements, is limited. Because of this situation this study is mainly concerned with specific export hogget production strategies involving changes to production policies to retain lambs for over-wintering and sale on an export schedule.

3.6 HOGGET SLAUGHTER PATTERNS

Traditionally, most hoggets on farms are ewe hoggets kept for breeding ewe replacements (refer Table 3.4). The obvious exception is in the South Island High Country class of farm where ewe and ewe hogget proportions are lower and more wethers are farmed for wool production. As indicated previously, 'surplus' ewe hoggets are often sold to other farms for breeding purposes. However, in the total farming sense, some ewe hoggets are surplus to the industry breeding requirements. These hoggets are mainly sold for local meat consumption. Similarly, wether lambs which are carried to the hogget stage are either sold on the local meat trade (butchers market), or killed for on-farm consumption. Very few hoggets of either sex have been graded for an export trade (refer Tables 3.5 and 3.6).

TABLE 3.5 Hogget Slaughtering (September Year)

	Local Trade	Export graded		Total Hogget Kill
	(000)	Numbers (000)	% of total Hogget Kill	(000)
1975/76	704	11	1.5	715
1976/77	764	17	2.2	781
1977/78	942	25	2.6	967
1978/79	768	29	3.6	797
1979/80	823	7	0.8	830
1980/81	809	19	2.3	828
1981/82	858	49	5.4	907

Source: Ministry-of Agriculture and Fisheries, and New Zealand Meat Producers Board Annual Reports.

Table 3.5 shows that as a proportion of the total sheep carcases graded for export, hogget slaughterings are very small indeed, averaging at less than 0.08% of total export slaughterings for the five seasons to 1981/82 (refer Table 3.6).

TABLE 3.6 Sheep Carcases Graded for Export

Season	Lamb	Mutton	Hogget	Hogget as % of Total slaughterings*
1977/78	25 105 892	5 398 577	25 257	0.08
1978/79	24 793 129	5 297 111	29 030	0.1
1979/80	27 247 710	5 407 528	7 413	0.02
1980/81	31 162 227	7 057 315	19 333	0.05
1981/82	31 079 454	6 546 404	49 336	0.13

Source: New Zealand Meat Producers Board Annual Reports

* Includes ram slaughterings

However, it is reasonable to assume that the figures for hogget carcases graded for export (Tables 3.5 and 3.6) underestimate the actual number of hoggets slaughtered. This is because hoggets graded for export must be mouthed at the freezing works prior to slaughter to confirm their age. Mouthing requires prior notification of a farmer's intention to send hoggets for export grading. Mouthing is not required for other sheep. Prior to the 1980/81 season there was no financial incentive to have hoggets graded, as both graded and ungraded hoggets realised the same schedule price as mutton (ewes). Consequently, it is likely that farmers would have seen little benefit in grading hoggets and therefore would not have requested hoggets to be mouthed. Under these conditions unmouthed hoggets would be classified as ewe (mutton carcases).

During the 1981/82 meat exporting season, two meat exporting companies encouraged export hogget slaughterings by offering farmers more attractive prices for hoggets than would be received from an export mutton grade (New Zealand Meat Producers Board, 1982). This encouragement is apparent in Table 3.5 which shows a slight increase in the proportion of hoggets slaughtered for export in the 1981/82 season. This increase appears to confirm the potential ability of existing farming systems to supply a small number of export hoggets, given the financial incentive to do so.

3.7 MARKET POTENTIAL FOR EXPORT HOGGET

The export of hoggets has been limited to only a few markets because of the restricted numbers available (Bryant, 1982), (refer to Table 3.5). Of the number which have been available, the main market has been the United Kingdom both for carcase sales (over 90% of total carcase exports) and higher valued cuts, namely legs, loins and square-cut shoulders. The lower valued cuts, such as fore quarters, breast and flap are exported mainly to Pacific markets (Bryant, 1982).

The main prospect for hogget meat is considered to be the hotel, restaurant and institution (HRI) sector of the United Kingdom market, during the period December through to March (Bryant, 1982). In order to reach this market, in which hogget is seen as an alternative to heavier lamb carcases when these are not available, hoggets are required to be slaughtered from October through to February/March (Bryant, 1982). It is also acknowledged that much of the potential market demand for hogget is dependent on the availability of PX and PH (16.5 kg to 19.5 kg liveweight) lambs from previous seasons' production (Bryant, 1982). (NOTE: In the new grading system introduced on 1 October 1983, lambs in this weight range are now graded PX.)

The type of hogget, which under the 1982/83 grading system, is most desirable for an export trade is one which will produce an HL or HX carcase (up to 22.0 kg carcase weight) with limited fat cover of about 10mm of fat over the loin (Bryant, 1982). Reservations are held regarding the HM grade (22.5 kg to 26 kg carcase weight) primarily because of the greater fat content of heavier carcases (Bryant, 1982). Hogget supplied to the local trade (butchers market) is generally significantly heavier and carries a greater amount of carcase fat than the type of hogget with potential for an export trade (Bryant, 1982). This indicates that to produce for an export market, specific export hogget production strategies would be required.

In response to a limited potential market increase for export hogget, the Meat Producers Board requested meat exporters to offer a separate schedule for hogget for the meat killing season beginning 1 October 1982. From 1 October 1983, changes to export hogget grading came into effect. Under the revised grading system, weight ranges are eliminated and hoggets are graded into two fatness groups. The new grades are: (New Zealand Meat Producers Board, 1983(a)).

HX all weights, with a GR measurement of up to and including 9 mm

HL all weights, with a GR measurement over 9 mm and up to and including 17 mm.

Carcases exceeding a GR of 17 mm are graded as mutton.

Under this new grading system, HX grade hoggets with light fat content (up to 9mm GR) are likely to be more desirable for export than the HL grade hoggets which have a greater fat content.

3.8 SHEEP MEAT CARCASE SUITABILITY FOR CONSUMER DEMANDS

The meat and wool sector of New Zealand agriculture contributed 42.7% of New Zealand's total export receipts for the year ending 30 September 1981. (New Zealand Meat Producers Board - Annual Report, 1982). Lamb in particular, has for a long time been the major contributor to the total meat industry receipts, contributing an average of 43% of total meat export receipts for the period 1975 to 1981 (Clough and Ojala, 1983).

Despite the significance of lamb to the New Zealand economy and the large numbers of lamb carcases exported each year (31 million in the year ending 30 September 1982), the suitability of lamb carcases to meet consumer demands has often been questioned (Barton, 1972; Marshall, 1979; Kirton, 1979; Frazer, 1982; Barton, 1981; Kempster, 1982). The question of carcase suitability centred initially on carcase fatness but latterly attention has been given to both carcase fatness and compostion, and carcase weight.

Consumer aversion to fat in lamb carcases has concerned the New Zealand Meat Producers Board since its inception in 1922 (Frazer, 1981 a). From 1 October 1983 the Meat Producers Board implemented changes to lamb and mutton export grades designed to 'improve market acceptability of New Zealand lamb and mutton' by encouraging lean meat production, recognising 'the increasing desire of consumers in overseas markets for leaner meat' (New Zealand Meat Producers Board, 1983 b). The discussion centred around the need to increase lamb carcase weight is more recent, but there is currently a significant body of thought which considers that the carcase weight of some lambs should be increased to bring about economies in slaughtering costs, as well as providing greater opportunities for carcase processing (Silcock and Shepherd, 1981; Frazer, 1981 b ; Kempster, 1982; Barton, 1982; Cullwick, 1983).

3.9 CARCASE COMPOSITION

Carcase composition refers to the relative proportion of fat, lean, and bone in a (lamb) carcase.

The most important single factor influencing carcase composition in continuously grown lambs of a given breed and sex, is body weight (Kirton, 1983 a). Body weight can in turn be influenced by such factors as age, birth rank, weaning age, level of nutrition, breed, and disease status (Scott et al, 1980). As body weight and carcase weight increases carcase fatness also increases.

Body weight and age tend on average to be related, because as animals become older they grow and increase weight until they reach their mature size (Kirton, 1983 a). Consequenty, older animals of given sex, breed and nutritional status, will be fatter than young animals and similarly, better fed lambs will be bigger than poorly fed lambs of the same age, breed and sex. However, if such poorly fed lambs are kept longer until they reach the same weight as better fed lambs, then at this same weight, both high and low fed lambs will be of similar carcase composition (Kirton, 1983 a).

Birth rank will also affect carcase composition, and lambs born and reared as twins will be on average 3.5 to 4.5 kg lighter at weaning and 1.0 to 2.3 kg lighter at October shearing than lambs born and reared as singles (Scott et al, 1980).

The effect of sex on carcase composition is well established (Rattray et al, 1976; Purchas, 1978; Kirton, 1983 a). In contrast to ewe lambs, ram lambs grow faster to reach slaughter weights in less time, are leaner, and have a lower dressing percentage. Wethers are intermediate between rams and ewes. Taste panel studies have shown that meat from ram lambs is equally acceptable to consumers as meat from ewe and wether lambs (Kirton 1971, cited in Rattray et al, 1976).

The effect of sire breed on the growth and carcase composition of lamb is also well known. (Coop and Clark, 1952; Rattray et al, 1976; Kirton, 1983 a). Rams of late maturing breeds with heavy mature weights, produce larger, leaner lambs (Rattray et al, 1976).

A number of management strategies have been identified as possible means of affecting carcase composition. The management strategies are briefly reviewed in the next section (3.10), beginning with a discussion of factors affecting lamb carcases, then introducing hogget production as an alternative approach to producing larger, leaner carcases for export.

3.10 MANAGEMENT STRATEGIES TO PRODUCE LEANER, LARGER CARCASES

Most of the attention in the "lean large" debate has centred on traditional production systems and the following comments relate to management changes possible under existing farming systems.

Over-fatness in lambs normally occurs in two periods during the killing season. Nationally there is a spring peak in mid-October to November, and an autumn peak in May/June (Kirton, 1980; 1981).

The following strategies have been suggested to reduce the number of overfat lambs produced on New Zealand farms.

3.10.1 Slaughter at Lighter Weights

This strategy uses the well established general relationship between lamb liveweight and carcase fatness. As weights increase so does the proportion of fat in the carcase. Consequently, slaughtering at lighter weights will reduce fatness in lambs killed (Kirton, 1980; 1981). However, killing at lighter weights reduces the volume of meat production and is contrary to the objective of producing larger carcases.

3.10.2 Stocking Rate

The influence of increased stocking rate is to increase feed competition at critical times of the year and thereby reduce lamb slaughter weights. The reduction in individual carcase weight is balanced by an increase in numbers sold, resulting in increased volume of meat (Kirton, 1980; 1981). Again however, the effect is to produce individually smaller carcases. Increasing stocking rates may not be desirable on many farms and where practised may reduce management flexibility and increase risk.

3.10.3 Ram Lambs

Entire male (ram) lambs grow faster than wethers or ewes provided adequate feed is available (Kirton, 1983 a). Ram lambs are leaner than wethers, which in turn are leaner than ewes of similar weight (Purchas, 1978). Non-castration results in ram carcases which are heavier and leaner than corresponding wether or ewe carcases of a similar age. However, on-farm management difficulties associated with carrying ram lambs, processing problems associated with ram lambs, and the likelihood of larger lambs being graded as ram, imposes limitations to adoption of this strategy (Packard, 1983).

3.10.4 Breeds

Breeds differ in the age and weight at which fat deposition occurs, so the use of specialised 'meat breeds' can result in both larger and leaner carcase production (Kirton, 1980; 1981). However, most New Zealand sheep farming systems rely on dual purpose meat and wool breeds to generate income and where replacement stock must be retained, specialist meat breeds are not considered satisfactory. Consequently, the widespread adoption of specialist meat breeds has not occurred on New Zealand sheep farms.

In addition, breeds with black faces can cause difficulties with dark hairs on carcases resulting in carcase rejection (MAF, 1983 d). A number of specialised meat breeds are black faced sheep (South Suffolk, Hampshire, Suffolk, Dorset Down, and Shropshire).

3.10.5 Early Weaning

Early weaning increases the tendency for fat mobilisation in lambs, thereby resulting in leaner carcases at slaughter. This effect on lamb carcase composition is greatest in lambs weaned at four weeks of age and is negligible in lambs weaned after eight weeks of age (Kirton, 1980; 1981). However, such early weaning requires provision of very high quality feed for lambs to be weaned on to, and failure to provide high quality feed results in depressed liveweight gains and subsequent liveweights at 12-16 weeks of age (Scott et al, 1980).

3.10.6 Increased Twinning

Increased twinning has two effects. Firstly it increases the stocking rate while lambs are on the farm, thereby reducing lamb growth rates. And secondly, twinning results in lambs which are lighter and therefore leaner than singles of the same age (Scott et al, 1980). Increased twinning may therefore achieve the objective of a leaner carcase, but this is likely to be at the expense of reduced individual carcase weights.

This practice has similar types of potential management difficulties as increasing stocking rates, and requires that due consideration is given to the total effect on the farming system. It also results in a greater proportion of lighter lamb carcases.

3.10.7 Rotational Grazing

Rotationally grazed lambs are less likely to be over-fat than lambs in set stocked mobs. Rotational grazing would appear to offer some scope as a means of reducing fatness in lamb carcases where lambs are run at medium and low stocking rates. The effect is less pronounced at higher stocking rates (Kirton, 1980; 1981).

3.10.8 Differential Slaughter Patterns

At comparable ages or weights, ewe lambs are fatter than wether or ram lambs respectively. Consequently, planning drafting patterns to slaughter ewe lambs earlier in the season, before wether lambs and ram lambs could result in a leaner average farm draft (Kirton, 1981).

3.10.9 Selection

The heritability of carcase composition is believed to be moderate (Kirton, 1983 a). Consequently, selecting for leanness within breeds has potential as a means of developing leaner strains of sheep.

3.10.10 Combination Strategies

Although a number of management strategies are possible, there is no known single management practice which will result in lambs of desirable carcase composition. There is some potential, however, for farmers to adopt a combination of the practices discussed in this section to reduce carcase fatness (Kirton, 1983 b).

Despite these known management strategies there has been little financial incentive for farmers to produce leaner lambs (New Zealand Meat Exporters Schedules). Accordingly, the average carcase weight of lambs sold for export has varied little within a weight range of 12.9 to 13.6 kg carcase weight over the last five years. The 'five year average' for lamb carcase weight for the period 1977/78 to 19798/80 is 13.24 kg CW (New Zealand Meat Producers Board Annual Reports).

Changes to lamb grades from the killing season beginning 1 October 1983, accompanied by changes in payments for the new lamb grades from 1 October 1984, are designed to encourage production of leaner lambs. There is concern however, that farmer reaction might be to slaughter lambs at lighter weights rather than risk down-graded payments for heavier, fatter lambs.

3.10.11 Hogget Carcase Composition

Hogget, as a means of lean meat production, has received little attention in the current deliberations of the meat industry. This is not entirely surprising when consideration is given to the relative production levels of lamb and hogget (Tables 3.5 and 3.6). However, a review of literature provides some indication that hogget production may have some advantages for producing large, lean carcases for export processing.

A number of trials indicate that wether carcases killed as hoggets at 12-15 months of age have lower levels of fat than lambs of the same weight killed before winter (Rattray et al, 1976; Kirton, 1980; Kirton et al, 1982). This effect was interpreted by Rattray et al (1976) to be due to a loss of body fat by lambs over the winter (9 to 12 months of age). The ability of hoggets to grow to higher carcase weights at the 10 to 15 month stage folowing over-wintering, without an increase in the proportion of fat in the carcase, offers possibilities for producing heavier, leaner carcases (Kirton et al, 1982). This effect, which has been reported in wether hoggets only, covers a range of climatic conditions on New Zealand hill country (Rattray et al, 1976; Kirton et al, 1982). The author was unable to locate references detailing similar trials for ewe hoggets.

Before export hogget could be recommended as an export meat production system on a wide scale, more information on carcase composition of both wether - but particularly ewe hoggets - is required. Discussion later in the study shows that hogget carcase composition, particularly potential over-fattening, significantly affects the profitability of export hogget production.

3.11 CHAPTER CONCLUSION

Chapter three concluded the situation analysis begun in the later stages of chapter two. A review of sheep farming sytems and the hogget composition of flocks indicates a potential - albeit limited - supply of surplus (breeding) ewe hoggets available for an export market.

In recent years most hogget slaughterings have been for the local trade but it has been shown that due to a lack of financial incentive to grade hoggets for export, a significant number of potential export grade hogget carcases may have been graded as mutton.

A review of the market potential for export hogget has shown that a potential increase for export hogget sales is thought to exist, although currently export hogget production and export hogget marketing is caught in a "catch 22" situation. Despite this, the New Zealand Meat Producers Board has indicated some confidence in the prospect for export hogget production when they requested meat exporters to offer a separate export schedule for hogget for the season beginning 1 October 1982.

A brief introduction to the current movement within the New Zealand meat industry to produce leaner, larger carcases was presented as a prelude to discussion of known management strategies to produce leaner, larger export (lamb) carcases. Some data indicates that export hogget production may be an alternative to lamb as a potential means of producing a limited number of large, lean carcases for export.

Having completed a brief industry situation analysis, the study now turns to a more in-depth investigation of on-farm export hogget production sytems. The next chapter (Chapter 4) is concerned with Situation Analysis in which the components and inter-relations of the export hogget production sytems under investigation are presented as a lead-in to Systems Synthesis described in Chapter 5.

CHAPTER FOUR

SYSTEMS ANALYSIS - EXPORT HOGGET PRODUCTION; SYSTEM COMPONENTS AND INTER-RELATIONSHIPS

4.1 INTRODUCTION

This chapter presents an analysis of the on-farm export hogget production systems under investigation in this study. A diagrammatic representation of the pastoral production system under consideration is given in Figure 4.1

Figure 4.1 highlights the relationships and inter-relationships between the components which occur via the pasture subsystem. This feature, whereby the influence of one subsystem on others occurs not so much directly, but mainly by way of a central subsystem, is an important feature of pastoral farming systems. It is this linkage mechanism that confers a high degree of component interdependence and dynamism to grazing management systems.

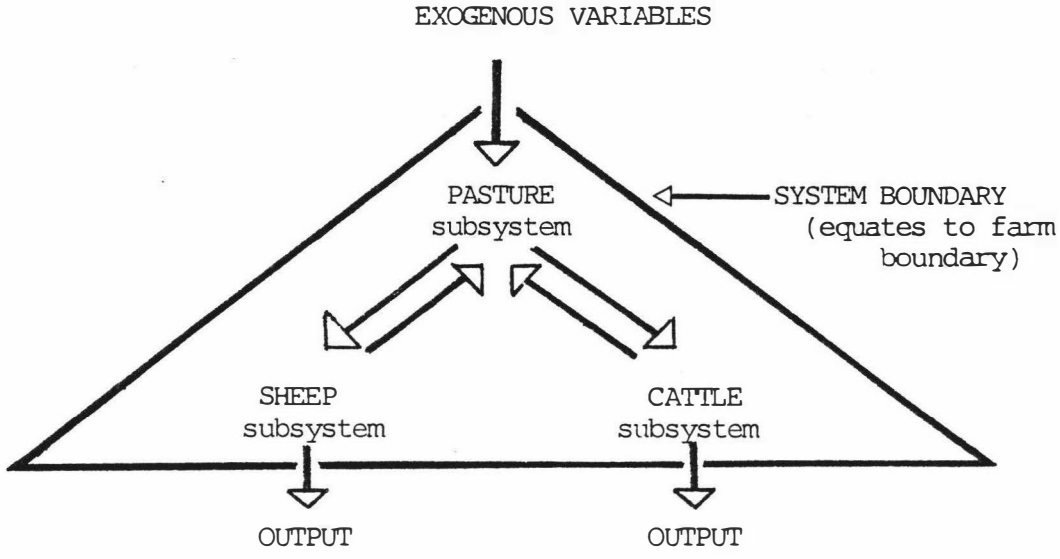
In grazing management, the effect of altering management strategies for one class of stock will directly increase or decrease the amount of pasture available to other stock classes (components). Similarly, grazing management practices may alter pasture growth rates following defoliation (Brougham, 1960, cited in Langer, 1967) thereby affecting total pasture production within the system. Grazing management is also known to affect pasture herbage quality and pasture utilisation (Smetham, 1967). All these factors influence pasture balance within a pastoral farming system and, therefore, the dynamics of the system.

Epidemiology trials show that manipulation of grazing management has major effects on parasite proliferation, with consequent influence on animal performance (Jagusch, 1980). This effect of one animal subsystem on another, is again largely transmitted via the pasture subsystem.

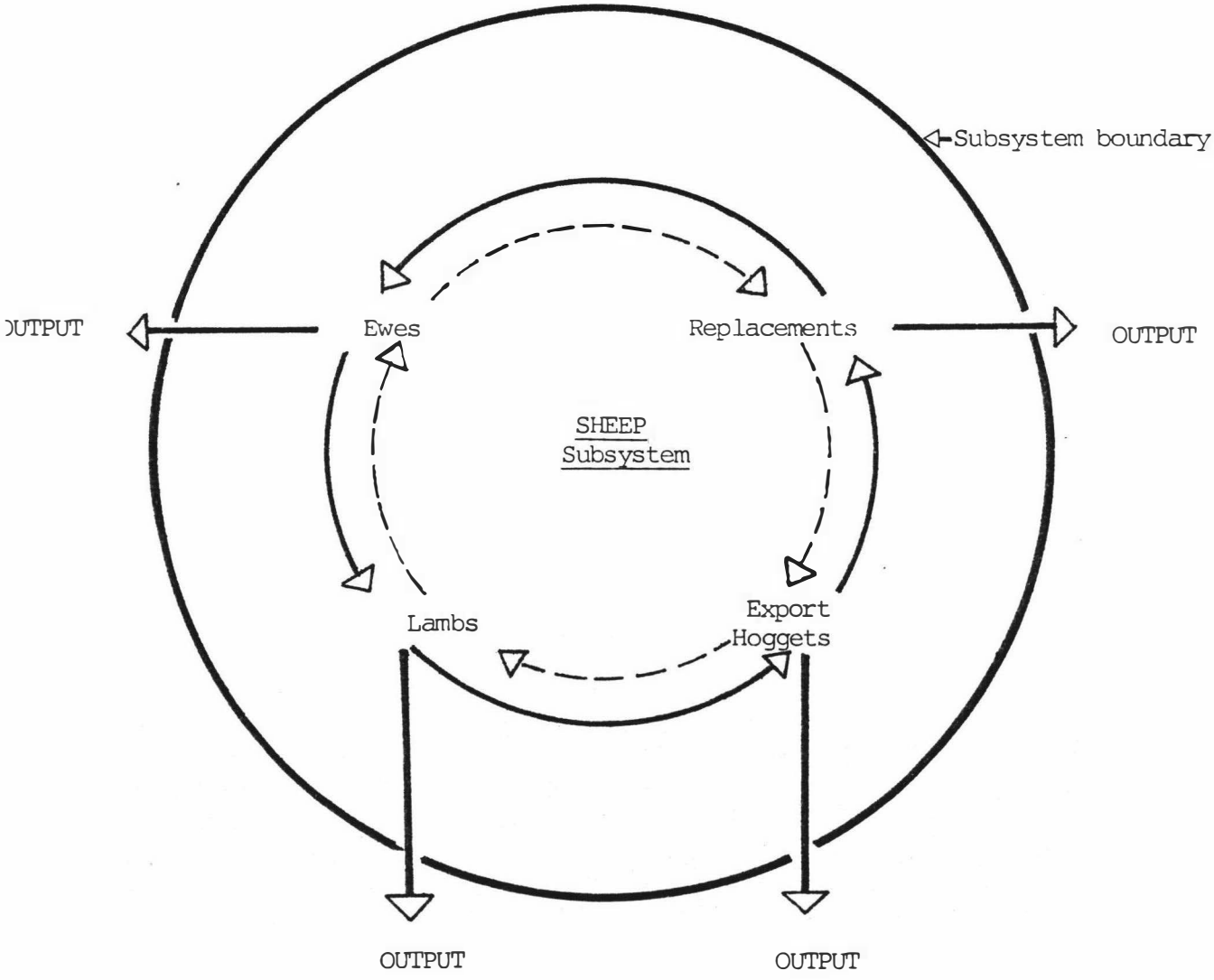
It can be seen then, that in pastoral animal production systems grazing management is the major interacting and integrative element which is under direct farmer control. In the system under consideration in this study, any management or policy change in any animal subsystem may influence the pasture component, and therefore other animal subsystems.

FIGURE 4.1 Schema of Export Hoggett Production System - Showing Components (subsystems) and Inter-relationships

(a) FARM PRODUCTION SYSTEM.



(b) SHEEP SUBSYSTEM



4.2 PASTURE SUBSYSTEM COMPONENTS

This section presents the two aspects of pasture production of concern in this study - these being pasture supply and pasture quality. It is not intended to discuss the numerous strategies available to influence both pasture production and pasture quality in this thesis.

In a pastoral production system it is both the seasonal distribution, and total level of pasture supply which influence production and management strategies and total system output. For any given system, performing at a given level of output, total feed demand may not exceed total feed supply.

Where the management objectives are to maximise profits or total livestock output (in value or physical terms), management strategies usually involve feed transfer from one period to another in an attempt to equate animal feed requirements and pasture feed supply. Alternative management strategies may also involve altering livestock production levels and hence feed requirements. (Animal feed requirements are discussed in Section 4.3).

The general process of investigating management strategies to equate feed supply and demand, or at least to ensure that feed demand is feasible, is described as feeding budgeting. However, in addition to total feed supply, consideration also needs to be given to pasture management practices to ensure that pasture quality is adequate to achieve the budgeted levels of animal performance.

In this study, since pasture rate of growth information was not available for any of the farm monioring situations, it was necessary to derive theoretical feed supply profiles for each status quo situation, using production policies and animal performance levels supplied by local Farm Advisory Officers (MAF,1982 c). When considering this theoretical feed demand for each status quo (pre export hogget) situation, it was assumed that it was both feasible, and 'well matched' to the actual pasture supply profiles.

In pastoral production sytems animal performance is affected by both pasture quality and quantity (Smetham, 1967). In the literature, feed requirements to maintain animal liveweights and to give production responses, are either expressed in terms of energy (megajoules of metabolizable energy per day [MJ ME/day]) or kilograms of pasture dry matter per day (kg DM/day). Pasture quality is expressed in terms of energy concentration per kilogram of dry matter (MJ ME/kg DM).

In practice, pasture quality ranges seasonally from about 11.7 to 10.3 MJ ME/kg DM under good grazing management when feed is always leafy (MAF, 1976). Where grazing management is poor and pastures are permitted to go to seed, seasonal variations in pasture quality become greater (Milligan, 1981).

Seasonal quality variation is also influenced by pasture species. Brown-top dominant pastures typically show greater seasonal quality variations than ryegrass dominent pastures (Ulyatt et al, 1980).

Initial investigations showed that pasture utilisation levels for the models of export hogget production considered in this study were generally less than the equivalent status quo situation (refer to Section 5.6). Consequently, it could be anticipated that export hogget production may result in poorer pasture quality. However despite the uncertainty of pasture quality variation associated with export hogget production, it was assumed for modelling simplicity that pasture quality in any given time period would not differ significantly in the post export hogget system from that of the pre export hogget (status quo) system. Therefore pasture quality variation was considered from a seasonal viewpoint only, and the inter-relationships between the type of production system, the type of pasture and pasture quality, were excluded at this stage of the study.

At the time of making this assumption it was intended to test the reality of the situation with farmers during later stages of the study to investigate the significance of any impact of pasture quality on system output.

As animal feed requirements are given in terms of pasture with a constant quality of 10.8 MJ ME/kg DM (Milligan, 1981), pasture 'quality coefficients' are used in this study to account for seasonal variation in pasture quality. These are shown in Table 4.1.

TABLE 4.1 Seasonal Pasture Quality Coefficients

Month	ME Concentration (MJ ME/kg DM)	'Qualify Coefficient' (Rounded)
January	10.3	1.05
February	9.3	1.14
March	10.0	1.08
April	10.8	1.0
May	10.8	1.0
June	11.0	0.98
July	11.2	0.96
August	11.2	0.96
September	11.3	0.96
October	11.0	0.98
December	11.0	0.98

Source: Derived by the author from MAF Feed Budgeting, 1976.

The seasonal pasture 'quality coefficients' are based on a standard pasture energy content of 10.8 MJ ME/kg DM. When applied to the animal feed requirement coefficients, the pasture 'quality coefficients' adjust animal feed requirements in each monthly period. The result is to derive equivalent pasture intake figures required to meet animal nutritive requirements in terms of feed with a constant nutritive value of 10.8 MJ ME/kg DM. Adjusting stock intake requirements in this manner was the only feed quality factor considered during the modelling phases of this study, as it was assumed that there was no variation in the efficiency of utilisation of pasture ME between the pre and post export hogget situations.

4.3 ANIMAL SUBSYSTEM COMPONENTS

4.3.1 Ewe Feed Requirements

A number of authors in New Zealand have presented patterns of feed requirements for ewes (Rattray, 1980; Ullyatt et al, 1980; Lincoln College, 1981). Ulyatt et al data is used in this study as their figures are commonly used by MAF ASD staff.

Ewe feed demand profiles used in this study are based on ewe maintenance requirements of 0.55 MJ ME/kg ewe liveweight $^{.75}$/day and the seasonal target ewe liveweight targets given in Table 4.2. Table 4.2 presents the liveweight changes for a 55 kg ewe at tupping.

TABLE 4.2 Target Ewe Liveweights and Liveweight Changes

Period	Target Weight (kg LW)	Mean Weight Change necessary to achieve target weight (grams/day)
Weaning to start flushing	52-55	+30 to +35
Flushing to 1st cycle mating	55-62	+120 to +140
End mating to 6 weeks pre-lambing	62-54	-60 to -70
6 weeks pre-lambing to lambing	54-56	+60 to +50
Lambing to weaning	52	maintenance LW

Source: Milligan, 1981.

(Note: loss in liveweight at lambing is due to lamb plus placenta)

In the feed budget calculations performed in this study, ewe feed requirement profiles for a whole flock are adjusted to account for changes to feed requirements due to variation in:

(a) average flock tupping weights, including flushing requirement;

(b) average flock lambing percentages (which incorporates an allowance for the percentages of twinning ewes, single bearing ewes, barren ewes, and ewe deaths in the flock);

(c) flock lambing date and spread;

(d) lamb weaning weights; and

(e) flock weaning dates.

(a) Ewe Tupping Weight

Ewes of higher tupping weights have higher feed demands than ewes of lighter tupping weights. Consequently it is necessary to alter whole flock feed demand profiles according to ewe tupping weights. Calculations for a whole flock feed demand profile were based on average ewe tupping weights for each status quo monitoring model supplied by local Farm Advisory Officers. Seasonal variations in ewe liveweight, and feed requirements, for ewe flocks not weighing an average of 55 kg LW at tupping, were estimated relative to the standard profile for the 55 kg LW ewe presented in Table 4.2

Ewe flushing requirements also increase ewe feed demand for a short time in late summer. Flushing was assumed to occur during the period three weeks prior to the start of tupping, to three weeks after the ram was joined. During this period ewes are assumed to be fed at 1.5 times maintenance.

(b) Flock Lambing Percentage

The feed requirements of a ewe flock in the period six weeks pre-lambing to weaning varies according to the proportion of twin bearing, single bearing and barren ewes in the flock. In addition to lamb death rates, these factors also determine the final flock lambing percentage. Consequently it was necessary, when deriving whole flock feed demand profiles for flocks with varying lambing percentages, to consider the different feed requirements of twin bearing, single bearing and barren ewes which together constitute the total flock feed demand.

In this study a method suggested by D.G.McCall (pers. comm.) was used to estimate the proportion of twin bearing, single bearing and barren ewes for each lambing percentage (survival to sale) as required in the systems modelling stage. The method is based on data from Quinlivan and Martin (1971) and Kelly and Knight (1979) and Knight (1979) to establish the proportion of twin and single ewes, and barren ewes. Lamb deaths from birth to sale were assumed to vary from 9% to 12.5%, according to farm type (MAF Farm Advisory Officers pers.comm.) From this data the theoretical proportions of twin bearing, single bearing, and barren ewes used in determining flock feed requirements were derived. These are presented in Table 4.3.

TABLE 4.3 Flock Lambing Status At Specified Lambing Percentages(1) (rounded)

Lambing % (STS)(2)	% twin bearing ewes	% single bearing ewes	% barren/dry ewes
84	5	86	9
88	7	84	9
90	12	79	9
92	14	77	9
94	17	74	9
95	18	73	9
98	22	69	9
100	23	69	8
103	27	65	8
105	30	62	8
107	32	60	8
108	32	61	7
115	41	52	7

Note: (1) Lambing percentage in this table is calculated:

$$\frac{\text{Lambs sold} \times 100}{\text{Ewes to ram}}$$

(2) Survival to Sale

(c) Flock Lambing Date and Spread

Lambing date and lambing spread affect total flock feed demand profile during the period from six weeks prior to lambing, to weaning. In this study, adjustments to flock feed demand profiles are made for lambing date for each farm monitoring model on the basis of information supplied by local Farm Advisory Officers. However, as no data were available for lambing spread, standard lambing spread distributions were assumed to be as shown in Table 4.4

TALBE 4.4 Lambing Spread

	% Ewes Lambing in
Week 1	22%
Week 2	40%
Week 3	18%
Week 4	6%
Week 5	4%
Week 6	4%
After Week 6	6%

Source: Documentation for Advisory Services Division Feed Budget Programme on Northstar microcomputer (1981).

(d) Lamb Weaning Weight

Lambs typically have birth weights of around 5.0 kg for single lambs and 4.5 kg for twin lambs (Ulyatt et al, 1980). From about week six onwards, pre-weaned lambs begin to consume appreciable amounts of pasture, and reduce milk intake (Sykes and Geenty, 1983). The amount of pasture consumed prior to weaning varies according to lamb growth rate and weaning age. Pre-weaning lamb feed requirements used in this study are based on an average pre-weaning lamb growth rate of 200 grams liveweight gain per day, with lambs receiving 50% of their feed from milk and 50% from pasture. After weaning, ewe feed requirements

are reduced to maintenance, plus target liveweight growth requirements, as appropriate. Lamb post-weaning feed requirements are calculated separately for each sale mob on the basis of straight line growth rates from weaning to sale, sufficient to achieve target slaughter weights.

(e) Shearing Policies

Shearing significantly affects animal feed requirements in the period after shearing. Estimates quoted in the literature for increases in feed required after shearing vary. Rattray (1980) 'temporarily' increases feed requirements of adult sheep by 10-20% in summer and 50-70% in winter.

In this study however, it is assumed that the feed requirement for ewes shorn in summer is not increased, as in practice ewe intake in summer is typically controlled. Consequently, while shearing may increase feed demand, this demand is not usually met by an increase in the amount of feed offered to ewes.

The feed intake of ewes shorn, in periods other than summer, and of other classes of stock irrespective of shearing dates, are adjusted in the feed budget calculations undertaken in this study. Hoggets shorn in October have their feed requirements increased by an average of 20% for the month following shearing. Lambs and two-tooths shorn in summer have their intakes increased by an average of 10% for the month following shearing. In the feed budgets presented in Chapter Five, shearing dates are assumed to be at the beginning of the month therefore removing the need to calculate proportionate increases in feed demand over successive months.

4.3.2 Post-Weaning Lamb and Hogget Feed Requirements

Feed requirement calculations referred to in this section relate to the post-weaning situation for lambs and hoggets to sale, or for flock replacements to two-tooth mating.

Published feeding standards for lambs and hoggets vary considerably (Lincoln College, 1981; Ulyatt et al, 1980; Rattray, 1980). This variation is shown in Table 4.5 using data from each source.

Data used in this study to derive lamb and hogget feed requirements are from Ulyatt et al (1980). This data is used because of its widespread acceptance amongst Farm Advisory Officers of Advisory Services Division.

TABLE 4.5 Lamb Feed Requirements (MJ ME/day) For Maintenance and Liveweight Gain (LWG) from Three Data Sources

	Maintenance (MJ ME/day)			Liveweight Gain (MJME/100g LWG/day)		
	Lincoln	Ulyatt	Rattray	Lincoln	Ulyatt	Rattray
Liveweight (kg)						
20	5.0	5.7	6.4	4.8	3.8	3.0
30	6.7	7.7	8.7	5.2	4.7	4.0
40	7.9	9.5	10.8	5.6	5.9	5.0

Data presented by both Ulyatt et al (1980) and the Lincoln College Farm Budget Manual (1981) are for ewe and wether lambs and hoggets. Rattray (1980) presents data which is broken down into feed requirements for wether lambs and hoggets (3-5 months), and ewe hoggets (6-12 months). Requirements for ewe hoggets are higher than for wether hoggets because of greater fat deposition in ewe hoggets (Rattray, 1980). However, neither Lincoln College (1981) or Ulyatt et al (1980) differentiate between the feed requirements of ewes or wether lambs, or between lambs and hoggets. Consequently, as data from Ulyatt et al (1980) are used in this study the feed requirements presented for all lambs hoggets and two-tooths up to two-tooth mating, are determined by liveweight and liveweight gain only, and are not differentiated according to sex.

4.3.2.1 Derivation of Lamb/Hogget Feed Requirements

MAF Advisory Services Division staff responsible for assembling data for each farm model used in this study provided liveweight profiles for each class of livestock involved. During the systems synthesis phase of this study, alternative liveweight profiles were used depending on the final target liveweights, or carcase weights required. This phase of the research therefore required estimation of feed requirements for a large number of alternative lamb, hogget and two-tooth growth profiles.

In order to facilitate easy estimation of feed demand from liveweight growth profiles, feed requirements for lambs and hoggets (expressed in MJ ME/head/day) as reported by Ulyatt et al (1980), were integrated by Townsley (1983) to give a function which was used to estimate feed requirements for lambs and hoggets of any initial liveweight (in the range of 15 to 50 kg liveweight) growing at any specified pattern of liveweight gains (in the range of 0 to 300 grams per day). (See Appendix Two for details).

In order to facilitate estimation of feed requirements for given growth profiles, the function was incorporated into a simple simulation programme for an Apple II microcomputer. This programme calculates, for any initial (weaning) liveweight (expressed in kilograms) and pattern of daily liveweight gains (expressed in grams per day), the total estimated feed requirement for each sub period (fortnightly or monthly), and the final liveweight at the end of the growth period. Feed requirements may be expressed in either MJ ME/head/day or kg DM/head/day, using a conversion of 10.8 MJ ME/kg DM (Milligan, 1981).

The estimated feed requirements for lambs and hoggets were adjusted manually for the effects of shearing on animal feed requirements, and seasonal pasture quality variation.

4.3.2.2 Dressing Out Percentages for Lambs, Export Hoggets, and Ewes

In order to estimate the carcase weight of stock slaughtered it was necessary to convert paddock liveweights to equivalent carcase weights. Although this relationship is known to vary according to animal liveweight, animal sex, and the period of time between removal from pasture and slaughter (Rattray et al, 1976), it was assumed in this study that lamb dressing out percentages were 47.5% (Shadbolt, 1982). Hogget and ewe dressing out percentages were both assumed to be 45.0% (Davison, 1982). Dressing out percentage is expressed as:

$$\frac{\text{Carcase weight (kg)} \times 100}{\text{Live weight (kg)}}$$

4.3.3 Cattle Feed Requirements

Cattle production and management policies were supplied by MAF Farm Advisory Officers for each status quo farm model from which corresponding cattle feed demand requirements were estimated.

(a) Breeding Cows

Feed requirements for cows and calves up to weaning were estimated from standard beef cow requirement data (MAF, 1976). Feed demand profiles were based on calving and weaning date information appropriate to each model. Breeding cow requirements were not adjusted for pasture quality as in practice breeding cows are often used for pasture management purposes to "clean-up" pastures of lower quality.

(b) Weaned Steers and Heifers

Farm Advisory Officers were not able to supply accurate steer or heifer liveweight growth profiles. Consequently, when calculating feed demand for steers or heifers, 'standard' growth profiles were assumed based on weaning weight, purchase

weight, and sale weight as appropriate to each farm model situation. The 'standard' liveweight profiles were used to estimate feed requirements by using a cattle feed demand simulation model developed on an Apple II micro-computer (A.F.McRae, pers. comm.). The McRae programme is based on functions derived from MAF daily feed requirement data for growing steers and heifers (MAF, 1976). As in the case for breeding cows, no adjustments were made to steer or heifer feed intakes for variations in seasonal pasture quality.

4.4 CHAPTER CONCLUSION

This chapter presented the Situation Analysis phase of the study, in which the subsystems and their inter-relationships, constituting export hogget production systems were discussed.

Of importance was a discussion highlighting the integrative nature of the relationships between animal subsystems, and consequently total system output, occurring via the pasture subsystem. Further discussion factors which influence pasture feed demand by each of the animal subsystems.

The discussion in this chapter has established the setting for the feed budgeting approach used to model export hogget production systems in the Systems Synthesis phase of the study presented in Chapter Five.

CHAPTER FIVE

SYSTEMS SYNTHESIS - FEED BUDGETING

5.1 INTRODUCTION

This chapter describes the study method by which models of hogget production systems were synthesised in a feed budgeting format. The two objectives of the synthesis stage were to increase the author's understanding of export hogget production, and develop feasible models of export hogget production systems under a range of farm types for use in interactive discussions with farmers.

Systems synthesis in this study is the stage in which the system components and interactions are integrated into export hogget production systems. It was during the interactive procedures of system analysis and system synthesis that the author's understanding of export hogget production improved substantially. Innis (1975) refers to such benefit gained by a researcher during systems modelling as 'development utility'. It is during the stages of system development (model construction) that the researcher is forced to make his thinking more precise. In order to model a system the researcher is forced to quantify, in mathematical terms, the system components and their inter-relations. Even though the modelling exercise carried out in this study was relatively simple in both concept and detail, development utility was felt to be high.

Development utility was important in this study because as a Northlander for the eight years prior to commencement of the study, the author began the study with limited appreciation of farming in the lower North Island. Consequently it was necessary to develop both an understanding of existing farming systems in the study area, as well as an understanding of export hogget production systems, as a pre-requisite for interactive discussion with farmers. (Interactive discussion is discussed in Chapter Seven).

The second major objective of the analysis/synthesis phases of this study was to develop feasible - though not necessarily optimal - models of export hogget production to use in the interactive discussions with farmers.

The main systems synthesis modelling tool used was a simple feed budget programme developed by the MAF for use on their Northstar micro-computers. This programme required stipulation of stock numbers and animal feed requirement coefficients, to calculate total monthly feed demand. Pasture supply is derived from effective pasture area and daily pasture rate of growth data. The programme does not have the capacity to permit unused feed to be transferred from one (monthly) period to the next. However, it was assumed (and this was validated in discussions with farmers) that similar pasture management practices would be followed in both the pre and post export hogget situations. Consequently, the feed budgeting procedures used in the study do not specifically consider feed transfers in either the pre or post export hogget situations as it is implicitly assumed that similar but unspecified feed transfer practices occur for management systems in both the pre and post export hogget situations.

5.2 'FEED BALANCE' APPROACH; EWE REDUCTION STRATEGIES

The feed balance objective was to determine, for a number of 'feed release' strategies, the number of export hoggets which could be wintered for each model, using existing management practices, stocking policies, animal performance levels and known technologies. The objective was not to develop new production systems to winter export hoggets, but rather to investigate how existing production systems could be adapted to produce export hogget.

The 'feed balance' procedure, as it was applied to each of the five ASD Farming Monitoring models to synthesise export hogget production systems, is now outlined.

5.2.1 Status Quo Feed Demand

It was not possible to obtain accurate pasture growth rate information specific to each farm monitoring model situation. To overcome this knowledge limitation, it was decided to derive a theoretical status quo feed demand for each farm monitoring situation and use this as the 'feed supply' for export hogget production systems. Several assumptions were made regarding the status quo feed supply derived in this way.

Firstly, it was assumed that the status quo feed demand is feasible, that is, that the actual (field) pasture growth would be sufficient to meet stock demand for the given status quo levels of performance. And secondly, it was assumed that the feed demand profile for each status quo situation is "well matched" to the seasonal growth pattern for the area, and that in the status quo situation there is no surplus feed capacity on which to carry extra stock such as export hoggets, over the winter.

Each status quo feed demand profile was derived from the monthly stock numbers on hand and the average monthly feed demand for the stock, using existing management practices (lambing, weaning, shearing dates etc), stock performance levels, and stock sale and purchase policies. Supplementary feed strategies were not explicitly introduced and grazing management practices were not stipulated.

It was a simple matter to use animal feed demand coefficients which considered the aspects discussed in Chapter 4, to derive monthly feed demand profiles for the existing whole farm situations for each status quo model. Animal performance levels used in each status quo model as given by local farm advisors are referred to as 'average' for that model.

5.2.2 Feed Release

Since it was assumed that each status quo situation did not contain surplus feed capacity on which to winter export hoggets, it was necessary to alter existing stock policies to 'release' feed to export hoggets by reducing stock numbers in each status quo model.

The initial 'feed release' strategy applied was to reduce June ewe numbers and supporting stock in each status quo model by 10% and then calculate the new feed demand profile for this reduced winter number. In order to investigate the effect of varying animal performance levels on export hogget production, two levels of animal performance (based on status quo ewe tupping weights) were considered for the ewe reduction strategy. In effect, this resulted in two ewe reduction strategies being considered for each model: (a) ewe reduction - average performance, and (b) ewe reduction - medium performance.

(a) Average Performance Levels:

These performance levels are those used initially to calculate the status quo feed demand. Management strategies and sale policies equate to those given for each status quo situation but at reduced numbers.

(b) Medium Performance Levels:

Preliminary feed budgeting analyses indicated the possibility of increased animal performance associated with the introduction of export hoggets. The assumed sale of export hoggets in November, coupled with the reduction in stock numbers (ewes and replacements, or cattle) to create the capacity to winter hoggets for export, results in a budgeted feed surplus relative to the status quo feed demand, particularly in the summer/autumn period. (Refer to Chapter Six for details). In spite of possible pasture control difficulties during summer (discussed in Section 4.2), this additional feed could permit an overall increase in animal performance relative to the status quo situation.

After discussions with local Farm Advisory Officers and as a prelude to interactive discussions with farmers, the following changes to animal performance levels were made as one possible consequence of export hogget production. These performance levels are associated with increases in average ewe tupping weights of 2.0 to 2.5 kg LW. (The range applies to varying performance levels for models of different farm types).

Medium performance parameter changes relative to the status quo situation were:

		Increase
(i)	Lambing percentage (Rattray, 1980)	3 to 4%
(ii)	Two-tooth tupping weights	2 to 3 kg LW
(iii)	Lamb weaning weights	1.0 kg LW
(iv)	Lamb sale weight	1.25 kg LW
(v)	Wool weight	0.1 to 0.15 kg/hd
(vi)	Where lambs are sold prime and store in the status quo situation, the proportion sold store is reduced by 15 percentage points in Model 3, and by 8 percentage points in Model 4.	

Lamb and hogget growth profiles were changed by a required percentage amount relative to the status quo situation, to obtain medium performance liveweights.

Other management practices, such as stock purchases and sales, were kept in the same proportion as for the status quo situation.

5.2.3 Introduction of Export Hoggets

As a consequence of the 'feed release' strategies presented in Section 5.2.2, unused feed capacity is created when base stock numbers are reduced. This feed was assumed to be available for export hogget production. The method used to calculate the number of export hoggets to be retained and over-wintered follows.

Preliminary feed budgeting analyses showed that June was most likely to be the month limiting the carrying capacity of export hogget numbers. The number of June export hoggets was obtained by dividing the amount of June feed available for export hoggets ('released' by the reduction in base stock numbers), by the June feed requirement per export hogget for each level of performance (average and medium). The numbers of export hoggets on hand during the other months of the year were calculated according to expected death rates for export hoggets, from weaning through to sale in mid-November.

The initial Situation Analysis survey indicated that in order to retain lambs for over-wintering to the export hogget stage, farmers were most likely to retain slower finishing prime lambs, or store lambs. After discussions with local Farm Advisory Officers it was concluded that over-wintering such lambs could result in slightly higher death rates than was normal for ewe hogget replacements. Consequently, the assumed death rate for export hoggets incorporated in the systems models, was based on a 1.0% death rate from weaning to June, and a 2.5% death rate from June to sale in mid-November.

The method of determining lamb sales policies when synthesising export hogget production systems, reflected farmer beliefs noted during the initial survey, that, apart from retaining lambs from later drafts, lamb sales policies would not change significantly from the status quo. In the modelling phase of the study a three-stage approach was used to synthesise assumed lamb sales/export hogget reduction strategies. Firstly, the total number of lambs available for sale was determined for each ewe reduction/stock performance combination. Secondly, a lamb selling policy directly proportional to the status quo was used to calculate the potential number of lambs available for sale in each draft prior to retaining any export hoggets. Finally, the required number of export hoggets was "retained" by progressively reducing later lamb sales drafts. Preference was also given to "retaining" lambs for export hogget production from drafts of store lambs, in preference to prime lambs.

As the objective of synthesising models was to develop a basis for discussion with farmers the validity of the assumptions regarding lamb sales/export hogget retention strategies was not considered to be critical to this phase of the study. Similarly, in the absence of information indicating how export hoggets might be managed, it was assumed during modelling that both ewe replacement and export hoggets would be managed to follow the same growth profile.

By this method June became the pivot month in determining export hogget production strategies for each situation modelled. Once skeletal models for each export hogget production system were established, further feed budgets were prepared in order to evaluate monthly feed demands relative to the status quo (pre export hogget) situation. Comparison with the status quo revealed the "feed balances" presented in Section 5.7.

5.3 CATTLE REDUCTION STRATEGIES

Where cattle are farmed, reducing cattle numbers to create surplus capacity on which to winter export hoggets is an alternative to reducing sheep numbers. The method used in the study to adjust cattle numbers was similar in principle to that described for ewe reduction strategies in Section 5.2. However, rather than reducing cattle numbers by a specific proportion and then estimating how many export hoggets could be carried, the reverse approach was used.

For each farm model, the reduction in cattle numbers was calculated to release sufficient feed to winter the number of export hoggets carried in the ewe reduction/average performance strategy (June figures).

Where cattle numbers were reduced, only the average performance level was analysed. The reason for this assumption lies in an understanding of the role of cattle in summer pasture management. During summer cattle are typically used to control pasture quality by being forced to graze pasture which has become rank. Generally, such 'cattle feed', as it is often referred to, is not capable of sustaining high

levels of sheep performance. However, by grazing rank pastures with cattle it is often possible to retain sufficient pasture quality for the pasture to be grazed by sheep. In this manner, cattle grazing management which involves integrating sheep and cattle (mixed grazing), is complementary to sheep performance. Cattle grazing management practices may also be used to benefit internal parasite control of sheep in general, but of lambs in particular. Consequently, reducing cattle numbers appears to be unlikely to benefit sheep performance levels and therefore under cattle reduction strategies in this study, only status quo levels of sheep performance were considered.

Combination strategies, where varying proportions of ewes and cattle numbers are reduced, are possible in practice. It was not considered necessary to examine such strategies in this study as the outcomes would be somewhere between the all-ewe and the all-cattle reduction strategies.

5.4 CULL TWO-TOOTH SALE STRATEGIES

This export hogget strategy refers to a situation in which farmers could elect to sell surplus ewe hogget replacements on an export hogget schedule (earlier in the season) rather than carrying hoggets through to two-tooth fairs in January/February. This strategy does not require any alteration to existing farming policies other than to bring normal two-tooth sales forward in the season and sell two-tooths on an export schedule rather than through the yards.

This strategy was included only after the phase of interactive discussions with farmers (refer to Chapter Seven) when it became apparent that many of the farmers interviewed indicated that if a "profitable" export hogget schedule did exist they would use this market outlet to sell surplus breeding stock before summer.

5.5 MISCELLANEOUS PRODUCTION (MODELLING) ASSUMPTIONS

During the systems synthesis stage of modelling, some production assumptions not previously discussed were included in the feed budgeting models.

5.5.1 Sale of Cull Two-Tooths as Export Hoggets

A basic premise assumed during the synthesis stage of the study was that it is both 'profitable' and 'feasible' to produce export hogget. Therefore it is logical that farmers adopting either ewe reduction or cattle reduction strategies (as outlined in Sections 5.2 and 5.3) would also include the sale of "two-tooths" on to an export hogget market (as outlined in Section 5.4) as part of an overall whole farm export hogget production system.

Consequently, in the models synthesised for ewe and cattle reduction strategies 75% of those two tooth-ewes which would normally have been sold as 'culls' in January/February, were sold as export hoggets in mid-November. As a result, all models contain two sources of export hoggets. Firstly, there are those lambs specifically retained for export hoggets, and secondly, there are 75% of cull two-tooths. The figure of 75% was chosen arbitrarily, based on the consideration that farmers may wish to retain some additional culling margin until later in the season. This assumption later proved to be incorrect, as farmers indicated that if a 'profitable' export schedule were to exist they would consider selling all surplus breeding stock on to an export schedule in mid-November. (refer to Chapter Eight).

5.5.2 Lambing Percentage

Lambing percentage figures supplied by Farm Advisory Officers for each farm monitoring model are based on survival to sale, but also include an allowance for wether lambs to be retained as killers. Consequently, the sum of the number of lambs sold, plus ewe replacements retained, is less than the lambing percentage figures

would indicate. In the feed budgets presented, these wether lambs retained as killers, are included with the rams. For simplicity, the total June ram/killer figure was not altered seasonally to allow for deaths as the number was small and information on the timing of slaughter (death) was not available. Killer losses are, however included in the death figures in the stock reconciliations presented.

5.5.3 Amalgamation of Lamb Feeding Mobs

In the models presented for the Manawatu/Taihape Hill and Hawkes Bay/Wairarapa Harder Hill mobs, of prime and store lambs sold in the same month were amalgamated into "feeding mobs" in order to reduce the total number of stock classes in the feed budgets to a maximum of ten. This procedure was required as the feed budgeting programme used in the study only had facilities to handle up to ten categories of stock.

Where amalgamation was required, appropriate changes were made in both the pre and post export hogget situations, and in both instances all lambs in a "feeding mob" were assumed to be fed according to the requirements for prime lambs. Final store lamb weights were not altered however.

5.6 SPECIFIC FARM MONITORING MODELS

In this section the feed requirement detail used in the feed budgets for the status quo and export hogget production systems for each farm monitoring model type are presented.

In each model, lamb feed requirements were based on an average straight line growth rate from weaning to slaughter for each sale mob. Livestock performance/feed requirement relationships and data sources were discussed previously in Secton 4.3. Details of lamb sale policies, including sale weights are presented.

Liveweight profiles and associated feed requirements for replacement ewe lambs and export hoggets were taken to be the same for the period from weaning to mid-November (when export hoggets are slaughtered). Hogget liveweight profiles and feed requirement tables are presented for average and medium performance levels for each model. Monthly whole flock ewe feed requirements based on specified tupping weights and lambing percentages, are presented for average and medium performance levels for each model. Cattle feed requirements based on average performance levels, are included in each feed balance.

5.6.1 Manawatu Small Hill

This model represents a more intensive regional variation of the Hill Country North Island (Class 4) sheep farming system. Farms of this type are located on the easier hill country mainly to the north of Palmerston North in the Pohangina and Kiwitea counties. Sheep breeds are typically Romney and Coopworth with either Angus or Angus - Hereford cross cattle.

(a) Production Details

Brief production details are presented in Table 5.1.1. For additional detail refer to Appendix Three (Stock Reconciliations) and Appendix Four (Feed Budgets).

(b) Ewe Feed Requirements

Ewe feed requirements, incorporating allowance for the differing feed requirements of ewes in the flocks according to the proportions of ewes which are twin bearing, single bearing or dry at the tupping weights given, are presented in Table 5.1.2.

(c) Ewe Lamb/Hogget Growth Profiles and Feed Requirements

Growth profiles and associated feed requirements for ewe lambs up to two-tooth mating, and export hoggets up to slaughter, are given in Table 5.1.3.

(d) Lamb Growth Profiles and Feed Requirements

Growth profiles, and associated feed requirements for each lamb sale mob are given in Table 5.1.4.

TABLE 5.1.1 Manawatu Small Hill:- Production Details

		Average Performance	Medium Performance
Ewe tupping weight (kg LW)		53.0	57.0
Lambing Percentage		103	108
Lambing date		September	September
Weaning date		December	December
	Month	kg CW	kg CW
Lamb sales	December	12.5	12.9
(all prime)	January	12.85	13.4
	February	13.0	13.6
	April	13.0	13.4
Ewe sales	October	21.6	22.0
	February	23.4	23.85
2-tooth sales	February	21.5	21.6

		Shearing Date	Wool Weight (kg)	Wool Weight (kg)
Wool :	Ewes	December	4.6	4.75
	2-tooths	January	3.2	3.3
	Lambs	March	1.0	1.05
	Hoggets	October	2.7	2.8
Cattle : Purchases		September) October)	R 1 Yr Steers	R 1 Yr Steers
Cattle : Sales		November) January) February)	R 2 Yr Steers	R 2 Yr Steers

TABLE 5.1.2 Manawatu Small Hill:- Whole Flock Feed Requirements[1]

(kg DM/head/day - at 10.8 MJ ME/kg DM)[2]

	Month											
Performance Level	Shear Dec Wean	Jan	Feb	Mar Flush	Apr	June	July	Crutch Aug	Sept Lamb	Oct	Nov	Dec
Average	1.5	1.05	1.14	1.35	1.5	1.4	0.98	0.96	1.15	1.6	1.86	2.48
Medium	1.54	1.09	1.18	1.4	1.6	1.43	1.02	1.0	1.18	1.7	1.96	2.64

Note (1) Incorporating the proportion of twin bearing ewes, single bearing ewes, and barren ewes - see Table 4.3.

(2) See Section 4.2

TABLE 5.1.3 Manawatu Small Hill:- Replacement and Export Hogget Growth Profiles (grams liveweight gain/day and Feed Requirements (kg DM/head/day - at 10.8 MJ ME/kg DM)(1)

Weaning Weight (kg)	Average Performance 20.5 kg LW		Medium Performance(3) 21.5 kg LW	
Month	Growth Profile(2) (g/day)	Feed Requirement (kg DM/head/day)	Growth Profile(2) (g/day)	Feed Requirement (kg DM/head/day)
December	175/175	1.22	155/155	1.17
January	155/90	1.24	125/95	1.19
February (shear x 1.1)	60/60	1.23	90/90	1.41
March	60/65	1.12	80/80	1.24
April	65/65	1.09	75/75	1.18
May	65/65	1.14	30/30	0.99
June	30/30	0.98	20/20	0.99
July	30/10	0.93	20/20	0.94
August	10/10	0.88	20/20	0.95
September	10/10	0.88	25/50	1.05
October (shear x 1.2)	10/120	1.43	75/80	1.58
November	120/120	1.6	80/80	1.41
December	120/45	1.47	85/80	1.49
January	45/45	1.37	55/55	1.46
February	55/55	1.59	60/60	1.67
March (shear x 1.1)	60/60	1.76	60/60	1.8
Export Hogget Slaughter Weight (CW)	19.3 kg CW		20.0 kg CW	
Tupping Weight (as a two-tooth)	51.9 kg LW		53.4 kg LW	

Note: (1) LWG figures given in half monthly periods (15 days).

(2) See Section 4.2

(3) The Manawatu Small Hill model differs in that actual hogget liveweight profiles from survey data were used in the 'average' situation (B. Withell pers. comm.) and MAF 'desirable liveweight' profile for the medium performance situation. As a consequence, the liveweight profile for the medium performance level is not simply a proportion of the liveweight profile for the average performance level.

TABLE 5.1.4 Manawatu Small Hill:- Lamb Growth Profiles (LWG in grams/day) and Feed Requirements (kg DM/head/day - - at 10.8 MJME/kg DM)[1]

	Average Performance			Medium Performance		
	Weaning Weight	LWG[2]	kg DM/head/day	Weaning Weight	LWG[2]	kg DM/head/day
Mob 1:	22.0kg			23.0kg		
December		144/144	1.14		139/139	1.15
Mob 2:	20.05kg			21.05kg		
December		146/146	1.02		161/160	1.18
January		145/0[3]	1.28		160/0	1.38
Mob 3:	20.05kg			21.0kg		
December		92/92	0.89		102/102	0.94
January		92/91	1.02		102/101	1.09
February		91/0	1.16		101/0	1.26
Mob 4:	18.0kg			19.0kg		
December		70/70	0.74		69/69	0.76
January		70/69	0.84		69/68	0.86
February (shear x 1.1)		69/69	1.06		68/68	1.09
March		69/69	0.97		68/68	0.99
April		69/0	0.94		68/0	0.96

Note: (1) See Section 4.2

5.6.2 Hawkes Bay/Wairarapa Easier Hill

This model represents East Coast hill country farms typical of the better class of Hill Country North Island (Class 4) farms. Farms of this type are located on easy/good hill country on the east coast south of Wairoa. This model represents farms in the upper level of the performance range due mainly to greater summer rainfall. Sheep breeds may be Romney, Coopworth or Perendale, and cattle breeds either Angus, Hereford or Hereford-Angus cross.

(a) Production Details

Brief production details are presented in Table 5.2.1. For additional detail refer to Appendix Three (Stock Reconciliations) and Appendix Four (Feed Budgets).

(b) Ewe Feed Requirements

Ewe feed requirements incorporating allowance for the differing feed requirements of ewes in the flock according to the proportions of ewes which are twin bearing, single bearing or dry at the tupping weights given, are presented in Table 5.2.2.

(c) Ewe Lamb and Hogget Growth Profiles and Feed Requirements

Growth profiles and associated feed requirements for ewe lambs up to two-tooth mating, and export hoggets up to slaughter, are given in Table 5.2.3.

(d) Lamb Growth Profiles and Feed Requirements

Growth profiles and associated feed requirements for each lamb sale mob are given in Table 5.2.4.

TABLE 5.2.1 Hawkes Bay/Wairarapa Easier Hill: - Production Details

		Average Performance	Medium Performance
Ewe Tupping weight (kg LW)		53.0	55.0
Lambing Percentage		98%	102%
Lambing Date		September	September
Weaning Date		December	December
	Month	kg CW	kg CW
Lamb Sales	December	13.0	13.7
	January	15.0	15.5
	February	14.0	14.5
	April	14.0	14.5
	June	14.0	None sold (1)
Ewe Sales	November	22.5	23.4
	February	20.5	21.6
	April	18.5	18.9
2-tooth Sales	January	23.75	24.3
	Shearing Date	Wool Weight (kg)	Wool Weight (kg)
Wool : Ewes	December	4.5	4.65
2-tooths	March	2.6	2.7
Lambs	January	1.0	1.1
Hogget	October	3.0	3.1
Cattle Purchases	March)	Weaners	Weaners
	April)		
Cattle Sales	January)		
	March)	2/3 Yr Steers	2/3 Yr Steers
	May)		

Note: (1) In an export hogget production system

TABLE 5.2.2 Hawkes Bay/Wairarapa Easier Hill:- Whole Flock Fed Requirements[1]

(kg DM/head/day - at 10.8 MJ ME/kg DM)[2]

	Month											
Performance Level	Shear Dec Wean	Jan	Feb	Mar	Apr	June	July	Crutch Aug	Sept Lamb	Oct	Nov	Dec
Average	1.52	1.05	1.14	1.35	1.5	1.39	0.98	0.96	1.15	1.56	1.79	2.4
Medium	1.58	1.09	1.18	1.39	1.56	1.43	1.02	1.0	1.18	1.65	1.96	2.72

Note: (1) Incorporating the proportions of twin bearing ewes, single bearing ewes and barren ewes - see Section 4.3.

(2) See Section 4.2

TABLE 5.2.3 Hawkes Bay/Wairarapa Easier Hill:- Replacement and Export Hogget Growth Profiles (grams liveweight gain/day) and Feed Requirements (kg DM/head/day at 10.8 MJ ME/kg DM)(1)

	Average Performance		Medium Performance	
Weaning Weight (kg)	22.0 kg		22.5 kg	
Month	Growth Profile (g LWG/day)(2)	Feed Requirement (kg DM/head/day)	Growth Profile (g LWG/day)(2)	Feed Requirement (kg DM/head/day)
December	150/150	1.17	170/170	1.27
January	150/150	1.39	170/170	1.53
February (shear x 1.1)	83/83	1.42	85/85	1.49
March	83/83	1.29	85/85	1.36
April	65/65	1.17	70/70	1.24
May	30/10	0.96	35/10	1.01
June	10/10	0.90	10/10	0.934
July	10/10	0.89	10/10	0.92
August	10/35	0.96	10/35	1.0
September	55/60	1.16	55/70	1.24
October (shear x 1.2)	60/56	1.45	65/70	1.59
November	56/56	1.26	67/67	1.39
December	50/50	1.26	60/50	1.36
January	50/50	1.39	50/50	1.46
February	50/50	1.54	50/50	1.62
March (shear x 1.1)	50/50	1.64	50/50	1.74
Export Hogget Slaughter Weight (CW)	19.9 kg CW		20.0 kg CW	
Tupping Weight (as a two-tooth LW)	50.9 kg LW		53.9 kg LW	

Note: (1) See Section 4.2

(2) In 15 day periods

TABLE 5.2.4 Hawkes Bay/Wairarapa Easier Hill:- Lamb Growth Profiles (LWG in grams/day) and Feed Requirements (kg DM/head/day - at 10.8 ME ME/kg DM)(1)

		Average Performance			Medium Performance		
		Weaning Weight	LWG(2)	kg DM/head/day	Weaning Weight	LWG(2)	kg DM/head/day
Mob 1:	December	23.0kg	146/146	1.18	24.0kg	147/146	1.21
Mob 2:	December	22.0kg	160/160	1.21	22.5kg	169/169	1.26
	January		159/159	1.45		168/168	1.52
Mob 3:	December	22.0kg	83/83	0.89	22.5kg	90/89	0.93
	January		83/83	1.01		89/89	1.06
	February		83/83	1.17		89/89	1.23
Mob 4:	December	22.0kg	56/56	0.78	22.5kg	60/60	0.81
	January		50/50	0.87		60/60	0.91
	February (shear x 1.1)		55/55	1/08		59/59	1.13
	March		55/55	0.94		59/59	1.02
	April		55/0(3)	0.94		59/0(3)	0.98
Mob 5:	December	21.0kg	47/47	0.72	None Sold(4)		
	January		47/47	0.80			
	February (shear x 1.1)		47/47	0.99			
	March		47/47	0.89			
	April		47/47	0.86			
	May		47/47	0.89			

Note: (1) See Section 4.2
(2) In 15 day periods
(3) Sold mid month

5.6.3 Manawatu/Taihape Hill

This model represents west coast and central North Island hill country farms typical of Hill Country North Island (Class 4) farms. Farms of this type are located on moderate hill country to the north and north-east of the Manawatu Province, and in the hill country of the Taihape region. It does not include farms on the more difficult Wanganui and Ohakune areas. Sheep breeds are mainly Romney and Perendale and cattle breeds are either Angus, Hereford or Hereford-Angus cross.

(a) Production Details

Brief production details are presented in Table 5.3.1. For additional detail refer to Appendix Three (Stock Reconciliations) and Appendix Four (Feed Budgets).

(b) Ewe Feed Requirements

Ewe feed requirements incorporating allowance for the differing feed requirements of ewes in the flock according to the proportions of ewes which are twin bearing, single bearing or dry at the tupping weights given, are presented in Table 5.3.2.

(c) Ewe/Hogget Growth Profiles and Feed Requirements

Growth profiles and associated feed requirements for ewe lambs up to two-tooth mating, and export hoggets up to slaughter, are given in Table 5.3.3.

(d) Lamb Growth Profiles and Feed Requirements

Growth profiles and associated feed requirements for lamb feeding mobs are given in Table 5.3.4.

TABLE 5.3.1 Manawatu/Taihape Hill:- Production Details

		Average Performance	Medium Performance
Ewe Tupping weight (kg LW)		53.0	56.0
Lambing Percentage		95%	100%
Lambing Date		September	September
Weaning Date		December	December
	Month	kg CW	kg CW
Lamb Sales (a) prime	January	12.8	13.2
(70%)	February	13.3	13.6
	March	12.9	13.4
(b) store	February	12.0	12.25
(30%)	March	12.2	None sold(1)
	April	11.0	None sold
Ewe Sales	December	21.6	22.1
	January	22.5	22.5
2-tooth Sales	February	20.75	21.6
	Shearing Date	Wool Weight (kg)	Wool Weight (kg)
Wool : Ewes	December	4.2	4.3
2-tooths	March	2.75	2.8
Lambs	January	0.85	0.85
Hogget	October	2.5	2.6
Cattle: Purchases	March) April)	Weaner Steers	Weaner Steers
Cattle: Sales	February) March)	18 Month Steers	18 Month Steers
	February) March) April)	2½ Yr Steers	2½ Yr Steers

Note: (1) In an export hogget production system

TABLE 5.3.2 Manawatu/Taihape Hill:- Whole Flock Feed Requirements[1]

(kg DM/head/day - at 10.8 MJ ME/kg DM)[2]

Performance Level	Month											
	Shear Dec Wean	Jan	Feb	Mar Flush	Apr	May	June	July	Crutch Aug	Sept Lamb	Oct	Nov
Average	1.47	1.05	1.14	1.35	1.5	1.4	1.0	0.98	1.05	1.6	1.78	2.41
Medium	1.56	1.1	1.2	1.42	1.6	1.44	1.03	1.0	1.19	1.64	1.95	2.63

Note: (1) Incorporating the proportions of twin bearing ewes, single bearing ewes and barren ewes - see Section 4.3.

(2) See Section 4.2

TABLE 5.3.3 Manawatu/Taihape Hill : Replacement and Export Hogget Growth Profiles (grams liveweight gain/day) and Feed Requirements (kg DM/head/day at 10.8 ME ME/kg DM)(1)

Weaning Weight (kg)	Average Performance 20.5 kg		Medium Performance 21.5 kg	
Month	Growth Profile(2) (g LWG/day)	Feed Requirement (kg DM/head/day)	Growth Profile(2) (g LWG/day)	Feed Requirement (kg DM/head/day)
December	160/160	1.16	160/160	1.19
January	160/50	1.26	160/50	1.29
February (shear x 1.1)	50/50	1.04	50/50	1.06
March	48/48	1.01	60/75	1.14
April	48/48	0.91	70/70	1.12
May	35/35	0.93	40/35	1.0
June	35/35	0.93	35/35	0.99
July	35/35	0.94	35/35	0.99
August	35/35	0.96	35/35	1.01
September	35/35	0.97	35/45	1.05
October (shear x 1.2)	35/37	1.21	45/75	1.44
November	77/77	1.28	80/80	1.39
December	77/77	1.34	80/80	1.45
January	77/77	1.49	70/70	1.55
February	75/75	1.67	75/75	1.78
March (shear x 1.1)	80/80	1.86	80/80	1.98
Export Hogget Slaughter Weight (CW)	18.0 kg CW		19.6 kg CW	
Tupping Weight (as a two-tooth LW)	50.4 kg LW		53.9 kg LW	

Note: (1) See Section 4.2
(2) In 15 day periods

TABLE 5.3.4 Manawatu/Taihape Hill:- Lamb Growth Profiles (LWG in grams/day) and Feed Requirements (kg DM/head/day - at 10.8 MJ ME/kg DM)(1)

		Average Performance			Medium Performance		
		Weaning Weight	LWG(2)	kg DM/head/day	Weaning Weight	LWG(2)	kg DM/head/day
Mob 1:	December	22.5kg	74/74	0.86	23.0kg	80/80	0.9
	January		74/75	0.98		80/79	1.02
Mob 2:	December	20.5kg	84/84	0.85	21.0kg	85/85	0.87
	January (shear x 1.1)		83/83	1.07		85/84	1.09
	February		83/83	1.13		84/84	1.15
Mob 3:	December	20.5kg	56/56	0.74	21.0kg	60/60	0.77
	January (shear x 1.1)		56/56	0.92		60/60	0.87
	February		55/55	0.94		60/60	0.99
	March		55/55	0.94		60/61	0.99
Mob 4:	December	18.0kg	49/49	0.66	None sold(3)		
	January (shear x 1.1)		49/48	0.81			
	February		48/48	0.84			
	March		48/48	0.83			
	April		48/48	0.80			

Note: (1) See Section 4.2

(2) In 15 day periods

(3) In an export hogget production system

5.6.4 Hawkes Bay/Wairarapa Harder Hill

This model represents east coast farms of the Hill Country North Island (Class 4) category. Farms of this model type are generally located south of Wairoa to South Wairarapa. Farms of this type represent the more difficult farms at the lower end of the performance range of the Hill Country North Island Class. Sheep breeds are mainly Romney and Perendale, and cattle breeds are either Angus or Hereford.

(a) Production Details

Brief production details are presented in Table 5.4.1. For additional detail refer to Appendix Three (Stock Reconciliations) and Appendix Four (Feed Budgets).

(b) Ewe Feed Requirements

Ewe feed requirements incorporating allowance for the differing feed requirements of ewes in the flock according to the proportions of ewes which are twin bearing, single bearing or dry at the tupping weights given, are presented in Table 5.4.2

(c) Ewe Lamb/Hogget Growth Profiles

Growth profiles and associated feed requirements for ewe lambs up to two-tooth mating, and export hoggets up to slaughter, are given in Table 5.4.3.

(d) Lamb Growth Profiles and Feed Requirements

Growth profiles and associated feed requirements for each lamb feeding mob, are given in Table 5.4.4.

TABLE 5.4.1 Hawkes Bay/Wairarapa Harder Hill : Production Details

			Average Performance	Medium Performance
Ewe Tupping weight (kg LW)			50.0	53.0
Lambing Percentage			90%	94%
Lambing Date			late Aug/Sept	late Aug/Sep
Weaning Date			late Nov/Dec	late Nov/Dec
		Month	kg CW	kg CW
Lamb Sales (a)	Prime	December	12.0	12.5
	(50%)	January	12.0	12.5
		February	12.0	12.5
		March	11.5	12.3
		April	12.0	12.4
	(b) Store	December	9.3	9.6
	(50%)	March	10.3	10.6
Ewe Sales		January	20.75	21.4
		February	20.5	22.6
2-tooth Sales		December	20.5	22.1
		Shearing Date	Wool Weight (kg)	Wool Weight (kg)
Wool :	Ewes	December	4.1	4.25
	2-tooths	March	2.5	2.6
	Lambs	January	1.0	1.05
	Hogget	October	2.8	2.9
Cattle -	Calving date		mid August	mid August
	Weaning date		mid April	mid April
Cattle Sales		2/3 Yr Heifers	late April	late April
		1/2 Yr Heifers	late May	late May
		Weaner Heifers	mid April	mid April
		Weaner Steers	late April	late April
		Fat Cows	late April	late April

TABLE 5.4.2 Hawkes Bay/Wairarapa Harder Hill:- Whole Flock Requirements(1)

(kg DM/head/day - at 10.8 MJ ME/kg DM)(2)

	Month											
Performance Level	Shear Dec	Jan	Feb	Mar	Apr	May	June	July	Crutch Aug	Sept	Oct	Nov
			Flush							lamb		wean
Average	1.46	1.0	1.1	1.34	1.4	1.3	0.92	0.91	1.05	1.54	1.8	2.3
Medium	1.53	1.05	1.14	1.42	1.49	1.34	0.98	0.96	1.13	1.66	1.97	2.56

Note: (1) Incorporating the proportions of twin bearing ewes, single bearing ewes and barren ewes - see Section 4.3

(2) See Section 4.2

TABLE 5.4.3 Hawkes Bay/Wairarapa Harder Hill:- Replacement and Export Hogget Growth Profiles (grams liveweight gain/day) and Feed Requirements (kg DM/head/day at 10.8 MJ ME/kg DM)[1]

Weaning Weight (kg)	Average Performance 20.5 kg		Medium Performance 21.5 kg	
Month	Growth Profile[2] (g LWG/day)	Feed Requirement (kg DM/head/day)	Growth Profile[2] (g LWG/day)	Feed Requirement (kg DM/head/day)
December	145/145	1.06	160/160	1.15
January (shear x 1.1)	135/125	1.32	155/150	1.48
February	50/50	1.01	50/50	1.06
March	50/50	0.99	50/50	1.05
April	66/60	1.02	66/60	1.07
May	11/11	0.81	16/16	0.87
June	11/11	0.80	16/16	0.86
July	11/11	0.79	16/16	0.86
August	16/30	0.85	16/30	0.90
September	50/90	1.09	50/100	1.17
October (shear x 1.2)	90/90	1.51	100/100	1.70
November	90/75	1.31	110/90	1.50
December	65/42	1.20	65/42	1.29
January	40/40	1.23	40/40	1.32
February	40/40	1.36	40/40	1.49
March (shear x 1.1)	40/40	1.53	40/40	1.64
Export Hogget Slaughter Weight (CW)	19.0 kg CW		20.6 kg CW	
Tupping Weight (as a two-tooth LW)	46.6 kg LW		50.5 kg LW	

Note: (1) See Section 4.2
(2) In 15 day periods

TABLE 5.4.4 Hawkes Bay/Wairarapa Harder Hill:- Lamb Growth Profiles (LWG in grams/day) and Feed Requirements (kg DM/head/day - at 10.8 MJ ME/kg DM)[1]

		Average Performance			Medium Performance		
		Weaning Weight	LWG[2]	kg DM/head/day	Weaning Weight	LWG[2]	kg DM/head/day
Mob 1:	December	20.5kg	159/159	1.16	21.0kg	177/177	1.25
Mob 2:	December	20.0kg	117/117	0.97	20.5kg	129/129	1.03
	January (shear x 1.1)		117/0	1.06		129/0	1.12
Mob 3:	December	19.0kg	84/84	0.82	19.5kg	91/91	0.86
	January (shear x 1.1)		83/83	0.97		90/90	1.02
	February		83/0	1.06		90/0	1.12
Mob 4:	December	19.0kg	49/49	0.68	19.5kg	61/61	0.74
	January (shear x 1.1)		50/50	0.80		61/61	0.87
	February		49/49	0.87		60/60	0.95
	March		49/0	0.86		60/0	0.94
Mob 5:	December	18.0kg	53/53	0.67	18.5kg	56/56	0.695
	January (shear x 1.1)		54/54	0.79		56/56	0.81
	February		54/54	0.87		57/57	0.898
	March		53/53	0.86		56/56	0.89
	April		53/0	0.82		56/0	0.86
Mob 6:	December	18.0kg	53/53	0.67	18.5kg	67/67	0.74

Note: (1) See Section 4.2

(2) In 15 day periods

5.6.5 Taihape/Wanganui North Island Hard Hill

This model represents farms of the west coast of the North Island in the category of Hard Hill Country, North Island (Class 3). Farms of this type are the most extensive sheep farming systems considered in this study. Sheep breeds are mainly Romney and Perendale, and cattle mainly Angus and Hereford. All stock in this model are sold store.

(a) Production Details

Brief production details are presented in Table 5.5.1. For additional detail refer to Appendix Three (Stock Reconciliations) and Appendix Four (Feed Budgets).

(b) Ewe Feed Requirements

Ewe feed requirements incorporating allowance for the differing feed requirements of ewes in the flocks according to the proportions of ewes which are twin bearing, single bearing or dry at the tupping weights given, are presented in Table 5.5.2

(c) Ewe Lamb/Hogget Growth Profiles

Growth profiles and associated feed requirements for ewe lambs up to two-tooth mating, and export hoggets up to slaughter, are given in Table 5.5.3.

(d) Lamb Growth Profiles and Feed Requirements

Growth profiles and associated feed requirements for each lamb feeding mob, are given in Table 5.5.4.

TABLE 5.5.1 Taihape/Wanganui North Island Hard Hill : Production Details

		Average Performance	Medium Performance
Ewe Tupping weight (kg LW)		50.0	53.0
Lambing Percentage		80%	83%
Lambing Date		September	September
Weaning Date		December	December
	Month	kg CW	kg CW
Lamb Sales (all store)	January	11.3	11.8
	February	11.05	11.5
	March	11.5	11.8
	April	11.24	None sold(1)
Ewe Sales	September	19.3	19.6
	January	20.0	20.7
2-tooth Sales	March	18.5	18.9
	Shearing Date	Wool Weight (kg)	Wool Weight (kg)
Wool : Ewes	December	4.0	4.15
2-tooths	March	2.4	2.5
Lambs	January	0.65	0.66
Hogget	October	2.0	2.1
Cattle - Calving date		mid September	mid September
Weaning date		mid March	mid September
Cattle Sales	Cull cows	March	March
	Weaners (M/S)	late March	late March
	18 Month Steers	mid April	mid April
	2 Yr Heifers	April	April

Note: (1) In an export hogget production system.

TABLE 5.5.2 Taihape/Wanganui North Island Hard Hill:- Whole Flock Feed Requirements[1]

(kg DM/head/day - at 10.8 MJ ME/kg DM)[2]

Performance Level	Month											
	Shear Dec Wean	Jan	Feb	Mar Flush	Apr	May	June	July	Crutch Aug	Sept Lamb	Oct	Nov
Average	1.45	1.0	1.09	1.31	1.46	1.35	0.94	0.92	1.01	1.48	1.67	2.27
Medium	1.51	1.04	1.13	1.35	1.5	1.39	0.99	0.95	1.09	1.58	1.8	2.43

Note: (1) Incorporating the proportions of twin bearing ewes, single bearing ewes, and barren ewes - see Section 4.3.

(2) See Section 4.2

TABLE 5.5.3 Taihape/Wanganui North Island Hard Hill:- Replacement and Export Hogget Growth Profiles (grams liveweight gain/day) and Feed Requirements (kg DM/head/day at 10.8 MJ ME/kg DM)(1)

Weaning Weight (kg)	Average Performance 20.0 kg		Medium Performance 20.5 kg	
Month	Growth Profile(2) (g LWG/day)	Feed Requirement (kg DM/head/day)	Growth Profile(2) (g LWG/day)	Feed Requirement (kg DM/head/day)
December	85/85	0.84	85/85	0.86
January	82/82	0.96	85/85	0.98
February (shear x 1.1)	58/58	1.09	60/60	1.11
March	54/54	0.97	55/55	0.99
April	50/50	0.91	55/50	0.94
May	50/50	0.95	50/50	0.96
June	35/20	0.86	35/20	0.87
July	20/20	0.82	20/20	0.83
August	20/20	0.83	20/20	0.85
September	20/20	0.84	20/25	0.86
October (shear x 1.2)	50/50	1.2	50/60	1.25
November	50/50	1.05	60/60	1.13
December	80/80	1.40	85/80	1.46
January	80/80	1.40	85/80	1.46
February	55/55	1.42	55/60	1.47
March (shear x 1.1)	50/50	1.49	55/55	1.57
Export Hogget Slaughter Weight (CW) (mid November)		16.3 kg CW		16.8 kg CW
Tupping Weight (as a two-tooth, LW)		46.0 kg LW		46.7 kg LW

Note: (1) See Section 4.2
(2) In 15 day periods

TABLE 5.5.4 Taihape/Wanganui North Island Hard Hill:- Lamb Growth Profiles (LWG in grams/day) and Feed Requirements (kg DM/head/day - at 10.8 MJ ME/kg DM)(1)

		Average Performance			Medium Performance		
		Weaning Weight	LWG(2)	kg DM/head/day	Weaning Weight	LWG(2)	kg DM/head/day
Mob 1:	December	20.5kg	110/109	0.96	21.0kg	128/128	1.04
Mob 2:	December	20.0kg	55/55	0.73	20.25kg	66/66	0.78
	January		54/54	0.81		66/66	0.88
Mob 3:	December	19.5kg	53/53	0.71	19.75kg	57/57	0.73
	January (shear x 1.1)		52/52	0.87		57/56	0.9
	February		52/52	0.9		56/56	0.93
Mob 4:	December	19.0kg	39/39	0.64	None sold(3)		
	January (shear x 1.1)		52/52	0.87		57/56	0.9
	February		52/52	0.9		56/56	0.93

Note: (1) See Section 4.2
(2) In 15 day periods
(3) In an exports hogget production system

5.7 FEED BALANCE FINDINGS

The feed balance studies show that where export hogget production strategies are feasible, they may not be compatible with pasture growth profiles in all regions.

The results of the feed balance studies for each export hogget production strategy are shown in Tables 5.6.1, 5.6.2, 5.6.3, 5.6.4, and 5.6.5 respectively.

The figures presented in these tables indicate the percentage amount by which feed demand in export hogget strategies fall short of (shown by a negative figure), or exceed (shown by a positive figure), the status quo feed demand. As no hard data was available to indicate how closely the status quo feed demand matches actual feed supply, positive values may not represent absolute infeasible sets in practice. The smaller figures represent a smaller change from the status quo, and the larger figures represent a larger change.

Despite not providing absolute values, feed balance figures are useful in indicating the likely impact of export hogget production systems on pasture management. The negative figures represent likely problems in pasture quality control as they indicate the percentage by which pasture utilisation is reduced by an export hogget production strategy. Conversely, the positive values represent an infeasible set relative to the status quo, and indicate the percentage by which pasture requirements of an export hogget production system exceeds the pasture requirement of the status quo situation. The positive values result from June not always being the feed limiting month.

The Tables show that most of the positive values are relatively small, which indicates that in practice the feed shortfall may be overcome by feed transfers. However, where the positive figures are larger, particularly in October for medium performance ewe reduction strategies, some other feed management policy may have to be adopted

in situations where the status quo feed demand is tight. Such policies could include the provision of additional feed through improved grazing management, or the use of nitrogen, crop, or hay to overcome the deficit. Conversely, policies which reduce feed demand, such as altered stock feeding and/or sale and purchase policies could be considered.

The feed demand profiles indicate that relative to the status quo situations, export hogget production systems require most feed during winter months when pasture supply is often limited. For this reason, the number of export hoggets which can be retained is limited primarily by June and July feed availability.

In some situations, demand for early spring feed in September and October may also be limiting to export hogget production systems. This is particularly noticeable as performance levels increase resulting in higher early spring feed requirements of both ewes and hoggets. Under these conditions of higher performance levels, the monthly spring feed demand of export hogget production systems may exceed the comparative status quo feed demand. Although there is opportunity to reduce export hogget feed demand during spring, to avoid reducing feed supply to ewes and lambs, this would reduce export hogget slaughter weights. Chapter Six shows that the profitability of export hogget production is significantly influenced by final hogget slaughter weights. Under such conditions there could be direct conflict for spring feed between ewes and lambs, and export hoggets.

Similarly, there may be situations under export hogget production systems in which feed demand for some autumn months can be tight relative to the status quo. However, in practice inter-month feed transfers would be possible, and it is therefore considered unlikely that inadequate autumn feed would be a serious limitation to export hogget production.

TABLE 5.6.1 Manawatu Small Hill:- Feed Demand Profiles

	Status Quo	Export Hogget Production Strategies			
		Ewe Reduction		Cattle Reduction	Surplus 2-Tooth Sale
	(kg DM/Day)	Average Performance	Medium Performance	Average Performance	
		% Change	% Change	% Change	% Change
December	5375.95	- 8.7	- 6.5	- 5.1	-2.5
January	4493.38	- 8.6	- 5.7	- 7.3	-2.8
February	4031.33	- 7.5	- 1.4	- 7.6	N/A(1)
March	3928.99	- 7.9	- 3.7	- 6.3	N/A
April	3720.5	- 5.1	- 0.32	- 2.5	N/A
May	3403.8	- 1.3	- 5.2	+ 1.12	N/A
June	2597.6	Nil (balance)	Nil (balance)	Nil (balance)	N/A
July	2531.9	+ 0.17	- 0.05	- 0.07	N/A
August	2776.33	- 1.6	- 0.52	- 0.51	N/A
September	3789.77	- 3.1	+ 2.1	- 4.6	N/A
October	4585.38	- 1.5	+ 1.7	- 2.1	N/A
November	5370.7	- 6.4	-5.2	- 4.6	-1.4

Note: (1) No change from status quo

TABLE 5.6.2 Hawkes Bay/Wairarapa Easier Hill :- Feed Demand Profiles

		Export Hogget Production Strategies			
	Status Quo	Ewe Reduction		Cattle Reduction	Surplus 2-Tooth Sale
	(kg DM/Day)	Average Performance	Medium Performance	Average Performance	
		% Change	% Change	% Change	% Change
December	8401.21	- 10.1	- 7.3	- 8.9	-5.3
January	7227.96	- 5.0	- 0.66	- 5.9	N/A(1)
February	6927.16	- 6.2	- 2.7	- 5.1	N/A
March	6650.36	- 6.2	- 3.2	- 5.0	N/A
April	6659.74	- 5.7	- 3.6	- 5.1	N/A
May	5655.27	- 5.4	- 5.3	- 6.0	N/A
June	4035.35	Nil (balance)	Nil (balance)	Nil (balance)	N/A
July	3981.0	Nil	Nil	- 0.28	N/A
August	4501.59	- 0.61	- 1.1	- 0.15	N/A
September	5619.21	- 1.3	+ 0.88	+ 1.29	N/A
October	6495.15	- 0.68	+ 4.06	+ 1.81	N/A
November	7712.54	- 7.57	- 1.1	- 5.5	-2.9

Note: (1) No change from status quo

TABLE 5.6.3 Manawatu/Taihape Hill :- Feed Demand Profiles

		Export Hogget Production Strategies			
	Status Quo	Ewe Reduction		Cattle Reduction	Surplus 2-Tooth Sale
	(kg DM/Day)	Average Performance	Medium Performance	Average Performance	
		% Change	% Change	% Change	% Change
December	7195.05	- 10.0	- 5.1	- 7.8	-4.1
January	6731.4	- 10.8	- 6.9	- 8.8	-4.9
February	5816.5	- 8.4	- 4.5	- 7.2	N/A(1)
March	5589.95	- 5.9	- 2.2	- 5.9	N/A
April	5288.44	- 3.9	+ 1.87	- 4.2	N/A
May	4775.27	- 2.0	- 1.4	- 0.18	N/A
June	3786.7	Nil (balance)	Nil (balance)	Nil (balance)	N/A
July	3714.24	+ 0.18	- 0.67	Nil	N/A
August	4178.4	- 5.7	- 0.45	- 1.0	N/A
September	5281.85	- 2.4	- 1.76	- 1.5	N/A
October	5946.96	- 1.8	+ 5.8	- 0.85	N/A
November	7415.85	- 7.3	- 1.1	- 5.2	-1.9

Note: (1) No change from status quo

TABLE 5.6.4 Hawkes Bay/Wairarapa Harder Hill:- Feed Demand Profiles

		Export Hogget Production Strategies			
	Status Quo	Ewe Reduction		Cattle Reduction	Surplus 2-Tooth Sale
	(kg DM/Day)	Average Performance	Medium Performance	Average Performance	
		% Change	% Change	% Change	% Change
December	11313.65	- 9.7	- 4.9	- 9.4	-5.0
January	8805.3	- 4.4	- 0.29	- 6.3	N/A(1)
February	82818.15	- 6.5	- 3.7	- 9.2	N/A
March	8546.7	- 4.4	- 2.0	- 6.6	N/A
April	7620.95	- 1.4	- 0.78	- 0.26	N/A
May	6644.25	- 2.0	- 3.0	+ 0.43	N/A
June	5366.9	Nil (balance)	Nil (balance)	Nil (balance)	N/A
July	5315.05	Nil	- 0.29	- 0.33	N/A
August	6886.85	- 0.39	- 1.15	- 3.1	N/A
September	8333.79	- 1.1	+ 0.28	- 1.24	N/A
October	9994.31	- 0.05	+ 2.6	- 0.21	N/A
November	11433.11	- 6.9	- 0.38	- 6.3	-2.7

Note: (1) No change from status quo

TABLE 5.6.5 Taihape/Wanganui North Island Hard Hill :- Feed Demand Profiles

		Export Hogget Production Strategies			
	Status Quo	Ewe Reduction		Cattle Reduction	Surplus 2-Tooth Sale
	(kg DM/Day)	Average Performance	Medium Performance	Average Performance	
		% Change	% Change	% Change	% Change
December	6581.7	- 9.1	- 4.9	- 8.8	-1.7
January	5458.25	- 9.4	- 5.5	- 9.9	-2.3
February	5053.5	- 6.6	- 3.98	- 9.3	N/A(1)
March	5029.75	- 4.0	- 4.1	- 6.9	N/A
April	4677.2	- 2.4	- 2.6	+ 0.01	N/A
May	4386.75	- 1.7	- 2.4	+ 1.06	N/A
June	3371.6	Nil (balance)	Nil (balance)	Nil (balance)	N/A
July	3273.85	- 0.37	- 1.5	- 0.38	N/A
August	3665 M6	- 0.58	+ 1.4	- 3.6	N/A
September	4776.9	- 2.6	- 0.26	- 3.5	N/A
October	5561.5	- 1.3	+ 1.4	- 2.4	N/A
November	6842.2	- 6.6	- 2.0	- 6.0	-0.7

Note: (1) No change from status quo

The most obvious effect of export hogget production is a significant under-utilisation of feed supply relative to the status quo. This situation is most pronounced during the summer period once export hoggets have been sold. As would be expected, increasing animal performance levels will increase feed demand and thereby reduce the level of feed under-utilisation. It is also noticeable that cattle reduction strategies appear to result in a better 'fit' between the feed demand of export hogget systems and the status quo feed demand profile.

However, summer feed under-utilisation is likely to be the major pasture management difficulty experienced in export hogget production systems. Inadequate early summer grazing pressure, as is likely in export hogget production systems, results in pastures changing from vegetative to reproductive stages with subsequent reduction to pasture quality and annual production (Sheath, 1982). Neither is desirable if maximal levels of animal performance are to be achieved.

To minimise the impact of summer pasture under-utilisation under export hogget production, two alternatives would appear possible. Firstly, export hoggets could be retained on the property and sold later, at higher weights. While this would have advantages from a pasture management viewpoint, farmer experience with local trade hoggets would suggest that hogget over-fattening may result. While there is inadequte research information to fully confirm this effect on hogget carcase composition, financial analyses discussed in Chapter 6 indicate that export hogget profitability is significantly reduced if hoggets are unsuitable for export. A second alternative would be to integrate alternative stock policies, with an export hogget policy, to utilise and control summer feed. For example, beef policies such as bull-beef, or the purchase of additional spring cattle, could be considered. Unfortunately time did not allow consideration of such policies in this study.

5.8 SIMULATION MODELLING OF WINTER PASTURE MANAGEMENT

Because of the nature of the analysis, feed balance modelling can only investigate the relative feed demands of alternative management strategies. To provide a more detailed understanding of the limiting effect of winter pasture management on export hogget production, simulation modelling was carried out using the 'Grazing Management Package' developed at Massey University for use on the Apple II micro-computer.

This model is used by Massey University staff to plan winter grazing management on Massey University farms. To operate, the grazing management programme requires that the following information is stipulated:

- pasture cover (kg DM/ha) at the beginning of the period for each paddock on the farm;
- pasture growth rates in two-weekly periods (kg DM/ha/day);
- graze-down levels for each class of stock (RDM(1) in kg DM/ha);
- number of stock in each mob, and the daily per head feed requirement (kg DM/head/day); and
- grazing management plan, i.e. the order in which paddocks are to be grazed, and by which mob of stock.

Using this information, the model calculates the following:

- when each mob moves into a paddock and when it comes out of the paddock,ie the rotation lengths;
- the average pasture cover of the whole property, for each day of the stipulated period; and

Note (1) RDM refers to Residual Dry Matter (Milligan, 1981).

- the average pasture cover for each paddock at the end of the grazing period.

Because of the detail required to run the model (viz individual paddock pasture cover, pasture growth rates, and the farm grazing management policy), it was not possible to simulate farm monitoring models. Accordingly, Massey University's "Riverside Farm" which is similar to a Hawkes Bay/Wairarapa Easier Hill farm type was chosen as all the relevant data was readily available (W.J. Parker, pers. comm.).

Using 'Riverside Farm', four situations were simulated:

(a) the existing winter stock policies and grazing management strategy of a long winter rotation (114 days for the main ewe mob)(1)

(b) the existing stock policies on a short winter rotation (40 days)(1)

(c) a ewe reduction average performance export hogget production system, for 'Riverside Farm', on a long winter rotation (106 days); and

(d) the same export hogget system on a short winter rotation (47 days).

Data collected from 'Riverside Farm' during early winter of 1983 was used to validate the model. Once the model was simulating the actual pasture cover measured on Riverside, an export hogget production system similar to the situation for the Hawkes Bay/Wairarapa Easier Hill model was imposed on the simulation model of Riverside. This required reducing ewe numbers and supporting stock by 10% and retaining 22% of the status quo lamb numbers through the winter as export hoggets.

Note (1) The difference in rotation lengths is due to modelling difficulties as the model determines rotation lengths from stock policies and grazing management strategies.

The results of the simulation modelling for the period 21 May to 31 July are presented in Tables 5.7.1 and 5.7.2.

TABLE 5.7.1 'Riverside' Simulation : Average Pasture Cover at 31 July 1983 (kg DM/ha)

Management Systems	Main Mob Rotation Length (days)	Average Pasture Cover (kg DM/ha)
Pre Export Hogget (Status quo):		
(a) Long rotation	114	1311
(b) Short rotation	40	962
Post Export Hogget (Ewe reduction, average performance)		
(a) Long rotation	106	1303
(b) Short rotation	47	995

Table 5.7.1 shows that the average pasture cover over the whole farm in both the pre and post export hogget situations did not vary significantly for either the long or short rotation lengths. This was to be expected, as in all the models presented in this study, the export hogget strategy was selected according to stock feed requirements to maintain the same total feed demand as the status quo.

The main effect shown on average pasture cover in Table 5.7.1 is the result of altering rotation lengths. In both the pre and post export hogget situations, fast rotations reduce average pasture cover relative to slow rotations, by around 25%. Such a decrease in total feed availability could be expected to exaggerate stock feeding

difficulties normally experienced in the periods immediately before lambing and during early early lactation.

The main impact of the export hogget production system under investigation on pasture cover is shown in Table 5.7.2.

TABLE 5.7.2 Pasture Cover Distribution at 31 July 1983 Under Various Management Strategies (expressed as percentage of total farm area)

	Average Pasture Cover on 31 July 1983					
	Percentage Area of Farm with Final Pasture Cover					
Management Strategy	<750 kg DM/ha	751-1000 kg DM/ha	1001-1250 kg DM/ha	1251-1500 kg DM/ha	1501-1750 kg DM/ha	>1750 kg DM/ha
Pre Export Hogget (Status quo)						
(a) Long rotation	9.6%	28.9%	10.6%	13.6%	20.1%	17.2%
(b) Short rotation	25.4%	41.8%	16.4%	13.9%	0.3%	3.1%
Post Export Hogget (Ewe reduction, average performance)						
(a) Long rotation	15.4%	18.6%	9.7%	19.9%	17.5%	18.9%
(b) Short rotation	32.7%	24.6%	7.3%	17.2%	9.3%	8.9%

This table, derived from figures produced by the model for pasture cover on individual paddocks, shows the distribution of the average pasture cover over the farmed area.

Table 5.7.2 shows the benefit that a longer rotation has on individual paddock pasture cover in both the pre and post exort hogget situations. Short rotations result in a larger proportion of the farm with low pasture cover at the end of winter (lambing time). Conversely, the effect of lengthening rotation lengths results in a more even distribution of pasture cover over the farm, benefiting

management when ewes are set stocked prior to lambing (W. J. Parker, pers. comm.).

In the post export hogget situation, both the long and short rotation grazing management strategies, result in more even pasture cover distribution than the corresponding pre export hogget situation. This effect is due to ewe numbers constituting a lower proportion of the total stock wintered in the post export hogget situation. And, as ewes graze to lower post grazing residuals than do hoggets, the result is a smaller proportion of the farm which has been grazed 'hard' by ewes, and a greater proportion which has been grazed more 'laxly' by hoggets. The end result is a more even pasture cover distribution, benefiting both stock and pasture management practices in the late winter/early spring period.

The effect of 'evening out' average pasture cover is most pronounced, relative to the status quo situation, in the post export hogget short rotation, situation. Under this production policy and management strategy combination, 35.4% of the total area has pasture cover in excess of 1250 kg DM/ha, compared with 17.3% in the pre export hogget, fast rotation situation. Similarly, under the slow rotations, the pre export hogget situation results in 50.9% of the farm with pasture cover in excess of 1251 kg DM/ha compared to 56.3% in the post export hogget situation.

These analyses show that winter grazing management under export hogget production systems can convey significant pasture management advantages to the whole farm particularly under 'faster' winter rotations.

5.9 CHAPTER CONCLUSION

This chapter presented the Systems Synthesis stage of the study, and discussed the feed budgeting (feed balance) approach used to develop technically feasible export hogget production systems based on five ASD farm monitoring models for use as the basis for interactive discussions with farmers. For each farm monitoring model, the effects on feed demand relative to the status quo, of four export

hogget production strategies (ewe reduction - average performance, ewe reduction - medium performance, and cattle reduction - average performance and cull two-tooth), were investigated.

The feed balance approach indicated that export hogget production systems are feasible. While the approach served to highlight possible management difficulties associated with the production system, it did not permit an investigation of alternative management strategies (ways to manage the production system). Therefore, advantage was taken of an existing grazing management programme to investigate the effects of fast versus slow winter rotations for simulated pre and post export hogget situations based on a Massey University farm.

Having established technically feasible export hogget production systems as a basis for interactive discussions with farmers, the next stage was to investigate the physical and financial output of these systems to determine relativity to the status quo. The methods by which the physical and financial implications of the export hogget production systems were evaluated, and the sensitivity of export hogget production to various output and price parameters, are discussed in Chapter Six.

CHAPTER SIX

OUTPUT ANALYSIS - FINANCIAL AND PHYSICAL

6.1 INTRODUCTION

This chapter on output analysis presents the last stages of the desk research phase of the study, and describes the methods used to evaluate the financial and physical implications of export hogget production systems relative to the status quo. The chapter also discusses the effects of on-farm management variables and off-farm product price variables on the profitability of export hogget production.

6.2 GROSS MARGINS ANALYSIS

A gross margin is defined as the total income from a particular enterprise less the direct costs of production associated with that enterprise. Therefore, costs such as rates, interest and principal repayments, labour, repairs and maintenance, etc, which are costs common to all enterprises, are excluded (M A F, 1982 b).

The objective of the financial analysis performed in this study was to determine for each export hogget production strategy and each farm model, a break-even schedule price for export hogget meat expressed in cents per kilogram of carcase weight.

The procedure used was first to derive the status quo (pre export hogget) gross margin for each farm monitoring model. Gross margins, excluding export hogget meat returns, were then calculated for each export hogget production strategy. By difference, the required meat schedule price (expressed in c/kg CW) to break-even with the status quo gross margin was derived.

The derived break-even schedule for export hogget allowed for additional returns from hogget pelt and wool. This method calculated for each strategy a direct comparison between returns from traditional production systems in which export lamb returns are assumed to be 149 c/kg CW, and the break-even schedule price required for export hogget meat in c/kg CW.

The figures used in the gross margins analysis were 1982/83 estimates of costs and returns supplied for each of the ASD status quo farm monitoring models by Farm Advisory Officers. However, for prime lamb and wool returns, the author used wool and lamb production estimates supplied by Farm Advisory Officers and the then ruling product prices to derive itemised returns for prime lamb and wool respectively. For prime lamb actual schedule payments for PM grade lamb and pelt and wool payments, were taken from the advertised schedule for the North Island (excluding Auckland) (New Zealand Meat Exporters Schedules). For simplicity it was assumed that no grade of lamb other than PM was produced. This assumption allowed direct comparison of the derived break-even export hogget schedule with lamb sold on a PM grade lamb schedule. It was felt that a direct comparison with one grade of lamb only would allow for a more straight-forward hogget-to-lamb comparison, and therefore benefit interpretation of the break-even export hogget schedule, rather than attempting to include a range of other lamb grades in the comparison. As the PM grade lamb schedule did not alter during the study period, all the export hogget schedules derived can be directly related to lamb schedule of
149 cents per kilogram. In practice however, it would be expected that within any draft of lambs sold on export schedule, some lambs would grade into a number of lower paying grades. The net result of this would be to reduce the break-even schedule required for export hogget.

Wool production was based on per head wool production figures supplied by Farm Advisory Officers for each status quo model. From these production figures wool revenue was derived using average 1982/83 wool prices received for various wool types, net of levies, brokerage and handling fees (G.A. Wickham, pers. comm.). Fleece wool returns are based

on 25% of the total fleece weight being comprised of oddments. All other figures used in the gross margins analyses were taken directly from ASD farm monitoring budget figures for each model. The full set of data used in the gross margins analyses are presented in Appendix Five.

Using a comparative gross margins method, break-even export hogget schedules were derived for the following export hogget production strategies:

(a) ewe reduction; average performance

(b) ewe reduction; medium performance

(c) cattle reduction; average performance

Additional costs associated with export hogget production are assumed to be; hogget shearing costs, hogget drenching (two doses) (MAF, 1983 b) and hogget freight. Additional returns are assumed to be from hogget meat, hogget fleece, and hogget pelt and skin sales. No allowance was made for variation in capital requirements and/or overdraft costs associated with the different strategies.

The fourth strategy, involving sale of cull animals normally retained to the two-tooth stage, simply required evaluation by partial budgets. Partial budgeting involves consideration of only those items of revenue and expenditure directly affected by a change to the status quo policy.

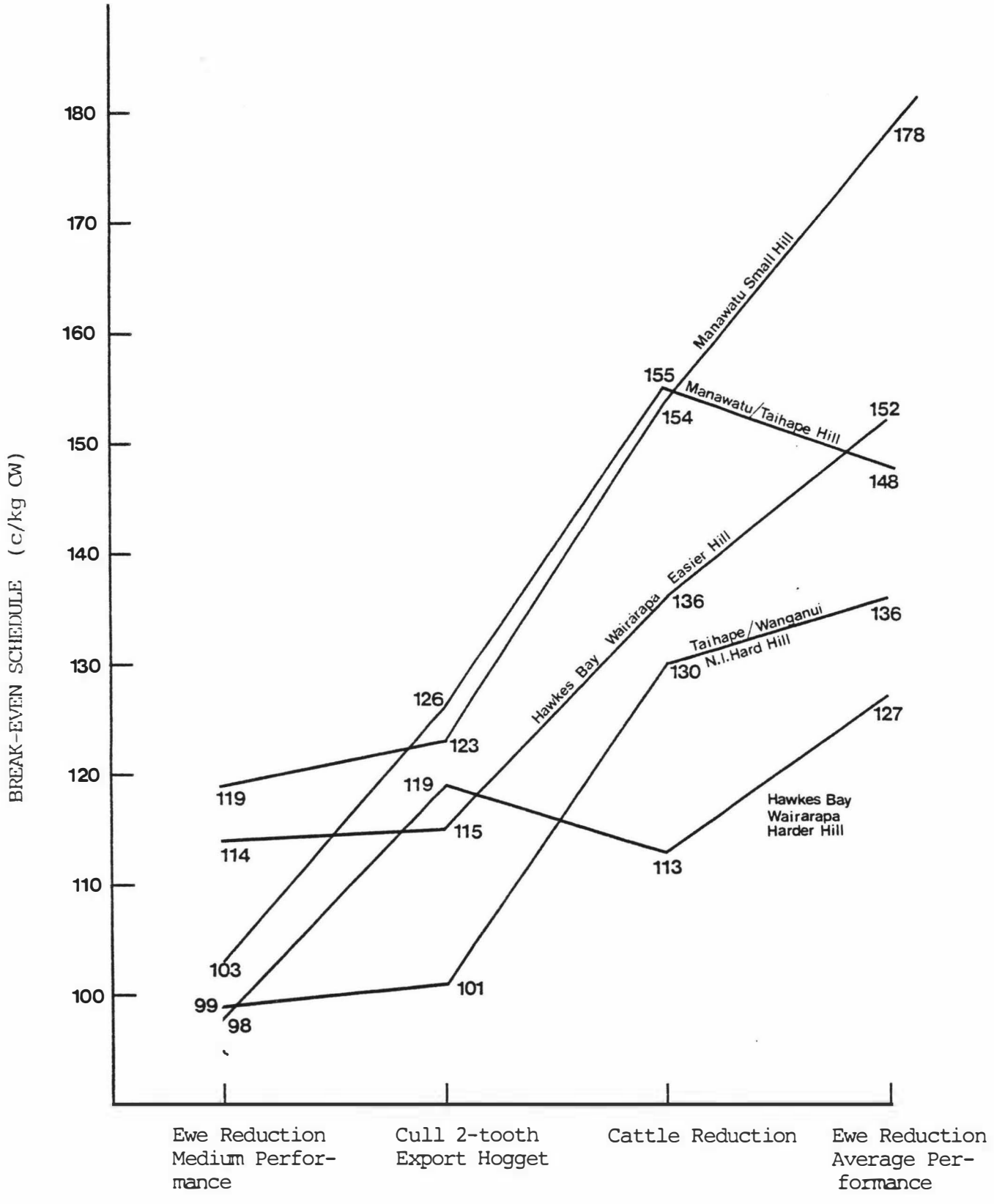
The results of the analyses deriving break-even export hogget schedules for each strategy by farm type based on mid-November hogget weights, are presented in Table 6.1.

TABLE 6.1 Derived Export Hogget Break-Even Schedule for Export Hogget Production Strategies (c/kg CW rounded to nearest cent)

Export Hogget Strategy	Farm Monitoring Model Type				
	Model 1 Manawatu/ Small Hill	Model 2 Hawkes Bay/ Wanganui Easier Hill	Model 3 Manawatu/ Taihape Hill	Model 4 Hawkes Bay/ Wairarapa Harder Hill	Model 5 Taihape/ Wanganui Hard Hill
Ewe Reduction Medium Performance	119	114	103	119	101
Cull 2-tooth/ Export Hogget	123	115	126	119	101
Cattle Reduction (average performance)	154	136	155	113	130
Ewe Reduction Average Performance	178	152	148	127	136

In order to demonstrate the relationships of break-even export hogget schedules between export hogget production systems and farm types, the break-even export hogget schedules in c/kg CW are expressed diagrammatically in Figure 6.1

FIGURE 6.1 Derived Export Hogget Break-Even Schedules For Various Export Hogget Production Strategies
(cents per kilogram of carcase weight)



The general trends evident in Figure 6.1 indicate that the assumed medium performance level gives a significant improvement in profitabilty of export hogget production relative to the status quo (average) performance level. The Figure highlights the fact that extensive production systems can produce produce export hoggets at a lower opportunity cost than more intensive systems. Similarly, the opportunity cost of releasing feed by decreasing cattle numbers, is less than by decreasing ewe numbers at average performance levels.

However, it is apparent that these general trends are not entirely consistent between farm models, thus indicating a need to analyse export hogget production strategies separately for each model. This evidence of a lack of consistency in export hogget production opportunity costs between farm models is likely to have implications for extension practices. The suggestion is that recommendations for production strategies may well need to be tailored to both farm type and management performance.

6.3 SENSITIVITY ANALYSIS

In this section of the study the objective was to determine the effects of animal performance factors and product price variables on break-even export hogget schedule prices. These investigations were carried out on the ewe reduction (average performance) export hogget strategy using the 'standard' model assumptions discussed in Chapters 4 and 5. Additional sensitivity analyses investigated the effects, on export hogget break-even schedules, of changing the hogget growth profiles assumed in previous models.

The method used in the sensitivity analyses, was to change stock performance and product price variables by a specified amount (usually 10%), and calculate the effect on the break-even schedule. This involved changing one variable at a time in both the status quo and export hogget strategy, and then by difference, calculating the effect on the break-even export hogget schedule.

When altering the animal performance parameters of export hogget slaughter weight and lambing percentage, it was assumed that such changes did not require additional pasture (feed) input to the production system. This simplifying assumption was not considered unreasonable for several reasons. Firstly, in real production systems, different management practices may result in variations to the efficiency with which feed is transformed from pasture into animal products. Such changes to total farm system output due to management of the system do not require additional exogenous physical inputs into the production system. Secondly, the theoretical relationships used when deriving animal feed requirement coefficients, for given levels of animal performance, are not precise. Figure 4.3 showed significant variations in published animal feed requirements for given weights and weight gains (MAF, 1976; Rattray, 1980; Lincoln College, 1981). Thirdly, the sensitivity analyses carried out in this study are concerned with what if? questions, and without the use of sophisticated simulation models it was outside the bounds of the modelling approach used in this to study investigate the effects of simultaneously altering a range of variables.

The individual influence of the following factors, on the break-even schedule for export hogget, was considered for each farm monitoring model situation:

Hogget slaughter weight
Lambing percentage
Hogget non-grading (overfatness)
Fat lamb returns
Store lamb returns
Two-tooth returns
Cull ewe returns
Fleece wool returns
Hogget wool returns (independent of fleece wool returns)

The objective of undertaking the sensitivity analyses was to establish which variables are likely to influence export hogget profitability significantly . In farm management research, this knowledge indicates areas in farming systems where management control would be most desirable. In addition, sensitivity analyses can indicate areas requiring additional component research where a sensitive area is one in which current research knowledge is 'poor'. Conversely, a variable or component which is not shown to be sensitive may not warrant further research, even if the current state of knowledge about the component is regarded as 'poor'.

The outcome of the sensitivity analyses performed in this study are presented in Table 6.2.

TABLE 6.2 Break-Even Export Hogget Schedule Variations Resulting From Varying Parameters
(ewe reduction - average performance)

Parameter (% variation)	Model 1 Manawatu Small Hill	Model 2 Hawkes Bay/Wairarapa Easier Hill	Model 3 Manawatu/Taihape Hill	Model 4 Hawkes Bay/Wairarapa Harder Hill	Model 5 Taihape/Wanganui NI Hard Hill
	Percentage variation from pre-sensitivity schedule				
Hogget slaughter weight (kg CW)					
(+ 5%)	- 4.8	- 4.8	- 4.8	- 4.8	- 4.8
(+ 10%)	- 9.1	- 9.2	- 9.1	- 9.0	- 9.0
(+ 15%)	-13.0	-13.0	-13.0	-13.0	-13.0
Lambing Percentage					
(+ 5%)	+ 3.2	+ 2.9	+ 3.5	+ 2.8	+ 7.6
Hogget Non-Grading					
(10%)	+ 7.4	+ 6.8	+ 6.5	+ 5.9	+ 7.0
(15%)	+11.7	+10.8	+10.2	+ 9.4	+10.7
(20%)	+16.4	+15.3	+14.5	+13.4	+15.0
Fat Lamb Price					
(+ 10%)	+ 6.4	+ 4.6	+ 5.2	+ 0.93	N/A
Store Lamb Price					
(+ 10%)	N/A	N/A	+ 1.9	+ 5.1	+ 7.6
2-tooth Price					
(+ 10%)	+ 1.7	+ 3.9	+ 3.1	+ 4.6	+ 1.6
Cull Ewe Price					
(+ 10%)	+ 0.5	+ 0.2	+ 0.4	+ 0.3	+ 0.8
Fleece Wool Price/production					
(+ 10%)	+ 2.4	+ 1.7	+ 0.8	+ 2.1	+ 3.9
Hogget Wool Price/production					
(+ 10%)	- 1.1	- 1.1	- 1.4	- 1.6	- 1.2

Hogget non-grading is the situation where not all hoggets produced will grade for export. It is assumed that those hoggets not graded for export are sold on the mutton schedule (56 c/kg). The analyses presented show the effects of 'grading' 10%, 15% or 20% of the total hogget draft on a mutton schedule. In practice this is most likely to be due to over-fattening hoggets.

Within the specific parameters investigated, hogget slaughter weight and hogget non-grading (over-fattening) have the greatest effects on export hogget returns. Both these parameters are under direct management control.

Increasing lambing percentage is another production variable which can significantly influence the export hogget break-even schedule. Increasing total wool production has a less significant influence on the break-even schedule for export hogget.

The influence of changes to productivity or product prices on export hogget break-even schedules varies according to the importance of the product to total farm revenue. Of the price variables, returns for both prime and store lambs have the greatest influence on export hogget break-even schedules. Product prices can be considered to be partially under management control. This is particularly applicable to revenue generated by lamb sales, as both prime and store lamb returns can be strongly influenced by improved management practices since lambs which are bigger and better finished or grade better, result in better lamb returns. Farmers generally have less control over wool returns, other than increasing their wool weights.

Increased hogget wool prices (or production) result in decreased export hogget break-even schedules as more hogget wool is produced under export hogget production systems than under traditional lamb sales policies.

Sensitivity analyses show that export hogget production systems are most sensitive to the combined effects of increasing animal performance levels from average to medium.

The comparison of break-even schedules for export hogget at average and medium performance levels shown in Table 6.3 demonstrates the cumulative effect of simultaneously increasing a range of productivity variables. The figures presented in Table 6.3 also involve the impact of increasing animal feed requirements, and therefore reducing winter stock numbers, as animal performance increases.

TABLE 6.3 Export Hogget Break-Even Schedules for Ewe Reduction Strategies at Two Levels of Performance

Farm Monitoring Model	Average Performance (c/kg)	Medium Performance (c/kg)
Manawatu Small Hill	178	119
Hawkes Bay/Wairarapa Easier Hill	152	114
Manawatu/Taihape Hill	148	103
Hawkes Bay/Wairarapa Harder Hill	127	98
Taihape/Wanganui N.I. Hard Hill	146	99

An important consideration to emerge from both the pre-sensitivity and post-sensitivity break-even schedules for export hogget is the large variation in export hogget break-even schedules between farm types and export hogget production strategies. This has implications for extension programmes as it indicates that export hogget production strategies should be evaluated relative to existing production practices at the farm type level.

Export Hogget Growth Profile

There are an infinite number of possible ewe and hogget growth profile combinations. However, the limited objectives set for the interactive discussion phase of the research programme did not warrant an exhaustive examination of alternative hogget and ewe growth profiles to obtain the maximum expected profit situation.

In order to determine the influence of varying hogget growth profiles on the export hogget break-even schedule, an alternative export hogget growth profile, based on the maximum number of export hoggets which could be wintered under ewe reduction average performance strategies, was examined. These export hogget growth profiles were based on assumed minimum June and July export hogget liveweights and, therefore, feed requirements which would still allow export hoggets to reach target slaughter weights in mid-November.

The approach used was to assume maximum practicable post-winter hogget growth rates for each model and, then by working back from the desired slaughter weight estimate the minimum liveweight possible in June and July. It was assumed that hoggets do not follow a growth pattern which allows weight loss over winter to be followed by compensating weight gain in spring/early summer. Consequently maintenance feed levels were the lowest winter feed intakes considered.

Having used this method to determine June export hogget feed demand, June export hogget numbers were adjusted, then with appropriate changes to lamb sales policies, the export hogget break-even schedule was calculated for each model. The results of this analysis are shown in Table 6.4.

Table 6.4 shows that varying export hogget growth profiles does provide some management opportunity to influence export hogget break-even schedule. Again, this management effect although variable, is generally of greater importance than the effects of product price variation on export hogget break-even schedules.

TABLE 6.4 Export Hogget Break-Even Schedule For Alternative Hogget Growth Profiles (Ewe Reduction - average performance strategy)

	Model 1 Manawatu Small Hill	Model 2 Hawkes Bay/Wairarapa Easier Hill	Model 3 Manawatu/Taihape Hill	Model 4 Hawkes Bay/Wairarapa Harder Hill	Model 5 Taihape/Wanganui NI Hard Hill
(1) Assumed post winter export hogget LWG (grams/day)	95	90	80	85	75
June liveweight (kg LW)	32.75	34.5	31.45	31.0	28.2
(2) June Feed Requirement (DM/head/day)	0.76	0.79	0.74	0.173	0.68
June Export hogget Number	290 (+65)	456 (+96)	443 (+91)	584 (+52)	425 (+89)
Break-Even Schedule (c/kg)	154	142	132	123	123
% Variation from Break-even Schedule for 'standard' growth profile	-13.5	-6.6	-9.9	-3.1	-9.6

Note: (1) For 107 days from August 1 to mid November

(2) Maintenance feed requirement (kg DM/head/day) $\frac{0.6 \text{ MJ ME/kg } \cdot^{75}\text{/day}}{10.8 \text{ MJ ME/kg DM}}$

(3) Figures in brackets indicate the increased numbers of export hoggets wintered relative to the standard hogget growth profile assumptions.

This method of investigating the effect of changing export hogget liveweight gain profiles (a management effect) on export hogget 'profitability' is not entirely satisfactory. While it does indicate that there is moderate opportunity to influence export hogget returns by altering hogget liveweight gain profiles, a more useful approach would have been to investigate the effect of altering hogget growth profiles in accordance with feed availability as a means of maximising hogget liveweight gain from weaning to slaughter. This latter approach however was not easily undertaken due to the inflexibility of the systems modelling methods used in this study. (This is discussed further in Chapter 9).

6.4 SYSTEM OUTPUT ANALYSIS

Export hogget production alters both total farm output, and produce mix, relative to pre export hogget output. A new product, export hogget, is produced largely at the expense of (export) lamb, and more hogget wool and less ewe fleece wool is produced. These alterations to the produce mix, and total farm output of meat and wool are shown in Tables 6.5, 6.6 and 6.7 for ewe reduction strategies at average and medium performance levels, and cattle reduction strategies at average performance levels respectively. For full details of meat and wool production from export hogget production strategies refer to Appendix Six.

TABLE 6.5 Export Hogget Systems : Output Analysis (a) Ewe Reduction - Average Performance

	Percentage Variation From Status Quo				
	Model 1 Manawatu Small Hill	Model 2 Hawkes Bay/Wairarapa Easier Hill	Model 3 Manawatu/Taihape Hill	Model 4 Hawkes Bay/Wairarapa Harder Hill	Model 5 Taihape/Wanganui NI Hard Hill
Total sheep meat production	- 5.6%	- 6.8%	- 5.4%	- 0.8%	- 5.3%
Total Beef Production (kg)	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged
Export lamb meat sales (kg)	-30.5%	-34.8%	-11.5%(1)	-26.3%	N/A
Total Wool Production (kg)	- 4.9%	- 3.5%	- 4.4%	- 3.3%	- 4.9%
Ewe & 2-tooth Fleece Production (kg)	-10.0%	-10.0%	-10.0%	-10.0%	-10.0%
Hogget Fleece Production (kg)	+30.7%	+30.1%	+32.0%	+33.7%	+37.7%

Note: (1) Export hoggets retained from store and prime lambs

TABLE 6.6 Export Hogget Systems : Output Analysis (b) Ewe Reduction - Medium Performance

	Percentage Variation From Status Quo				
	Model 1 Manawatu Small Hill	Model 2 Hawkes Bay/Wairarapa Easier Hill	Model 3 Manawatu/Taihape Hill	Model 4 Hawkes Bay/Wairarapa Harder Hill	Model 5 Taihape/Wanganui NI Hard Hill
Total sheep meat production	- 0.3%	- 2.2%	- 0.4%	+ 0.2%	- 5.3%
Total Beef Production (kg)	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged
Export lamb meat sales (kg)	-14.4%	-16.7%	+13.6%(1)	+31.5%(2)	N/A
Total Wool Production (kg)	- 2.9%	- 2.1%	- 4.3%	- 4.3%	- 3.3%
Ewe & 2-tooth Fleece Production (kg)	- 7.1%	- 7.0%	- 7.9%	- 6.7%	- 6.5%
Hogget Fleece Production (kg)	+22.7%	+18.9%	+21.0%	+10.3%	+24.8%

Note: (1) Medium performance reduces proportion of store lambs sold by 15% therefore increasing export lamb sales.

(2) Increase due to reduction in proportion of store lambs and retention of export hogget from store lambs only.

TABLE 6.7 Export Hogget Systems : Output Analysis (c) Cattle Reduction - Average Performance

	Percentage Variation From Status Quo				
	Model 1 Manawatu Small Hill	Model 2 Hawkes Bay/Wairarapa Easier Hill	Model 3 Manawatu/Taihape Hill	Model 4 Hawkes Bay/Wairarapa Harder Hill	Model 5 Taihape/Wanganui NI Hard Hill
Percentage reduction to cattle numbers	-56.3%	-41.4%	-60.0%	-38.9%	-59.8%
Total sheep meat production (kg)	+ 4.3%	+ 2.3%	+ 1.5%	+ 4.0%	+ 7.1%
Export Lamb Meat sales (kg)	-20.5%	-24.8%	Unchanged (1)	Unchanged(1)	N/A(1)
Total Wool Production (kg)	+ 5.0%	+ 6.5%	+ 5.7%	+ 6.7%	+ 5.1%
Ewe & 2-tooth Fleece Production (kg)	Unchanged	Unchanged	Unchanged	Unchanged	Unchanged
Hogget Fleece Production (kg)	+40.6%	+40.1%	+42.0%	+43.7%	+47.7%

Note: (1) Export hoggets retained from store lambs.

These tables show that system output and product mix vary according to the export production strategy adopted relative to the status quo production system. Strategies which involve reduction in ewe numbers generally result in reduced total sheep meat production. Exceptions occur in models 4 and 5 where it is assumed that store lambs are retained for export hogget production. Consequently, meat output is increased through retaining lightweight store lambs and selling them at the export hogget stage. Under average performance levels export hogget is produced largely at the expense of prime lamb sales. In the medium performance levels of models 3 and 4 however, it is assumed that increasing performance results in an increased proportion of prime lamb sales whilst export hogget production is still largely achieved by the retention of store lambs.

Total wool production is reduced by the introduction of export hogget strategies due to a reduction in ewe numbers. The reduction in ewe and two-tooth fleece output is only partially balanced by an increase in hogget fleece production.

As expected, cattle reduction strategies at average levels of performance result in lower beef production. However, as sheep numbers stay the same, total sheep meat production increases when lambs which would normally be sold at lighter carcase weights, are retained to heavier weights and sold on an export hogget schedule.

Similarly, wool production increases under cattle reduction strategies as a clip of wool is taken from the additional number of export hoggets on hand in October.

6.5 CASH FLOW ANALYSIS

Export hogget production strategies result in an altered distribution of seasonal revenue. Lamb sales are foregone in late summer/autumn, and revenue is increased in October when hogget wool is sold, and in November when income is received from the sale of export hogget carcases.

In order to investigate the financial implications of altered seasonal revenue distribution, monthly cash flow profiles were compared for the status quo and ewe reduction average performance export hogget strategy for the Hawkes Bay/Wairarapa Easier Hill model. This model was chosen because more detailed financial information was available than for other models.

Based on 1982/83 Farm Monitoring estimates two aspects of the seasonal cash flow were considered for the Hawkes Bay/Wairarapa Easier Hill model. Table 6.8 shows the impact of export hogget production on only the sheep component of the whole farm production system under conditions where export hogget returns are based on the break-even schedule of 152 c/kg.

TABLE 6.8 Hawkes Bay/Wairarapa Easier Hill - Monthly Cash Flow Profile for Sheep Gross Margins

	Pre Export Hogget (Status Quo)	Post Export Hogget Ewe Reduction Strategy	
	$ (+/-)	$ (+/-)(1)	
January	+16243	+ 9215	(-43%)
February	+ 8931	+ 7471	(-16%)
March	+ 2438	+ 2191	(-10%)
April	+ 8734	+ 4923	(-44%)
May	- 109	- 148	(-36%)
June	+ 5074	- 98	(-102%)
July	- 109	- 98	(+10%)
August	+ 401	+ 207	(-48%)
September	- 109	- 98	(+10%)
October	+ 6292	+ 8232	(+31%)
November	- 1559	+16353	(+1149%)
December	+25416	+22872	(-10%)
Sheep Gross Margin	$71022	$71022	

Note (1) Export hogget returns based on a schedule of 152 cents/kilogram of carcase weight.

TABLE 6.9 Hawkes Bay/Wairarapa Easier Hill : Monthly Whole Farm (Revenue and Expenditure) Cash Flow, Including Estimated Overdraft Payments at 15% O/D Interest Rate

	PRE EXPORT HOGGET (Status Quo)			POST EXPORT HOGGET Ewe Reduction average performance strategy		
	Whole Farm Cash Flow $	Cumulative Overdraft $	Overdraft Interest paid $	Whole Farm Cash Flow $(1)	Cumulative Overdraft $	Overdraft Interest paid $
January	+11297	6094	215	+ 4269	5750	124
February	+15669	-	76	+14839	-	72
March	- 6637	6637	-	- 6884	6884	-
April	+ 923	5797	83	- 2888	9858	86
May	-17727	23596	72	-17766	27747	123
June	+ 9077	14814	295	+ 3095	24189	347
July	- 5344	20343	185	- 5333	29824	302
August	- 4295	24892	254	- 4498	34695	373
September	- 7402	32605	311	- 7391	42520	434
October	+ 1408	31605	408	+ 3348	39704	532
November	- 5843	37843	395	+12069	28131	496
December	+21132	17176	468	+18588	9895	352
Total Annual Cash Surplus	$12258	Total Overdraft Interest Paid	$2767	$12258		$3241

Note: (1) Export hogget returns based on a break-even schedule of 152 c/kg.

(2) The small impact of higher interest payments on tax, and therefore cash flow, has not been included.

The comparison is taken further in Table 6.9, where the analysis considers all items of income and expenditure (including personal expenditure) for both the status quo and ewe reduction average performance strategy. In addition Table 6.9 highlights the estimated overdraft payments due for both situations, assuming an overdraft interest rate of 15% per annum and a zero bank balance at 1 March. It was assumed that overdraft interest was paid on the full monthly deficit occurring in any one month, but that the interest payment was made at the beginning of the next month.

The analysis presented in Table 6.9 shows that whilst the estimate of the total annual surplus (income less expenditure) before overdraft payments stays constant (at + $12,258) for both the pre and post export hogget situations, there is significant variation in both the monthly cumulative overdraft totals and total overdraft interest payment due. Due to the lamb revenue foregone in an export hogget system, the winter overdraft level increases to a significantly higher peak relative to the status quo situation in September (+30%). In addition, overdraft payments due in months of negative cash flow are higher, therefore resulting in a higher total annual overdraft payment. The total overdraft interest due, under the export hogget production system, is $474 (17.2% higher) than the status quo situation. Full details of both cash flow analyses are presented in Appendix Eight.

In practical terms, despite breaking even on schedule payments, export hogget production disadvantages a farmer in both total overdraft payments due, and in the timing and amount of overdraft facilities required. Consideration may therefore need to be given to arranging increased overdraft limits if export hogget production is to be practiced.

6.6 CHANGE-OVER TO EXPORT HOGGET PRODUCTION

The following analysis is based on the assumption that a complete policy change is made from a status quo situation to an export hogget production system in one year, and that surplus breeding ewes and two-tooths are sold in the change-over year.

As a result of the change, the Hawkes Bay/Wairarapa Easier Hill model June ewe numbers are reduced by 242 (from 2420 to 2178) and ewe hogget numbers by 88 (from 880 to 792) with an additional 351 export hoggets wintered. Assuming that the surplus breeding stock are sold in the yards at $18.00 per ewe (net) and $25/two-tooth (net), the change-over releases $6556 from the sale of breeding stock. However, stock sales incur a taxation liability, and assuming sheep standard values of $5.00/head on all stock wintered, and a marginal tax rate of 35%, a tax liability of $2331 is incurred in the change-over year (assuming a June 30th balance date). This reduces the net benefit in the change-over year to $4225.

Although not likely to be viewed as major factors influencing any possible decision to adopt an export hogget production system, the implications of export hogget production on factors such as cash flow profiles, cumulative overdraft, total overdraft payments due, asset reduction (in capital stock), capital release, and taxation liablility would nevertheless need to be considered when evaluating a farm production policy change from status quo to export hogget production.

6.7 CHAPTER CONCLUSION

This chapter concluded the last stages of the desk research phase of the study.

The chapter discussed the gross margins analyses used to determine break-even schedules for export hogget, relative to the status quo situation. Break-even schedules were presented for the four main export hogget production strategies.

Sensitivity analyses were used to establish the effects on the break-even schedule for export hogget of varying animal performance and product price parameters. These analyses provided an insight into

some of the management aspects of export hogget production systems which are of significance in determining 'profitability' of export hogget production.

This section on output analysis presented the effects of export hogget production, relative to the status quo, on physical productivity (meat and wool) and product output mix. The final section discussed other financial aspects (cash flow, overdraft payments, taxation liability, and capital release) associated with adopting an export hogget strategy (ewe reduction average performance) in the Hawkes Bay/Wairarapa Easier Hill farm type.

Along with previously discussed aspects of the research project (situation analysis, system analysis, and systems modelling) the physical and financial evaluation of export hogget production systems completed the author's appreciation of export hogget production systems to a stage where interactive discussion with farmers was possible.

CHAPTER SEVEN

SYSTEM VALIDATION - INTERACTIVE DISCUSSION

7.1 INTRODUCTION

This chapter presents the second phase of the study; - interactive discussion as an approach to system validation. This chapter briefly discusses the theory underlying interactive discussion, and describes the method by which farmers were involved in validation of a production system. The latter stages of the chapter present and discuss the outcome of the discussions.

7.2 OBJECTIVES OF INTERACTIVE DISCUSSION

The 'interactive discussion' phase of farm management research in this study was designed to obtain farmer reaction, firstly to the general proposition of export hogget production systems, and secondly to the specific assumptions used to model and analyse alternative hogget production systems. In order to implement the interactive discussion research phase with farmers, it was necessary to develop models of production systems which could then be used as the basis for discussion with farmers.

In a systems research context, this phase of the study can be viewed as being closely related to system validation. In this study it was not possible to validate models of export hogget production systems by comparing model output to the performance of real systems since the latter do not currently exist in New Zealand agriculture. In this situation then, the process of interactive discussion with farmers involved investigating farmer beliefs in a general area where current information about the production system is poor. However, the author

was working under the premise that 'every farm is a research station and every farmer a director thereof' (Warren, 1905; cited in Candler, 1965). Farmers are therefore likely to hold beliefs about the components of export hogget production systems inferred from their current production systems. Hence it was felt that especially in areas identified during the modelling phase where current information is lacking that interactive discussion with farmers could improve the author's perspective of the system and its applicability. Some ideas may be rejected, but others modified and incorporated into the final (validated) production system. The overall expectation was that a greater appreciation of the management issues and component interrelationships, and hence enhanced credibility of the research findings, would result from the involvement of farmers in the research process.

7.3 THEORETICAL BASIS FOR INTERACTIVE DISCUSSION

The theoretical basis for interactive discussion is based on the 'Personal Interaction Model of Extension' (Woog, 1982) presented in Figure 7.1. Woog's extension model was developed by adapting Kelly's Personal Construct Theory (1955) to agricultural extension.

Kelly's theory: 'Man the Scientist', focuses on the whole person and is based on the premise that human activities are conditioned by the expected outcome of their activities. In Kelly's theory, people develop hypotheses (constructs) about all the things in their field of experience. They then test and evaluate these outcomes and use the results to make further predictions. Kelly stressed that his theory emphasises the creative capacity of living beings to represent the environment, not merely to respond to it. Kelly's fundamental postulate is:

> 'A person's processes are psychologically channelised by the ways in which he anticipates events.' (Kelly, 1955).

This contains two important implications: (Bannister and Fransella, 1971).

(a) that man is not reacting to the past as much as reaching out for the future, and

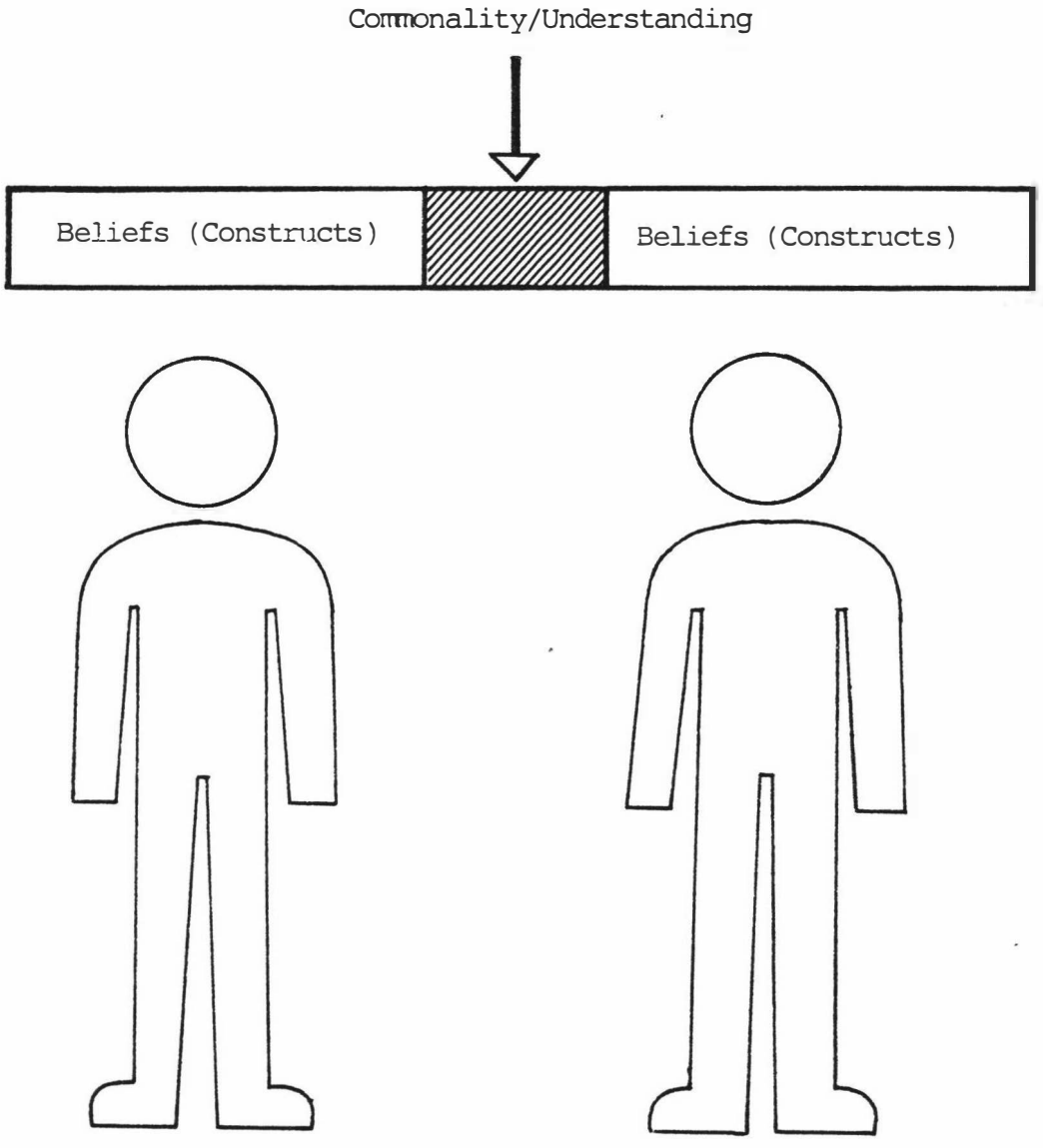
(b) that man checks how much 'sense' he has made out of his world by seeing how well his sense enables him to anticipate it.

Kelly (1970) argued that man is in business to make sense out of the world and to test the sense he has made in terms of its predictive capacity. To Kelly, the ultimate aim of all individuals is to predict and control events by 'asking questions and anticipating answers about them'. In this way every person develops a system of "constructs".

Constructs are a person's ideas; his view of his world. They are the way in which some things are construed as being alike yet different from others. Constructs are mental images associated with objects, events, goals, etc. They are built up over time and are subject to revision or replacement as man modifies his view of the world. The results of "construct experimentation" may be either positive or negative. Positive results reassure the individual that his construct model is accurate, and he then continues to use this 'verified model' as the basis for anticipating future events. Negative results are likely to result in two outcomes; either the construct model is modified, or there is continued effort to find other validating evidence to support existing constructs. Building and remodelling constructs in this manner is the process of learning.

Kelly's theory is also a theory of change, as constructs change and extend their 'range of convenience'. If this did not happen individuals would attempt to avoid new situations, or if new situations were experienced they would be pushed into existing constructs, regardless of the "badness of fit" (Fransella, 1982). To Kelly (1970) a personal construct system contains all that a person has learned and is a statement of his values and intentions.

GURE 7.1 The Personal Interaction Model of Extension
(Woog, 1982)



In the initial stages of interactive discussions with farmers in this study, the objective was to establish construct uniformity between the farmer's and the interviewer's construct systems (beliefs). Having established this the interviewer then gradually introduced new concepts, thereby encouraging each farmer to alter and expand his construct system.

Finally, once the new ideas and concepts had been discussed, each farmer was asked a series of questions designed to test his reaction to export hogget production systems.

The discussion format was designed to encourage farmers initially to expose their existing constructs. This was accomplished by first asking farmers to describe, and give reasons for, their current production systems and management practices. This phase allowed the interviewer some opportunity to assess subjectively each farmer's beliefs (constructs) before introducing possible changes to the current farm production system.

The format followed was intended to allow each farmer to first 'relax with' his current set of constructs. Then, by way of controlled discussion on export hogget, information about export hogget production possibilities was extracted from each farmer through questions and discussion. It was anticipated that during this stage each farmer would be supplying new information to his own (belief) construct system. Only when each farmer had had opportunity to alter his construct system, which in Kelly's theory is the basis for anticipating future events, was the farmer asked for his reaction to the proposition of an export hogget production system on his property.

In this manner, the author attempted to control the discussion in a non-overt manner, hence the reference to 'controlled interactive discussion'.

7.4 SURVEY METHOD

Two farmers whose farms were representative of each farm monitoring model type were selected, making a total of ten farmers visited. Farmers were not selected randomly, so it is not possible to accurately extrapolate the results of the farm visits beyond the survey sample.

Farmers were selected by local Farm Advisory Officers on their subjective assessment of the following criteria:

(a) that farms conformed to a specified farm monitoring model type,

(b) that the farmer had the ability to conceptualise a new (non-existing) production system, and

(c) that the farmer was willing to be visited in the time schedule provided by the author.

Prior to the author's visit, farmers were informed only that the author wished to discuss aspects of hill country farm management with them. Farmers were not pre-warned that the topic of the discussion was to be export hogget production.

The questionnaire was designed not as a formal questionnaire to be strictly adhered to and the results analysed statistically, but rather as a document to form the basis for interactive discussion.

The questionnaire was arranged to guide each farmer through a series of stages. The initial stages sought information relating to physical aspects such as farm location, effective area, stage of development and/or improvement as well as some soil and climatic information. This was a period of 'icebreaking' and introduction.

The second stage asked each farmer to outline current stock policies and stock performance levels, as well as provide brief details on management practices. Both sheep and beef stock were included. Before beginning this stage the author explained to each farmer that he, the author, was not familiar with farming in the area (having been a Northlander). To 'overcome' the author's 'lack' of familiarity with farming in the area, farmers were asked to outline their reasons for current policies and management practices. During this stage the author offered no opinion on the policies and practices and often used counselling techniques such as, 'tell me more about ...?' or 'could you explain why ...?' to elicit further information and encourage full discussion.

This phase of the discussion allowed the author an opportunity to gain some understanding of each farmer's construct system and to establish construct alignment, and continued until the author felt he had a reasonable understanding of both the farm system and the farmer's reasons underlying the system.

During initial discussions of existing systems, the author made subjective assessments as to which sheep reduction export hogget strategy may be practicable for the farm/farmer situation under discussion.

Once the current management system had been discussed, each farmer was introduced for the first time to the concept of an export hogget production system. At this stage, each farmer was informed as to the type of product an export hogget is, when the export hoggets were to be slaughtered, and how many export hoggets the particular farm might possibly produce.

When the author was satisfied that the farmer understood what export hogget production involved, each farmer was asked to detail how he would produce a specified number of export hoggets on his farm. This number required that between 15% and 22% of status quo lamb sales were retained and over-wintered for an export hogget market. Farmers had the option as to whether or not they would also sell cull ewe hoggets on an export schedule. During this stage of the discussion it was stressed to each farmer that he was to assume that export hogget production is 'well worthwhile financially'. Accordingly, at this stage each farmer was asked to consider only physical production and management aspects related to a specified production strategy.

The method adopted during the early stages of discussion to record information about existing farming systems, was to note responses onto master sheets, with activities and associated reasons listed sequentially on the vertical axis, and months of the year along the horizontal axis. (For full detail of the questionnaire refer to Appendix Eight). After explanation of the hypothetical export hogget production system, farmer response to changes required to implement their chosen strategy, and the reasons underlying these changes, were recorded on to a tracing paper overlay folded down over the first answers. Being able to see the pre export hogget farm production and management detail the author was able to prompt farmers along the lines of '...last year you carried 2400 ewes, could you tell me whether you would need to alter your winter ewe numbers...?' etc.

The next stage in the interactive discussion was to ask each farmer a series of questions to elicit his personal attitude towards production of export hogget on his farm. These questions related to personal and enterprise goals, as well as district and social norms. Finally in this stage, each farmer was asked what returns he believed he would need to receive for export hoggets in order to make export hogget production financially attractive.

The penultimate stage of the discussion involved a series of short questions covering aspects of export hogget production not discussed previously. In addition, a series of questions was asked to ascertain farmer reaction to the practicability of the model assumptions made by the author. This was the first time during the discussion that farmers were prompted on specific issues. This stage concluded when farmers were asked to comment on the feasibility, compatibility and desirability of export hogget production on their property.

In the final stage of the discussion, each farmer was asked what, if any, further information he believed he would require if a 'profitable' schedule for export hogget was offered in the future.

In summary, the structure and the conditions under which farmers answered questions is presented in Figure 7.2.

FIGURE 7.2 Summary of Interactive Discussion Structure and Conditions

Stage	Discussion Area	Specified Conditions
(a)	Introduction/'icebreaking'	N/A
(b)	Current farm system; detail and reasons for current practices.	Farmer told interviewer has limited knowledge of area. Author does not prompt/ give opinion.
(c)	Production/Management Strategies necessary to produce specified number of export hoggets.	Farmer to assume that export hogget is profitable.
	Effect on existing system.	Farmer to consider technical production and management aspects only.
(d)	Farmer to discuss personal and enterprise goals, and social norms.	First introduction of 'personal element' to discussion.
(e)	Farmer asked for estimate of required returns to make export hogget production 'profitable' on his farm.	First introduction of requirement to consider export hogget returns.
(f)	Export hogget production system checklist for any previously unmentioned aspects.	First stage at which farmers were prompted (to ensure that all farmers gave views on all aspects).
(g)	Request for further information; - to ascertain if farmers believe they have areas of knowledge deficiency.	If 'profitable' schedule for export hoggets was offered in future.

7.5 INTERACTIVE DISCUSSION FINDINGS

The discussion method employed in this research project was primarily intended to obtain farmer reaction, firstly to the prospect of export hogget production, and secondly to the modelling assumptions made. Information was obtained from surveyed farmers about beliefs associated with current management practices, the potential practice of export hogget production, and model assumptions. However, the information obtained about the attitudes of those farmers with whom discussions were held, could only be described as superficial since the method was not designed specifically to elicit farmer attitude towards export hogget production systems.

The findings reported in the remainder of this chapter relate specifically to export hogget production and model assumptions.

7.5.1 Export Hogget Production

Export Hogget Schedule

Few farmers were aware of the existence of an export hogget schedule (introduced on 1 October 1982). Of the two farmers who were aware that an export schedule was offered for hogget, neither could quote the current schedule.

Export Hogget Returns

The farmers interviewed generally believed that export hogget production would be feasible and could be made compatible with their existing production systems.

Most farmers interviewed believed that an export carcase would need to return between $5 and $8 more than its lamb carcase value before hogget production systems would be economically viable. This range of values was additional to the return obtained from a hogget wool clip. In most instances, this calculation brought the value of an export hogget sold in mid-November up to ruling values for average

two-tooth ewes sold in January. On a carcase schedule basis, the returns the farmers interviewed believed would be needed to make export hoggets an economically viable proposition, equated reasonably closely to the model break-even schedule prices.

It was interesting to note that the farmers interviewed related beliefs about export hogget returns, to the returns a hogget would have earned as a lamb, rather than the returns it could earn as a two-tooth.

Feed Release Strategies

Farmers interviewed believed that under existing management and production strategies their properties did not have surplus feed on which to winter additional hoggets. The farmers interviewed indicated that in order to carry additional export hoggets over the winter, they would need to 'create' surplus capacity by; (in order of descending priority):

- reducing cattle numbers only;
- reducing sheep numbers only;
- continuing improvement programmes to increase carrying capacity;
- using crops or nitrogen, to grow more spring and early summer feed.

On the farms visited, it was apparent that specialized export hogget production would mainly have been at the expense of cattle numbers. This attitude appeared to be conditioned largely by economic rather than technical considerations, and could therefore be expected to change under conditions of improved cattle profitability relative to sheep production systems. In practice, the introduction of an export hogget schedule may not involve reduction of existing breeding stock numbers, as all farmers interviewed indicated that their initial

response to a 'profitable' export hogget schedule would be to supply existing numbers of surplus replacement breeding stock ("culls") for slaughter rather than carry them forward to two-tooth fairs. However, the numbers of export hoggets specified for each property by the author required farmers to also consider strategies for over-wintering an additional number of hoggets.

Lamb Retention

Farmers indicated that for preference they would retain medium to poorer lambs for export hogget. Where lambing percentage and selection pressure allowed, farmers indicated they would retain ewe lambs in preference to wether lambs. The reason unanimously given was that ewe lambs have an alternative sale outlet as replacement breeding hoggets or two-tooths, should the export schedule price for hogget collapse. Farmers also indicated they believed that retention of additional ewe lambs would minimise winter management difficulties associated with wintering more hoggets, as all hoggets could be run in a single mob. However, regardless of which class of stock would be retained, winter management was not perceived as being a potential difficulty of any magnitude.

Where store lambs were sold in the status quo situation, they would be retained, to the export hogget stage in preference to prime lambs.

Managment Changes

Farmers believed, that apart from the production considerations of altering stock numbers and lamb selling policies, few major changes to management systems would be required to produce export hoggets. One farmer believed he would wean his lambs 'about two weeks' earlier under an export hogget system because he considered that selling hoggets in early/mid November would release sufficient feed to allow weaning in late November/early December. No other farmers indicated the need for any change in current lambing, weaning or shearing policies under export hogget production strategies.

Stock Sale Patterns

Lamb sales policies could be altered under an export hogget system, depending on the season. Farmers in summer dry areas believed that selling export hogget in mid-November would release sufficient feed to allow them to feed their lambs better and therefore sell lambs (at the same weight) earlier in the season before the summer dry period. Conversely, farmers in areas of reasonable summer rain believed they might be able to delay lamb sales, and therefore increase lamb weight at sale. Some concern was expressed, however, at the possible effects that the new lamb grading system(1) might have on this strategy as farmers believed that heavier lambs will be fatter.

Farmers interviewed believed that the adoption of an export hogget production system would not necessitate any changes to their existing ewe sales strategies. However, two-tooth sale policies could vary appreciably from the status quo situation, given a 'profitable' export schedule for hoggets since all farmers indicated a preference to sell surplus replacement hoggets early (November) rather than retaining them for January two-tooth fairs.

Pasture Management

Winter management, either as a consequence of another hogget mob or a larger hogget mob, was not perceived as a problem by the farmers interviewed.

Summer pasture management was however perceived by some, but not all, farmers as a potential difficulty were export hoggets to be sold in mid-November. Four of the farmers interviewed believed that they might experience difficulty in maintaining pasture quality, under an export hogget system, once stock numbers were reduced following the sale of hoggets in mid-November.

(1) Introduced on 1 October 1983.

This problem was perceived to be greatest where cattle numbers were to be reduced to allow export hogget over-wintering. Other farmers, particularly those in summer dry areas, did not believe that summer pasture management difficulties would increase under export hogget production systems.

Export Hogget Sale Dates

Those farmers operating in areas with reliable summer pasture growth expressed the belief that hoggets for export should not be sold until just prior to the time when lambs are normally weaned. All farmers interviewed believed that hoggets for export could not easily be retained beyond lamb weaning as their presence would complicate established summer grazing management practices, and resrict post-weaning lamb growth rates. For these reasons, farmers indicated that their preference for export hogget sale dates would be between late October and late November.

Breeds

Farmers generally believed that existing white face sheep breeds would be suitable for export hogget production. Finishing export hoggets was not perceived as a potential problem even on harder hill country farms. The likelihood of over-fattening export hoggets was acknowledged, but farmers believed that if sale flexibility was permitted, over-fattening would not be a significant problem. Farmers who, when prompted, acknowledged that a potential over-fattening problem might exist, believed that by being aware of the possibility, they could 'manage' export hogget feed intake to avoid the situation.

Performance Levels

Some farmers considered that as a consequence of improved feeding, ewe and hogget profiles may be increased under an export hogget production system. One farmer believed that winter hogget growth rates would be affected adversely.

Most farmers believed that lamb growth profiles could improve but whether or not this would occur would be subject to management decisions related to lamb sales policy.

Risk

Risk, associated with factors such as autumn hogget ill-thrift, winter hogget mortality, or an increased time interval to hogget sale relative to lambs, was not perceived by farmers as likely to be increased appreciably by export hogget production. One farmer who sold lambs store, indicated that selling on to an export hogget schedule (with SMP's) would be less risky than selling on to a store market subject to unpredictable seasonal price fluctuations.

Selection Pressure

Most farmers interviewed believed that retaining more ewe lambs (or all ewe lambs) through until November would allow an increase in selection pressure. None were able to quantify the benefits of increased selection pressure other than to say they believed it 'would help increase wool weight and lambing percentages'.

Labour

Nearly half the farmers visited believed that export hogget production would ease labour requirements on their property. Only one, however, indicated that he might be able to reduce a full farm labour unit. There was general acknowledgement that as ewe and cattle numbers increased, labour saving advantages of export hogget production would become more important.

Farm Output

Most farmers believed that total farm production of meat and wool would remain relatively unchanged if an export hogget production system was adopted. No farmer predicted that output would fall, and three farmers believed that output would increase.

Cash Flow

Cash flow and capital commitments were regarded as relatively unimportant. Four farmers indicated their belief that additional income in November would be an advantage but were unsure of the magnitude of the advantage given that income would be foregone in the autumn.

Social Norms

Social norms and peer group pressure were not perceived as being relevant to any decisions to adopt, or not to adopt, an export hogget production system. All the farmers visited indicated that any decision would be based mainly on financial considerations. Many acknowledged that district conservatism was high, but then indicated that they were not unduly influenced by this. (The author believes this result may be due to the relatively young, enthusiastic innovative farmers selected for the visits. Factors no doubt associated with the selection criteria applied).

Goals

Most farmers visited indicated that their personal and enterprise goals were related mainly to income satisfaction, management challenge, or job satisfaction. None saw any conflict with their goals under an export hogget system, provided the proposition was financially rewarding.

Additional Information

When asked what further information they would require should they decide to adopt an export hogget strategy, few farmers indicated a perceived need for on-farm technical production or management information. Many farmers however, indicated a desire to know more about off-farm marketing considerations. It was apparent that at the time of the visits (August 1983) the long-term market stability for a product, production of which may require significant changes to farming systems, was of major concern to these farmers.

As a consequence, if a profitable schedule for export hogget was offered, initial farmer adoption rate of export hogget production systems might be limited by perceived off-farm uncertainties.

7.5.2 Modelling Assumptions

Performance Levels

Few of the farmers interviewed were able to accurately detail the full range of animal performance parameters achieved on their properties. None however disagreed strongly with the animal performance parameters assumed in the modelling phase of the study. All agreed that the average (status quo) performance levels were 'reasonable' for their farm type. However, farmers interviewed were evenly divided as to whether or not export hogget production would result in the increased levels of animal performance assumed in the medium performance models.

Stock Number Changes

The farmers interviewed indicated that they believed the reduction in ewe numbers and supporting stock as an export hogget production strategy was 'reasonable' for the purpose of this study. All farmers indicated that possible ewe reduction/export hogget retention strategies could only be determined when the relative profitability of export hogget production had been evaluated for their individual situation.

Hogget Growth Profiles

Most of the farmers interviewed could not detail growth profiles but believed that those used in the models 'appeared reasonable'.

7.5.3 Model Changes

One of the advantages of interactive discussion with farmers was that the approach provided an opportunity to alter model assumptions according to farmer beliefs. While there was little reason to change existing models (on the basis of new information obtained from farmers) the discussions indicated the requirement to consider a cattle reduction strategy. Prior to the interactive discussion phase of the study, a cattle reduction policy had not been included as it had been the author's intention to consider sheep reduction strategies only. However, an interactive discussion phase of the study showed that many farmers would adopt cattle reduction strategies as part of an export hogget production system, and so it became necessary to include the strategy in the study.

7.5.4 Externalities

During discussions with farmers, the author noted two areas of concern relating to the current state of knowledge and management practice on hill country sheep farms. Neither relate specifically to export hogget production, but as both have implications for potential export hogget production systems each is discussed briefly.

(a) Winter Feed Requirements

The farmers visited generally believed winter feed requirements of hoggets to be 70% of that for breeding ewes. This perception was based on the use of the stock unit system as a basis for determining animal feed requirements on a comparative basis.

This sytem, which classifies breeding ewes as constituting one stock unit (SU) and hoggets as constituting 0.7 SU, was used by the farmers interviewed to plan winter feed programmes. Both ewe and hogget winter grazing areas, and total winter feed requirements, were commonly based on this stock unit relationship.

The feed requirement coefficients used in the feed balance models prepared in this study are at variance with this assumption. These coefficients show that the July feed requirements of hoggets (for the growth profiles assumed in the study) varies from 87% to 97% of ewe feed requirements at average levels of performance, and from 87% to 99% at medium levels of performance. Thus, even at relatively low winter weight gains, management must plan to provide hoggets with very nearly as much feed on a per head basis, as for the ewe flock. Failure to adopt this approach to winter grazing management will result in poor hogget growth rates and subsequently poor two-tooth tupping weights. In the author's experience as a MAF Farm Advisory Officer, poor winter hogget growth rates and low two-tooth tupping weights are common occurrences on many hill country sheep farms.

(b) Winter Rotation Lengths

The second 'externality' noted is that, with one exception, all farms visited had the use of less than 35 main paddocks over winter. Consequently, short rotations and set stocking policies of main ewe mobs were the rule rather than the exception. Rotation lengths for the main ewe mobs were generally in the range of 40 to 60 days. One farmer had a winter ewe rotation of 20 days and the longest winter ewe rotation was 80 days.

It was apparent that farmers with the shorter winter rotations epxerienced greater feed deficits in late August/early September than those farmers with longer winter rotations. All farmers perceived either the immediate pre-lambing or immediate post-lambing period as a major period of significant feed pinch. The results of the simulation exercise (described in Chapter 5) predict such outcomes as well as predicting that export hogget production systems would help alleviate winter/early spring feed management difficulties.

Most farmers visited during the course of this study indicated that inadequate feed, either immediately pre-lambing, but more particularly in the post-lambing period, is a significant management problem. Indirectly, this study highlights potential causes (short winter rotations) and therefore the potential action required to remedy this situation.

7.6 CHAPTER CONCLUSION

The author believes that the 'interactive' discussions with farmers (and advisors) was instrumental in establishing that export hogget production systems are feasible, and that the modelling assumptions used in the desk research phase of the study were reasonable. The author further believes, that in a farm management research context, the interactive discussions can be considered to relate closely to system validation in systems research.

The approach also allowed discussion on a range of external, though related issues, implicit in export hogget production systems. These issues may not have been as clearly highlighted had the study been confined to a "non-interactive" desk research modelling exercise. Certainly, farmer beliefs could not have been elicited by a "non-interactive" approach. By providing a practical perspective, to what would otherwise have been a desk research project, interaction with farmers (and to a lesser extent with advisers) proved to be a major strength of the approach adopted in this study.

The completion of the interactive discussion phase and subsequent additions to the modelling strategies, marked the completion of the first two phases of the research approach presented in Figure 2.1. Phase three of the study, which is to present the research findings for possible use in decision support, continues in Chapter Eight.

CHAPTER EIGHT

USE OF RESEARCH FINDINGS IN DECISION SUPPORT

8.1 INTRODUCTION

One of the original sets of objectives (stated in Section 2.3.1) was to evalute the feasibility, profitability, compatibility and riskiness of export hogget production systems (relative to existing production systems), as well as investigating some of the possible off-farm implications of export hogget production. This chapter reviews the findings of this research project pertaining to these objectives. Chapter Nine reviews the approach taken in this study and evaluates the research approach.

8.2 EXPORT HOGGET PRODUCTION : POTENTIAL SUPPLY

Carcase Suitability for Export

The situation analysis corroborated research information (albeit limited) indicating that it is technically feasible to produce hogget carcases suitable for export in the spring/early summer period. This view was confirmed during farmer discussions. Relative to lamb, export hogget production appears to offer a realistic opportunity to produce larger and leaner carcases for export.

Export Hogget Supply

The study indicates that farmers regard the main advantage of an export schedule for hogget as an alternative outlet for ewe hoggets surplus to breeding requirements ('culls'), particularly at a time when two-tooth prices have declined. However, from a national perspective, selling ewe hogget breeding stock on an export schedule may not be in the best interests of New Zealand sheep production systems.(1)

(1) Refer to discussion in Chapter Three.

A review of New Zealand sheep production systems indicates limited opportunity for existing systems to supply export hogget from 'cull' breeding stock. Nationally there are likely to be three farm classes which have a potential to supply significant numbers of ('surplus' breeding) hoggets to an export market. These are : South Island Hill Country (Class 2) farms, North Island Hard Hill Country (Class 3) farms, and North Island Hill Country (Class 4) farms. The South Island Finishing/Breeding (Class 6) farms also have limited potential to supply 'cull' ewe hoggets. Together, these farm types have the potential to supply between 1.5 million to 2.0 million ('cull') breeding hoggets each year to an export market.(1) However, because of the interdependence of New Zealand sheep farming systems, a large number of these ewe hoggets surplus to breeding requirements on hill country farms are sold to lowland farms to form the basis of lowland breeding flocks. Because of these inter-relationships the potential ability of current farm production systems to supply ('cull') hoggets for an export market without significantly affecting established farm type inter-relationships appears limited and there is a good case for exploring national strategies which require additional hoggets to be wintered.

8.3 EXPORT HOGGET PRODUCTION SYSTEMS

8.3.1 Profitability

Profitability in this study was investigated by deriving break-even schedules for export hogget relative to a status quo situation for a range of farm types.

Break-Even Schedules

The break-even schedule for export hogget varied according to farm type, export hogget production strategy, and animal performance level.

Greater returns for export hogget are required to make the system 'profitable' where the status quo (pre export hogget) situation is more intensive with high animal performance levels. Consequently, it

(1) Note refer to Section 3.5

would appear that lowland farmers are less likely to be attracted financially to export hogget production than are farmers currently operating on harder hill farms.

This study indicates that where export hogget production involves a reduction in status quo ewe numbers, financial returns are likely to be highest on moderately intensive hill properties as exemplified by Model types 2, 3 and 4. Model 1 represents a more intensive production system, but despite good export hogget carcase weights, the income foregone through reducing ewe numbers and delaying lamb sales requires a high break-even schedule per kilogram of export hogget carcase. Conversely, under the conditions of Model 5 type farms (hard hill) hogget growth rates are poor, so despite foregoing poorer ewe and lamb returns, the return per kilogram of export hogget has to be greater to compensate for the light hogget carcase produced.

Of the two major export production strategies considered in this study (reducing ewe numbers, or reducing cattle numbers), cattle reduction is generally the most 'profitable'. An exception occurs in Model 3 and to a lesser extent in Model 5, where the returns from cattle relative to sheep are higher than in the other models. Reducing cattle numbers may, however, accentuate pasture management difficulties associated with export hogget production strategies.

Management Factors

In export hogget production strategies, the break-even return required from export hogget production is strongly influenced by factors under management control.

Hogget slaughter weight is the parameter which, as a single factor, has the greatest effect on export hogget 'profitability'. Hogget slaughter weight is directly under management control as hoggets may be fed to grow faster, or hogget selling policies altered, to affect final slaughter weight.

Hogget carcase composition also has an important influence on export hogget returns. Hogget carcase composition is potentially under management control as selling strategies could be adopted to manipulate carcase composition through known relationships between composition and weight. Weight can be strongly affected by animal feeding strategies (feed management).

Both lambing percentage and wool production also have a significant influence on break-even export hogget returns.

Product Prices

In export hogget production strategies, the break-even returns required from export hogget are only moderately influenced by changes to product prices (other than to export hogget).

Of the products produced, the export hogget schedule is affected most by changes to lamb receipts. Fleece and hogget wool prices have a noticeable, though less marked, effect on export hogget break-even schedules. Similarly, ewe and two tooth prices influence export hogget profitability but generally to a lesser extent than other product prices.

Cash Flow and Capital

Export hogget production strategies reduce summer/autumn income and increase spring and early summer income (by a corresponding amount in a break-even situation). In Model 2, the influence of cash flow on total overdraft payments is to increase the total overdraft interest payments made in a full year. The amount of capital released when stock are sold to facilitate export hogget production is not great in relation to the financial consideration of the total enterprise, and is offset by a reduction in stock assets. Capital considerations do not appear to be important, but the need for increased overdraft facilities in an export hogget production system could be of importance under certain financing arrangements.

Break-Even Range

In the analyses presented, the break-even schedules for export hogget production can be summarized:

		c/kg of Export hogget Meat
(a)	Under ewe reduction strategies:	
	(i) average performance	127 c/kg to 178 c/kg
	(ii) medium performance	98 c/kg to 119 c/kg
(b)	Under cattle reduction strategies:	(average performance only) 113 c/kg to 115 c/kg
(c)	Instead of selling two-tooths	101 c/kg to 126 c/kg

It could therefore be concluded, that when compared to traditional production systems in which prime lamb is sold on schedule of 149 c/kg (PM grade), farmers would require an export hogget schedule in the order of 135 c/kg to 145 c/kg to consider export hogget production financially attractive.

8.3.2 Feasibility

Export hogget production is considered to be feasible under a range of current farming systems, although the compatibility of export hogget production with pasture management may vary according to pasture growth patterns.

Feed Demands

Export hogget production strategies presented in this study have greatest feed demands, relative to status quo situations, during the winter months of June and July. Under some situations export hogget production also results in relatively high feed demand in early spring. Conversely, export hogget production sytems have lowest feed demands relative to status quo situations, over the summer.

As a result of the feed demand profile it would appear that, with all other things being equal, export hogget production systems are best suited to regions which experience a combination of relatively good winter pasture growth and relatively poor summer pasture growth.

Winter Feed Distribution Patterns

Simulation studies show that, all other things being equal, export hogget production systems result in more even distribution of pasture cover at lambing time when compared to status quo situations. This effect is most pronounced under situations of fast winter ewe rotations.

The effects of having a more even distribution of pasture cover at lambing is not quantified in the literature. However, farmer experience indicates that under conditions of even pasture distribution, grazing management in both the pre and post-lambing periods is easier to plan and implement.

Summer Feed Management

Feed balance studies show that export hogget production sytems relative to Status quo situations will require significantly less feed during the period from late November to early February.

Export hogget production systems are therefore likely to result in lax summer grazing of pastures. Under such conditions farm productivity could be affected as the development of late spring/early summer feed surpluses are known to reduce feed quality resulting in major nutritional limitations to breeding ewes and hoggets in late summer/autumn (Sheath, 1982). Pasture production is similarly affected by grazing pressure. Light grazing in late spring and summer results in reduced summer and autumn pasture growth rates (Sheath, 1982).

Farmers interviewed expressed concern at the likely implications of export hogget production on summer pasture management. The author believes that this concern is justified. It is apparent that export

hogget production could result in lax summer grazing in some situations and where this occurs, strategies to reduce the effects of lax grazing would need to be implemented. Although outside the scope of this study, integrative strategies such as purchasing trading cattle in early summer (rather than autumn) or purchasing bull beef animals, may be worth consideration.

Breeds

Farmers interviewed believed that existing hill sheep breeds, under current management practices, would be suitable for export hogget production. Data to confirm or refute this belief is not available. However, as carcase composition was shown to affect returns significantly for export hogget, the author considers it would be prudent to confirm the suitability of existing breeds and management practices, prior to recommending the production of export hogget.

8.3.3 Desirability

Profitability

The desirability of export hogget production was seen by farmers to be a function of export hogget returns relative to returns from other components of the production system (lambs, wool, culls, etc.).

Cash Flow and Capital

Capital and cash flow considerations were not perceived by farmers to significantly affect the desirability of export hogget production.

Personal Factors

Similarly, enterprise and personal goals, and district social norms, were not perceived as deterrants to export hogget production.

Labour

There is some indication that export hogget production would be perceived as an opportunity to reduce on-farm labour requirements. This influence is likely to be most significant on larger units where export hogget production could allow system expansion and/or intensification without the requirement for additional labour unit.

Similarly, export hogget production may allow labour input to be reduced without significantly reducing system output. As labour is a major variable farm cost, any farming system (management and/or production) which requires less labour, will, with all other things being equal, increase farm profitability.

The desirability of export hogget production is largely related to system 'profitability' but may be influenced by other management and/or production system variables. All would need consideration and evaluation at specific farm type level.

8.3.4 System Output

Export hogget production affects both total farm output and product output mix.

Sheep Meat

Total sheep meat production (output) decreases under ewe reduction strategies for both average and medium performance levels. The extent of the reduction in meat output is less however under medium performance levels.

Export hogget production systems produce significantly less lamb (prime or store) but this reduction is partially compensated by an increase in the amount of hogget meat produced.

Where beef reduction strategies are adopted, beef production is reduced but sheep meat production increases.

Wool

Total wool production under export hogget production systems decreases similarly. The reduction is due to reduced fleece wool production from ewes and two-tooths not being fully balanced by an increase in hogget fleece output.

8.3.5 Risk

The methods used in this study were not specifically designed to assess 'riskiness'. However, the farmers interviewed indicated that they do not believe that, under conditions of equal profitability, export hogget production would be significantly more risky than current lamb production policies. Conversely, farmers currently producing store lambs considered that supplying hogget on schedule could be less risky than producing store lambs for sale on an unpredictable seasonal store market.

There was nothing in the study to suggest that farmers perceived 'risk' associated with export hogget production as a limitation to export hogget production.

8.4 EXTERNALITIES

This section briefly discusses a number of aspects which, although outside the scope of this study, have implications for export hogget production systems.

8.4.1 On-Farm Externalities

Selection Pressure

Farmers made repeated references to advantages of export hogget production for hogget replacement 'selection pressure'. In a commercial situation 'selection pressure' refers to the lifetime increase in ewe performance which can be achieved through selection of ewe replacements from superior hoggets.

In terms of selecting replacement breeding stock for a flock, the greater the number of stock from which selection can be made, (ie the smaller is the proportion of stock retained to achieve a specified number) the greater the 'selection pressure' will be.

The two production factors of importance to commercial farmers are wool production and meat production. The latter is closely related to lambing percentage (twinning ability). Although it is possible to select replacement hoggets for wool weight and lambing percentage (by monitoring hogget oestrus) before winter hogget selection after winter for wool in particular (in October), is more effective (Butler, 1983). But because there have been no profitable outlets for spring culled hoggets, other than waiting for summer two-tooth fairs, most hogget selection is done prior to winter allowing cull ewe lambs(hoggets) to be sold on an export lamb schedule (Butler, 1983). Therefore it is apparent that a 'profitable' export hogget schedule would overcome this limitation to spring selection, and thereby provide farmers with an opportunity to improve selection pressure and consequently flock production levels .

Ewe/Hogget Winter Feed Requirements

Discussions with farmers indicated that winter grazing management plans often use standard livestock conversions as the basis for planning winter animal feed requirements.

Analyses undertaken during this study indicate that for reasonable hogget winter growth rates, winter hogget feed requirements are very similar to ewe feed requirements. This study indicates that an extension effort may be required to overcome this knowledge deficiency of farmers.

Winter Rotation Lengths

During the discussions with farmers, it became apparent that few farmers appreciate the relationship between winter grazing management and early spring feed deficits. Many farmers expressed concern at

experiencing a late August/early September feed pinch on their farms. It was noticeable that those farmers who were most concerned at a lack of spring feed also had the shortest winter rotation lengths. Simulation modelling undertaken as part of this study predicted that lengthening winter rotations would help alleviate such early spring feed pinches. Again, there may be a need for an extension effort to overcome this current knowledge deficiency of some farmers.

8.4.2 Off-Farm Externalities

Seasonality in the Meat Industry (and associated Agricultural Industries)

The seasonal pattern of sheep slaughtering in New Zealand shows marked seasonality, peaking in January/February (Taylor, 1982).

Taylor (1982) estimated that redistributing the peak lamb kill in the Auckland district could theoretically reduce killing charges by around 20%.

Output analyses carried out as part of this study indicated that export hogget production systems reduce lamb slaughtering in summer/autumn by around 20%, with a subsequent increase in hogget slaughterings in early summer. It is therefore apparent, that if practiced on a reasonable scale, export hogget production could result in reduced killing charges by reducing lamb killing peaks and evening out the total annual kill. However, in order to quantify the effect, it would be necessary to evaluate the implications of changing seasonal slaughter patterns by export hogget production in conjunction with processing and exporting companies. This was outside the scope of this study.

Farm Type Interdependence

The situation analysis undertaken as part of this study indicated that lowland farms often rely quite heavily on hill farms to supply their replacement breeding stock.

Farmers interviewed in this study indicated that they believed this flow of stock (via the two-tooth fairs) could be significantly disrupted by a 'profitable' schedule for export hogget. Sensitivity analysis undertaken in this study also showed that the break-even schedule for export hogget ('profitability') is moderately sensitive to two-tooth prices.

Consequently, before export hogget production could be advocated on a national scale it would be necessary to undertake further research to establish the likely supply situation, and flow-on effects, of export hogget production.

8.5 ADDITIONAL RESEARCH INFORMATION

If export hogget production is to be practised, this study has highlighted areas in which additional research information is required in order to improve the decision support information available to farmers.

Hogget Carcase Composition

Further research into hogget carcase composition following overwintering is required before the output and profitability of export hogget production systems can be predicted accurately. This study showed that both the system output and system profitability are likely to be strongly influenced by spring/early summer hogget carcase composition.

Data is required on hogget post-winter carcase composition for both ewes and wether hoggets of the major sheep breeds and for a range of liveweights (35 to 55 kg LW). Similarly, the effects of varying profiles of hogget liveweight gain over the winter/spring period on hogget carcase also needs investigation (for example, slow/fast versus 'average'; winter growth profiles).

Management Systems

While this study successfully investigated export hogget production systems on selected North Island hill country farm types, it did not investigate systems for managing export hogget production. This was partly a consequence of the stated objectives of this project, and partly a consequence of the methodologies used in this study.

The feed budgeting (balance) procedure could not investigate actual field relationships between stock feed demand and pasture feed supply profiles under export hogget production systems. If export hogget production were to be practised, additional research would be required to determine the influence of various grazing management strategies on export hogget production. For example, information would be required to determine the influence of late spring/early summer feed surpluses on subsequent farm production (pasture and stock) which this study showed are likely to occur under export hogget production. Nor did this study, for example, attempt to investigate the use of complementary mangement systems to utilise the feed surpluses likely to be generated by selling export hoggets in mid-November.

In addition, the study did not investigate the effects of alternative lamb and export hogget retention and sale strategies. For example, the type of effects which could not be investigated include the physical and financial impact of restricting export hogget feed intake over summer and concurrently increasing export lamb feeding, with the objective of selling heavier lambs earlier in the season, and then increasing export hogget feed levels as lamb sales progressed. Or similarly for example, it was not possible to consider the desirability of drafting export hoggets from top ewe hoggets in mid-November and then using additional early summer feed to grow medium or poor ewe hoggets to target two-tooth weights by tupping time.

Further management and technical research would be required to investigate these and other management possibilities should export hogget production become financially attractive.

8.6 CHAPTER CONCLUSIONS

With the caveats already discussed the study indicates that existing hill country sheep and beef farming systems can be modified to produce hoggets for slaughter in early summer, and that hogget production is possible under a range of farm types and climatic conditions.

The study has not investigated the suitability of hogget produced under a range of production systems and management strategies, for an export market. There is limited evidence to indicate that wether hoggets produced on hill country farms do result in a carcase suitable for export. However, before export hogget production could be advocated widely, the suitability for export of ewe hogget carcases produced under hill country conditions must be established. This is particularly important, given farmer preference to retain ewe hoggets, and the sensitivity of the system to hogget carcases attaining export grade standards.

The overall profitability of export hogget production is dependent on a viable overseas market. The current (September 1983) Meat Exporters schedule for hogget in the North Island, excluding Auckland, is:

HL	up to 22 kg CW	61 c/kg
HM	22.5 to 26 kg CW	74 c/kg
HX	up to 22.0 kg CW	48 c/kg

The study indicates that these schedule prices are inadequate to achieve income parity with existing sale policies for any of the models presented, or for any of the farms visited by the author. Consequently, there can be NO current recommendation, based on rational financial behaviour, to produce export hogget.

Post Script

Current (28 January 1984) schedules for export hogget are:
(new grading system)

HL	(all weights)	62 c/kg
HX	(all weights)	57 c/kg

[and PM lamb (13-16 kg CW) 148.5 c/kg]

CHAPTER NINE

EVALUATION

9.1 INTRODUCTION

Evaluation of the study is considered from three perspectives, the suitability of the research approach to the research topic, the research methods used in the research process, and the extent to which the project achieved the study objectives.

9.2 SUITABILITY OF RESEARCH APPROACH

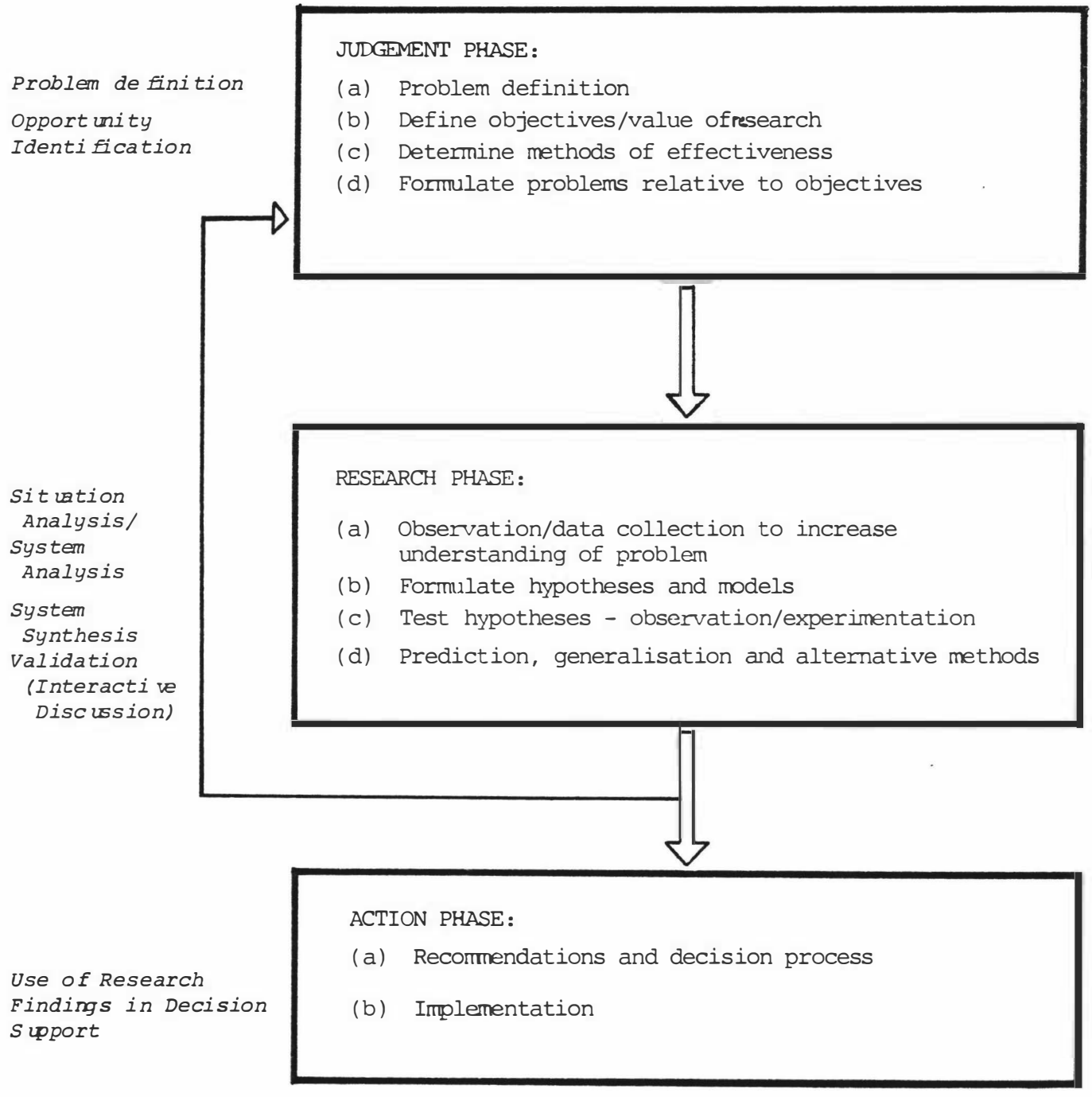
The main feature of the research approach followed in this study was the integration of desk and field research by way of interactive discussions with farmers.

9.2.1 Desk Research Phase

The stages and sequence of the desk research phase followed in this study parallel those followed in the Scientific Method of Operations Research presented by Saaty (1959), Business Research Methods (Emory, 1980; De La Mere, 1982; Cloughley, 1983), and the Agricultural Systems Research (Dent and Anderson, 1971). Each of the approaches to research is presented in diagrammatic form in Figures 9.1 to 9.3 inclusive. Included on each diagram, in italics on the left hand margin, are the corresponding stages followed in this study.

Saaty's (1959) approach to Scientific Method in Operations Research is represented schematically in Figure 9.1. Operations Research is concerned with solving management problems, or increasing operational or management efficiency. Operations Research is used widely in many fields, but has become closely associated with industry operational applications. Operations Research refers to a research approach, and may involve many analytical methods (Saaty, 1959).

FIGURE 9.1 Schematic Representation of Scientific Method in Operations Research (Saaty, 1959)



In a similar vein to Operations Research, Business Research Methods have evolved as a process of business management concerned with developing new products, or extending existing products. The literature refers synonomously to product development and investment opportunities. (De Le Mere, 1982; Cloughly, 1983). The most suitable product is usually that with the highest net present value but which also satisfies other specified criteria.

The research process, in this context, is broadly concerned with finding potential suitable projects from a mass of new product ideas.

This research process is shown schematically in Figure 9.2 (Cloughly, 1983).

The basic steps of Agricultural Systems Research adapted from Dent and Blackie are shown in Figure 9.3.

FIGURE 9.2 Schematic Representation of New Product Development Process (Cloughley, 1983)

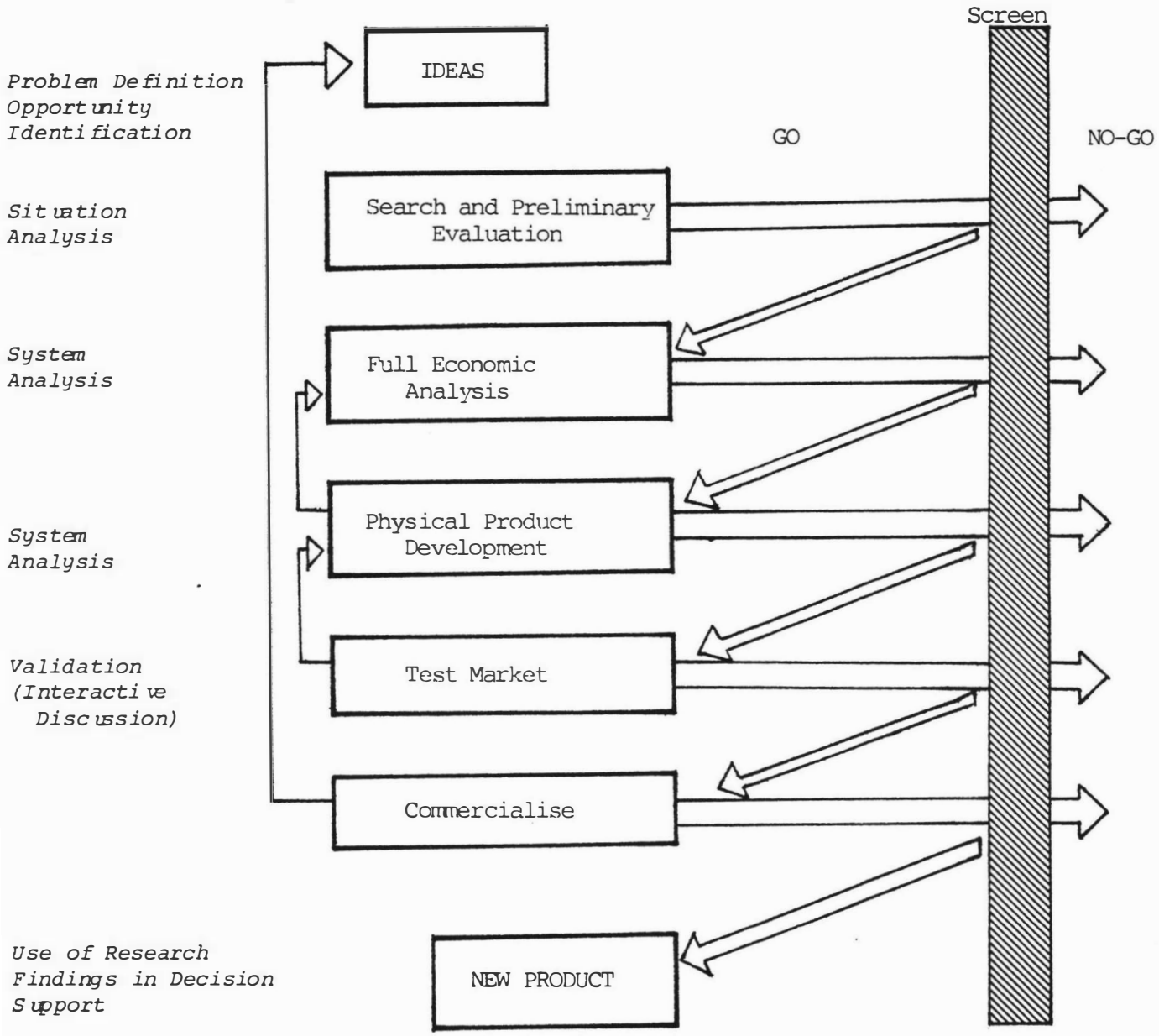
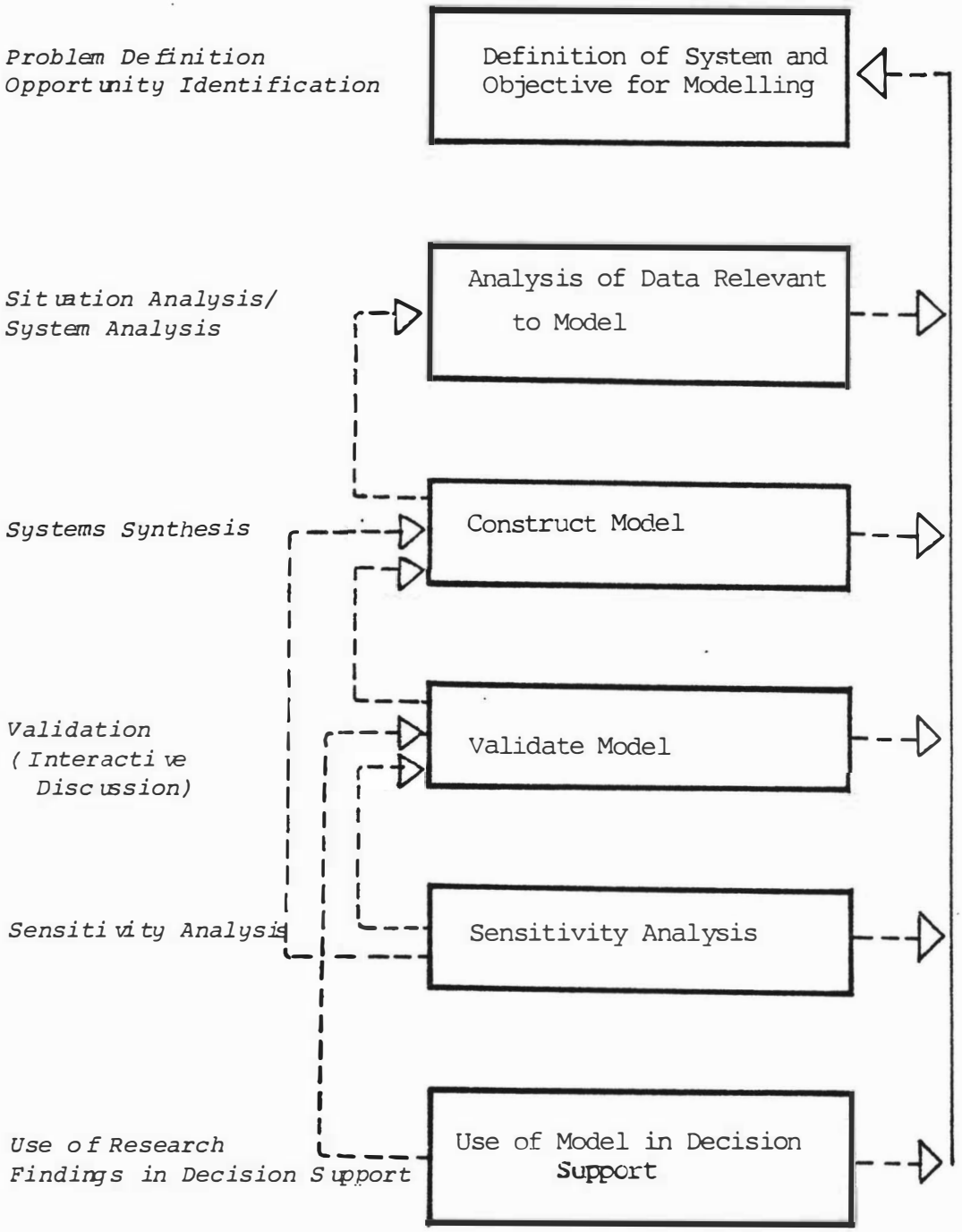


FIGURE 9.3 Basic Steps of Systems Research (Adapted from Basic Steps of Systems Simulation, (Dent and Blackie, 1979))



This brief review of approaches to research illustrates the close symmetry between the research approach followed in this study and other well established research approaches.

9.2.2 Interactive Discussion Phase

The production system researched in this project did not at the time of research exist as a real system. Therefore it was not possible to compare (validate) the performance of export hogget production models with the performance of real production systems. In this study interactive discussion was used as a method to investigate farmer beliefs about potential export hogget production systems. (In a systems research context this equates closely to system validation). However in the context of this project, the interactive discussion phase proffered additional research benefits as interaction with farmers and advisers served to highlight production and management issues not previously considered by the author (for example cattle reduction strategies, farmer view of risk, on-farm externalities, etc).

In the author's view, the role and function of the Economics Section of Advisory Services Division imposes special requirements on the type of, and approach to, farm management research performed by Advisory Officers (Economics) presented in Chapter Two. In order to achieve these requirements, the author believes that this project confirmed that some form of interactive research phase (with farmers/other advisers/industry personnel) is an important component of research performed by Advisory Officers (Economics).

9.3 RESEARCH METHODS

9.3.1 Desk Research Phase

Because the study showed that export hogget production is not at present financially viable at current hogget schedule prices, the author believes that the research methods used in this study were

adequate to answer the basic questions pertinent to export hogget production in the areas of profitability, feasibility, compatibility and risk. However, had export hogget production been shown to be profitable, or should it become profitable in the future, then the limitations of the feed budgeting/gross margins procedures as means of investigating production strategies and systems for managing export hogget production, would be important.

Chapter Five outlined how feed budgeting (balances) procedures were used to design feasible (in terms of feed supply and demand relative to status quo situations) export hogget production systems. 'Profitability' and system output were then determined by gross margins analysis. However these methods proved too inflexible to permit easy evaluation of alternative management strategies. For example, investigation of alternative hogget growth profiles would require recalculation of both a new feed budget and gross margin, since a changed hogget growth profile would alter the number of export hoggets retained, wintered, and sold. And, because the death rate for export hoggets was based on June (winter) numbers, recalculating the feed budget would require re-estimating export hogget numbers for each month from weaning to sale. Furthermore, changes to export hogget numbers which require retention of lambs through to hogget stage, alters lamb sale numbers and therefore associated gross margins and feed demands.

In the early stages to the study, consideration was given to synthesising the models of export hogget production in a Linear Programming (LP) framework. This method was rejected because it was intended to include aspects of the dynamics of grazing management and animal performance interactions in the production model. Indications were that these would have been difficult to achieve in an LP model. (refer to Appendix Nine a).

Therefore it was decided that gross feed budgeting, which would include manual estimates for the dynamics of grazing management and animal performance, could adequately indicate the direction of the changes required to incorporate export hoggets into existing

production systems as the requirement was simply to change stock numbers in order to release feed on which to carry export hoggets over the winter. Accordingly the potential difficulties with LP specification and solution procedure (described in Appendix Nine a) did not appear to be warranted. The author is aware that this was a subjective assessment, but the detailed comparison of alternative quantitative methods for farm production systems synthesis was not the major objective of the study. In addition, since feed budgeting models for micro-computers are readily available, and since Farm Advisory Officers are familiar with the process of simulating successive management decisions using this technique, the decision was made to use a feed budgeting approach rather than spend time developing a fully operational LP specification of the problem.

However, during the course of the feed budgeting studies, the effects of the conditional relationships between animal performance (feed requirements) and residual dry matter (refer to Appendix Nine a) on June hogget numbers was not found to be great. Consequently, these relationships were not considered in the final feed budgets presented in Chapter Five. Although this omission had removed the cause of the anticipated difficulties with LP modelling, the feed budgets had by this stage been completed and time limitation precluded recalculating the models in a LP framework. However, in order to demonstrate how the production systems could be specified in a LP context, a LP matrix for one strategy (Manawatu Small Hill: ewe reduction at average performance) is presented in Appendix Nine b). Accordingly, the method used by McRae (1975) in which feed shadow prices of a LP model were used to modify liveweight gain (refer to Appendix Nine a) could have been used in this study to experiment with alternative management strategies of export hogget production, thereby overcoming the main limitations of the feed budgeting/gross margins approach.

9.3.2 Interactive Discussion Phase

As the real system did not exist at the time of this study, it was necessary to develop a method to test farmer reaction (and validate the system) without access to a real system.

The method used was that of interactive discussion; a procedure based on Personal Construct Theory (Kelly, 1955) and the Personal Interaction Model of Extension (Woog, 1982).

The approach worked well, although part of the success is probably due to a number of human factors associated with the exercise. Firstly, farmers were selected by advisers on the basis of having ability to conceptualise a non-existent system. The approach may not be as successful where farmers do not have this ability. Secondly, the author has had eight years farm advisory experience with MAF which was of benefit in establishing a rapport (construct commonality) with the farmers interviewed in the study.

Under the conditions pertaining in the study, farmers and the author were able to estalish a high degree of construct commonality. In conjunction with this commonality, the ordered sequence of the discussion allowed farmers to expose and alter their construct systems (beliefs).

In addition to the sequencing of the discussion, the questionnaire itself was useful in the reconstruction process. The use of tracing paper on which to record post export hogget detail whilst still being able to view pre export hogget detail was an important aspect to the success of the interactive discussions. The method enabled the interviewer to retain commonality with the farmer and allowed use of counselling, questioning techniques.

9.4 STUDY OBJECTIVES

This section evaluates the general study objectives outlined in Section 1.1 and the more specific objectives outlined in Sections 2.4 and 2.5, in which the farm management implications of export hogget production on lower North Island Hill country sheep farms were considered from two perspectives; an industry perspective, and an institutional perspective.

9.4.1 Industry Perspective

The on-farm industry objectives were to research the feasibility, profitability, compatibility and riskiness associated with export hogget production. Previous discussion has shown that the study approach and method was successful in either meeting the requirements of these objectives or indicating areas of further research required to do so. A strength of the study method was that export hogget production was investigated over a range of farming conditions in such a way, by using Ministry of Agriculture and Fisheries farm models, which could allow extrapolation of findings over a range of existing farming systems.

The off-farm industry requirements were not so well covered by this study. While the findings could be expected to provide some indication to industry representatives of the likely implications of export hogget production, they do not provide definitive information. The study does however, indicate areas of concern and direction for further research, especially in the areas of hogget carcase composition, hogget marketing, and impact of export hogget production on the inter-dependence of New Zealand sheep farming systems. Also, by way of extrapolation through the farm monitoring models, the study could be useful in providing possible hogget supply information for consideration in meat industry seasonality issues.

9.4.2 Institutional Perspective

The study was concerned with the requirements of the Ministry of Agriculture and Fisheries, as a whole, and the Economics Section of the Advisory Services Division in particular. The study method, involving the complementary use of modelling techniques based on Advisory Services Division models, and interactive farmer discussion, was particularly well suited to meeting these requirements. Once the method was established the study was undertaken relatively quickly and easily. The approach allowed reasonable conclusions to be drawn for on-farm considerations as well as highlighting major areas of management control and system sensitivity.

And finally, an interactive approach to farm management research would likely be useful in assisting Farm Advisory Officers (Extension) and other advisers in the formulation of extension programmes in order to encourage on-farm adoption of research findings.

9.5 CHAPTER CONCLUSION

The author believes that the approach and methods used in this thesis have been satisfactory for the research project in the context from which it has been considered. Certainly, the author believes that from a vocational perspective the experience has been most worthwhile.

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APPENDIX ONE: Initial Survey

Farm and Hogget Management CHECKLIST

Date _____

Farm Information

Farmers Name/Model _____

Farm Location _____

Farm Type (Class) _____

Adviser's name _____

Farm Size - Total area (ha) _____

- Effective area (ha) _____

Number of main paddocks _____

Labour - full time _____

- Contract _____

- Other _____

Fertiliser/Lime _____

_____

Stock Numbers (Wintered 1982)

	Numbers	Stock Units
A. Sheep		
Mixed age ewes	_____	_____
2-tooth ewes	_____	_____
Ewe hoggets	_____	_____
Wether hoggets	_____	_____
Rams	_____	_____
Others	_____	_____

Number increasing/decreasing _____

Breed - ewes _____

- rams _____

B. Cattle

Breeding cows	_____	_____
R 2yr heifers	_____	_____
R lyr heifers	_____	_____
Steers - R lyr	_____	_____
- R 2yr	_____	_____
- older	_____	_____
Bulls - breeding	_____	_____
- others (age)	_____	_____
	_____	_____

Number increasing/decreasing _____

Calculate - stocking rate _____

Sheep/cattle ratio _____

Policies

A. Sheep:

Replacement Policy	Date of Purchase	Approx No per Year entering flock	Average Price
own replacements		_____	_____
Bought in lambs/hoggets	_____	_____	_____
Bought in 2-ths	_____	_____	_____
Bought in older ewes	_____	_____	_____

SHEEP MANAGEMENT

Lambing	Date Rams Out	Av. Ewe Wt (Kg)	Lambing %
Mixed age ewes			
2-tooth ewes			
Hoggets			

Weaning	Date (month)
Mixed age ewes	
2 tooth ewes	
Hoggets	

Wool

Shearing Policy (tick)

- Full wool ____
- 8 month ____
- Second shear ____

Normal Shearing Dates:

	Date	Av wt (Kg)	Number Shorn
Ewes - main shear			
- second shear			
Lambs - replacements			
- others			
Hoggets			
2-tooths			

COMMENTS _____

_____

_____

SELLING POLICIES for "typical season" - based on (static) 1982 stock numbers wintered.

(a) Lambs

Approximate proportion sold fat _____

Usual time of first draft _____

Number of lambs sold at weaning _____

Summary of Lamb Sales:		Approx Number	Av Carcase wt	Av Price (Net)
October	- Works			
	- Stores			
November	- Works			
	- Stores			
December	- Works			
	- Stores			
January	- Works			
	- Stores			
February	- Works			
	- Stores			
March	- Works			
	- Stores			
April	- Works			
	- Stores			
May	- Works			
	- Stores			
June	- Works			
	- Stores			
July	- Works			
	- Stores			
August	- Works			
	- Stores			
September	- Works			
	- Stores			

SHEEP PURCHASES (Other than replacements):

Class	Approx No	Month	Av Price

SHEEP SALES (Other than lambs)

(i) Surplus/Replacements	Approx No	Month	Av Price
Hoggets (breeding)			
2-tooths			
Ewes (i) Dries			
(ii) 5yr breeding			
(iii) Works			

COMMENTS _____

_____

_____

(ii) Hoggets	Approx No	Month	Average Price $	Average Carcase Weight
(Local trade/ export)				

COMMENTS (on sheep selling/buying policies: _____

_____

_____

B. CATTLE

General Policy _____

_____

Calving Dates	Date	Calving %
Mixed age breeding cows		
3 yr heifers		
2 yr heifers		

Weaning Dates _____

COMMENTS _____

_____

_____

Cattle Purchase Policies

Date	Class of Cattle Purchased	Approx No	Average Price

Cattle Selling Policies

(i) Steers/heifers/cows	Works/Yards	Date (Month)	Approx No	Average Price
Weaners				
1-2 years				
2 yr +				
Cull cows				

(ii) Bull Beef	Date	Approx No	Average Price

PASTURE MANAGEMENT

Set stocked _____ Controlled Grazing _____ (Tick)

Grazing Summary (SS = Set stocked)

Sheep	Winter	Spring	Summer	Autumn
		(Average rotation length -grazing days - spell)		
Mixed age ewes				
2-tooths				
Ewe hoggets				
Wether hoggets				
Others				

Comments _____

_____

_____

Cattle	Winter	Spring	Summer	Autumn
Breeding cows				
R 3yr				
R 2yr				
R 1yr				
Bull (beef)				
Others				

COMMENTS _____

_____

_____

Growth Rates

Total pasture production (kg/ha/yr) _____

Seasonal distribution (kg/ha/day)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

COMMENTS _____

FODDER CROPS

Crops Grown Name	Area (ha)	Grazed by (Class of stock)	When Grazed (month/time)	Feed Availability (Kg DM/ha)

COMMENTS _____

ARABLE CROPS

Rotation: _____

Crop Name	Area	Cultivation begins	Harvest Date	Forage Crop (Type/date)

SUPPLEMENTARY FEEDS (hay, silage, nitrogen):

(a) Conservation Policies

(i) Hay	Month Made	Area (ha)	No of Bales

(ii) Silage	Month Made	Area (ha)	Tonnes (W.M.)

(iii) Nitrogen	Month Applied	Area (ha)	Amount N Used

(b) Feeding Out	Month	Amount	Class of Stock
(i) Hay			
(ii) Silage			
(iii) Nitrogen			

Nitrogen Response: _____

COMMENTS

_____

_____

_____

_____

HOGGET MANAGEMENT

Management Objectives _____

_____

_____

_____

Management difficulties _____

_____

_____

_____

Hogget Weight Data (if Known)

	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Av. L.W.	___	___	___	___	___	___	___	___	___	___

Comments on current hogget management

_____

_____

_____

_____

"EXPORT" HOGGETS

If it was worth it, state possible sources of hoggets for export killing

_____

_____

_____

_____

If it was worth it (eg equivalent to lamb schedule) could you carry more hoggets? _____

If so, what changes would be required in:

(i) Stock (ie numbers/policy, etc)

(ii) Management (ie grazing)

GENERAL COMMENTS

APPENDIX TWO

Estimating Function for Lamb and Hogget Feed Requirements

Ulyatt et al in Fennessy and Drew (1980) provide estimates of daily feed requirements (MJME) for lambs and hoggets of different liveweights growing at varying rates of daily liveweight gain. Daily ME requirements for maintenance are given as: $0.6W^{0.75}$, where W is animal liveweight (15-50 kg). From the table of feed requirements presented by Ulyatt et al, Townsley (1983) has estimated the following relationship for above maintenance daily ME feed requirements:

$$\alpha(28.874 + 0.1771\ W + 0.014282\ W^2)$$

Where α is daily liveweight gain (kg). Total ME requirements for a period of T days, for lambs or hoggets of weight W kg at the start of the period, growing at kg/day ($0 < \alpha \leq 0.3$) is given by the integral:

$$\int_{t=o}^{T} ME_t\, dt$$

For the equations presented above, this expression becomes: $(\alpha > 0)$

$$28.874\ \alpha\ T + 0.1771\ W\ \alpha\ T + 0.08858\ \alpha^2\ T^2$$

$$+ 0.014282\ W^2\ \alpha\ T + 0.014282\ \alpha^2\ WT^2$$

$$+ 0.00476067\ \alpha^3\ T^3 + 0.6\ (1.75\alpha)^{-1}\ [(W + \alpha\ T)^{7/4} - W^{7/4}]$$

Townsley R.J. Feed Budgeting : Lambs and Hoggets (mimeograph). Department of Agricultural Economics and Farm Management, Massey University, 1983.

APPENDIX THREE : STOCK RECONCILIATIONS

APPENDIX III (a) Manawatu Small Hill

APPENDIX III (b) Hawkes Bay/Wairarapa : Easier Hill

APPENDIX III (c) Manawatu/Taihape North Island Hill

APPENDIX III (d) Hawkes Bay/Wairarapa : Harder Hill

APPENDIX III (e) Taihape/Wanganui North Island Hard Hill

STOCK RECONCILIATIONS

III(a)

MANAWATU SMALL HILL

STOCK CLASS	STATUS QUO		EWE REDUCTION (a) AVERAGE PERFORMANCE		EWE REDUCTION (b) MEDIUM PERFORMANCE		CATTLE REDUCTION	
	OPENING	CLOSING	OPENING	CLOSING	OPENING	CLOSING	OPENING	CLOSING
Breeding Ewes	1650	1650	1485	1485	1485	1485	1650	1650
Ewe Hoggets	550	550	495	495	495	495	550	550
Export Hoggets	-	-	225	225	157	157	225	225
Rams/Others	50	50	45	45	45	45	50	50
Rising 1 Year Steers	80	80	80	80	80	80	34	34
	PURCHASES	SALES	PURCHASES	SALES	PURCHASES	SALES	PURCHASES	SALES
Rams	8		7		7		8	
Lambs		1120		781		923		892
Export Hoggets	-			219		153		219
Ewe Hoggets (export)	-			62		62		69
Two-Tooths		92		21		21		23
Ewes		409		368		368		409
Weaner Steers	80		80		80			
Rising 2 Year Steers		78		78		78		
	BIRTHS	DEATHS	BIRTHS	DEATHS	BIRTHS	DEATHS	BIRTHS	DEATHS
Lambs	1700		1530		1604		1700	
Deaths - Sheep		87		86		84		96
- Cattle		2		2		2		1

STOCK RECONCILIATIONS

III(b)

HAWKES BAY/WAIRARAPA EASIER HILL

STOCK CLASS	STATUS QUO		EWE REDUCTION (a) AVERAGE PERFORMANCE		EWE REDUCTION (b) MEDIUM PERFORMANCE		CATTLE REDUCTION	
	OPENING	CLOSING	OPENING	CLOSING	OPENING	CLOSING	OPENING	CLOSING
Breeding Ewes	2420	2420	2178	2178	2178	2178	2420	2420
Ewe Hoggets	880	880	792	792	792	792	880	880
Export Hoggets	-	-	360	360	118	118	360	360
Rams/Others	80	80	72	72	72	72	80	80
Rising 2 Year Steers	85	85	85	85	85	85	50	50
Rising 1 Year Steers	85	85	85	85	85	85	49	49
	PURCHASES	SALES	PURCHASES	SALES	PURCHASES	SALES	PURCHASES	SALES
Rams	13		11		11		13	
Lambs		1461		951		1174		1097
Export Hoggets		-		351		219		351
Ewe Hoggets (export)		-		239		239		265
Two-Tooths		354		80		80		89
Weaners	85		85		85		50	
2/3 Year Steers		83		83	83	83		49
	BIRTHS	DEATHS	BIRTHS	DEATHS	BIRTHS	DEATHS	BIRTHS	DEATHS
Lambs	2372		2134		2222		2372	
Deaths - Sheep		159		154		151		172
- Cattle		2		2		2		1

STOCK RECONCILIATIONS

III(c)

MANAWATU/TAIHAPE - NORTH ISLAND HILL

STOCK CLASS	STATUS QUO		EWE REDUCTION (a) AVERAGE PERFORMANCE		EWE REDUCTION (b) MEDIUM PERFORMANCE		CATTLE REDUCTION	
	OPENING	CLOSING	OPENING	CLOSING	OPENING	CLOSING	OPENING	CLOSING
Breeding Ewes	2420	2420	2178	2178	2178	2178	2420	2420
Ewe Hoggets	840	840	756	756	756	756	840	840
Export Hoggets	-	-	352	352	219	219	352	352
Rams/Others	75	75	67	67	67	67	75	75
Rising 1 Year Steers	70	70	70	60	70	70	25	25
Rising 2 Year Steers	50	50	50	50	50	50	18	18
	PURCHASES	SALES	PURCHASES	SALES	PURCHASES	SALES	PURCHASES	SALES
Rams	10		9		9		10	
Lambs - prime		975		863		1078		975
- store		445		58		87		89
Export Hoggets		-		343		214		343
Ewe Hoggets (export)		-		149		149		165
Two-Tooths		220		49		49		55
Ewes		490		441		441		490
Weaner Steers	70		70		70		25	
18 Months Steers		19		19		19		7
2½ Year Steers		47		47		47		17
	BIRTHS	DEATHS	BIRTHS	DEATHS	BIRTHS	DEATHS	BIRTHS	DEATHS
Lambs	2299		2069		2178		2299	
Deaths - sheep		179		175		169		192
- cattle		4		4		4		1

STOCK RECONCILIATIONS

III(d)

HAWKES BAY/WAIRARAPA HARDER HILL

STOCK CLASS	STATUS QUO		EWE REDUCTION (a) AVERAGE PERFORMANCE		EWE REDUCTION (b) MEDIUM PERFORMANCE		CATTLE REDUCTION	
	OPENING	CLOSING	OPENING	CLOSING	OPENING	CLOSING	OPENING	CLOSING
Breeding Ewes	3500	3500	3150	3150	3150	3150	3500	3500
Ewe Hoggets	1200	1200	1080	1080	1080	1080	1200	1200
Export Hoggets	-	-	532	532	200	200	532	532
Rams/Others	180	180	162	162	162	162	180	180
Breeding Cows	175	175	175	175	175	175	107	107
Rising 2 Year Heifers	40	40	40	40	40	40	24	24
Rising 1 Year Heifers	42	42	42	42	42	42	26	26
Bulls	6	6	6	6	6	6	4	4
	PURCHASES	SALES	PURCHASES	SALES	PURCHASES	SALES	PURCHASES	SALES
Rams	20		18		18		20	
Lambs - prime		925		679		1165		813
- store		925		450		424		500
Export Hoggets		-		519		195		519
Ewe Hoggets (export)		-		321		321		357
Two-Tooths		476		107		107		119
Ewes		490		441		441		490
Bulls	2	2	2	2	2	2	1	1
Fat Cows		25		25		25		15
Weaner Steers		68		68		68		41
Weaner Heifers		26		26		26		15
1/2 Year Heifers		2		2		2		1
2/3 Year Heifers		6		6		6		5
	BIRTHS	DEATHS	BIRTHS	DEATHS	BIRTHS	DEATHS	BIRTHS	DEATHS
Lambs	3150		2835		2961		3150	
Calves	137		137		137		84	
Deaths - sheep		354		336		326		372
- cattle		10		10		10		7

STOCK RECONCILIATIONS

III(e)

TAIHAPE/WANGANUI - NORTH ISLAND HARD HILL

STOCK CLASS	STATUS QUO		EWE REDUCTION (a) AVERAGE PERFORMANCE		EWE REDUCTION (b) MEDIUM PERFORMANCE		CATTLE REDUCTION	
	OPENING	CLOSING	OPENING	CLOSING	OPENING	CLOSING	OPENING	CLOSING
Breeding Ewes	2360	2360	2124	2124	2124	2124	2360	2360
Ewe Hoggets	700	700	630	630	630	630	700	700
Export Hoggets	-	-	336	336	203	203	336	336
Rams/Others	70	70	63	63	63	63	70	70
Breeding Cows	70	70	70	70	70	70	29	29
Rising 2 Year Heifers	17	17	17	17	17	17	6	6
Rising 1 Year Heifers	17	17	17	17	17	17	7	7
Rising 1 Year Steers	10	10	10	10	10	10	4	4
Bulls	3	3	3	3	3	3	1	1
	PURCHASES	SALES	PURCHASES	SALES	PURCHASES	SALES	PURCHASES	SALES
Rams	10		9		9		10	
Lambs - store		1285		803		1038		946
Export hoggets		-		328		198		328
Ewe Hoggets (export)		-		61		61		68
Two-Tooths		90		20		20		22
Ewes		460		414		414		460
Bulls	1	1	1	1	1	1	1/3	1/3
Cull Cows		12		12		12		5
Weaner Steers		20		20		20		8
Weaner Heifers		14		14		14		6
18 Months Steers		8		8		8		3
2 Year Heifers		2		2		2		1
	BIRTHS	DEATHS	BIRTHS	DEATHS	BIRTHS	DEATHS	BIRTHS	DEATHS
Lambs	1982		1784		1869		1982	
Calves	59		59		59		24	
Deaths - sheep		157		151		147		168
- cattle		3		3		3		1

APPENDIX FOUR : FEED BUDGETS

NOTE: (i) All feed demand coefficients expressed in terms of kg DM/head/day (at 10.8 MJ ME/kg DM).

(ii) Death rates implicit in monthly stock figures presented; actual deaths can be calculated by cross referencing monthly stock numbers and stock sales (refer to Chapter Five and Appendix Five for detail).

APPENDIX IV (a) Manawatu Small Hill

(i) Sheep status quo (average performance)
(ii) Cattle status quo (average performance)
(iii) Ewe reduction (a) average performance
(iv) Ewe reduction (b) medium performance
(v) Cattle reduction (average performance)

APPENDIX IV (b) Hawkes Bay/Wairarapa : Easier Hill

(i) Sheep status quo (average performance)
(ii) Cattle status quo (average performance)
(iii) Ewe reduction (a) average performance
(iv) Ewe reduction (b) medium performance
(v) Cattle reduction (average performance)

APPENDIX IV (c) Manawatu/Taihape Hill Country

(i) Status quo sheep and cattle (average performance)
(ii) Ewe reduction (a) average performance
(iii) Ewe reduction (b) medium performance
(iv) Cattle reduction (average performance)

APPENDIX IV (d) Hawkes Bay/Wairarapa : Harder Hill

(i) Sheep status quo (average performance)
(ii) Cattle status quo (average performance)
(iii) Ewe reduction (a) average performance
(iv) Ewe reduction (b) medium performance
(v) Cattle reduction (average performance)

APPENDIX IV (e) Taihape/Wangnui NI Hard Hill Country

(i) Sheep status quo (average performance)
(ii) Cattle status quo (average performance)
(iii) Ewe reduction (a) average performance
(iv) Ewe reduction (b) medium performance
(v) Cattle reduction (average performance)

FEED BUDGET IV(a)1

MANAWATU SMALL HILL

SHEEP STATUS QUO (average performance)

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	1530	1530	1220	1220	1220	1670	1650	1630	1630	1630	1630	1530
	Feed	1.5	1.05	1.14	1.35	1.5	1.4	.98	.96	1.15	1.6	1.86	2.48
Two-Tooths	No.	542	542	450	450	450							
	Feed	1.47	1.37	1.59	1.76	1.5							
Ewe Hoggets	No.	562	560	560	560	550	550	550	550	542	542	542	542
	Feed	1.22	1.24	1.23	1.12	1.09	1.14	.98	.93	.88	.88	1.43	1.6
Lamb Mob 1	No.	200											
	Feed	1.14											
Lamb Mob 2	No.	200	200										
	Feed	1.02	.64										
Lamb Mob 3	No.	400	400	400									
	Feed	.89	1.02	.58									
Lamb Mob 4	No.	320	320	320	320	320							
	Feed	.74	.84	1.06	.97	.47							
Rams/Others	No.	50	50	50	50	50	50	50	50	50	50	50	50
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
SHEEP TOTAL (kg DM/day)		4852.18	3898.24	3416.3	3426.6	3304.9	3015	2206	2126.3	2401.46	3134.96	3856.86	4711.6
CATTLE TOTAL (kg DM/day)		523.77	595.14	615.03	502.39	415.6	338.8	391.6	405.6	374.87	654.81	728.52	659.1
WHOLE FARM TOTAL (kg DM/day)		5375.95	4493.38	4031.33	3928.99	3720.5	3503.8	2597.6	2531.9	2776.33	3789.77	4585.38	5370.7

IV(a)11

FEED BUDGET

MANAWATU SMALL HILL

CATTLE STATUS QUO

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mob 1	No.	39	39	39	40	40	40	40	40	40	39	39	39
	Feed	6.83	7.76	8.01	4.75	5.34	4.98	5.01	5.19	5.37	8.58	9.52	8.6
Mob 2	No.	39	39	39	39	40	40	40	40	39	39	39	39
	Feed	6.6	7.5	7.76	8.01	5.05	4.74	4.78	4.95	5.13	8.21	9.16	8.3
CATTLE TOTAL (kg DM/day)		523.77	595.14	615.03	502.39	415.6	388.8	391.6	405.6	374.81	654.81	728.52	659.1

Initial Liveweight - 192 kg (100 kg/w)
Final Liveweight - 441 kg (230 kg/w)

FEED BUDGET

MANAWATU SMALL HILL

EWE REDUCTION (a) AVERAGE PERFORMANCE

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	1377	1377	1098	1098	1908	1503	1485	1467	1467	1467	1467	1377
	Feed	1.5	1.05	1.14	1.35	1.5	1.4	.98	.96	1.15	1.6	1.86	2.48
Two-Tooths	No.	426	426	405	405	405							
	Feed	1.47	1.37	1.59	1.76	1.5							
Ewe Hoggets	No.	504	504	504	504	495	495	495	495	488	488	488	426
	Feed	1.22	1.24	1.23	1.12	1.09	1.14	0.98	.93	.88	.88	1.43	1.6
Export Hoggets	No.	227	227	227	226	226	225	225	224	223	221	220	281
	Feed	1.22	1.24	1.23	1.12	1.09	1.14	.98	.93	.88	.88	1.43	0.8
Lamb Mob 1	No.	180											
	Feed	1.14											
Lamb Mob 2	No.	180	180										
	Feed	1.02	.64										
Lamb Mob 3	No.	360	360	360									
	Feed	.89	1.02	.58									
Lamb Mob 4	No.	61	61	61	61	61							
	Feed	.78	.84	1.06	.97	.47							
Rams	No.	45	45	45	45	45	45	45	45	45	45	45	45
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
SHEEP TOTAL (kg DM/day)		4382.88	3514.55	3113.26	3116.87	3114.06	2970	2205.9	2121.99	2357.73	3016.12	3786.06	4366.36
CATTLE TOTAL (kg DM/day)		523.77	595.14	615.03	502.39	415.6	388.8	391.6	405.6	374.87	654.81	723.52	659.1
WHOLE FARM TOTAL (kg DM/day)		4906.65	4106.69	3728.29	3619.26	3529.66	3358.8	2597.5	2527.59	2732.6	3670.93	4514.58	5025.46
STATUS QUO WHOLE FARM (kg DM/day)		5375.95	4493.38	4031.33	3298.99	3720.5	3403.8	2597.6	2531.9	2776.33	3789.77	4585.38	5370.7
Difference (kg DM/day)		469.3	366.69	303.04	309.73	190.84	45.0	0.1	4.31	43.73	118.84	70.8	345.24
PERCENTAGE VARIATION FROM STATUS QUO		-8.73	-8.61	-7.52	-7.9	-5.13	-1.32	Nil	-0.17	-1.58	-3.13	-1.54	-6.43

FEED BUDGET IV(a) iv

MANAWATU SMALL HILL

EWE REDUCTION (b) MEDIUM PERFORMANCE

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	1377	1377	1098	1098	1098	1503	1485	1467	1467	1467	1467	1377
	Feed	1.54	1.09	1.18	1.4	1.6	1.43	1.02	1.0	1.18	1.7	1.96	2.64
Two-Tooths	No.	426	426	405	405	405							
	Feed	1.49	1.46	1.67	1.8	1.6							
Ewe Hoggets	No.	504	504	504	504	495	495	495	495	488	488	488	426
	Feed	1.17	1.19	1.41	1.24	1.18	.99	.991	.94	.95	1.05	1.58	1.41
Export Hoggets	No.	159	159	158	158	158	157	157	157	155	154	153	215
	Feed	1.17	1.19	1.41	1.24	1.18	.99	.991	.94	.95	1.05	1.58	.71
Lamb Mob 1	No.	193											
	Feed	1.15											
Lamb Mob 2	No.	193	193										
	Feed	1.18	.69										
Lamb Mob 3	No.	386	386	386									
	Feed	1.94	1.09	.63									
Lamb Mob 4	No.	151	151	151	151	151							
	Feed	.76	.86	1.09	.99	.48							
Rams	No.	45	45	45	45	45	45	45	45	45	45	45	45
	Feed	1	1	1	1	1	1	1	1	1	1	1	1

SHEEP TOTAL (kg DM/day)	4503.32	3640.63	3358.18	3281.57	3292.82	2839.77	2205.83	2124.88	2386.91	3213	3933.1	4433.59
CATTLE TOTAL (kg DM/day)	523.77	595.14	615.03	502.39	415.6	388.8	391.6	405.6	374.87	654.81	728.52	659.1
WHOLE FARM TOTAL (kg DM/day)	5027.09	4235.77	3973.21	3783.96	3708.42	3228.57	2597.43	2530.48	2761.78	3867.81	4661.62	5092.69
STATUS QUO WHOLE FARM (kg DM/day)	5375.95	4493.38	4031.33	3928.99	3720.5	3403.8	2597.9	2531.9	2776.33	3789.77	4585.38	5370.7
Difference (kg DM/day)	348.86	257.61	58.12	145.03	12.08	175.23	0.17	1.42	14.55	-78.04	-76.24	278.01
PERCENTAGE VARIATION FROM STATUS QUO	-6.49	-5.73	-1.44	-3.7	-0.32	-5.15	-	-0.06	-0.52	+2.1	+1.66	-5.18

FEED BUDGET

MANAWATU SMALL HILL

CATTLE REDUCTION

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	1530	1530	1220	1220	1220	1670	1650	1630	1630	1630	1630	1530
	Feed	1.5	1.05	1.14	1.35	1.5	1.4	.98	.96	1.15	1.6	1.86	2.48
Two-Tooths	No.	480	480	450	450	450							
	Feed	1.47	1.37	1.59	1.76	1.5							
Ewe Hoggets	No.	562	560	560	560	550	550	550	550	542	542	542	480
	Feed	1.22	1.24	1.23	1.12	1.09	1.14	.98	.93	.88	.88	1.43	1.6
Export Hoggets	No.	227	227	227	226	226	225	225	224	223	221	220	281
	Feed	1.22	1.24	1.23	1.12	1.09	1.14	.98	.93	.88	.88	1.43	0.8
Lamb Mob 1	No.	200											
	Feed	1.14											
Lamb Mob 2	No.	220	220										
	Feed	1.02	.64										
Lamb Mob 3	No.	400	400	400									
	Feed	.89	1.02	.58									
Lamb Mob 4	No.	93	93	93	93	93							
	Feed	.74	.84	1.06	.97	.47							
Rams	No.	50	50	50	50	50	50	50	50	50	50	50	50
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
SHEEP TOTAL (kg DM/day)		4870.0	3904.1	3454.89	3459.53	3444.6	3271.5	2426.5	2334.62	2597.7	3329.44	4171.46	4837.2
CATTLE TOTAL (kg DM/day)		229.75	361.06	269.78	220.37	182.3	170.55	171.77	177.92	164.44	287.23	319.56	289.11
WHOLE FARM TOTAL (kg DM/day)		5099.75	4165.16	3274.67	3679.9	3626.9	3442.05	2598.27	2512.54	2762.14	3616.67	4491.02	5126.31
STATUS QUO WHOLE FARM (kg DM/day)		5375.95	4493.38	4031.33	3928.99	3720.5	3403.8	2597.6	2531.9	2776.33	3789.77	4585.38	5370.7
Difference (kg DM/day)		276.2	328.22	306.66	249.09	93.6	-38.25	-0.67	19.36	14.19	173.1	94.36	244.39
PERCENTAGE VARIATION FROM STATUS QUO		-5.14	-7.30	-7.61	-6.3	-2.52	+1.12	-	-0.76	-0.51	-4.57	-2.06	-4.55

IV(b)1

FEED BUDGET

HAWKES BAY/WAIRARAPA : EASIER HILL

SHEEP STATUS QUO (AVERAGE PERFORMANCE)

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	2230	2225	2225	2125	2123	2430	2420	2410	2400	2370	2340	2230
	Feed	1.52	1.05	1.14	1.35	1.5	1.39	.98	.96	1.15	1.56	1.79	2.4
Two-Tooths	No.	877	523	523	523	518							
	Feed	1.26	1.39	1.54	1.65	1.5							
Ewe Hoggets	No.	895	895	890	890	890	880	880	880	880	877	877	877
	Feed	1.17	1.39	1.42	1.29	1.17	.96	.90	.89	.96	1.16	1.45	1.26
Lamb Mob 1	No.	219											
	Feed	1.18											
Lamb Mob 2	No.	300	300										
	Feed	1.21	1.45										
Lamb Mob 3	No.	350	350	350									
	Feed	.89	1.01	1.17									
Lamb Mob 4	No.	342	342	342	342	342							
	Feed	.78	.87	1.08	.94	.47							
Lamb Mob 5	No.	250	250	250	250	250	250						
	Feed	.72	.80	.99	.89	.86	.89						
Rams	No.	80	80	80	80	80	80	80	80	80	80	80	80
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
SHEEP TOTAL (kg DM/day)		7001.45	5673.31	5712.08	5503.78	5458.54	4525	3243.6	3176.8	3684.8	4794.52	5540.25	6537.02
CATTLE TOTAL (kg DM/day)		1339.76	1554.65	1215.08	1146.58	1201.2	1130.27	791.63	804.2	816.79	824.7	954.9	1175.52
WHOLE FARM TOTAL (kg DM/day)		8401.21	7227.96	6927.16	6650.36	6659.74	5655.27	4035.23	3981.0	4501.59	5619.21	6495.15	7712.54

FEED BUDGET

HAWKES BAY/WAIRARAPA : EASIER HILL

CATTLE STATUS QUO (AVERAGE PERFORMANCE)

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Weaner Cattle	No.	-	-	-	-	85	85	85	85	85	84	84	84
	Feed					4.68	4.46	3.64	3.7	3.77	3.83	4.55	5.22
1/2 Year Cattle	No.	84	84	84	84	84	83	83	83	83	83	83	83
	Feed	6.19	7.53	8.08	7.05	6.87	6.39	5.81	5.9	5.98	6.06	6.9	8.88
2/3 Year Cattle	No.	83	83	53	53	23	23	-	-	-	-	-	-
	Feed	10.6	11.11	10.12	10.46	9.84	9.6						
TOTAL FEED (kg DM/day)		1399.76	1554.65	1215.08	1146.58	1201.2	1130.27	791.63	804.2	816.79	824.7	954.9	1175.52

FEED BUDGET

HAWKES BAY/WAIRARAPA : EASIER HILL

EWE REDUCTION (a) AVERAGE PERFORMANCE

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	2007	2003	2003	1913	1911	2187	2178	2169	2160	2133	2106	2007
	Feed	1.52	1.05	1.14	1.35	1.5	1.39	.98	.96	1.15	1.56	1.79	2.4
Two-Tooths	No.	550	470	470	470	466							
	Feed	1.26	1.39	1.54	1.65	1.5							
Ewe Hoggets	No.	806	806	801	801	801	792	792	792	792	789	789	550
	Feed	1.17	1.39	1.42	1.29	1.17	.96	.90	.89	.96	1.16	1.45	1.26
Export Hoggets	No.	364	364	363	362	361	360	360	357	355	353	352	590
	Feed	1.17	1.39	1.42	1.29	1.17	.96	.90	.89	.96	1.16	1.45	.63
Lamb Mob 1	No.	197											
	Feed	1.18											
Lamb Mob 2	No.	270	270										
	Feed	1.21	1.45										
Lamb Mob 3	No.	315	315	315									
	Feed	.89	1.01	1.17									
Lamb Mob 4	No.	169	169	169	169	169							
	Feed	.78	.87	1.08	.94	.47							
Rams/Others	No.	72	72	72	72	72	72	72	72	72	72	72	72
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
SHEEP TOTAL (kg DM/day)		6155.87	5311.43	5283.17	5089.18	5076.47	4217.85	3243.24	3176.85	3657.12	4724.2	5496.19	5953.5
CATTLE TOTAL (kg DM/day)		1399.76	1554.65	1215.08	1146.58	1201.2	1130.27	791.63	804.2	816.79	824.7	954.9	1175.52
WHOLE FARM TOTAL (kg DM/day)		7555.63	6866.08	6498.25	6235.76	6277.67	5348.12	4034.87	3981.05	4473.91	5548.9	6451.09	7129.02
STATUS QUO WHOLE FARM (kg DM/day)		8401.21	7227.96	6927.16	6650.36	6659.74	5655.27	4035.23	3981.0	4501.59	5619.21	6495.15	7712.54
Difference (kg DM/day)		845.58	361.88	428.91	414.6	382.07	307.15	0.36	-0.05	27.68	70.31	44.06	583.52
PERCENTAGE VARIATION FROM STATUS QUO		-10.06	-5.01	-6.19	-6.23	-5.74	-5.43	-	-	-0.61	-1.25	-0.68	-7.57

FEED BUDGET

HAWKES BAY/WAIRARAPA : EASIER HILL

EWE REDUCTION (la) MEDIUM PERFORMANCE

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	2007	2003	2003	1913	1911	2187	2178	2169	2160	2133	2106	2007
	Feed	1.52	1.09	1.18	1.39	1.56	1.43	1.02	1.0	1.18	1.65	1.96	2.72
Two-Tooths	No.	550	470	470	470	466							
	Feed	1.36	1.46	1.62	1.74	1.56							
Ewe Hoggets	No.	806	806	801	801	801	792	792	792	792	789	789	550
	Feed	1.27	1.53	1.49	1.36	1.24	1.01	.934	.92	1.0	1.24	1.59	1.39
Export Hoggets	No.	227	227	226	226	225	225	225	224	222	221	220	219
	Feed	1.27	1.53	1.49	1.36	1.24	1.01	.934	.94	1.0	1.24	1.59	0.7
Lamb Mob 1	No.	210											
	Feed	1.21											
Lamb Mob 2	No.	288	288										
	Feed	1.26	1.52										
Lamb Mob 3	No.	336	336	336									
	Feed	.93	1.06	1.23									
Lamb Mob 4	No.	340	340	340[$]	340	340							
	Feed	.81	.91	1.13	1.02	.49							
Rams	No.	45	45	45	45	45	45	45	45	45	45	45	45
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
Others	No.	27	27	27	27	27	27	27	27	27	27	27	27
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
SHEEP TOTAL (kg DM/day)		6387.41	5625.28	5524.65	5292.39	5218.96	4226.58	3243.44	3175.72	3634.8	4843.85	5804.07	6448.84
CATTLE TOTAL (kg DM/day)		1399.76	1554.65	1215.08	1146.58	1201.2	1130.27	791.63	804.2	816.79	824.7	954.9	1175.52
WHOLE FARM TOTAL (kg DM/day)		7787.17	7179.93	6739.73	6438.97	6420.16	5356.85	4035.07	3979.92	4451.59	5668.55	6758.97	7624.36
STATUS QUO WHOLE FARM (kg DM/day)		8401.21	7227.96	6927.16	6650.36	6659.74	5655.27	4035.23	3981.0	4501.59	5619.21	6495.15	7712.54
Difference (kg DM/day)		614.04	48.03	187.43	211.39	239.58	298.42	0.16	1.08	50	-49.34	-263.8	88.18
PERCENTAGE VARIATION FROM STATUS QUO		-7.31	-0.66	-2.71	-3.18	-3.6	-5.28	-	-	-1.11	+.88	+4.06	-1.14

FEED BUDGET IV(b)v

HAWKES BAY/WAIRARAPA : EASIER HILL

CATTLE REDUCTION

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	2230	2225	2225	2125	2123	2430	2420	2410	2400	2370	2340	2230
	Feed	1.52	1.05	1.14	1.35	1.5	1.39	.98	.96	1.15	1.56	1.79	2.4
Two-Tooths	No.	612	523	523	523	518							
	Feed	1.26	1.39	1.54	1.65	1.5							
Ewe Hoggets	No.	895	895	890	890	890	880	880	880	880	877	877	612
	Feed	1.17	1.39	1.42	1.29	1.17	.96	.898	.89	.96	1.16	1.45	1.26
Export Hoggets	No.	364	364	363	362	361	360	360	357	355	353	352	616
	Feed	1.17	1.39	1.42	1.29	1.17	.96	.898	.89	.96	1.16	1.45	.63
Lamb Mob 1	No	219											
	Feed	1.18											
Lamb Mob 2	No.	300	300										
	Feed	1.21	1.45										
Lamb Mob 3	No.	350	350	350									
	Feed	.89	1.01	1.17									
Lamb Mob 4	No.	228	228	228	228	228							
	Feed	.78	.87	1.08	.94	.47							
Rams/Others	No.	80	80	80	80	80	80	80	80	80	80	80	80
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
SHEEP TOTAL (kg DM/day)		6824.51	5880.09	5856.92	5641.1	5612.33	4648.1	3565.12	3494.53	4025.6	5204	6050.65	6591.2
CATTLE TOTAL (kg DM/day)		827.47	919.03	718.29	677.8	710.09	668.16	466.69	475.4	482.85	487.52	564.49	694.91
WHOLE FARM TOTAL (kg DM/day)		7651.98	6799.12	6575.21	6318.9	6322.42	5316.26	4031.81	3969.93	4508.45	5691.52	6615.14	7286.11
STATUS QUO WHOLE FARM (kg DM/day)		8401.21	7227.96	6927.16	6650.36	6659.74	5655.27	4035.23	3981.0	4501.59	5619.21	6495.15	7712.54
Difference (kg DM/day)		749.23	428.84	351.95	331.46	337.32	339.01	3.42	11.07	-6.86	-72.31	-119.99	426.43
PERCENTAGE VARIATION FROM STATUS QUO		-8.92	-5.93	-5.08	-4.98	-5.07	-6.0	-	0.28	+.15	+1.29	+1.81	-5.53

IV(c)1

FEED BUDGET

MANAWATU/TAIHAPE HILL COUNTRY

STATUS QUO SHEEP AND CATTLE (average performance)

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	2125	2125	1835	1830	1830	2425	2420	2398	2376	2354	2332	2324
	Feed	1.47	1.05	1.14	1.35	1.5	1.4	1.0	0.98	1.15	1.6	1.78	2.41
Two-Tooths	No.	830	830	600	600	600							
	Feed	1.34	1.49	1.67	1.86	1.5							
Ewe Hoggets	No.	850	850	850	850	840	840	840	830	820	820	820	820
	Feed	1.16	1.26	1.04	1.01	.91	.93	.93	.94	.96	.97	1.21	1.28
Lamb Mob 1	No.	400	400										
	Feed	.86	.98										
Lamb Mob 2	No.	650	650	650									
	Feed	.85	1.07	1.13									
Lamb Mob 3	No.	275	275	275	275								
	Feed	.74	.92	.94	.94								
Lamb Mob 4	No.	95	95	95	95	95							
	Feed	.66	.81	.84	.83	.80							
Rams/Others	No.	75	75	75	75	75	75	75	75	75	75	75	75
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
Cattle	No.	-	-	-	30	70	70	70	70	70	70	70	70
	Feed				3.6	4.1	3.7	3.65	3.6	4.7	4.7	5.7	6.1
1/2 Year Cattle	No.	70	70	70	60	50	50	50	50	49	49	48	48
	Feed	5.5	5.3	5.1	5.6	6.1	5.3	5.1	5.2	5.2	6.45	6.85	7.5
2/3 Year Cattle	No.	48	47	47	37	17	-	-	-	-	-	-	-
	Feed	7.3	7.0	7.1	7.8	8.0							
SHEEP TOTAL (kg DM/day)		6459.65	6031.4	5125.7	4857.35	4560.4	4251.2	3276.2	3205.24	3594.6	4636.8	5218.16	6727.85
CATTLE TOTAL (kg DM/day)		735.4	700.0	690.7	732.6	728.0	524.0	510.5	512.0	583.8	645.05	727.8	787.0
WHOLE FARM TOTAL (kg DM/day)		7195.05	6731.4	5816.4	5589.95	5288.4	4775.2	3786.7	3717.24	4178.4	5281.85	5945.96	7514.85

FEED BUDGET IV(c)11

MANAWATU/TAIHAPE HILL COUNTRY

EWE REDUCTION (a) AVERAGE PERFORMANCE

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	1913	1913	1652	1647	1647	2183	2178	2158	2138	2119	2099	2093
	Feed	1.47	1.05	1.14	1.35	1.5	1.4	1.0	.98	1.05	1.6	1.78	2.41
Two-Tooths	No.	589	589	540	540	540							
	Feed	1.34	1.49	1.67	1.86	1.5							
Ewe Hoggets	No.	765	765	765	765	756	756	756	747	738	738	738	789
	Feed	1.16	1.26	1.04	1.01	.91	.93	.93	.94	.96	.97	1.21	1.28
Export Hoggets	No.	356	356	355	354	353	352	352	349	349	345	344	492
	Feed	1.16	1.26	1.04	1.01	.91	.93	.93	.94	.96	.97	1.21	.64
Lamb Mob 1	No.	354	354										
	Feed	.86	.98										
Lamb Mob 2	No.	456	456	456									
	Feed	.85	1.07	1.13									
Lamb Mob 3	No.	111	111	111	111								
	Feed	.74	.92	.94	.94								
Rams	No.	67	67	67	67	67	67	67	67	67	67	67	67
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
SHEEP TOTAL (kg DM/day)		5742.91	5302.68	4636.5	4529.38	4356.69	4153.64	3275.44	3212.08	3355.42	4507.91	5112.44	6179.93
CATTLE TOTAL (kg DM/day)		735.4	700.0	690.7	732.6	728.0	524.0	510.5	512.0	583.8	645.05	727.8	787.0
WHOLE FARM TOTAL (kg DM/day)		6478.31	6002.68	5327.2	5261.98	5084.69	4677.64	3785.94	3724.08	3939.22	5152.96	5840.24	6966.93
STATUS QUO WHOLE FARM (kg DM/day)		7195.05	6731.4	5816.4	5589.95	5288.4	4775.2	3786.7	3717.24	4178.4	5281.85	5945.96	7514.85
Difference (kg DM/day)		716.74	728.72	489.2	327.97	203.71	97.56	0.76	-6.84	239.18	128.89	105.72	547.92
PERCENTAGE VARIATION FROM STATUS QUO		-9.96%	-10.83	-8.41	-5.87	-3.85	-2.04	-	+.18	-5.72	-2.44	-1.78	-7.29

FEED BUDGET IV(c)111

MANAWATU/TAIHAPE HILL COUNTRY

EWE REDUCTION (b) MEDIUM PERFORMANCE

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	1913	1913	1652	1647	1647	2183	2178	2158	2138	2119	2099	2093
	Feed	1.56	1.1	1.2	1.42	1.6	1.44	1.03	1.0	1.19	1.64	1.95	2.63
Two-tooths	No.	589	589	540	540	540							
	Feed	1.45	1.55	1.78	1.98	1.6							
Ewe Hoggets	No.	765	765	765	765	756	756	756	747	738	738	738	589
	Feed	1.19	1.29	1.06	1.14	1.12	1.0	.99	.99	1.01	1.05	1.44	1.39
Export Hoggets	No.	221	221	220	220	220	219	219	218	217	216	215	363
	Feed	1.19	1.29	1.06	1.14	1.12	1.0	.99	.99	1.01	1.05	1.44	.70
Lamb Mob 1	No.	443	443										
	Feed	.9	1.02										
Lamb Mob 2	No.	584	584	584									
	Feed	.87	1.09	1.15									
Lamb Mob 3	No.	138	138	138	138								
	Feed	.77	.87	.99	.99								
Rams	No.	67	67	67	67	67	67	67	67	67	67	67	67
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
TOTAL SHEEP (kg DM/day)		6091.71	5564.67	4862.92	4743.46	4659.32	4185.52	3275.59	3180.35	3575.77	4543.86	5532.37	6644.4
CATTLE TOTAL (kg DM/day)		735.4	700.0	690.7	732.6	728.0	524.0	510.5	512.0	583.8	645.05	727.8	787.0
WHOLE FARM TOTAL (kg DM/day)		6827.11	6264.67	5533.62	5467.06	5387.32	4709.52	3786.09	3692.35	4159.57	5188.91	6260.17	7431.4
STATUS QUO WHOLE FARM (kg DM/day)		7195.05	6731.4	5816.4	5589.95	5288.4	4775.2	3786.7	3717.24	4178.4	5281.85	5945.96	7514.85
Difference (kg DM/day)		367.94	466.73	262.78	122.89	-98.92	65.68	0.61	24.89	18.83	92.94	-314.21	83.45
PERCENTAGE VARIATION FROM STATUS QUO		-5.11	-6.93	-4.52	-2.2	+1.87	-1.38	-	-.67	-.45	-1.76	+5.28	-1.11

IV(c) iv

FEED BUDGET

MANAWATU/TAIHAPE HILL COUNTRY

CATTLE REDUCTION

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	2125	2125	1835	1830	1830	2425	2420	2398	2376	2354	2332	2325
	Feed	1.47	1.05	1.14	1.35	1.5	1.4	1.0	.98	1.15	1.6	1.78	2.41
Two-Tooths	No.	655	655	600	600	600							
	Feed	1.34	1.49	1.67	1.86	1.5							
Ewe Hoggets	No.	850	850	850	850	840	840	840	830	820	820	820	655
	Feed	1.16	1.26	1.04	1.01	.91	.93	.93	.94	.96	.97	1.21	1.28
Export Hoggets	No.	356	356	355	354	353	352	352	349	346	345	344	508
	Feed	1.16	1.26	1.04	1.01	.91	.93	.93	.94	.96	.97	1.21	.64
Lamb Mob 1	No.	400	400										
	Feed	.86	.98										
Lamb Mob 2	No.	539	539	539									
	Feed	.85	1.07	1.13									
Lamb Mob 3	No.	125	125	125	125								
	Feed	.74	.92	.94	.94								
Rams	No.	75	75	75	75	75	75	75	75	75	75	75	75
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
SHEEP TOTAL (kg DM/day)		6370.06	5885.49	5148.67	4995.04	4805.63	4578.56	3603.56	3533.3	3926.76	4971.45	5634.4	6841.77
CATTLE TOTAL (kg DM/day)		263.79	251.1	247.75	262.78	261.13	187.96	183.05	183.65	209.41	231.38	261.06	282.3
WHOLE FARM TOTAL (kg DM/day)		6633.85	6136.59	5396.42	5257.82	5066.76	4766.52	3786.61	3716.95	4136.17	5202.83	5895.46	2124.07
STATUS QUO WHOLE FARM (kg DM/day)		7195.05	6731.4	5816.4	5589.95	5288.4	4775.2	3786.7	3717.24	4178.4	5281.85	5945.96	7514.85
Difference (kg DM/day)		561.20	594.81	419.98	332.13	221.64	8.68	0.09	0.29	42.23	79.02	50.5	390.78
PERCENTAGE VARIANCE FROM STATUS QUO		-7.8	-8.84	-7.22	-5.94	-4.19	-.18	-	-	-1.01	-1.5	-.85	-5.2

FEED BUDGET IV(d)1

HAWKES BAY/WAIRARAPA : HARDER HILL

SHEEP STATUS QUO (average performance)

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	3320	3310	2903	2795	2785	3500	3500	3480	3455	3390	3355	3330
	Feed	1.46	1.0	1.1	1.34	1.4	1.3	.92	.91	1.05	1.54	1.8	2.13
Two-Tooths	No.	1191	715	715	715	715							
	Feed	1.2	1.23	1.36	1.53	1.4							
Ewe Hoggets	No.	1215	1215	1215	1210	1210	1205	1200	1195	1194	1191	1191	1191
	Feed	1.06	1.32	1.01	.99	1.02	.81	.80	.79	.85	1.09	1.51	1.31
Lamb Mob 1	No.	300											
	Feed	1.16											
Lamb Mob 2	No.	300	300										
	Feed	.97	.53										
Lamb Mob 3	No.	150	150	150									
	Feed	.82	.97	.53									
Lamb Mob 4	No.	525	525	525	525								
	Feed	.68	.80	.87	.43								
Lamb Mob 5	No.	75	75	75	75	75							
	Feed	.67	.79	.87	.86	.41							
Lamb Mob 6	No.	500											
	Feed	.67											
Rams	No.	80	80	80	80	80	80	80	80	80	80	80	80
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
SHEEP TOTAL (kg DM/day)		9148.55	6657.0	6074.35	6407.4	6244.95	5606.05	4620	4190.85	4722.65	6598.79	7917.41	9299.21
CATTLE TOTAL (kg DM/day)		2165.1	2148.3	2143.8	2139.3	1376.0	1038.2	1106.9	1124.15	1664.2	1735.10	2076.9	2133.9
WHOLE FARM TOTAL (kg DM/day)		11313.65	8805.3	8218.15	8546.7	7620.95	6644.25	5366.9	5315.05	6386.85	8333.79	9994.31	11433.11

Note: Lamb Mob 4 comprises 100 prime and 425 store lambs. Lamb Mob 6 are store lambs.

FEED BUDGET

HAWKES BAY/WAIRARAPA : HARDER HILL

CATTLE STATUS QUO (average performance)

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Breading Cows	No.	167	167	167	167	167	142	175	175	173	170	168	167
	Feed	9.9	9.9	9.9	9.9	2.9	3.0	4.1	4.2	7.4	7.4	9.5	9.6
RWB Heifers	No.	39	39	39	39	39	39						
	Feed	6.0	6.0	6.1	6.2	6.3	6.0						
R 2 Year Heifers	No.	42	42	42	42	42	40	40	40	39	39	39	39
	Feed	5.9	5.5	5.3	5.1	5.6	5.3	5.1	5.2	5.2	6.4	6.5	6.7
R 1 Year Heifers	No.		-	-	-	42	42	42	42	42	42	42	42
	Feed					3.6	4.1	3.7	3.6	3.6	4.7	4.7	5.7
Weaner Steers	No.					68							
	Feed					2.0							
Weaner Heifers	No.					2.6							
	Feed					3.6							
Bulls	No.	6	6	6	6	6	6	6	6	6	6	6	6
	Feed	5	5	5	5	5	5	5	5	5	5	5	5
CATTLE TOTAL (kg DM/day)		2165.1	2148.3	2143.8	2139.3	1376.0	1038.2	1106.9	1124.2	1664.2	1735.0	2076.9	2133.9

FEED BUDGET

HAWKES BAY/WAIRARAPA : HARDER HILL

EWE REDUCTION (average performance)

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	2988	2979	2613	2516	2507	3150	3150	3132	3100	3051	3020	2997
	Feed	1.46	1.0	1.1	1.34	1.4	1.3	.92	.91	1.05		1.8	2.3
Two-Tooths	No.	750	643	643	643	643							
	Feed	1.2	1.23	1.36	1.53	1.4							
Ewe Hoggets	No.	1094	1094	1094	1089	1089	1084	1080	1076	1075	1072	1072	750
	Feed	1.06	1.32	1.01	.99	1.02	.81	.80	.79	.85	1.09	1.51	1.31
Export Hoggets	No.	537	537	536	535	534	533	532	530	525	525	520	840
	Feed	1.06	1.32	1.01	.99	1.02	.81	.80	.79	.85	1.09	1.51	.66
Lamb Mob 1	No.	270											
	Feed	1.16											
Lamb Mob 2	No.	270	270										
	Feed	.97	.53										
Lamb Mob 3	No.	139	139	139									
	Feed	.82	.97	.53									
Lamb Mob 6	No.	450											
	Feed	.67											
Rams	No.	72	72	72	72	72	72	72	72	72	72	72	72
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
SHEEP TOTAL (kg DM/day)		8053.92	6272.74	5540.75	6034.99	6137.46	5476.77	4259.6	4190.86	4697.5	6509.09	7911.92	8502.0
CATTLE TOTAL (kg DM/day)		2165.1	2148.3	2143.8	2139.3	1376.0	1038.2	1106.9	1124.2	1664.2	1735.0	2076.9	2133.9
WHOLE FARM TOTAL (kg DM/day)		10219.02	8421.04	7684.55	8174.29	7513.46	6514.97	5366.5	5315.06	6361.7	8244.09	9988.1	10635.9
STATUS QUO WHOLE FARM (kg DM/day)		11313.65	8805.3	8218.15	8546.7	7620.95	6644.25	5366.9	5315.05	6386.85	8333.79	9994.31	11433.11
Difference (kg DM/day)		1094.63	374.26	533.6	372.41	107.49	129.28	0.4	-0.01	25.15	89.7	5.49	797.21
PERCENTAGE VARIATION FROM STATUS QUO		-9.68	-4.36	-6.49	-4.36	-1.41	-1.95	-	-	-.39	-1.08	-0.5	-6.97

Note: Store lambs sold in December were not considered for retention as export hoggets. Exports hoggets are retained from the March prime and store mob and the April prime mob.

FEED BUDGET

HAWKES BAY/WAIRARAPA : HARDER HILL

EWE REDUCTION (h) MEDIUM PERFORMANCE

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	2988	2979	2613	2516	2507	3150	3150	3132	3110	3051	3020	2997
	Feed	1.53	1.05	1.14	1.42	1.49	1.34	.98	.96	1.13	1.66	1.97	2.56
Two-Tooths	No.	750	643	643	643	643							
	Feed	1.29	1.32	1.49	1.64	1.49							
Ewe Hoggets	No.	1094	1094	1094	1089	1089	1084	1080	1076	1075	1072	1072	750
	Feed	1.15	1.48	1.06	1.05	1.07	.87	.86	.86	.9	1.17	1.7	1.5
Export Hoggets	No.	202	202	201	201	200	200	200	199	198	197	196	516
	Feed	1.15	1.48	1.06	1.05	1.07	.87	.86	.86	.9	1.17	1.7	.75
Lamb Mob 1	No.	378											
	Feed	1.25											
Lamb Mob 2	No.	378	378										
	Feed	1.03	.56										
Lamb Mob 3	No.	189	189	189									
	Feed	.86	1.02	.56									
Lamb Mob 4	No.	212	212	212	212								
	Feed	.74	.87	.95	.47								
Lamb Mob 5	No.	94	94	94	94	94							
	Feed	.695	.81	.898	.89	.43							
Lamb Mob 6	No.	338											
	Feed	.74											
Rams	No.	72	72	72	72	72	72	72	72	72	72	72	72
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
SHEEP TOTAL (kg DM/day)		8598.25	6631.83	5773.24	6237.04	6185.15	5410.08	4259.8	4175.22	4732	6621.39	8177.0	9256.32
CATTLE TOTAL (kg DM/day)		2165.1	2148.3	2143.8	2139.3	1376.0	1038.2	1106.9	1124.2	1664.2	1735.0	2076.9	2133.9
WHOLE FARM TOTAL (kg DM/day)		1076.35	8780.13	7917.04	8376.34	7561.15	6448.28	5366.7	5299.42	6392.2	8356.39	10253.9	11390.22
STATUS QUO WHOLE FARM (kg DM/day)		11313.65	8805.3	8218.15	8546.7	7620.95	6644.25	5368.9	5315.05	6386.85	8333.79	9994.31	11433.11
Difference (kg DM/day)		550.3	25.17	301.11	170.36	59.8	195.97	.2	15.63	-9.35	-22.6	-259.59	42.89
PERCENTAGE VARIANCE FROM STATUS QUO		-4.86	-.29	-3.66	-1.99	-.78	-2.95	-	-.29	+.15	-.27	+2.6	-.38

FEED BUDGET

HAWKES BAY/WAIRARAPA : HARDER HILL

CATTLE REDUCTION

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	3320	3310	2903	2795	2785	3500	3500	3480	3455	3390	3355	3330
	Feed	1.46	1.0	1.1	1.34	1.4	1.3	.92	.91	1.05	1.54	1.8	2.3
Two-Tooths	No.	834	715	715	715	715							
	Feed	1.2	1.23	1.36	1.53	1.4							
Ewe Hoggets	No.	1215	1215	1215	1210	1210	1205	1200	1195	1195	1191	1191	834
	Feed	1.06	1.32	1.01	.99	1.02	.81	.80	.79	.85	1.09	1.51	1.31
Export Hoggets	No.	537	537	536	535	534	533	532	530	525	523	520	876
	Feed	1.06	1.32	1.01	.99	1.02	.81	.80	.79	.85	1.09	1.51	.66
Lamb Mob 1	No.	300											
	Feed	1.16											
Lamb Mob 2	No.	300	300										
	Feed	.97	.53										
Lamb Mob 3	No.	150	150	150									
	Feed	.82	.97	.53									
Lamb Mob 4	No.	63	63	63	63								
	Feed	.68	.80	.87	.43								
Lamb Mob 6	No.	500											
	Feed	.67											
Rams	No.	80	80	80	80	80	80	80	80	80	80	80	80
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
SHEEP TOTAL (kg DM/day)		9824.96	6936.99	6148.52	6673.89	6758.88	6037.78	4685.6	4609.55	5169.75	7168.67	8702.61	9409.7
CATTLE TOTAL (kg DM/day)		1324.8	1314.52	1311.78	1309.01	842.0	635.26	677.3	687.9	1018.31	1061.63	1270.83	1305.71
WHOLE FARM TOTAL (kg DM/day)		10249.76	8251.51	7460.30	7982.9	7600.88	6673.04	5362.9	5297.45	6188.06	8230.3	9973.44	10715.41
STATUS QUO WHOLE FARM (kg DM/day)		11313.65	8805.3	8218.15	8546.7	7620.95	6644.25	5366.9	5315.05	6386.85	8333.79	9994.31	11433.11
Difference (kg DM/day)		1063.89	553.79	757.85	563.8	20.07	-28.79	4.0	17.6	198.79	103.49	20.87	717.7
PERCENTAGE VARIATION FROM STATUS QUO		-9.4	-6.29	-9.22	-6.6	-.26	+.43	-	-.33	-3.11	-1.24	-.21	-6.28

FEED BUDGET

TAIHAPE/WANGANUI NI HARD HILL COUNTRY

SHEEP STATUS QUO (average performance)

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	2150	2145	1785	1780	1765	2365	2360	2335	2310	2285	2260	2260
	Feed	1.45	1.00	1.09	1.31	1.46	1.35	.94	.92	1.01	1.48	1.67	2.27
Two-Tooths	No.	690	690	600	600	600							
	Feed	1.26	1.40	1.42	1.49	1.46							
Ewe Hoggets	No.	715	710	710	710	710	700	700	700	690	690	690	690
	Feed	.84	.96	1.09	.97	.91	.95	.86	.82	.83	.84	1.2	1.05
Lambs Mob 1	No.	360											
	Feed	.96											
Lambs Mob 2	No.	360	360										
	Feed	.73	.81										
Lambs Mob 3	No.	400	400	400									
	Feed	.71	.87	.9									
Lambs Mob 4	No.	165	165	165	165								
	Feed	.64	.79	.81	.79								
Rams/Others	No.	70	70	70	70	70	70	70	70	70	70	70	70
	Feed	1	1	1	1	1	1	1	1	1	1		
SHEEP TOTAL (kg DM/day)		5655.5	4632.55	4135.2	4114.85	4169.0	3927.75	2890.4	2792.2	2975.8	4031.4	4672.2	5924.7
CATTLE TOTAL (kg DM/day)		926.2	825.7	918.3	914.9	508.2	459.0	481.2	481.6	689.8	745.5	889.3	917.5
WHOLE FARM TOTAL (kg DM/day)		6581.7	5458.25	5053.5	5029.75	4677.2	4386.75	3371.6	3273.8	3665.6	4776.9	5561.5	6842.2

FEED BUDGET

TAIHAPE/WANGANUI NI HARD HILL COUNTRY

CATTLE STATUS QUO (average performance)

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Breading Cows	No.	68	68	68	68	56	56	70	70	69	69	68	68
	Feed	9.9	9.9	9.9	9.9	2.9	3.0	4.1	4.1	7.4	7.4	9.6	9.6
RWB Heifers	No.	16	16	16	16	16	14	-	-	-	-	-	-
	Feed	5.5	6.0	6.1	6.2	6.3	6.0						
R 2 year Heifers	No.	17	17	17	17	17	17	17	17	16	16	16	16
	Feed	6.0	5.5	5.3	5.1	5.6	5.3	5.1	5.2	5.2	6.4	6.5	6.7
R 1 year Heifers	No.	-	-	-	-	17	17	17	17	17	17	17	17
	Feed					3.6	4.1	3.7	3.65	3.6	4.7	4.7	5.7
Weaner Steers	No.	-	-	-	8	8	8	8	8	8	8	8	8
	Feed					3.6	4.1	3.7	3.65	3.6	4.7	4.7	5.7
R 1 year Cattle	No.	8	8	8	8	8							
	Feed	6.0	5.5	5.3	5.1	5.6							
Bulls	No.	3	3	3	3	3	3	3	3	3	3	3	3
	Feed	5	5	5	5	5	5	5	5	5	5	5	5
CATTLE TOTAL (kg DM/day)		926.2	825.7	918.3	914.9	508.2	459.0	481.2	481.6	689.8	745.5	889.3	917.5

IV(e)111

FEED BUDGET

TAIHAPE/WANGANUI NI HARD HILL COUNTRY

EWE REDUCTION (a) AVERAGE PERFORMANCE

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	1935	1931	1607	1602	1589	2129	2124	2102	2079	2057	2034	2034
	Feed	1.45	1.0	1.09	1.31	1.46	1.35	.94	.92	1.01	1.48	1.67	2.27
Two-Tooths	No.	560	560	540	540	540							
	Feed	1.26	1.40	1.42	1.49	1.46							
Ewe Hoggets	No.	644	639	639	638	637	630	630	621	621	621	621	560
	Feed	.84	.96	1.09	.97	.91	.95	.86	.82	.83	.84	1.2	1.05
Export Hoggets	No.	339	339	338	338	337	336	336	334	333	330	329	389
	Feed	.84	.96	1.09	.97	.91	.95	.86	.82	.83	.84	1.2	0.53
Lamb Mob 1	No.	316											
	Feed	.96											
Lamb Mob 2	No.	316	316										
	Feed	.73	.81										
Lamb Mob 3	No.	171	171	171									
	Feed	.71	.87	.90									
Rams	No.	63	63	63	63	63	63	63	63	63	63	63	63
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
SHEEP TOTAL (kg DM/day)		5055.52	4121.6	3800.26	3912.94	4057.68	3854.85	2890.32	2779.94	2954.61	3096.2	4599.78	5474.35
CATTLE TOTAL (kg DM/day)		926.2	825.7	918.3	914.9	508.2	459.0	481.2	481.6	689.8	745.5	889.3	917.5
WHOLE FARM TOTAL (kg DM/day)		5981.72	4947.31	4718.56	4827.84	4665.88	4313.85	3371.52	3261.54	3644.41	4651.7	5489.08	6391.85
STATUS QUO WHOLE FARM (kg DM/day)		6581.7	5458.25	5053.5	5029.75	4677.2	4386.75	3371.6	3273.8	3665.6	4776.9	5561.5	6842.2
Difference (kg DM/day)		599.98	510.94	334.94	201.91	111.32	72.9	.08	12.26	21.19	125.2	72.42	450.35
PERCENTAGE VARIATION FROM STATUS QUO		-9.11	-9.36	-6.63	-4.01	-2.38	-1.66	-	-.374	-.58	-2.62	-1.3	-6.58

FEED BUDGET IV(e)iv

TAIHAPE/WANGANUI NI HARD HILL COUNTRY

EWE REDUCTION (la) MEDIUM PERFORMANCE

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	1935	1931	1607	1602	1589	2129	2124	2102	2079	2057	2034	2034
	Feed	1.51	1.04	1.13	1.35	1.5	1.39	.99	.95	1.09	1.58	1.8	2.43
Two-Tooths	No.	560	560	540	540	540							
	Feed	1.31	1.46	1.47	1.57	1.5							
Ewe Hoggets	No.	644	639	639	638	637	630	630	621	621	621	621	560
	Feed	.86	.98	1.11	.99	.94	.96	.87	.83	.85	.86	1.25	1.13
Export Hoggets	No.	205	205	204	204	203	203	203	202	201	200	199	259
	Feed	.86	.98	1.11	.99	.94	.96	.87	.83	.85	.86	1.25	.57
Lamb Mob 1	No.	344											
	Feed	1.04											
Lamb Mob 2	No.	344	344										
	Feed	.78	.88										
Lamb Mob 3	No.	350	350	350									
	Feed	.73	.9	.93									
Rams	No.	63	63	63	63	63	63	63	63	63	63	63	63
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
SHEEP TOTAL (kg DM/day)		5330.17	4333.68	3933.94	3907.08	4046.1	3821.99	2890.47	2742.99	3027.81	4019.12	4749.2	5786.05
CATTLE TOTAL (kg DM/day)		926.2	825.7	918.3	914.9	508.2	459.0	481.2	481.6	689.8	745.5	889.3	917.5
WHOLE FARM TOTAL (kg DM/day)		6256.37	5159.38	4852.24	4821.98	4554.3	4280.99	3371.67	3224.59	3717.61	4764.62	5638.5	6703.55
STATUS QUO WHOLE FARM (kg DM/day)		6581.7	5458.25	5053.5	5029.75	4677.2	4286.75	3371.6	3273.8	3665.6	4776.9	5561.5	6842.2
Difference (kg DM/day)		325.33	298.87	201.26	207.77	122.9	105.76	-0.07	49.21	-52.01	12.28	-77.0	138.65
PERCENTAGE VARIATION FROM STATUS QUO		-4.94	-5.48	-3.98	-4.13	-2.63	-2.41	-	-1.5	+1.42	-.26	+1.38	-2.03

FEED BUDGET

IV(e)v

TAIHAPE/WANGANUI NI HARD HILL COUNTRY

CATTLE REDUCTION

		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
Mixed Age Ewes	No.	2150	2145	1785	1780	1765	2365	2360	2335	2310	2285	2260	2260
	Feed	1.45	1.0	1.09	1.31	1.46	1.35	.94	.92	1.01	1.48	1.67	2.27
Two-Tooths	No.	622	622	600	600	600							
	Feed	1.26	1.40	1.42	1.49	1.46							
Ewe Hoggets	No.	715	710	710	710	710	700	700	700	690	690	690	622
	Feed	.84	.96	1.09	.97	.91	.95	.86	.82	.83	.84	1.2	1.05
Export Hoggets	No.	339	339	338	338	337	336	336	334	333	330	329	396
	Feed	.84	.96	1.09	.97	.91	.95	.86	.82	.83	.84	1.2	.53
Lamb Mob 1	No.	360											
	Feed	.96											
Lamb Mob 2	No.	360	360										
	Feed	.73	.81										
Lamb Mob 3	No.	226	226	226									
	Feed	.71	.87	.9									
Rams	No.	70	70	70	70	70	70	70	70	70	70	70	70
	Feed	1	1	1	1	1	1	1	1	1	1	1	1
SHEEP TOTAL (kg DM/day)		5625.44	4581.06	4213.37	4312.36	4475.67	4246.95	3179.36	3066.08	3252.19	4308.6	5067.0	6063.18
CATTLE TOTAL (kg DM/day)		375.72	334.95	372.51	371.13	206.15	186.19	195.2	195.36	279.82	302.41	360.75	372.19
WHOLE FARM TOTAL (kg DM/day)		6001.16	4916.01	4585.88	4683.49	4681.82	4433.14	3374.56	3261.44	3532.01	4611.01	5427.75	6435.37
STATUS QUO WHOLE FARM (kg DM/day)		6581.7	5458.25	5053.5	5029.75	4677.2	4386.75	3371.6	3273.8	3665.6	4776.9	5561.5	6842.2
Difference (kg DM/day)		580.54	542.24	467.62	346.26	-4.62	-46.39	-2.96	12.36	133.59	165.89	133.75	406.83
PERCENTAGE VARIATION FROM STATUS QUO		-8.82	-9.93	-9.25	-6.88	+.01	+1.06	-	-.38	-3.64	-3.47	-2.40	-5.95

APPENDIX FIVE : GROSS MARGINS/BREAK-EVEN SCHEDULES

APPENDIX V (a) Manawatu Small Hill
Sheep only: status quo and reduction strategies

APPENDIX V (b) Hawkes Bay/Wairarapa : Easier Hill
Sheep only: status quo and reduction strategies

APPENDIX V (c) Manawatu/Taihape Hill Country
Sheep only: status quo and reduction strategies

APPENDIX V (d) Hawkes Bay/Wairarapa : Harder Hill
Sheep only: status quo and reduction strategies

APPENDIX V (e) Taihape/Wanganui North Island Hard Hill
Sheep only: status quo and reduction strategies

APPENDIX V (f) All Models
Cattle only: status quo gross margins

APPENDIX V (g) All Models
Cattle only: reduction strategies

GROSS MARGINS (SHEEP ONLY) - MANAWATU SMALL HILL

V(a)

REVENUE ITEMS

ITEM		PRICE/UNIT		STATUS QUO $	EWE REDUCTION (a) AVGE PER-FORMANCE $	EWE REDUCTION (b) MEDIUM PER-FORMANCE $
Prime Lamb						
- meat		149 c/kg		21,486	14,953	18,400
pelts/skin	DEC	105 c/hd				
	JAN	184 c/hd				
	FEB	15 c/hd				
	APR	147 c/hd	Total	1,108	664	838
Stock Sales		Av.	Med			
ewes	works	$8.50/hd	$9.50	850	765	855
	yards	$13.00/hd	$14.00	4,017	3,614	3,892
Two-Tooths		$24.00/hd	$24.00	2,208	504	504
Export Hogget				-		
pelt /skins		113 c/hd		-	318	243
[meat kg]					[5,418]	[4,300]
Wool						
fleece	75%	275 c/kg		17,486	15,738	16,250
	25%	175 c/kg		3,708	3,337	3,446
lamb		250 c/kg		3,200	2,880	3,150
hogget		295 c/kg		4,316	5,640	5,295
ram		275 c/kg		413	371	371
crutchings		255 c/kg		1,040	826	936
TOTAL REVENUE (1)				$59,832	$49,610	$54,180

EXPENDITURE ITEMS

ITEM	COST/ UNIT	STATUS QUO $	EWE REDUCTION (a) AVGE PER-FORMANCE $	EWE REDUCTION (b) MEDIUM PER-FORMANCE $
Shearing	120 c/hd	4,586	4,424	4,402
Shed expenses				
Ewes/2-tooths	30 c/hd	594	535	535
Others	20 c/hd	365	381	377
Crutching	30 c/hd	489	440	440
Animal health	95 c/hd	1,549	1,411	1,411
Hogget drench	14.22 c/hd	-	32	22
Ram replacement	$160/hd	1,280	1,120	1,120
Wool freight	4.5 c/kg	529	504	515
Stock freight:				
lambs	80 c/hd	896	625	738
ewes)				
2-tooths)	included in stock prices			
Export Hoggets	90 c/hd	-	253	194
Stock sale Comm	- included in stock prices			
TOTAL EXPENSES		$10,288	$9,725	$9754

Revenue Required from Export Hogget Meat to Break-Even with Status Quo		$9,659	$5,118
EXPORT HOGGET BREAK-EVEN SCHEDULE (rounded to nearest cent)		178 c/kg	119 c/kg

Note: (1) Exccluding revenue from export hogget meat

GROSS MARGINS (SHEEP ONLY) - HAWKES BAY/WAIRARAPA : EASIER HILL

V(b)

REVENUE ITEMS

ITEM		PRICE/UNIT		STATUS QUO	EWE REDUCTION (a) AVGE PER-FORMANCE	EWE REDUCTION (b) MEDIUM PER-FORMANCE
				$	$	$
Prime Lamb						
- meat		149 c/kg		30,597	19,147	25,480
pelts/skins	DEC	105 c/hd				
	JAN	229 c/hd				
	FEB	294 c/hd				
	APR	150 c/hd				
	MAY	107 c/hd	Total	2,727	2,005	2,379
Stock Sales		Av.	Med.			
ewes		$9.00/hd	$10.00/hd	3,699	3,330	3,700
two-tooths		$25.00/hd	$27.00/hd	8,850	2,000	2,160
Export Hoggets						
pelt/skins		113 c/hd		-	667	518
[meat kg]		-		-	[11,712]	[9,636]
Wool						
fleece	75%	275 c/kg		23,502	21,150	21,868
	25%	175 c/kg		4,986	4,485	4,638
lamb		250 c/kg		3,718	3,348	3,775
hogget		295 c/kg		7,761	10,098	9,228
ram		275 c/kg		413	371	371
crutchings		255 c/kg		1,530	1,215	1,215
TOTAL REVENUE (1)				$87,783	$68,616	$75,332

EXPENDITURE ITEMS

ITEM	COST/ UNIT	STATUS QUO	EWE REDUCTION (a) AVGE PER-FORMANCE	EWE REDUCTION (b) MEDIUM PER-FORMANCE
		$	$	$
Shearing	120 c/hd	6,200	6,002	5,885
Shed expenses				
ewes/2-tooths	30 c/hd	826	743	743
others	20 c/hd	483	505	485
Crutching	30 c/hd	720	648	648
Animal health	108 c/hd	2,614	2,352	2,352
Hogget drench	14.22 c/hd	-	50	32
Ram replacement	$150/hd	1,950	1,650	1,650
Wool freight	5 c/kg	813	785	796
Stock freight:				
lambs	120 c/hd	1,753	1,141	1,409
ewes	139 c/hd	571	514	514
2-tooths	97 c/hd	344	78	78
export hoggets		-	797	618
Stock Sale Comm.	5.5%	487	110	119
TOTAL EXPENDITURE		$16,761	$15,375	$15,329

	EWE REDUCTION (a) AVGE PER-FORMANCE	EWE REDUCTION (b) MEDIUM PER-FORMANCE
Revenue Required from Export Hogget Meat to Break-Even with Status Quo	$17,781	$11,019
EXPORT HOGGET BREAK-EVEN SCHEDULE (rounded to nearest cent)	152 c/kg	114 c/kg

Note: (1) Excluding revenue from export hogget meat.

GROSS MARGINS (SHEEP ONLY) - MANAWATU/TAIHAPE HILL COUNTRY

V(c)

REVENUE ITEMS

ITEM	PRICE/UNIT		STATUS QUO	EWE REDUCTION (a) AVGE PER-FORMANCE	EWE REDUCTION (b) MEDIUM PER-FORMANCE
			$	$	$
Prime Lamb					
- meat	149 c/kg		18,950	16,771	21,539
pelts/skins JAN	110 c/hd				
FEB	15 c/hd				
MAR	92 c/hd	Total	623	551	689
Stock Sales	Av.	Med.			
Store lambs	$15.50/hd	$16.50	6,898	899	1,436
Ewes: works	$7.50 /hd	$8.50	1,500	1,350	1,530
yards	$12.00/hd	$13.00	3,480	3,132	3,393
Two-tooths	$23.00/hd	$23.00	5,060	1,127	1,127
Export Hogget					
pelt/skins	113 c/hd		-	556	410
[meat kg]			-	[8,856]	[7,115]
Wool					
fleece 75%	275 c/kg		21,810	19,635	20,086
25%	175 c/kg		4,627	4,165	4,260
lamb	250 c/kg		4,020	3,588	3,630
hogget	295 c/kg		6,048	7,980	7,310
ram	275 c/kg		619	553	553
crutchings	255 c/kg		1,515	1,364	1,364
TOTAL REVENUE (1)			$75,150	$61,671	$67,327

EXPENDITURE ITEMS

ITEM	COST/ UNIT	STATUS QUO	EWE REDUCTION (a) AVGE PER-FORMANCE	EWE REDUCTION (b) MEDIUM PER-FORMANCE
		$	$	$
Shearing	120 c/hd	6,588	6,348	6,217
Shed expenses				
ewes/2-tooths	30 c/hd	818	736	736
others	20 c/hd	553	567	546
Crutching	30 c/hd	713	641	641
Animal health	95 c/hd	2,299	2,069	2,069
Hogget drench	14.22c/hd	-	50	31
Ram replacement	$160/hd	1,600	1,440	1,440
Wool freight	5c/kg	753	720	720
Stock freight:				
prime lamb	80c/hd	780	690	862
store lamb)				
ewes)	included in net price			
2-tooths)				
export hoggets	90c/hd	443	327	
Stock sale Comm.	included in net price			
TOTAL EXPENDITURE		$14,104	$13,704	$13,589

Revenue Required from Export Hogget Meat to Break-Even with Status Quo		$13,079	$7,308
EXPORT HOGGET BREAK-EVEN SCHEDULE (rounded to nearest cent)		148 c/kg	103 c/kg

Note: (1) Excluding revenue from export hogget meat.

GROSS MARGINS (SHEEP ONLY) - HAWKES BAY/WAIRARAPA : HARDER HILL

V(d)

ITEM		PRICE/UNIT		STATUS QUO $	EWE REDUCTION (a) AVGE PER-FORMANCE $	EWE REDUCTION (b) MEDIUM PER-FORMANCE $
Prime Lamb						
- meat		149 c/kg		16,465	12,141	21,648
pelts/skins	OEC	105 c/hd				
	JAN	229 c/hd				
	FEB	204 c/hd				
	MAR	227 c/hd				
	APR	147 c/hd	Total	1,780	1,311	2,243
Stock Sales		Av.	Med.			
Store lambs		$16/hd	$17.00	14,800	7,200	7,208
Ewes	DEC	$12/hd	$12.50	4,704	4,236	4,413
	FEB	$7/hd	$8.00	686	616	704
Two-Tooths		$25/hd	$260	11,900	2,675	2,782
Export Hogget				-		
pelts/skins		113 c/hd		-	949	583
(kg meat)				-	(15,960kg)	(10,650)
Wool						
fleece	75%	275 c/kg		31,763	28,584	29,640
	25%	175 c/kg		6,738	6,064	6,288
lamb		250 c/kg		4,538	4,078	4,205
hogget		295 c/kg		9,838	13,151	10,847
ram		275 c/kg		660	594	594
crutchings		255 c/kg		2,203	1,984	1,984
TOTAL REVENUE (1)				$106,075	$83,583	$93,139

ITEM	COST/ UNIT	STATUS QUO $	EWE REDUCTION (a) AVGE PER-FORMANCE $	EWE REDUCTION (b) MEDIUM PER-FORMANCE $
Shearing	120 c/hd	8,454	8,311	7,888
Shed expenses:				
ewes/2-tooths	30 c/hd	1,211	1,089	1,089
others	20 c/hd	617	659	588
Crutching	30 c/hd	1,037	933	933
Animal health	96 c/hd	3,360	3,024	3,024
Hogget drench	14.22 c/hd	-	76	28
Ram replacement	$150 c/hd	3,000	2,700	2,700
Wool freight	6 c/kg	1,299	1,257	1,243
Stock freight:				
prime lambs	128 c/hd	1,184	869	1,491
store lambs	87 c/hd	805	392	369
ewes	135 c/hd	662	595	529
2-tooths	120 c/hd	571	128	144
export hoggets	132 c/hd	-	1,109	681
Stock Sale Comm.	5.5%	1,727	677	831
TOTAL EXPENSES		$24,018	$21,819	$21,538

Revenue required from Export Hogget Meat to Break-Even with Status Quo		$20,293	$10,456
EXPORT HOGGET BREAK-EVEN SCHEDULE (rounded to nearest cent)		127 c/kg	98 c/kg

Note: (1) Excluding revenue from export hogget meat.

GROSS MARGINS (SHEEP ONLY) - TAIHAPE/WANGANUI - NORTH ISLAND HARD HILL

V(e)

REVENUE ITEMS

ITEM		PRICE/UNIT		STATUS QUO	EWE REDUCTION (a) AVGE PER-FORMANCE	EWE REDUCTION (b) MEDIUM PER-FORMANCE
				$	$	$
Store Lambs		$13.70	$14.20	17,605	11,001	14,740
Ewes		$7.0	$7.50	3,220	2,898	3,105
Two-tooths		$16.00	$16.00	1,440	320	320
Export Hoggets						
pelts/skins		113 c/hd		-	440	293
(meat kg)		-		-	[6,341]	[4,351]
Wool	fleece 75%	275 c/kg		20,708	18,637	19,346
	25%	175 c/kg		4,393	3,953	4,104
	lamb	250 c/kg		2,073	1,868	1,970
	hogget	295 c/kg		4,071	5,605	5,080
	ram	275 c/kg		413	371	371
	crutchings	255 c/kg		1,474	1,326	1,326
TOTAL REVENUE (1)				$55,397	$46,419	$50,655

EXPENDITURE ITEMS

ITEM	COST/ UNIT	STATUS QUO	EWE REDUCTION (a) AVGE PER-FORMANCE	EWE REDUCTION (b) MEDIUM PER-FORMANCE
		$ Av.	$ Med.	$	$
Shearing	120 c/hd	5,718		5,543	5,558
Shed expenses					
ewes/2-tooths	30 c/hd	825		743	743
others	20 c/hd	403		429	412
Crutching	30 c/hd	693		624	624
Animal health	90 c/hd	2,124		1,912	1,912
Hogget drench	14.22 c/hd	-		48	29
Ram replacement	$160 /hd	1,600		1,440	1,440
Wool freight	5 c/kg	649		617	627
Stock freight					
lambs)					
ewes)	included in net stock prices				
2-tooths)					
export hoggets	85 c/hd	-		331	220
Stock Sale Comm.	included in net stock prices				
TOTAL EXPENSES		$12,012		$11,687	$11,565

Revenue Required from Export Hogget Meat to Break-Even with Status Quo	$8,653	$4,295
EXPORT HOGGET BREAK-EVEN SCHEDULE (rounded to nearest cent)	136 c/kg	99 c/kg

Note: (1) Excluding revenue from export hogget meat

GROSS MARGIN - CATTLE STATUS QUO : ALL MODELS V(f)

MODEL	REVENUE		EXPENDITURE						
	STOCK SALES	$	STOCK PURCHASES	$	FREIGHT $	ANIMAL HEALTH $	FEED $	TOTAL GROSS MARGIN $	GM/HEAD WINTERED $
MANAWATU SMALL HILL	78 R 2yr steers	25,272	80 Whr Steers	16,800	508	640	600	$6,724	$84.05
HAWKES BAY/WAIRARAPA EASIER HILL	83 R 3 yr steers	32,943	85 Whr Steers	17,000	1,612	712	526	$13,087	$76.98
MANAWATU/TAIHAPE HILL	19 18 mths steers 47 2½ yr steers	5,700 18,800	70 Whr Steers	12,000	455	560	1,000	$9,885	$82.38
HAWKES BAY/WAIRARAPA HARDER HILL	25 fat cows 2 bulls 6 R 3 yr heifers 2 R 2 yr heifers 26 Whr heifers 68 Whr steers	4,844 1,000 1,500 400 3,640 10,880	2 bulls	2,600	2,051	1,107	923	15,583	$89.04/breeding cow
TAIHAPE/WANGANUI NI HARD HILL	12 cows 1 bull 2 R 3 yr heifers 8 18 mths steers 14 Whr heifers 20 Whr steers	2,400 450 440 1,680 1,820 3,300	1 bull	650	480	245	1,650	$7,065	$100.93/ breeding cow

GROSS MARGINS - CATTLE REDUCTION STRATEGIES - WHOLE FARM V(g)

	MODEL 1 MANAWATU SMALL HILL	MODEL 2 HAWKES BAY/WAIRARAPA EASIER HILL	MODEL 3 MANAWATU/TAITHAPE HILL COUNTRY	MODEL 4 HAWKES BAY/WAIRARAPA HARDER HILL	MODEL 5 TAITHAPE/WANGANUI NI HARD HILL
SHEEP REVENUE:	$	$	$	$	$
Prime lambs	17,879	25,382	18,950	16,118	-
Store lambs	-	-	1,380	8,000	12,960
Ewe sales	4,867	3,699	4,980	5,390	3,220
Two-tooths	552	2,225	1,265	2,975	352
Export hogget (pelt&skin)	325	696	574	990	447
Wool - fleece	21,194	28,488	26,437	38,501	25,101
lamb	3,200	3,718	4,020	4,538	2,073
hogget	6,068	10,877	8,585	14,133	6,012
ram	371	413	619	660	413
crutchings	1,040	1,530	1,515	2,203	1,474
TOTAL SHEEP REVENUE	$55,496	$77,028	$68,325	$93,508	$52,052
SHEEP EXPENDITURE:					
Shearing	4,850	6,623	7,001	9,169	6,113
Shed expenses	1,003	1,379	1,440	1,932	1,294
Crutching	489	720	713	1,037	693
Animal health	1,549	2,614	2,299	3,360	2,124
Extra hogget drench	32	50	50	76	47
Ram replacement	1,280	1,950	1,600	3,000	1,600
Wool freight	556	866	796	1,387	682
Stock freight	967	2,805	1,237	3,437	337
Stock Sale Commission	-	122	-	862	-
TOTAL SHEEP EXPENDITURE	$10,726	$17,129	$15,136	$24,260	$12,890
SHEEP GROSS MARGIN	44,770	59,899	53,189	69,248	39,162
CATTLE GROSS MARGIN	2,942 (35 head)	7,621 (99 head)	3,542 (43 head)	9,527 (107 Br.Cows)	2,297 (29 Br.Cows)
WHOLE FARM GROSS MARGIN	$47,712	$67,520	$56,731	$78,775	$42,089
STATUS QUO GROSS MARGIN	$56,268	$84,109	$70,931	$97,640	$50,450
EXPORT HOGGET MEAT (kg)	5553 kg	12228 kg	9144 kg	16644 kg	6455 kg
BREAK-EVEN SCHEDULE (c/kg - rounded to nearest cent)	154 c/kg	136 c/kg	155 c/kg	113 c/kg	130 c/kg

APPENDIX SIX : PHYSICAL OUTPUT

ALL MODELS/PRODUCTION STRATEGIES

see following page

APPENDIX SIX

PHYSICAL OUTPUT — ALL MODELS/PRODUCTION STRATEGIES — ALL WEIGHTS IN KILOGRAMS

	MANAWATU SMALL HILL				HAWKES BAY/ AIRARAPA EASIER HILL				MANAWATU/TAIHAPE HILL COUNTRY				HAWKES BAY/WAIRARAPA: HARDER HILL				TAIHAPE/WANGANUI N.I. HARD HILL			
PRODUCTION STRATEGY	Status Quo	Ewe Reduction Average	Ewe Reduction Medium	Cattle Reduction	Status Quo	Ewe Reduction Average	Ewe Reduction Medium	Cattle Reduction	Status Quo	Ewe Reduction Average	Ewe Reduction Medium	Cattle Reduction	Status Quo	Ewe Reduction Average	Ewe Reduction Minimum	Cattle Reduction	Status Quo	Ewe Reduction Average	Ewe Reduction Medium	Cattle Reduction
PARAMETER																				
SHEEP																				
Sheep Meat (Total	25799	24357	25713	26918	37147	34609	36322	37985	33392	31583	33513	33899	39905	39550	41596	41485	25296	23958	25345	27097
Prime Lamb	14430	10036	12349	11479	20535	13387	17101	15439	12718	11256	14456	12718	11050	8148	14529	9725	-	-	-	-
Store Lamb	-	-	-	-	-	-	-	-	5275	696	1066	1068	9027	4185	3916	4650	14501	9030	12145	11105
Export Hogget																				
(a) Total	-	5418	4300	5553	-	11712	9636	12228	-	8856	7115	9144	-	15960	10650	16644	-	6341	4351	6455
(b) Excluding two-tooths (1)	-	(4222)	(3060)	(4357)	-	(6967)	(4608)	(6997)	-	(6174)	(4194)	(6174)	-	(9861)	(4025)	(9861)	-	(5346)	(3326)	(5346)
Total Wool	11779	11169	11435	12373	16263	15691	15915	17319	15052	14396	14404	15912	21654	20942	20724	23110	12977	12338	12790	13635
Fleece Wool	8478	7630	7878	8478	11395	10254	10602	11395	10575	9520	9738	10575	15400	13859	14371	15400	10040	9036	9625	10040
Hogget Wool	1463	1912	1795	2057	2631	3423	3128	3687	205	2705	2478	2910	3335	4458	3677	4791	1380	1900	1722	2038
CATTLE:																				
Net Meat Production (Total)	9940	9940	9940	4344	16875	16875	16875	9939	11310	11310	11310	4524	12010	12010	12010	7338	6380	6380	6380	2565
					BEEF PARAMETERS - ESTIMATED CARCASS WEIGHT (kg)*															
Cows				-			-				-				200				190	
Bulls				-			-				-				350				340	
Weaner Steers				100			70				70				65				75	
Weaner Heifers				-			-				-				50				60	
R 2yr Steers				230			-				210				-				180	
R 2yr Heifers				-			-				-				120				160	
R 3yr Steers				-			275				260				-				-	
R 3yr Heifers				-			-				-				175				-	

* Based on 'Total Beef Sales' less Total Weight of Beef Purchased

NOTE (1): This total refers to export hogget meat produced from over-wintered export hoggets only; it does not include meat from sale of cull two-tooths on to an export market.

APPENDIX SEVEN : CASH FLOW PROFILES

FOR HAWKES BAY/WAIRARAPA : EASIER HILL

APPENDIX VII (a) Sheep only : Status Quo
(pre export hogget) Cash Flow Profile

APPENDIX VII (b) Cattle only : Status Quo
Cash Flow Profile

APPENDIX VII (c) Whole Farm : Monthly (non-gross margin)
Farm Expenditure

APPENDIX VII (d) Whole Farm : Status Quo
Cash Flow Profile (average performance) including
overdraft payments

APPENDIX VII (e) Sheep only : Post Export Hogget Cash Flow
(average performance)

APPENDIX VII (f) Whole Farm : Post Export Hogget
Cash Flow Profile (average performance) -
including overdraft payments

HAWKES BAY/WAIRARAPA : EASIER HILL - CASH FLOW PROFILES VII(a)

(a) SHEEP ONLY : STATUS QUO (PRE EXPORT HOGGET) CASH FLOW PROFILE

	JAN $	FEB $	MAR $	APR $	MAY $	JUN $	JUL $	AUG $	SEPT $	OCT $	NOV $	DEC $	
INCOME ITEMS:													
Lamb Sales	7392	8330		7647		5483						4472	
Ewe Sales		900		1899							900		
Two-Tooth Sales	8850												
Wool Sales:													
Ewes												25088	
Two-Tooths			3400										
Lambs	3718												
Hoggets										7761			
Rams												413	
Crutchings								1530					
MONTHLY REVENUE	19960	9230	3400	9546	-	5483	-	1530	-	7761	900	29973	TOTAL $87,783
less													
EXPENDITURE:													
Shearing:													
Ewes												3345	
Two-Tooths			785										
Lambs	2082												
Hoggets										1288			
Rams												70	
Crutching								720					
Animal Health	370	370	109	109	109	109	109	370	109	109	370	370	
Ram Replacement											1950		
Stock Freight	704	559		703		300					139	263	
Wool Freight	74		68					30		132		509	
Stock Sale Comm.	487												
MONTHLY EXPENDITURE	3717	929	962	812	109	409	109	1120	109	1469	2459	4577	TOTAL $16,761
MONTHLY SURPLUS/ DEFICIT (+/-)	+16243	+8301	+2438	+8734	-109	+5074	-109	+410	-109	+6292	-1559	+25416	GROSS MARGIN $71,022

HAWKES BAY/WAIRARAPA : EASTER HILL - CASH FLOW PROFILES VII(b)

(b) CATTLE ONLY : STATUS QUO CASH FLOW PROFILE

	JAN $	FEB $	MAR $	APR $	MAY $	JUN $	JUL $	AUG $	SEPT $	OCT $	NOV $	DEC $	
REVENUE ITEMS:													
Cattle Sales													
2/3 Year Steers													
265 kg @ 1.56c/kg	2402												
270 kg @ 1.49c/kg			11973										
250 kg @ 1.49c/kg					8658								
MONTHLY REVENUE	12402	-	11973	-	8568	-	-	-	-	-	-	-	TOTAL $32,943
less													
EXPENDITURE:													
Cattle Purchases			4250	12750									
Freight Inwards			115	344									
Winter Feed		263		263									
Animal Health	33	33	353	33	33	33	33	33	33	33	33	33	
Freight Outward	434		417		304								
MONHTLY EXPENDITURE	467	296	5135	13390	337	33	33	33	33	33	33	33	TOTAL $19,856
MONTHLY SURPLUS/DEFICIT	+11935	-296	+6838	-13390	+8231	-33	-33	-33	-33	-33	-33	-33	GROSS MARGIN $13,087

HAWKES BAY/WAIRARAPA : EASIER HILL - CASH FLOW PROFILES VII(c)

(c) WHOLE FARM : MONTHLY (NON GROSS MARGIN) FARM EXPENDITURE

	JAN $	FEB $	MAR $	APR $	MAY $	JUN $	JUL $	AUG $	SEPT $	OCT $	NOV $	DEC $	
Wages	347	347	347	347	347	347	520	520	520	520	520	520	
Electricity	92	92	92	92	92	92	92	92	92	92	92	92	
Fertilizer				9488									
Lime									425				
Freight - general	33	33	33	33	33	33	33	33	33	33	33	33	
Winter Feed		263		263									
Repairs & Maint.	393	393	393	551	551	551	472	472	472	157	157	157	
Vehicle Expenses	590	590	590	393	393	393	393	393	393	590	590	590	
Weed and Pest.	70	70	70	70				70		117	117	117	
Rates	600			600			600			600			
Administration	163	163	163	187	187	187	467	467	467	117	117	117	
Taxation Due			4466						2233				
Mortgage Interest	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	
Mortgage Principal	167	167	167	167	167	167	167	167	167	167	167	167	
Personal Drawings	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
School Fees & Insurance	208	208	208	208	208	208	208	208	208	208	208	208	
TOTAL MISCELLANEOUS EXPENDITURE *	4913	4567	8779	14649	4228	4228	5202	4672	7260	4851	4251	4251	TOTAL $71,851

* except overdraft interest

HAWKES BAY/WAIRARAPA : EASIER HILL - CASH FLOW PROFILES VII(d)

(d) WHOLE FARM : STATUS QUO CASH FLOW PROFILE INCLUDING OVERDRAFT PAYMENTS

	JAN $	FEB $	MAR $	APR $	MAY $	JUN $	JUL $	AUG $	SEPT $	OCT $	NOV $	DEC $		
SHEEP GROSS MARGIN	16243	8301	2438	8734	-109	5074	-109	410	-109	6292	-1559	25416		
CATTLE GROSS MARGIN	-33	11935	-296	6838	-13390	8231	-33	-33	-33	-33	-33	-33		
MONTHLY FARM EXPENSES	-4913	-4567	-8779	-14649	-4228	-4228	-5202	-4672	-7260	-4851	-4251	-4251		
MONTHLY SURPLUS/ DEFICIT	+11297	+15669	-6637	+923	-17727	+9077	-5344	-4295	-7402	+1408	-5843	+21132		
OVERDRAFT AT 15% INTEREST	215	76	-	83	72	295	185	254	311	408	395	468	TOTAL	$2,767
CUMULATIVE OVERDRAFT	6094	(+9499)*	6637	5797	23596	14814	20343	24892	32605	31605	37843	17176		
											[MAXIMUM 0/0]			

* Withdrawn

HAWKES BAY/WAIRARAPA : EASIER HILL - CASH FLOW PROFILES

(e) SHEEP ONLY : POST EXPORT HOGGET CASH FLOW (AVERAGE PERFORMANCE)

	JAN $	FEB $	MAR $	APR $	MAY $	JUN $	JUL $	AUG $	SEPT $	OCT $	NOV $	DEC $	
INCOME ITEMS:													
Prime lamb	6654	7497		3778								4023	
Export Hogget											18448		
Ewe Sales		810		1710							810		
Two-Tooth Sales	2000												
Wool - ewes												22580	
two-tooths			3055										
lambs	3348												
hoggets										10098			
rams												371	
crutchings								1215					
MONTHLY REVENUE	12002	8307	3055	5488	-	-	-	1215	-	10098	19258	26974	TOTAL $86,397
less													
EXPENDITURE ITEMS:													
Stock freight:													
lambs	324	378		203								236	
export hogget											797		
ewes		125		264							125		
two-tooths	78												
Shearing	1607		564							1369		2462	
Crutching								648					
Shed Expenses	268		141							228		611	
Wool Freight	67		61					27		171		459	
Animal Health	333	333	98	98	98	98	98	333	98	98	333	333	
Extra Hogget drench					50								
Ram Replacement											1650		
Stock Sale Comm.	110												
MONTHLY EXPENDITURE	2787	836	864	565	148	98	98	1008	98	1866	2905	4102	TOTAL $15,375
MONTHLY SURPLUS/ DEFICIT (+/-)	+9215	+7471	+2191	+4923	-148	-98	-98	+207	-98	+8232	+16353	+22872	GROSS MARGIN $71,022

HAWKES BAY/WAIRARAPA : EASIER HILL - CASH FLOW PROFILES VII(f)

(f) WHOLE FARM : POST EXPORT HOGGET CASH FLOW PROFILE (AVERAGE PERFORMANCE) INCLUOING OVERDRAFT PAYMENTS

	JAN $	FEB $	MAR $	APR $	MAY $	JUN $	JUL $	AUG $	SEPT $	OCT $	NOV $	OEC $		
SHEEP GROSS MARGIN	9215	7471	2191	4923	-148	-98	-98	207	-98	8232	16353	22872		
CATTLE GROSS MARGIN	-33	11935	-296	6838	-13390	8231	-33	-33	-33	-33	-33	-33		
MONTHLY FARM EXPENSES (non-gross margin)	-4913	-4567	-8779	-14649	-4228	-4228	-5202	-4672	-7260	-4851	-4251	-4251		
MONTHLY SURPLUS DEFICIT	4269	14839	-6884	-2888	-17766	3905	-5333	-4498	-7391	3348	12069	18588		
OVERDRAFT AT 15% INTEREST	124	72	-	86	123	347	302	373	434	532	496	352	TOTAL	$3,241
CUMULATIVE OVERDRAFT	5750	- (+9107)*	6884	9858	27747	24189	29824	34695	42520 [MAX. O/D]	39704	28131	9895		

* withdrawn

APPENDIX EIGHT : QUESTIONNAIRE/CHECK LIST

used during INTERACTIVE DISCUSSIONS

DATE _____

MODEL TYPE _____ DISTRICT _____

FARMER _____ ADDRESS _____ ADVISOR _____

FARM INFORMATION:

TOTAL AREA _____ EFFECTIVE AREA _____

NUMBER MAIN PDKS _____ WATER SUPPLY _____

STAGE OF DEVELOPMENT _____

_____

FARM TOPOGRAPHY _____

_____

SOIL _____

_____

CLIMATE _____

_____

SHEEP — STATUS QUO : PRE EXPORT HOGGETS — 2a

NUMBERS/PURCHASES		DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
BREED JUNE/ NO. MTH $	EWES 2-TOOTHS EWE HOGGETS WETHER HOGGETS [EXPORT HOGGETS] RAMS												
PERFORMANCE [ACTUAL ESTIMATE]	LAMBING 82/83 TREND WEIGHTS (kg) EWES LAMBS HOGGETS/2-TOOTHS TREND												
MANAGEMENT Date Spread	LAMBING - PRACTICE - REASONS												
Date Spread	WEANING - PRACTICE - REASONS												
Date Wt Reasons	SHEARING - EWES - LAMBS - 2-TOOTHS - HOGGETS												
SELLING Date No.	FAT LAMBS - PRACTICE - REASONS												
WT $	STORE LAMBS - PRACTICE - REASONS												
Date No. $	EWES - PRACTICE - REASONS												
No. Date, Basis	HOGGETS/2-THS - SELECTION - REASONS												
Date, No. $	SALE - PRACTICE - REASONS												

CATTLE

STATUS QUO : PRE EXPORT HOGGETS

3a

NUMBERS/PURCHASES	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
CLASS NO. WT. MTH. $.												
PERFORMANCE CALVING %												
WEIGHT PROFILE (DRY STOCK) [ACTUAL/ESTIMATE]												
MANAGEMENT CALVING - DATE - SPREAD - REASONS												
WEANING - DATE - AGE - SPREAD REASONS												
SELLING DATE CLASS NO. $ WT(?) REASONS												

STATUS QUO : PRE EXPORT HOGGETS

4a

GRAZING/MANAGEMENT	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV
EWES - PRACTICE REASONS												
LAMBS - PRACTICE - REASONS												
HOGGETS - PRACTICE - REASONS												
2-TOOTHS - PRACTICE - REASONS TEETH ERUPTION												
CATTLE - PRACTICE - REASONS												
PASTURE GROWTH [ACTUAL- EST] PROFILE												
DEFICIT STRATEGIES [PRIORITY STOCK]												
SURPLUS STRATEGIES												

PRINCIPLES of:	PASTURE GROWTH	ANIMAL REQUIREMENTS	MATCHING
NEW GRADING	AWARENESS	MECHANICS	OBJECTIVES

PERSONAL
LAND TENURE
TYPE
LENGTH

MGT DECISIONS
WHO?

GOALS - (i) PERSONAL (Does Hgt system fit/conflict with goals)

(ii) ENTERPRISE

NEW ENTERPRISE MAX PROFIT
MIN COST
MGT CHALLENGE
MGT EASE

SOCIAL NORMS
FARMER VIEW OF NEIGHBOURS
WHO ADOPT NEW PRACTICES:

DISTRICT RESPONSE TO
PRACTICE ADOPTION

EXPORT HOGGETS

AWARE HOGGET SCHEDULE

B.E. SCHEDULE ESTIMATE

NEIGHTBOUR'S VIEW IF ADOPTED
EXPORT HOGGET SYSTEM

EXPORT HOGGET/MODELS : CHECKLIST

CHECKLIST (a) EXPORT HOGGET SYSTEM (b) MODEL ASSUMPTIONS

FAVOURABLE/UNFAVOURABLE (+ / - / =)

MANAGEMENT

(i) DIFFICULTIES
- DISEASE
- MORTALITY
- GRAZING MGT
- EXTRA MOB(S)
- LARGER MOB(S)
- PDK NOS.
- AFFECT OTHER STOCK
- LABOUR

(ii) ADVANTAGES
- OUTPUT
- SURPLUS CAPACITY
- FEED UTILIZATION
- STOCK PERFORMANCE
- HOGGET GROWTH
- LAMB GROWTH
- STORE REDUCTION
- SELECTION PRESSURE
- MGT FLEXIBILITY
- LABOUR

MISCELLANEOUS
- CASH FLOW
- CAPITAL
- SALE FLEXIBILITY
- RISK
- SOCIAL NORMS

- PERFORMANCE LEVELS
- GROWTH PROFILES
- LAMB RETENTION (tops v bottoms)
- EWE NO. CHANGES
- FEED LEVELS
- MGT CHANGES
- OVERFATTENING
- BREEDS

- NOT FINISH HGTS
- FEED SUPPLY/DEMAND
- REDUCTION IN STORES

IS EXPORT HOGGET SYSTEM? (on your farm)

- FEASIBILITY
- COMPATIBILITY
- DESIRABILITY
- PROFITABILITY

FURTHER INFORMATION

RING BACK PHONE NO.

APPENDIX NINE : LINEAR PROGRAMMING

APPENDIX IX (a) Linear Programming Specification of Export Hogget Production Models

APPENDIX IX (b) Linear Programming Matrix for Ewe Reduction
(a) Average Performance strategy for Manawatu Small Hill (refer to Matrix)

APPENDIX NINE

(a) Linear Programming Specification of Export Hogget Production Models

Linear programming (LP) is one quantitative method which has been quite widely used for systems synthesis (and sensitivity analysis etc) in pastoral farming systems research (for example: Lowe, 1971; Pollard, 1972; McRae, 1975).

In the early stages of his study consideration was given to synthesizing models of export hogget production, involving the dynamics of grazing management and animal performance, in a LP framework. The rationale for wanting to incorporate the interaction of grazing management and animal performance was based on the knowledge that different levels of animal performance for any class of livestock are related to feed intake requirements, and that the actual feed intake by grazing animals is conditioned by the quantity of pasture which is left after a grazing (residual). Established interrelationships between animal performance, intake and residual pasture dry matter, for different classes of livestock, and at different times of the year, have been integrated into the Residual Dry Matter (RDM) aproach to controlled grazing (Milligan, 1982). The dynamics of the grazing management systems, which the author initially wished to incorporate in his models of export production, therefore required that the severity of grazing would be considitional on the performance levels of the classes of livestock involved. (For any class of livestock a variety of performance specifications and corresponding patterns of RDM's is possible).

While McRae (1975) constructed a LP model of grazing systems for bull beef production which allowed "lax" (RDM of 1200 kg DM/ha) or "tight" (RDM or 700 kg DM/ha) grazing, with consequent implications for subsequent pasture growth rates,

McRae's model assumed that the animal feed requirements could be met under either grazing system. Current knowledge of the dynamics of livestock grazing systems casts some considerable doubt on the validity of this assumption, and the need to adjust pasture growth rates for pasture cover (within a certain range).

The initial desire to incorporate such conditional relationships between animal performance (feed requirements) and RDM posed severe problems in terms of LP specification. An approach similar to that adopted by McRae (1975), to determine optional patterns of bull beef liveweight gain could have been used in this study. McRae used an iterative LP procedure to model the non-linear bull-beef production functional where the production function was used (by McRae) to specify feed requirements for any pattern of liveweight gain. The LP was optimized for this pattern of liveweight gain (activity of feed requirements per bull) and the resulting feed shadow prices were then used to modify the pattern of liveweight gain. The optimal solution was obtained where the marginal value product of feed was equal between periods, ie there was no further gain from changing relative feed demand between periods.

In the situation, which it was hoped to model in this study, it would have been possible to select one performance level, and hence pattern of feed requirement and RDM's for each class of stock. And then, by adopting the assumption that pasture growth rates are not dependant on RDM (a simplifying assumption which is known not to be true) a relatively simple LP model could have been constructed, and the optimal pattern of livestock performance and pasture RDM obtained in an iterative procedure, similar to that used by McRae. The calculations involved would have been analogous to those in feed budgeting,

from which information on the general direction of change in livestock performance towards optimality would have had some similarities with that obtained from an LP model. In both LP or feed budgeting models, low or high levels of average pasture cover indicate a need to change feed requirements, and hence livestock performance. By close examination of the LP output it should have been possible to determine relative gains from changing performance levels of the different classes of livestock involved (ewes, replacement stock, lambs and export hoggets). However, since this approach would have essentially involved simultaneous sensitivity analysis of a set of input/output coefficients it seemed unlikely, ex ante, that such analysis would be simple. Consequently it was decided to use non-optimizing feed budgets which subjectively incorporated the dynamic interrelationships between grazing management and animal performance. However, as discussed in Chapter Nine, these requirements were eventually relaxed, and feed budgets, which could have been specified in a LP model, were used in the final approach adopted in this study. As an example, a linear programme specification for the ewe reduction - average performance export hogget production strategy, for the Manawatu Small Hill model, is presented in Appendix Nine (b).

MANAWATU SMALL HILL - EWE REDUCTION (a) AVERAGE PERFORMANCE IX(b)

(b) LINEAR PROGRAMMING MATRIX FOR MANUWATU SMALL HILL

CONSTRAINT		B (RHS)	Relationship	ACTIVITIES: June Ewes	April two-tooths	June Ewe Hoggets	June Rams	June Export Hoggets	November Feed	Export Hogget Sales	December Lambs	Lamb Sale Mob 1	Lamb Sale Mob 2	Lamb Sale Mob 3	Lamb Sale Mob 4
JUNE EWE NUMBERS		1485	=	1											
FEED SUPPLY	DEC	4852.18	≥	1.39091	1.77053	1.246618	1	1.230844				1.14	1.02	.89	.74
(status quo)	JAN	3898.24	≥	.973636	1.165009	1.262546	1	1.251022					.64	1.02	.84
	FEB	3416.3	≥	.84291	1.59	1.252364	1	1.240933						.58	1.06
	MAR	3422.1	≥	.99818	1.76	1.140364	1	1.124978							.97
	APR	3304.9	≥	1.10909	1.5	1.09	1	1.094844							.47
	MAY	3015	≥	1.41697		1.14	1	1.14							
	JUN	2206	≥	.98		.98	1	.98							
	JUL	2126.3	≥	.94836		.93	1	.925867							
	AUG	2401.46	≥	1.136061		.8672	1	.872178							
	SEP	3134.96	≥	1.58061		.8672	1	.864356							
	OCT	3856.86	≥	1.83746		1.4092	1	1.39822							
	NOV	4711.6	≥	2.29964		1.576727	1	.77867	-.788364						
JUNE EWE/RAM TIE		0	=	-.0303			1								
JUNE EWE/APRIL 2-TOOTH TIE		0	=	-.27273	1										
JUNE EWE/EWE HOGGET TIE		0	=	-.3334		1									
EXPORT HOGGET "POOL"		0	≥					-1	-1	1					
JUNE EWE HGT/EXPORT HGT TIE		0	≥			-.127049			1						
DECEMBER LAMB TOTAL		0	≥	-1.0194		1.021818					1				
LAMB MOB 1		0	≥								-.17857	1			
LAMB MOB 2		0	≥								-.17857		1		
LAMB MOB 3		0	≥								-.35714			1	
LAMB MOB 4		0	≥								-.28571				1
DECEMBER LAMB RECON.		0	≥	-1.0194		1.021818		1.00888		1		1	1	1	1
JUNE HOGGET BALANCE		0	≥			-.872951									
C (price units) (1)				0	0	0	0	0	0	100	0	60	40	20	10

NOTE (1): To force retention of export hoggets.