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# **The Potential for Out-of-Season Beef Finishing Systems on Farms in the Lower North Island**

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**A thesis presented in partial fulfilment of the requirements for the  
degree of Master of Applied Science in Agricultural Systems and  
Management**

**at**

**Massey University  
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**Thomas Jon Sherlock  
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**Title:** *The potential for Out-of-Season beef finishing systems on farms in the lower North Island.*

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## **Abstract**

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Beef production in New Zealand is strongly seasonal and reflects the pattern of pasture production on which livestock farming is based. Providing a more uniform supply of beef cattle to processors has the potential to improve returns to the New Zealand beef industry, first by increasing the market opportunities for New Zealand products, especially in the more lucrative markets requiring fresh (short shelf-life) beef cuts, and second by improving the utilisation of capital invested in processing.

The primary aim of this study was to investigate the potential of Out-of-Season (OOS) beef finishing systems to reduce the seasonality of beef cattle supply to meat processors. The study focused on developing an understanding of the biophysical, social and economic factors that would affect the implementation of OOS policies for a sample of 14 farmers in the lower North Island. A Farming Systems Research (FSR) approach provided the framework for the field work and methods used in the study. A secondary objective of the study was to investigate the applicability of Farming Systems Research (FSR) methods for obtaining an improved understanding of the on-farm implications of OOS finishing systems and thereby enhancing the relevance of the findings to industry stakeholders.

The first phase of the study involved semi-structured interviews with eight meat industry key informants. Their views were obtained on the effects of the seasonal pattern of beef cattle supply and the potential of OOS production systems to address this issue. Semi-structured interviews with 14 farmers with contrasting farming resources in a defined study region were then completed. Data was obtained from these farmers in order to identify the constraints, costs and opportunities they associated with OOS beef finishing policies. The final phase of the study included three in-depth case farm studies. The whole-farm computer simulation model StockPol™ was used to investigate and quantify the costs and implications of OOS finishing systems for each case farm.

The seasonal pattern of beef cattle supply was confirmed as being a major disadvantage for processors and marketers in the New Zealand meat industry. Processing and marketing representatives believed that on-farm OOS beef finishing systems provided a realistic option for addressing the disadvantages. However, farmers believed that OOS finishing systems were less suited to, and more demanding of, their pasture-based systems. The effects of OOS policies on winter feed levels, summer pasture quality, and soil damage were identified by farmers as constraints to their adoption. The simulation of alternative production systems for the case farms suggested that premiums for cattle produced OOS would need to be about 20% above normal schedule payments in order to compensate for the lower biological efficiency of OOS systems.

While it was difficult to formally evaluate the success of the FSR approach, the methods used proved successful in obtaining a detailed understanding of the constraints and impacts of OOS beef finishing systems faced by farmers.

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# Chapter One: Introduction

## 1.1 INTRODUCTION

Historically beef has been a significant contributor to New Zealand's export earnings. For example, in 1995 beef represented 45% of export meat production and 46% of export meat value (New Zealand Meat Producers Board, 1995). Overall meat production contributed 31% of the value of exports from the pastoral sector and 12% of the value of all exports from New Zealand (Statistics New Zealand, 1995).

Beef production in New Zealand is seasonal. This seasonality is clearly shown in monthly livestock slaughter data (Figure 1-1). Much of the seasonal pattern of livestock slaughter results from limitations imposed on producers by the pattern of pasture production on which New Zealand livestock farming is based, and the natural breeding cycle of the livestock farmed.

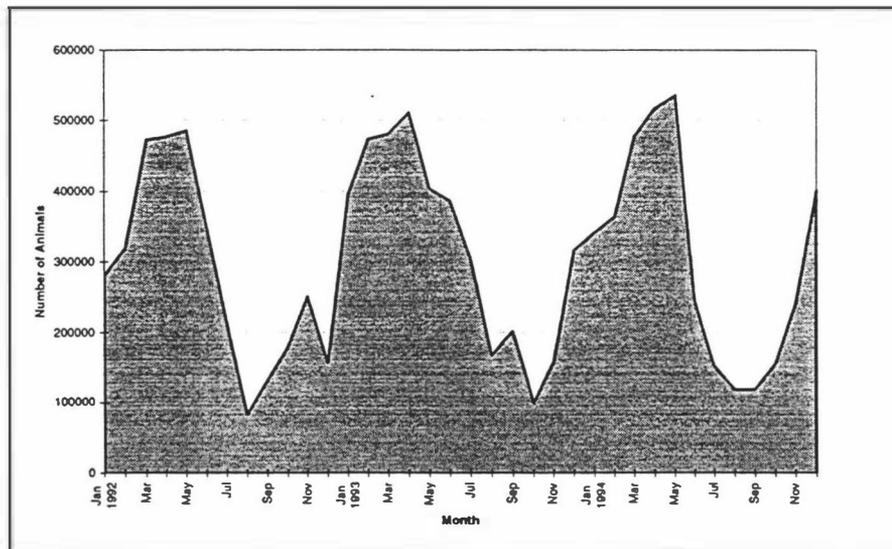


Figure 1-1: Monthly export beef slaughter pattern from 1992 to 1994.

Improving the continuity of beef production has the potential to increase returns to the New Zealand meat industry by increasing its competitive advantage. Increased returns to the

industry are expected at the marketing and processing levels if two important constraints are addressed.

First, the seasonal nature of year-round beef supply has been recognised as an important limitation to the development of markets requiring fresh (short shelf-life) beef cuts (Frith, 1992). These higher priced markets require a reliable, year round supply of quality chilled beef cuts. Increasing the continuity of beef supply would assist the beef industry to target these higher paying markets and improve the returns to participants in the beef production, processing and marketing chain.

Second, the seasonal nature of livestock slaughter lowers the utilisation and efficiency of capital and human resources invested in meat processing plants (Sheppard, 1982; Talyor et al., 1982). To accommodate the peak supply in summer (Figure 1-1) processing companies have built sufficient capacity to handle this throughput, but this capacity is significantly under-utilised at other times of the year (Sheppard, 1982). A more uniform supply of beef cattle from producers would, in the long-term, increase the utilisation of processing capacity and lower the average fixed costs of processing.

Increased adoption of out-of-season (OOS) beef production systems on farms would help to reduce the seasonality of beef supply. Out-of-season beef production systems involve farmers producing a greater proportion of beef cattle for slaughter during the winter and early spring months when livestock supply is traditionally low (Figure 1-1).

The main aim of this study was to investigate the potential use of OOS beef production systems as a method to reduce the seasonal supply of beef cattle within the New Zealand beef industry. The study focused on the on-farm implications of the use of OOS production systems in the lower North Island.

### **1.1.1 Problem Statement**

Most beef cattle farmers have not adopted systems to produce a greater proportion of their beef cattle out-of-season, despite the potential advantages that a more uniform supply of beef animals for slaughter could provide them and other stakeholders in the beef industry.

## 1.1.2 Primary Hypotheses

Farmers do not adopt OOS beef production systems because they:

- a) do not fit their circumstances and biophysical constraints; and
- b) are not sufficiently profitable to compensate for these constraints.

## 1.1.3 Primary Objectives

- To identify and investigate the biophysical, social and economic factors that affect the potential to implement OOS policies for a sample of farmers, using a semi-structured interview technique.
- To model and design OOS beef systems on different case farms, using a whole-farm computer simulation model, and to incorporate information on farmers' circumstances through their direct participation, in order to quantify the productivity and financial returns of OOS production.

The methods used during the research are associated with the Farming Systems Research approach, and in this respect the study had a secondary objective to investigate the applicability of Farming Systems Research methods in the context of New Zealand pastoral agriculture.

## 1.1.4 Investigation of Farming Systems Research

The goal of the Farming Systems Research (FSR) approach to problem solving in agriculture is to develop solutions and technologies with increased relevance to, and consequently higher adoption by, end-users. To achieve this outcome, FSR methods seek to incorporate the circumstances and constraints of farmers and other end-users of research through their active participation in the investigation and development of solutions and technologies. FSR represents an alternative approach to agricultural research and extension that should be able to complement the traditional approaches applied in New Zealand. It has been successfully applied over the past two decades in a large number of developing countries (Merrill-Sands, 1986; Tripp, 1991) and is increasingly being employed in developed countries in Europe and Australasia (Ison et al., 1992; Dent et al., 1994; Lussignea, 1994).

The use of OOS beef production systems represents an opportunity to increase farmers' income as a consequence of the improvements that continuity of supply provides to those involved in the processing and marketing channel. However, increased income needs to more than offset the costs that farmers are likely to incur from this change in management. Many factors,

including profitability, will have an important influence on a farmer's decision to implement management changes, such as OOS production systems (Brazendale et al., 1993; Reid et al., 1993). The range factors that affect farmer decision making can be defined as farmer circumstances. These include biophysical factors, such as rainfall and soils, and socio-economic factors such as markets, farmer goals and resource constraints (Byerlee et al., 1980).

While, farmers may hold the view that there is considerable scope to increase their returns, it would be hasty to assume that farmers are able, or want to respond to this opportunity (McRae, 1992). Therefore any exploration of the potential benefits to the meat industry of a more continual supply of beef cattle must take into account the constraints and circumstances that exist on farms to changing beef cattle production systems. In this study FSR methods are used to develop an understanding of the constraints and circumstances of farmers in relation to the use of OOS beef production systems.

### **1.1.5 Secondary Hypothesis**

Farming Systems Research methods are appropriate for investigating the potential of OOS beef systems and will enhance the usefulness and relevance of the findings to industry stakeholders, and hence the overall value of the research.

### **1.1.6 Secondary Objective**

To investigate the applicability of Farming Systems Research (FSR) to obtain an improved understanding of the constraints to, and impacts of, management changes required on-farm to produce higher proportions of beef cattle out-of-season (OOS).

## **1.2 OUTLINE OF THESIS**

The New Zealand Meat Industry and the presence and implications of seasonality are introduced in Chapter Two. The potential use of OOS production systems is discussed. The development and definition of FSR research and extension methods is discussed and the role of the Farmer First Research programme and the use of FSR in New Zealand is reviewed.

Chapter Three outlines the application of FSR as the research approach, and introduces and discusses the specific methods used during the study.

Chapters Four, Five and Six present details of the key informant interview, farmer interview and case farm analysis phases of the research process, respectively. Each chapter involves a description of the method, presentation and discussion of the results and findings.

Chapter Seven summarises and discusses the major findings of the overall study and evaluates the study in relation to the stated objectives. The appropriateness of FSR methods in achieving these objectives is also discussed.

# Chapter Two: Background and Review of Relevant Literature

---

## 2.1 INTRODUCTION

Background information on the meat industry in New Zealand is provided in the first section of this Chapter. The presence and implications of seasonality of supply within the industry is also discussed. Farming Systems Research is discussed and defined as a research approach.

## 2.2 THE NEW ZEALAND RED-MEAT INDUSTRY

The New Zealand meat industry is small in the context of world production. New Zealand accounts for 7.8% of world mutton and lamb production, and only 1% of beef and veal production (New Zealand Meat Producers Board, 1993a). However, a high proportion of New Zealand's meat production is traded internationally. Around 97% of lamb production, 71% of the mutton production, and 81% of the beef production is exported each year (New Zealand Meat & Wool Board's Economic Service, 1994). For this reason New Zealand's meat industry is unique in an international context, as overseas market prices strongly influence the prices farmers receive for meat.

The red-meat industry is an important contributor to the New Zealand economy. In 1994/95 the industry accounted for 4.9% of the nation's Gross Domestic Profit (New Zealand Department of Statistics, 1996). In 1995, the industry was the second most important export earner, behind the dairy industry, with NZ\$2.6 billion, representing 12.5% of the total value of exports from New Zealand (New Zealand Department of Statistics, 1996). Capital investment in the industry in 1996 was approximately NZ\$25 billion, and it directly employs 58,000 people. Employment related to the meat and wool industry is estimated to be 206,000 (Ernst & Young, 1996). The red-meat industry is therefore a substantial contributor to New Zealand's workforce.

There are three main sectors of the meat industry within New Zealand: production; processing; and marketing. While farmers make up the production sector, it is common for individual meat companies to both process and market meat. Therefore the meat industry in New Zealand consists of two main stakeholders; farmers and meat companies.

Most of the industry's \$25 billion of capital mentioned above is held on the 35,000 sheep and beef farms (\$22 billion) which employ 37,100 people. These farms cover 12.2 million hectares and are New Zealand's largest single commercial land-use (Ernst & Young, 1996). In 1996, 28 meat export companies operated a total of 60 export meat processing plants. These plants incorporated 65 sheep chains and 37 beef chains. The processors employed 21,000 people and have \$2.2 billion of capital invested in the industry.

While the red-meat industry is important to New Zealand, it is slowly declining in prominence, as indicated by the changes in land-use in Table 2-1. The land area utilised for sheep and beef cattle farming reached a peak of 11.4 million hectares in 1985 after a period of government subsidies, including the Livestock Incentive Scheme and Land Development Encouragement Loans (Rayner, 1990). Since 1985 the area in sheep and beef cattle production has declined to 9.5 million hectares (1995), a drop of 14%. Correspondingly, sheep numbers have declined from a peak in 1986 of 68 million to 48 million in 1996. Over the same period beef cattle numbers changed slightly from 4.9 million to 5.0 million. In contrast, the land area used by the other major biomass producing industries (especially forestry) have increased over the last 25 years (Table 2-1).

**Table 2-1: Change in agricultural land-use areas in New Zealand.**

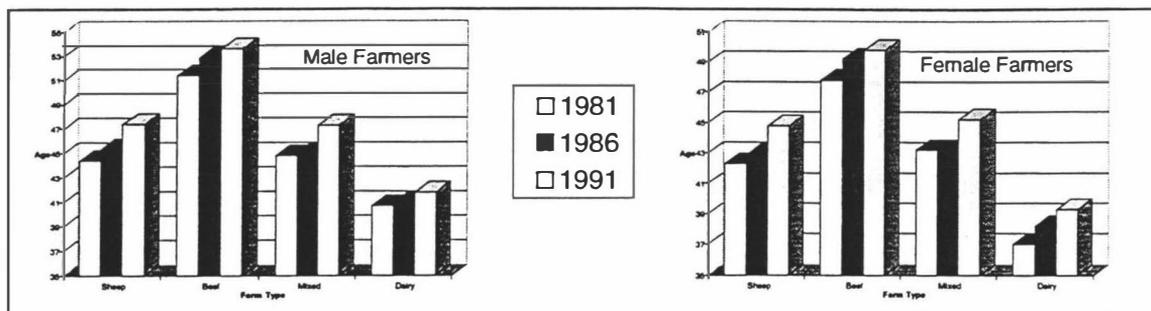
	1985	1990	1995	% Change (10 yrs)
<b>Sheep &amp; Beef</b>	11,356	10,392	9,461	-17%
<b>Forestry</b>	1,098	1,304	1,658	+34%
<b>Dairy</b>	1,256	1,433	1,807	+30%
<b>Deer</b>	64	178	218	+71%
<b>Pipfruit</b>	8	15	17	+53%
<b>Kiwifruit</b>	15	18	11	-27%
<b>TOTAL</b>	13,797	13,340	13,172	-5%

Source: (MAF Policy, 1996).

The dynamics of change in the meat industry have been driven mostly by profitability, and this ultimately must reflect market demand and price (Davison, 1995). Returns to the industry are low, averaging 2-3% on equity for farms and processors (Ernst & Young, 1996). Depressed meat prices and a high exchange rate has resulted in reduced farm profits since the 1994 financial year (MAF Policy, 1996). The opportunity cost of investing in sheep and beef cattle production is high when compared to dairy, deer and forestry. The net present value per

hectare for dairy is estimated at \$11,400, deer \$4,900, forestry \$4,000 and hill country sheep \$2,800 (Ernst & Young, 1996). Urban development in "lifestyle" blocks is also gradually taking up significant areas of finishing land around urban centres.

Overall, the industry's low returns between 1985 and 1995 have resulted in a loss from the industry of two key inputs: land (Table 2-1) and human capital. While the loss of human capital is difficult to quantify, the rising average age of sheep and beef cattle farmers suggests it is serious (Figure 2-1).



Source: (Ministry of Agriculture and Fisheries, 1996).

**Figure 2-1: Change in average age of male and female farmers.**

The challenge for the meat industry is to build profitability into the sector for both the farm suppliers and the export processors (Davison, 1995). Both must be profitable for the New Zealand meat industry to remain competitive in the international market for meat. The industry has responded to low returns for their products in the two areas that industry stakeholders can most easily exercise influence: increasing the efficiency of the production and processing sectors; and product diversification to meet the changing demands of markets.

### 2.2.1.1 Productivity

The productivity of the New Zealand meat industry has increased over the last decade. Processing companies were substantially more efficient in 1995 than in 1982, as illustrated in Table 2-2.

**Table 2-2: Change in export slaughter facilities and capacity (1982 versus 1995).**

	1982	1995	% Change
<b>No. of Companies</b>	17	27	+59%
<b>Cattle Processors</b>			
No. of Companies	NA	18	-
No. of Plants	32	37	+16%
No. of Chains	32	37	+16%
Daily Capacity	20,000	12,450	-38%
Sept. Year (000s)	1,643	2,060	+25%
Days to Process at Capacity	82	165	+101%
<b>Sheep Processors</b>			
No. of Companies	NA	18	-
No. of Plants	42	32	-24%
No. of Chains	110	65	-41%
Daily Capacity <sup>1</sup>	370,000	210,000	-43%
Sept. Year (000s)	39,000	31,400	-20%
Days to Process at Capacity	105	150	+43%
<b>No. of Employees</b>	34,000	20,000e	-41%

1 lamb equivalents, where 1 sheep = 1.15 lambs.

Source: NZ Meat and Wool Board's Economic Service.

NZ Meat Producers Board.

NZ Meat Industry Association.

Efficiency in the meat processing sector is significantly affected by plant utilisation. Increased plant utilisation lowers fixed costs per unit of production. The daily capacity figures shown in Table 2-2 are based on the industry maximum weekly throughput achieved in the season, divided by an assumed 5.5 working days each week, to obtain the "daily processing capacity throughput equivalent". The daily processing capacity of sheep chains in 1995 was 43% lower than 1982, while lamb and sheep processed, on a lamb equivalent basis, declined by 20%. This meant that it would take 45 more days at capacity to process lamb and sheep in 1994-95 compared to 1982. This implies the industry has achieved a 43% increase in plant utilisation for sheep processing relative to the capacity in 1982 (Davison, 1995).

There was also a large capacity relative to the supply of cattle in 1982, as illustrated by the fact that the annual kill could have been processed 82 days. In 1994-95 the supply of cattle could have been processed in 165 days, representing a 101 per cent increase in plant utilisation compared to 1982 (assuming other factors are constant).

Farm (production) productivity has also increased over the last decade, but not to the same extent. One key measure of productivity for New Zealand sheep and beef cattle farms is meat production per hectare. Between 1990 and 1995 the average output of meat per hectare increased by 11% (Ministry of Agriculture and Fisheries, 1996). The increases in farm

productivity are also shown in the gains made in other production indicators over the last decade (Table 2-3).

**Table 2-3: Changes in farm productivity indicators for meat production.**

	1986/87	1990/91	1994/95
Average Export Beef Carcass Weight (kg)	240.9	246.7	262.9
Average Export Lamb Carcass Weight (kg)	13.4	13.9	15.0
Average Calving %	83.3	85.7	85.5
Average Lambing %	100.3	102.8	109.3

Source: NZ Meat and Wool Board's Economic Service.

### 2.2.1.2 Product Diversification

Because 85% of New Zealand's annual meat production is exported, the meat industry is heavily dependant on the prices received in overseas markets. This contrasts with most other major meat producing countries where the domestic market sets the prices received for meat (Davison, 1991).

Markets for New Zealand's red-meats are changing rapidly. While GATT (now WTO) has generally improved access into foreign markets, red-meat is facing increasing competition from white meats and other food products such as pasta, pizza and vegetarian dishes. This is causing a strong swing away from red meat, and particularly beef, consumption in the industry's traditional markets (Table 2-4).

**Table 2-4: Population and per capita meat consumption in selected countries<sup>1</sup>.**

	1985	1995	% Change
Population (m)	871	945	8.5
Consumption (000t)			
Beef	23,284	24,660	5.9
Pork	22,285	27,812	24.8
Sheepmeat	2,161	2,513	16.3
Poultry	16,186	24,529	51.5
TOTAL	63,916	79,514	24.4
Consumption (kg/hd)			
Beef	26.7	26.1	-2.4
Pork	25.6	29.4	15.1
Sheepmeat	2.5	2.7	7.2
Poultry	18.6	26.0	39.7
TOTAL	73.4	84.2	14.7

<sup>1</sup>Countries include the European Union, North America, the Middle East, Japan, Korea, Australia and New Zealand.  
Source: USDA, FAO publications, New Zealand Meat and Wool Board's Economic Service.

The New Zealand meat industry has responded to changing market demands and increased competition through market and product diversification. Table 2-5 shows how the markets for New Zealand beef products have diversified, with reduced reliance on the United States market. However, there has been less change in the proportion of beef exported as carcasses, cuts, and manufacturing beef (Table 2-6), indicating only small changes in product diversification. More opportunities appear to exist for diversification of beef products with New Zealand still being largely reliant on the United States manufacturing beef market.

**Table 2-5: Percentage of beef exports (tonnes) to major markets.**

	1987	1991	1995
<b>United States</b>	79%	76%	65%
<b>Canada</b>	8%	8%	12%
<b>North Asia</b>	5%	8%	15%
<b>Pacific</b>	3%	2%	2%
<b>Other</b>	4%	8%	17%

Source: New Zealand Department of Statistics - Overseas Trade Statistics.

**Table 2-6: Percentage of export beef production<sup>1</sup> shipped as carcasses, cuts and manufacturing grade beef.**

	1984	1989	1994
<b>Carcasses</b>	0%	4%	7%
<b>Cuts</b>	22%	24%	21%
<b>Manufacturing Grade</b>	77%	72%	72%

<sup>1</sup> Tonnes of shipping weight, excluding veal.

Source: New Zealand Meat Producers Board.

The need for increased market and product diversification was recognised by the New Zealand Meat Producers Board in a document titled 'Strategic Plan - 1993-2000' (New Zealand Meat Producers Board, 1993a). A new direction for the industry was advocated that focused on diversifying and adding value to meat products in order to reposition them at the top end of export markets. This strategic plan sought to move away from commodity trading to focus instead on markets that are prepared to pay for product quality and customer service, thus ultimately providing increased and more sustainable returns to the meat industry.

## 2.2.2 Seasonality of Beef Production

New Zealand is situated in the South Pacific and has a predominately oceanic and temperate climate. Rainfall is abundant, although the El Nino Southern Oscillation weather pattern causes seasonal and regional patterns. The abundance of water, combined with rapid geological

activity, and the presence of temperate rain forests, has formed soils that are fertile and high in organic carbon. These factors combine to provide New Zealand with an international comparative advantage in pastoral based agricultural production (Ernst & Young, 1996).

The European colonisers exploited this feature of New Zealand. Removal of rain forests opened up large areas of land for grassland agriculture. Much of this land consisted of steep hillslopes suitable only for grazing with animals. Sheep, and later cattle, were used to harvest pasture off the hillsides. Thus, agriculture in New Zealand developed on the basis of a ryegrass-clover forage system that allowed for relatively low input, pastoral farming. The main products of this system include meat, wool and milk.

However, because the climate is sufficiently mild to graze animals outdoors all year round, agriculture in New Zealand is subject to a significant seasonal variation in product supply. In general, there is sufficient pasture growth in the winter months to feed animals at around maintenance levels, but insufficient growth occurs to allow a steady year round supply of product (Reardon, 1978; Ernst & Young, 1996). In contrast, the more severe winters in northern Europe and the United States require the housing of animals over the winter when they are fed with compound feeds. This more controlled environment allows for a more continual supply of product, but has higher direct costs for production.

The history of the meat industry's markets also has contributed to the current seasonal pattern of production. For much of its past, the New Zealand meat industry existed solely to supply the British market in its off-season. Between 1883 and 1954 all New Zealand beef and sheepmeat exports went to the United Kingdom as frozen whole carcasses or frozen hind quarters (New Zealand Rural Press Ltd, 1990). This market had a reliable and predictable demand and a stable exchange rate. The industry found itself focused on trading undifferentiated (commodity) product for the British winter. However, Britain joined the European Community in 1973, which largely curtailed access to this market, and reduced the need for this off-season complementarity in the supply of agricultural food products to Great Britain.

### **2.2.3 Implications of Seasonal Beef Supply**

The seasonal pattern of beef supply impacts on the meat industry. These implications were introduced in Chapter One, and are now discussed in more detail. To discuss these implications it is useful to consider the beef industry in its wider context. The beef marketing channel can be defined as the physical and organisational system linking beef producers and consumers

(Street, 1990). A range of players including processors, packers and distributors play a role in transforming the raw product into forms which are suitable to retailers and caterers who are the direct interface between the production sectors and consumers. At every stage of this marketing channel players are faced with a range of opportunities and constraints. Overall, the marketing channel is a demand-driven exercise with players constantly planning for survival, efficiency and profit. The marketing channel therefore reflects the changing consensus between the different interests of the range of players involved from producers through to consumers.

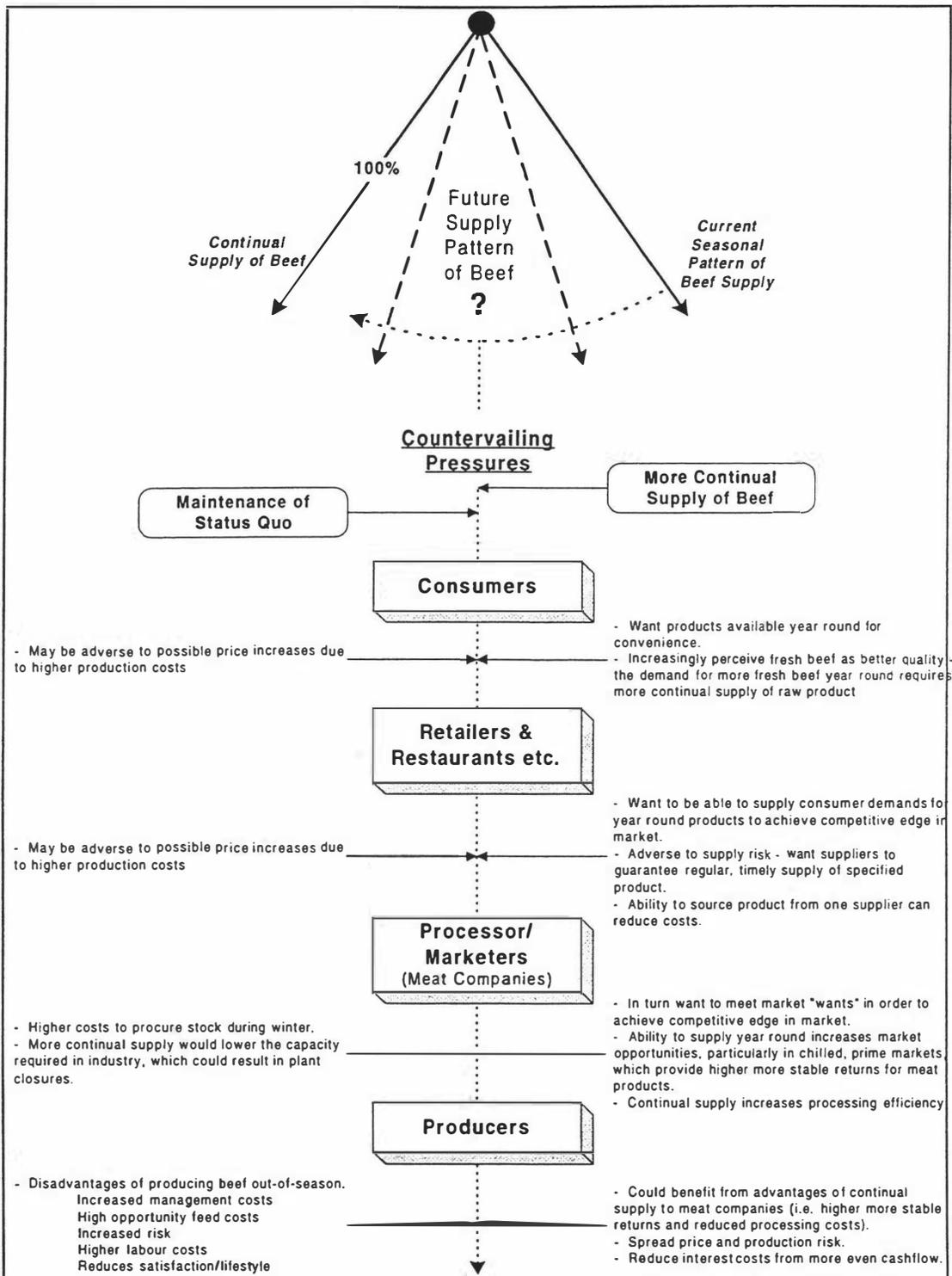
Figure 2-2 shows some of the issues and pressures involved in the marketing channel in increasing the continuity of beef supply. The future pattern of beef supply (represented by the pendulum at the top of the figure) will depend on the countervailing pressures at each stage of the marketing channel (shown in lower section of figure). There are conflicting interests, and therefore pressures to the left and right, at any given level of the chain and also between levels (Street, 1990). The pressure for continual supply of beef products begins with the consumer, who expect products to be available year round. Retailers respond directly to this consumer pressure by demanding regular delivery from suppliers (New Zealand Meat Producers Board, 1993b). As the major players in the New Zealand meat industry, meat companies and farmers are directly affected by these market signals.

### **2.2.3.1 Meat Companies**

The main advantages of obtaining a more continual supply of beef to meat companies are described under the headings of marketing and processing efficiency.

#### **Marketing**

The availability of product over a longer period of the year could contribute to a better flow of product into world markets by providing flexibility and control at sale. In recent years, there has been an increase in the number and type of markets to which New Zealand meat companies supply beef (Section 2.2.1.2). Supplying these more diverse markets involves meeting different customer needs with regard to the type and quality of product. Also, regular and timely delivery of product is becoming increasingly important (New Zealand Meat Producers Board, 1993b), especially in the markets demanding chilled primal cuts. A more continual livestock kill would enhance the ability of meat companies to target these lucrative markets (Reeves, 1995). These high-value chilled markets are considered to be important to the long-term viability of the beef industry (New Zealand Meat Producers Board, 1993a), which is positioned in the increasingly competitive consumer market for meat.



**Figure 2-2: Continuity of beef supply - the countervailing pressures in the marketing channel.**

### Processing

More efficient use could be made of the capital invested in meat processing plants if the seasonal slaughter pattern was spread more evenly through the year (Talyor et al., 1982;

Stannard, 1984). As introduced in Section 2.2.1.1, the efficiency and therefore profitability of meat companies is dependant to some degree on the level of utilisation of their facilities (Sheppard, 1982). The seasonal nature of beef cattle production and historical construction of capacity to process this supply means that meat processing plants are under-utilised during the off-season. This under-utilisation leads to higher per unit processing costs, and thus, decreased company profits and increased killing charges to farmers. In addition to reducing required processing and storage capacity, a more uniform supply would facilitate the marketing advantages described previously.

### **2.2.3.2 Farmers**

Seasonal climatic conditions result in a seasonal production pattern under New Zealand's pastoral beef production systems. Farmers' ability to produce stock at different times of the year is constrained by the nature of their farming environment. In order for any change to be made in the seasonal supply of beef cattle for slaughter, it will be necessary for animal feeding systems to be altered to overcome the seasonality factor. Since any alteration away from the present system is likely to result in increased production costs, farmers will require adequate incremental rewards to cover the extra costs of OOS production. While there may be no direct benefits for farmers to produce beef cattle OOS, there exists an opportunity for farmers to receive a share of the benefits gained by meat companies from a more continual supply of beef. This is likely to occur through decreased killing charges and payment of premiums from meat companies to farmers for OOS livestock. Out-of-season beef production systems and their likely on-farm effects are described in Section 2.2.4 below.

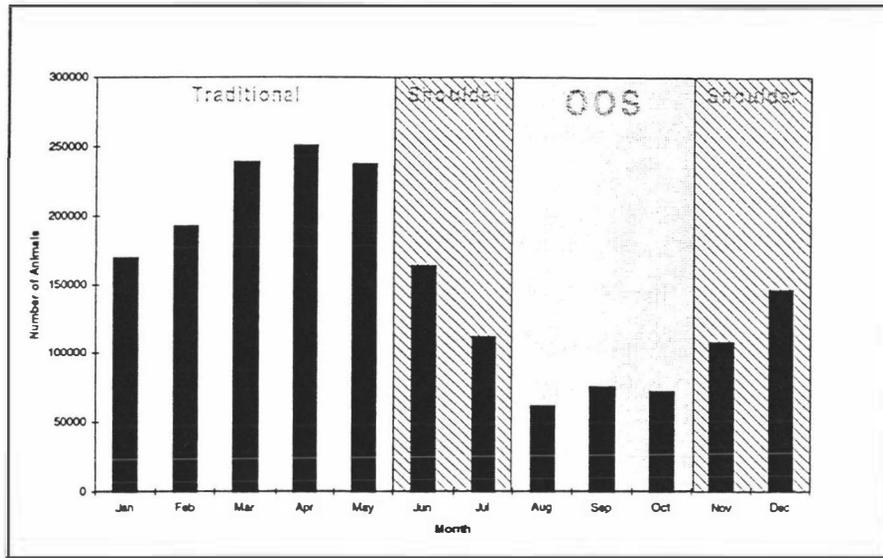
### **2.2.3.3 Addressing Seasonality**

Strategies to reduce the seasonality of meat production can be considered at different levels in the industry. For example, processing companies have developed packaging and storage technologies to extend the shelf-life of meat products. This technology reduces the effects of seasonal meat production by providing marketers with more flexibility with selling times. However, seasonality within the meat industry stems from the seasonal supply of livestock from producers, thus, there is potential to address the seasonality problem at the farm level.

## **2.2.4 Out-of-Season Beef Cattle Production**

In general, increasing the continuity of beef supply would involve farmers producing more beef cattle ready for slaughter during the winter and early spring months, when supply is traditionally low (Figure 1-1). For the purposes of this study 'OOS' beef production is defined

as finishing cattle for slaughter within the three month period between August and October. 'Shoulder' beef production includes the two month periods either side of the OOS range, i.e. June-July and November-December. Producing beef cattle for slaughter during the remainder of the season from January-May is defined as 'traditional' beef production. These definitions are based on New Zealand beef slaughter figures and reflect periods of high and low supply of beef cattle to processing plants. Figure 2-3 shows the defined periods against average monthly beef slaughter numbers from 1991-94.



**Figure 2-3: Definition of OOS, Shoulder and Traditional Beef production periods relative to the average number of beef cattle slaughtered between 1991-1994.**

Out-of-season beef production systems are likely to influence farm management decisions through the need to modify stock and pasture management. Beef cattle can be grown at a reasonably flexible rate over their 1½ to 3½ year lifespan, and while this allows some control over slaughter time, the availability of feed is a dominant factor in the ability to achieve this. Efficient, low cost grazing systems seek the best match between feed supply and demand in order to optimise pasture utilisation and avoid the expense of feed conservation and/or supplementation. OOS production may result in a poor match between feed supply (pasture growth) and feed demand (animal requirements) (McCall, 1992), which may decrease the efficiency and profitability of these systems (Sheath et al., 1987; Gray et al., 1989).

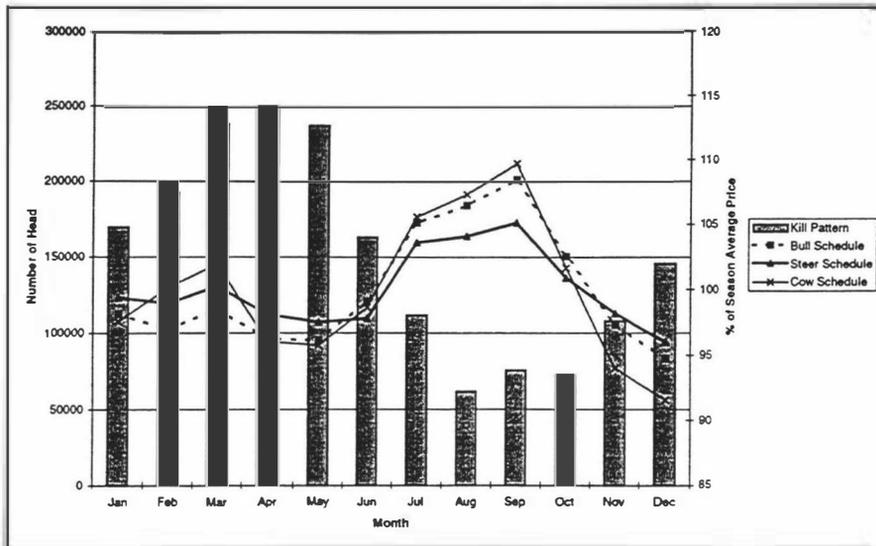
There is also more risk associated with achieving target liveweight gains with OOS production systems when animals must achieve high average daily gains during periods of highly variable pasture growth, such as autumn and early winter. Maintaining pasture quality is critical in any pastoral finishing system (McCall, 1992), and OOS production systems may be less suited to

controlling this quality, and thus may involve more pasture conservation. Also, farming heavy animals during the winter may increase pasture damage through pugging which in turn can reduce spring growth and animal performance (Thomson et al., 1992; Haynes, 1995).

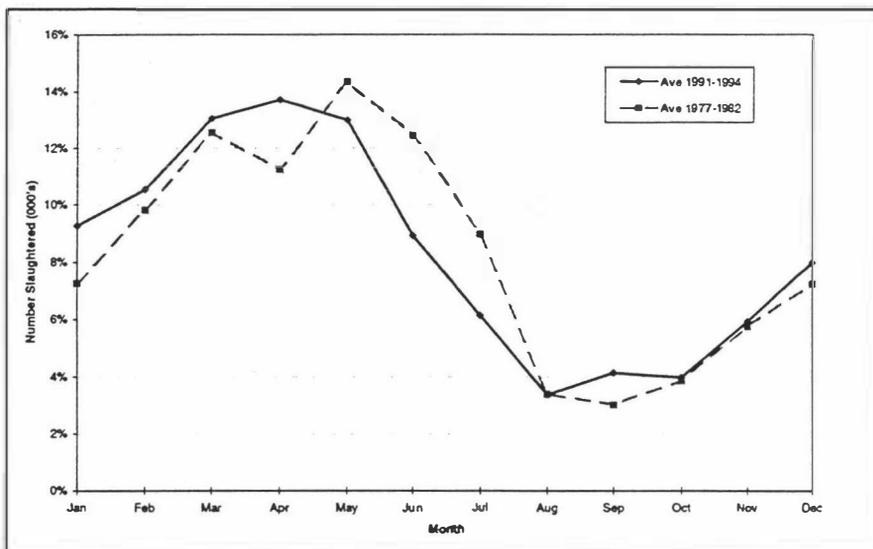
The likely management changes required for OOS production systems and the associated extra costs must be outweighed by improved financial returns before farmers are likely to consider their implementation. Using simulation modelling, McCall (1992) estimated that an OOS system for a farm selling steers at two years of age in September, and also at three years of age from June to August, must carry 30% less stock, and make 30% more silage than a traditional system. For this example, McCall (1992) reported that the OOS schedule would need to be 20% higher than prices received during December and March.

The level of schedule premiums will strongly affect the profitability of OOS beef production systems. The level of profitability required of OOS systems, in order to entice their increased adoption by farmers, will depend on the combination of the farmer wants and needs (i.e. farmer's objectives and goals) with physical resource factors such as soil type and fertility, topography, climate and labour. Also, less tangible issues such as knowledge and understanding of OOS production and the farmer's attitude to, and perception of risk associated with this system of beef supply will influence his/her decisions. The sum of the factors that influence a farmer's decision with respect to a policy change or the adoption of a new technology are described as the 'circumstances' of the farmer (Byerlee et al., 1980).

Despite the historical and current premiums for OOS production (Figure 2-4), the seasonality of beef production has changed little (Figure 2-5) and remains an issue for the meat industry. This suggests that farmers perceive that OOS premiums to be insufficient to cover the direct, and also the less tangible, costs of production. Nevertheless, farmers are responsive to market signals (McRae, 1992), and the opportunity therefore exists to increase the continuity of beef supply through the payment of higher premiums for OOS beef cattle. Premiums will need to reflect the greater cost of finishing cattle OOS, and production systems will need to be compatible with farmer circumstances before the required management changes will be entertained by beef producers.



**Figure 2-4: Percentage change in average monthly beef schedule prices between 1991-1994.**



**Figure 2-5: Average export beef slaughter pattern for 1977-1980 and 1991-1994 periods.**

Consequently, an investigation of the potential benefits of a more continual beef supply within the beef industry must take account of the on-farm costs and constraints to, and implications of, the required changes to beef cattle production systems. It would be hasty to assume that farmers want to, and are able, to respond to this opportunity. The basis of this study is to explore the on farm issues and implications of OOS beef cattle production systems. A Farming Systems Research approach, which is described in the next section, is used to incorporate the perspectives of farmers and other stakeholders into the research process.

## 2.3 FARMING SYSTEMS RESEARCH

As introduced in Chapter One, Farming Systems Research (FSR) is a systems-based approach to problem solving in agricultural research and extension. The approach is aimed at generating solutions and technologies that are relevant to the end-users of the research, and achieves this by incorporating information on their circumstances and constraints through their formal participation in the research process.

### 2.3.1 Systems Thinking

As the name implies, FSR incorporates systems thinking and approaches to address issues in agriculture. Systems thinking evolved in the 1920's when biologists began to doubt the usefulness of a purely reductionist approach in the investigation and understanding of biological organisms (Checkland, 1981a). Reductionism involved the division of an entity into its basic components. These components are analysed as discrete entities, to explain their behaviour, and then the individual explanations are aggregated to represent an understanding of the behaviour of the whole entity (Dillon, 1973). In contrast, systems thinking viewed the organism as a group of interacting, interrelated components operating together for a common purpose. Each component affected the properties of the system as a whole and each part was seen to be dependent on other components in the system for its own properties (Dillon et al., 1978; Spedding, 1979). The components in the system interacted and adapted to each other in a process of mutual influence, by continual feedback and adaptation (Spedding, 1979; Jamieson, 1985).

A systems approach is one in which a system is identified, described, studied, understood and/or improved in a way that serves a purpose (Spedding, 1994). A description of a system includes its contents (components, interactions, sub-systems), boundary, inputs and outputs and a reference to the context in which it operates. A system is made up of smaller sub-systems and is itself a sub-system of a higher system. For example, a cow may be viewed as a system. It is a group of interacting components (e.g. heart, lungs, etc.) operating in a co-ordinated way. The individual components can be viewed as systems themselves. The cow's heart, for example, is a group of individual and interacting cells. From a broader perspective, the cow can also be seen as a sub-system of the system defined as the farm. Thus, systems are very diverse in their character and level of complexity.

Checkland (Checkland, 1981b) distinguished between 'hard' and 'soft' systems. Hard systems are characterised by easy-to-define objectives, clearly defined decision making procedures and

quantitative measures of performance. These systems tend to be mechanical, although some biological systems fall into this category as well.

In contrast, soft systems tend to have objectives that are hard to define, decision making is uncertain, and measures of performance are often qualitative. People are commonly more intimately involved in soft systems. Human behaviour tends to be less predictable, thus adding to the complexity of the system. Soft system approaches recognise that a common factor contributing to the complexity of situations which involve humans is the fact that different people define the nature of the problem differently (Checkland, 1981b).

### **2.3.2 FSR, a Systems Approach**

Farming Systems Research represents one approach to systems analysis and synthesis. The desire to generate solutions and technologies that are more relevant to the end-users of research, implies that these end-users are central to the system of interest. Commonly FSR views the farm as a system, and a central component of this is the farmer and farm family. Thus, FSR acknowledges the importance of the farmer's perspective in the analysis of farm systems and the definition of problems and opportunities within those systems. While farmers may agree that they want to increase their profits, this can only be achieved within a wide range of constraints (Checkland, 1981b). These constraints include biophysical and economic factors, but the goals and values of the farmer are also important. Many farmers prefer to reduce risk, to incur less work, or to gain other satisfaction than to make additional money (Brazendale et al., 1993; Spedding, 1994). By incorporating these perspectives into the research process, changes or improvements to the system can be developed that are more relevant to, and therefore more likely to be accepted by the stakeholders who operate within those systems (Jamieson, 1985).

Systems thinking provides a framework for representing, analysing and influencing the system of interest to achieve a desired end state. As outlined previously, systems approaches view problems from a holistic perspective, allowing the nature and context of the problem to direct the process of inquiry. The FSR approach has its basis in systems thinking. It acknowledges the complex nature of interactions within a farming system and the significant influence that the goals and values of the farmer and farm family have on the operation of the farm system.

### 2.3.3 Evolution of FSR

The Green Revolution was a significant event in the development of FSR by contributing to the debate about, and strengthening the role of systems thinking in the context of rural development and agricultural research. The Green Revolution was sparked in the 1950's and 60's by increasing concerns about human poverty and hunger in a growing world population. International agencies for agricultural development and research sought to address this situation by transferring capital and technology from the rich industrialised nations to the poorer countries because it was widely believed that this would eventually result in their development (Jamieson, 1985).

Despite early successes of the Green Revolution in increasing food production (Falcon, 1970), concerns were increasing over the apparent inequality created by the predominance of farmers with relatively high levels of resources (resource rich farmers) adopting the new technology (Chambers et al., 1987a). Green Revolution technology was appropriate where there was adequate water, and farmers had access to sufficient monetary resources to purchase the seeds, fertilisers and pesticides required (Simmonds, 1985). However, for the farmers who did not have this level of resources the situation did not change. The problem of rural poverty related not only to the total amount of food produced but to who produced it and who could obtain it (Chambers et al., 1985).

As a consequence in the mid 1970's, a new view on agricultural technology development and research began to emerge. By the 1980's, what had started as a mixture of ideas emerged as a dominant concept (Simmonds, 1985). This new approach was labelled Farming Systems Research (FSR) and was concerned with ensuring that farmers with few resources benefited from the new agricultural technologies (Biggs, 1985).

The evolution and application of FSR took place in developing countries (Merrill-Sands, 1986; Tripp, 1991) where the traditional approach to agricultural research had been the Transfer of Technology (TOT) model (Chambers et al., 1987b). In this model researchers define research priorities and design experiments which are conducted under controlled conditions and the results are handed down to farmers and extension workers. The TOT approach resulted in significant increases in productivity and profitability in the developing country context (Chambers et al., 1985). However concerns were raised regarding the non-adoption of technologies by some farmers, particularly those that operated in less favourable conditions with few resources (resource poor farmers). Investigations determined that there appeared to

be differences in the selection and evaluation processes of farmers and agricultural scientists (Chambers et al., 1987b). The TOT approach involved the development of technologies on well-equipped research stations remote from farmers. It was suggested that these technologies were not widely used on the smaller less developed farms, because they did not fit the farmers' needs and their physical, social and economic conditions. FSR emerged in response to this lack of adoption and represented a fundamental change in perspective by agricultural researchers towards agricultural development (Saint et al., 1977).

### 2.3.4 Characteristics and Forms

The name FSR has been associated with many different projects and research approaches with varying interpretations and components of the FSR philosophy (Byerlee et al., 1982). However, some basic concepts are common to much of the literature that describe the FSR philosophy. In general:

- FSR is interested in the generation of technologies and solutions which are relevant and viable to farmers. This will take place only when the process is based around a full knowledge of the specific existing farming systems into which the technologies are to be implemented (Jamieson, 1985).
- the technologies should not be solely evaluated in terms of technical performance, but also with regard to their relevance to the goals, needs and circumstances of farmers (Merrill-Sands, 1986).

The term FSR does not apply to a single approach, but it generally refers to a set of methods associated with the diagnosis of farm problems, the design of alternative solutions or technologies, the evaluation of these solutions on farms, and the diffusions of the technologies to identified target farmers. In broad terms FSR is an approach that:

- (i) views the farm as a system, and central to the farming system is the farmer and farm family.
- (ii) is concerned primarily with the understanding and solving the problems of the farming system. The farm family is by definition the major beneficiary of the research.
- (iii) is by nature dynamic and iterative.
- (iv) inherently requires the active participation of farmers in the research process.
- (v) adopts on-farm research as a component of the research process.
- (vi) requires by definition researchers and practitioners to work in multi-disciplinary teams (Dillon et al., 1978; Norman, 1978; Simmonds, 1985; Merrill-Sands, 1986).

The evolution of FSR in differing contexts and environments has meant that many interests, points of emphasis, and emerging themes have become associated with the term "farming systems research" (Merrill-Sands, 1986). As a result, a confusing array of terminology and interpretations has emerged and this has led to confusion and misunderstanding about the objectives and role of FSR. This has generated doubts over the credibility and usefulness of some FSR research (Byerlee et al., 1982; Dillon et al., 1983). As a result, many practitioners have distanced themselves from the title of FSR, and developed other approaches that strongly reflect FSR in content. Some of the more significant of these approaches include: On-farm research (Tripp, 1991); Farmer-back-to-farmer (Rhoades et al., 1982); Farmer-First and Last (Chambers et al., 1985); Farmer Participatory Research (Farrington et al., 1988); Participatory Action Research; and Participatory Rural Appraisal (Etling et al., 1994; Okali et al., 1994).

### **2.3.5 Participatory Methods**

While the aim to incorporate the circumstances of farmers into the research process was common to FSR approaches in general, the methods of this incorporation varied. One of the common distinctions between FSR approaches was the varying degree and nature of farmer and end-user participation in the research process. FSR literature is increasingly supportive of the more participatory approaches to problem solving. Proponents of these more participatory approaches advocate that the best way to incorporate the knowledge and perspective of farmers is through their active involvement in the research process (Moris et al., 1994). The more participatory FSR approaches seek to utilise the knowledge of the farmer directly and thus rely less on the ability of the researchers to understand farmers' circumstances. This active participation is aimed at increasing the relevance, ownership and adoption of solutions and technologies generated from the research.

Participatory approaches utilise techniques that improve the communication between end users of research and individuals within the scientific community. They also rely on techniques that support the participation of farmers and communities in the identification and solving of problems in which they are involved.

Rapid appraisal techniques (Chambers, 1993) and on-farm research were core components of the FSR approach. Rapid appraisal techniques were used as the starting point for understanding a problematic situation and its context. These techniques commonly involve the collection of relevant secondary data, direct observation, and interviews (Beebe, 1985). On-farm research

was commonly used later in the research process and involved the implementation and evaluation of potential solutions and technologies in the context of the end user. On-farm trials helped to focus research by highlighting constraint variables, and better defining the requirements of the solution.

More recently, the wider acceptance of FSR in developed countries has been supported in part by the development and application of related approaches, such as soft systems approaches (Rosenhead, 1989), in areas other than agriculture. Soft system approaches emphasise stakeholder participation and provide a general framework for working through problematic situations to a point where action to improve the situation may be defined. The aim is to describe and model the problematic situation from the perspectives of those involved in the situation (Checkland et al., 1990). The clarification of the different perspectives leads to greater understanding of the issue by all parties, and is used as the basis for debate and discussion among the parties to define action to improve the situation (Reid, 1996). The incorporation of the different perspectives into the description of the issue aids in the development of action that is aimed at improving the situation, and is more relevant and acceptable to all parties.

## **2.4 FARMER FIRST RESEARCH**

A Farmer First Research group was established in the Department of Agricultural and Horticultural Systems Management at Massey University in 1992, with the goal to investigate, build on and adapt the FSR approach to define and address the range of complex issues facing New Zealand agriculture at the farm and industry level (Reid, 1996). Farming Systems Research offered an approach to agricultural research and extension that complemented the traditional 'top down' approach applied in New Zealand and was increasingly being employed in developed countries in Europe and Australasia (Ison et al., 1992; Dent et al., 1994; Lussignea, 1994). The systems and participatory elements of FSR provide a contrasting framework for solving problems in New Zealand agriculture, and create the potential to add to and complement the traditional model.

The traditional approach to agricultural research in New Zealand fits the description of the "transfer of technology model (TOT)" (Section 2.3.3) given by Chambers & Jiggins (1987b). As in the developing countries, support for the potential of FSR in New Zealand arises from concern about the lack of uptake by farmers of research results (McRae, 1992), and about farmers apparent lack of willingness to consider changes to their farming systems. Moore

(1990) presents data largely based on informal evidence to support this concern in New Zealand agriculture.

Over thirty years ago McMeekan (1963), a prominent applied agricultural researcher in New Zealand, praised the major impact agricultural research and extension had made on agricultural output. However, he also warned that unless research concentrated on the clearly defined needs of the industry, it would move from an applied to a basic orientation, and would not be as useful to the industry as it had been. Given the current concern over the lack of uptake of research results, there must be doubts that McMeekan's warnings have been acted upon.

In 1990, the Foundation for Research and Technology (FoRST) was formed in New Zealand to perform the primary function of allocating and prioritising funds for research and development (MoRST, 1993). This was part of the re-structuring of Government funded research that saw funding becoming output-based rather than institution-based (Theron, 1990). Improving the adoption of research results is a high priority for FoRST, which views this as an integral part of the research process (MoRST, 1993). FoRST believes that there needs to be increased end user participation in identifying research and science needs and in defining how research can be adapted and transferred into a product or process (Wright, 1993). Thus, research funding priority was reassessed to give more importance to projects that incorporate technology transfer, increased end user participation, and have a higher probability of adoption of research results (MoRST, 1993).

Agricultural researchers and research funders have recognised the need to assess alternative research and extension models in New Zealand (Mueller, 1993; Wright, 1993; C. Alma Baker Trust, 1995). The Farmer First Research group at Massey University argues that FSR is an approach to agricultural research that "will complement traditional research to ensure that [New Zealand] farmers' needs are kept central to the research process" (McRae et al., 1993, p.637) thus increasing the relevance of the research process to its end users, and thereby improving the uptake of research results.

## **2.5 SUMMARY**

Increasing the continuity of supply of cattle for slaughter through OOS beef finishing policies would bring benefits to the marketing and processing sectors of the NZ meat industry. In order to realise this opportunity however, a substantial commitment is required from farmers, who will be asked to change their management systems. A knowledge of the constraints and

circumstances of farmers in relation to these management changes is required if appropriate OOS beef production technology is to be developed and implemented. This is where the FSR approach, with its basis in systems thinking and participatory methods, can contribute to the investigation of OOS beef production. As such, FSR methods will help to enhance the relevance of the research to the stakeholders involved. The application of the FSR approach to this study is discussed in the next chapter.

# Chapter Three: Research Approach

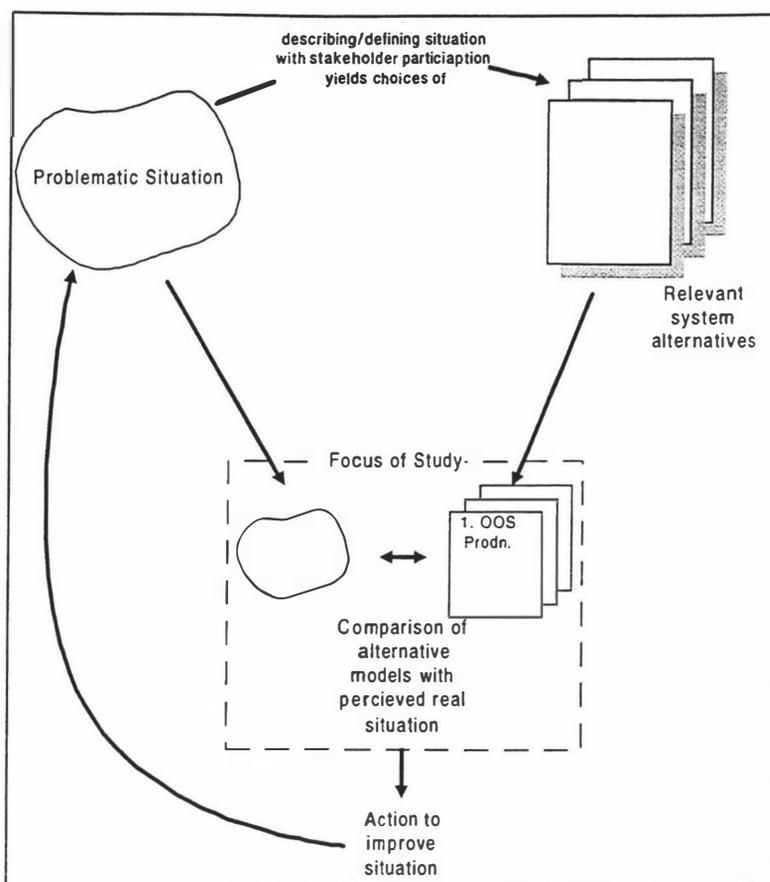
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## 3.1 INTRODUCTION

Application of a Farming Systems Research (FSR) approach in this study is discussed in this chapter. An overview is provided of the three major research phases of the study, and data collection and analysis methods are also described and discussed.

## 3.2 RESEARCH APPROACH

A FSR approach to problem solving with emphasis on systems thinking and stakeholder participation is applied in this study (Section 2.3). The approach and scope of this study generally fits within the framework outlined in Figure 3-1. This is a soft systems approach and involves describing and gaining an understanding of a problematic situation from the differing perspectives involved. Through this process, relevant alternative systems or system changes that would potentially improve the situation are developed. These systems are analysed and compared with the problematic situation, providing the basis for discussion and debate as to action that could be taken to bring about such improvement in the situation. The specific methods and sequence of the process are flexible and iterative in order to accommodate a wide range of situations.



**Figure 3-1: A soft systems approach framework.**

Adapted from Checkland & Scholes (1990).

Soft system approaches place emphasis on stakeholder participation to identify and describe problem situations. In this study the present seasonal pattern of beef production represents a problematic situation in the New Zealand meat industry for the reasons discussed in Chapter One. While the study initially scoped and described the problem from the perspectives of the main stakeholders involved, it generally focused on the analysis of one relevant system, i.e., the increased use of OOS beef production systems on farms. This alternative was identified by industry commentators (Frith, 1992) as a realistic option with the potential to improve the industry problem at the farm level.

### 1.3 RESEARCH PHASES

Following a review of relevant literature, the study consisted of three major phases: key informant interviews; farmer interviews; and case farms studies. These phases and their relationship within the research approach are briefly discussed below. Details of the methods and findings of each phase are developed fully in chapters Four, Five, and Six, respectively. While these phases were carried out sequentially, deliberate overlap occurred.

### **3.3.1 Phase One: Key Informant<sup>1</sup> Interviews**

Individuals with knowledge of various aspects of the meat industry were interviewed using semi-structured interview techniques (Section 3.4.1) to provide their perspectives on the problem of seasonal beef supply and OOS beef production. This provided a holistic overview of the problem within the “environment” of the meat industry in which farmers operate. The review of literature and interview process also confirmed that the on-farm use of OOS production systems was an important and realistic option for achieving a more continual supply of beef.

### **3.3.2 Phase Two: Farmer Interviews**

This phase focused on developing an understanding of the on-farm constraints and implications of OOS beef production systems. Farmers were interviewed personally, again using the semi-structure interview technique. The farmer interviews were completed within a transect of the Manawatu region and included farms in a range of biophysical circumstances. Data collected from the interviews were analysed and summarised to provide a description of the constraints and circumstances of farmers in relation to the use of OOS beef systems.

### **3.3.3 Phase Three: Farm Case Studies**

A more in-depth investigation of the use of OOS beef systems was carried out on three case farms. Whole-farm simulation modelling was used to examine, with the farmer, various management options for finishing beef cattle OOS. The modelling also enabled the financial and feed effects of the OOS management options to be estimated and quantified.

## **3.4 RESEARCH METHODS**

### **3.4.1 Personal Interviews**

Interviews are data collection methods used to elicit individuals’ knowledge, experiences, opinions, aspirations and feelings (Ackroyd et al., 1983). They are encounters between a researcher and a respondent in which the discussion focuses on the subject of the research. The dialogue is the raw data which is analysed by the researcher at a later point in time.

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<sup>1</sup> A key informant in agriculture is an individual who is accessible, willing to talk, and has a great depth of knowledge about an area, crops, credit, marketing and other problems (Rhoades, 1985b).

Personal interviews have been used as a core method in FSR approaches (Section 2.3.5) because of their ability to include the knowledge and perspectives of stakeholders (Beebe, 1985a; Rhoades, 1985a). They are a technique for acquiring information from farmers and key informants and were used in all the research phases to provide feedback to the researcher. The aim of the method is to gain a description and understanding of problematic situations and the context in which they exist, through the direct involvement of stakeholders.

Interviews are commonly characterised by their degree of structure and control. A structured interview is fully controlled by the researcher and commonly a pre-defined set of questions is used. At the other extreme, the unstructured interview has a low level of control by the researcher.

A semi-structured interview technique was utilised during all three phases of the research. It is an interview technique that is more closely modelled on the unstructured approach than the structured approach (Rhoades, 1985a). Topic areas developed by the researcher guide the discussion, but the questions asked are governed by the actual situation confronting the interviewer (Minichiello et al., 1995). The semi-structured interview is a flexible and adaptive technique which provides qualitative depth by allowing interviewees to talk about the subject in terms of their own 'frames of reference'. This facilitates an understanding of the meanings and interpretations that individuals attribute to events and relationships (May, 1993). Each interview is unique, with each person expressing his or her particular experiences and perspectives of the situation.

Rhoades (1985a) recommended that in order to enhance the interview encounter, the researcher should be friendly, and build rapport through personal comments interspersed through the conversation. This may mean allowing the discussion to stray away from the topic of study. However if the researcher can generally maintain the overall direction and focus of the interview, any time lost is made up for by the quality of information gained. A relaxed and 'secure' atmosphere builds rapport between the interviewer and interviewee, resulting in a fruitful experience for both participants. The overall goal of the semi-structured interview is for the interviewer to obtain in-depth qualitative information that expresses the interviewee's experiences and views.

### **3.4.2 Case Studies**

Case studies are used to assemble and analyse information about the characteristics of farming systems in a study area (Maxwell, 1986). They allow the collection of qualitative and quantitative farm level data, which enables many aspects of the case to be examined (Gummesson, 1991).

Case studies allow for detailed and holistic investigations of situations. The disadvantage of such in-depth investigation is that only a small number of cases (1 to 8) can be studied (Maxwell, 1986). Given this low coverage, and the fact that farms are usually not selected randomly, case studies do not represent a population accurately, and findings from them cannot be generalised to a whole population. However, case studies can be selected to represent a group within a population for the characteristics being studied (Maxwell, 1986). A group may consist of farms with similar natural and socio-economic characteristics, similar constraints and similar responses to new opportunities.

Case studies were used during the last phase of the study to investigate, with farmers, the potential use of alternative OOS production systems on their farms. Importantly, these case studies were participatory, in that they enable close collaboration between the researcher and farmer. This allows the farmer's extensive knowledge of their farm and farming system to be incorporated into the research.

#### **3.4.2.1 Simulation Modelling**

A whole farm computer simulation model was used in conjunction with the case studies to simulate and compare the financial and feed management effects of OOS production systems with current management policies. Simulation modelling is the construction of a replica or model of an object, system or idea which can be experimented with and tested for alternative courses of action (Shannon, 1975). Simulation models are 'input-output' models in that they generate an output from data entered into its interacting sub-systems.

Shannon (1975) explained that there was at least five legitimate and common uses for simulation models: an aid to thought; an aid to communication; aid in training and instruction; a tool of prediction; and an aid to experimentation. As such, a simulation model allows the user to observe and alter a system to increase his or her understanding of the system, thus aiding in the process of innovation (Shannon, 1975). A disadvantage of simulation models is that they can appear to accurately represent a real world system, when in reality they do not. Simulation,

especially of complex biological systems, is imprecise, and the degree of imprecision can be difficult to measure (McCall, 1984). However, if their limitations are acknowledged, simulation modelling can play a useful role in the investigation of the system of interest. Dent & Thornton (Dent et al., 1988) recognised potential benefits of the use of biological simulation models in Farming Systems Research to speed up the design process and the communication of appropriate technology packages to farmers.

The whole farm computer simulation model StockPol™ (Section 6.2.2) was used during the case farm studies (see Chapter Six). The simulation model had two major roles. First, to estimate and compare financial and feed costs of alternative farm management options for increasing OOS supply of beef cattle. Second, StockPol™ promoted thought processes of, and communication between the researcher and farmer participants during the analysis of OOS beef finishing options. The results of the simulation modelling were used to focus the discussion on the potential implications of OOS beef production systems on the case farm.

#### **3.4.2.2 Matrices**

Matrices were another technique used during the farm case studies research phase. The matrix technique used involved crossing two or more variables to see how they interact (Miles et al., 1984). Matrices can be used during semi-structured interviews to increase the relevance and understanding of information obtained by focusing the discussion on the topics of interest.

The matrix used in this study involved a grid that contained two components: elements and constructs (Ilbery et al., 1983). Elements are a group of issues that the researcher is investigating, while the constructs are bipolar verbal descriptions of the interviewee's perception of the elements in the matrix (Ilbery et al., 1983). In this case, the elements of the matrix were the alternative OOS finishing policies considered on the case farm. The constructs were implications and constraints that farmers associated with the application of OOS policies (Table 3-1). Interviewees were asked to complete the matrix by comparing and rating each element (alternative farm system) with each construct (implication or constraint of OOS). Farmers scored each alternative management system in terms of their possible implications and constraints. This was done using a pre-determined 5-point scale which indicated a positive (high score) or negative (low score) association between the elements and constructs.

**Table 3-1: Example of matrix used in semi-structured interview during farm case study phase of research.**

<i>Constructs</i>	<i>Elements</i>			
	Current System	All OOS	All Shoulder	Shoulder/Traditional
Feed Management	4	1	3	5
Compatibility with cropping	4	2	3	3
Ground damage	3	1	4	5
Type of country	3	1	2	2
Financial advantage	4	2	3	2
Price risk	3	3	2	1
Production risk	3	2	4	4
Preferences/goals	3	1	2	3

In this example, the farmer scored each alternative beef finishing option against 8 different constructs, including compatibility with the current cropping enterprise on the farm (highlighted in Table 3-1). A low score was associated with poor compatibility, while a high score was associated with good compatibility. For example, the results indicate that the interviewee believed that the current beef finishing system, with a score of ‘4’ was more compatible to his cropping enterprise than the ‘All OOS’ beef finishing system, which scored ‘2’.

Farmers were asked to ‘think aloud’ while scoring the matrix as it was their reasons and perceptions for each score that were most important. Thus, the matrix was used to help the interviewees clarify in their own minds the important issues regarding the alternative beef cattle finishing options, and communicate these issues to the researcher.

### **3.4.3 Qualitative Data Analysis**

The interview techniques used throughout the study resulted in the collection of qualitative data. Qualitative research involves observing and analysing real life situations. Qualitative, as opposed to quantitative, data deals with meanings and concepts that cannot be, or are not defined in numerical terms (Dey, 1993). These kinds of data are by nature relatively unstructured. The aim of qualitative data analysis is to bring structure to the data so that they are formatted in a way which is more useful for interpretation.

Dey (1993) advocated three steps in qualitative data analysis: description; classification or categorising; and connecting. In general terms the description stage involves the examination of raw data and understanding their meaning in context. The classification phase allots elements of the data with similar characteristics into categories. The research topic and objectives can help the researcher to differentiate between relevant and irrelevant data, and the categories reflect the concepts the researcher is investigating. The 'connecting' stage involves recognising associations between variables and between categories (Dey, 1993).

The qualitative data generated from the research were commonly in the form of recorded interviews on audio tape. The first stages of data analysis began during the interviews themselves. The flexibility of the semi-structured interviews allowed the interviewer to analyse and interpret responses, and to probe the interviewee further on specific issues to gain a richer understanding. The data analysis continued after the interview by developing summary notes of the interview tapes. These were interpreted and the responses and issues grouped into appropriate categories to provide structure to the data.

#### **3.4.3.1 Rich Pictures**

Rich pictures are a tool for summarising and analysing data collected from semi-structured interviews (Wilson et al., 1990). The technique involves a simple cartooning or mapping process that results in a pictorial display of the abundant information that typically results from the semi-structured interview (Checkland, 1988). This helps highlight the major activities, issues and people involved. Rich picturing can speed up the summary, understanding and analysis of individual interviews. The pictures or maps can also be used to communicate the outcomes of interviews and their analysis.

### **3.5 CHAPTER CONCLUSION**

The research approach used in this study was based on FSR methods for problem solving with emphasis on systems thinking and stakeholder participation. It involved first scoping and describing the problem of seasonal beef production patterns from the perspectives of those who are involved in the New Zealand meat industry. The study then focused on the use of OOS beef systems at the farm level to increase the continuity of beef supply. Farmer participation, through the use of semi-structured interviews, was used to develop an understanding of the on-farm constraints and implications of OOS beef systems. Finally, case studies were used to

investigate in more detail the potential and management implications of OOS beef production systems.

# Chapter Four: Key Informant Interviews

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## 4.1 INTRODUCTION

Individual stakeholders in the meat industry, including meat company representatives and agricultural consultants were interviewed to gain an overview of perspectives on the seasonality of beef supply in the industry, and the issues related to the use of OOS production systems. The exploratory survey had the following objectives:

- a) to confirm the need for research into this issue;
- b) to begin identifying implications and issues of the seasonal supply of beef from processing, marketing, and production perspectives; and
- c) to begin identifying the constraints to, and potential of, the use of out-of-season beef production systems.

This chapter includes a discussion of the methods used in conducting the key informant interviews and the structure of the interviews. Also included are a definition and a general description of the key informants. The results of the exploratory study are presented as a descriptive summary of the issues related to seasonality of supply and OOS beef production.

## 4.2 METHOD

### 4.2.1 Identification of Key Informants

As defined in Section 3.3.1, a key informant in agriculture is an individual who is accessible, willing to talk, and has a great depth of knowledge about aspects of agriculture such as area, crops, credit, marketing (Rhoades, 1985). Individuals with different perspectives, involvement and knowledge of the meat industry were identified and asked to participate in an interview process. The key informants included: three individuals involved at management level in different North Island meat companies; three agricultural consultants operating in the lower

North Island; a rural banker; and a research officer with a background in agricultural consultancy. Overall, the individuals provided a range of perspectives and knowledge of the New Zealand meat industry.

## 4.2.2 Interviews

A semi-structured interview technique (Section 3.4.1) was used to collect information and data from the key informants. The first step of the interview was to introduce the researcher and outline the research topic. It was made clear to the interviewee that any information collected would be treated confidentially. Permission was sought and granted to tape record each interview.

The direction of each interview was dependant on the experience and perspectives of the key informants. While there was no pre-defined list of questions, topic areas and relevant issues were developed by the researcher before the interviews. The following is an example of the topical outline that was loosely followed in interviews with meat company key informants:

1. Brief description of meat company.
2. Implications of the seasonal pattern of beef supply to business.
  - a) Processing efficiency
  - b) Marketing opportunities
  - c) Other implications
3. Importance of a more continual supply of beef cattle for slaughter.
4. Obtaining a more continual supply of beef cattle for slaughter.
  - a) Price incentives
  - b) Payment structures
5. Perception of on-farm constraints of OOS production.

These topics helped maintain direction and focus in the interviews. Particular questions were devised and phrased during the interview as discussed in Section 3.4.1. This flexibility enabled the researcher to follow the natural direction of the discussion and explore issues raised. The interviews lasted approximately one to two hours.

As stated above, all interviews were recorded on audio tape with only limited written notes being made. This allowed the researcher more time to concentrate on the discussion and probe where necessary for relevant. Initial analysis of the data occurred during the interview. This

was consistent with the use of the semi-structured interview technique described in Section 3.4.1, and allowed the researcher flexibility to probe and explore issues raised during the interview.

The formal data analysis began with summarising the interview recordings. This was done as soon as possible after the interview to ensure that the context of the discussion was retained during the summary process. Extensive notes were made of the discussion points and supporting dialogue. Obviously irrelevant points and issues were excluded from the summary. The interview summaries were then analysed by grouping and categorising the points and perspectives expressed by the interviewees.

### **4.3 RESULTS/FINDINGS**

The key informant interview summaries were used to generate the diagrammatic representation of the main issues relating to seasonality and out-of-season supply in the meat industry (Figure 4-1). The issues facing the two major industry stakeholders, meat companies and farmers, are depicted in Figure 4-1. The marketing channel in the centre of the diagram provides the context in which both stakeholders exist. It can be seen that the supply of raw product from farmers is the first stage in this channel, and its seasonal supply pattern affects the other processes in the chain through to the consumer markets. The implications of seasonality specific to meat companies are depicted on the right hand side of the diagram. The possible issues facing farmers, developed from the perspective of the key informants and FSR literature, are hypothesised on the left.

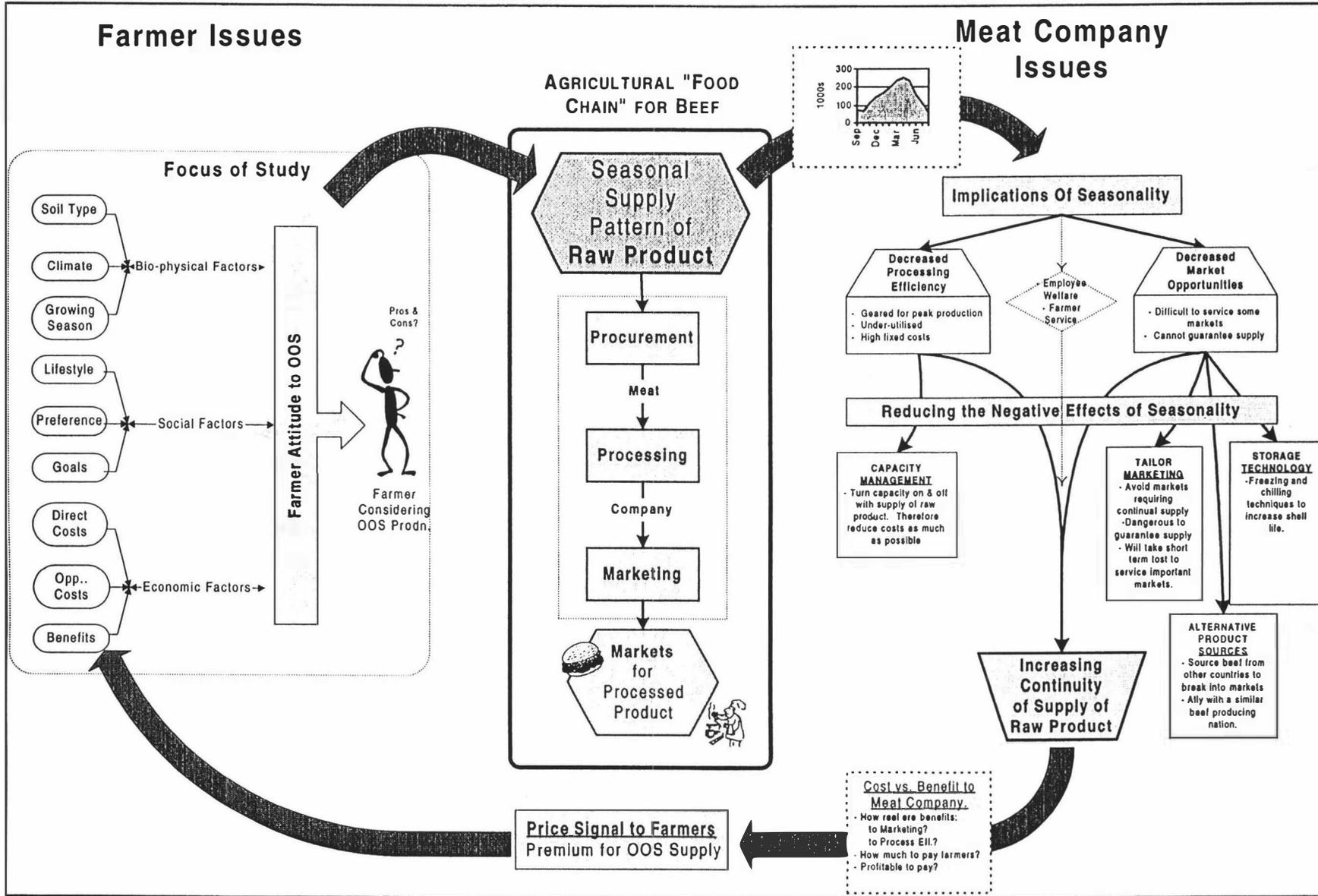


Figure 4-1: Seasonal beef supply issues - summary of key informant interview phase.

## 4.3.1 Issues Facing Meat Companies

### 4.3.1.1 Processing Efficiency

Processing efficiency was identified by all key informants as an area that is affected by seasonality in the industry. Sourcing and maintaining throughput was seen as vitally important to the efficiency and ultimately the profitability of meat companies. This is reflected in the comments from various meat company key informants:

*"We [the meat company] have a plant sitting here, therefore we're reliant on throughput to make money"*

*"It would be a huge advantage if we could utilise the factory 12 hours per day, 365 days per year"*

*"Processing is basically a numbers game.."*

*"...an empty hook on a chain equals lost revenue".*

Processing companies have capacity that is generally geared to periods of peak supply; thus, in periods of low supply, processing plants are under-utilised. There are large amounts of fixed (e.g. capital costs) and variable costs (e.g. labour costs) involved in a processing operation. Therefore, under-utilisation in the winter months makes it more difficult for costs to be covered and for the processing operation to remain profitable.

This situation is exacerbated when over-capacity exists in the industry as a whole. Meat companies compete to maintain adequate levels of throughput to remain profitable. This competition is reflected in the costs of procurement.

### 4.3.1.2 Marketing Opportunities

Beef markets are increasingly demanding even, year round supply of beef. "Uncertain and low supply over winter means it is more difficult [for meat companies] to service markets" (meat company key informant).

In particular, it is the markets requiring prime beef cuts in chilled form that are demanding a more uniform supply of product. These markets were generally identified as the higher paying markets, where product quality is important. While all markets demand 52 week a year supply, the frozen manufacturing beef market was considered to be less affected by seasonality because product can be stored for longer periods of time. The frozen manufacturing market was

generally regarded as commodity trading, with buyers mainly purchasing on the basis of price, while product quality and timing of supply are less important.

All the meat company informants indicated that they planned to increase the amount of product they were sending into the higher priced, chilled markets. These markets were seen as “big money makers”. At the same time, it was pointed out that New Zealand's beef industry would always be reliant on the manufacturing beef markets to some extent. This is understandable given that the majority of beef product exported from New Zealand is only suitable for manufacture, mechanical tenderisation or protracted cooking. For example, in 1994 approximately 18% of the total weight of beef (excluding veal) exported from New Zealand was cow, 34% was bull beef, and 27% was steer and heifer (New Zealand Meat Producers Board, 1995). Cow, and to a lesser extent bull beef carcasses yield only a small percentage of beef suitable for primal cuts. Only 15% of the boneless meat yield of a standard export steer carcass (35% of carcass value) is product which by ageing can assure quality to meet the standard of higher quality restaurant markets (Buxton, 1992).

While frozen manufacturing will remain an important export item in the long term, there was a general acceptance that the diversification of New Zealand's beef products and markets, particularly into chilled prime beef, will be important to the future success of the meat industry. It was pointed out by several key informants that the industry's reliance on a small number of commodity based markets could be dangerous. The 1995/96 downturn in beef returns to New Zealand producers, due to depressed product prices in the United States was used as an example of the disadvantages of such reliance.

Overall, it was considered that an opportunity exists for meat companies to increase the long term stability and sustainability of product prices by differentiating beef products and markets. The chilled prime beef market is seen as an important area for development, and since this market has a constant demand, the seasonal supply pattern of raw product to meat companies reduces their ability to develop this opportunity.

#### **4.3.1.3 Other Issues**

Year-round employment for processing plant and marketing staff is important in terms of their morale and security and ensures that reliable labour is available when needed. Seasonal employment is not appealing to many workers and this creates problems with staff satisfaction and retention.

Providing a year-round slaughter service to farmers was also a concern to some companies. Closure of a company's plant due to lack of livestock supply may result in farmers being unable to slaughter stock at a time that suits them. Providing a good service to farmers was seen as being important in the current highly competitive procurement environment.

#### **4.3.1.4 Reducing the Effects of Seasonality**

Meat companies have developed policies in response to the presence of seasonality within the industry, in order to minimise the adverse effects on their business. These policies are described below:

##### **Capacity Management**

By maintaining the flexibility to turn capacity off when livestock supply is low, companies can decrease the variable costs for that period. This was identified by meat company key informants as an important mechanism: "At the end of the day we are running a *capacity management* business"; "The secret of the business is to be able to put capacity on and take it off quickly". Processing companies have developed considerably over the last 20 years. Introduction of the chain system, increased mechanisation, and changes in employment and labour laws have contributed to the increased flexibility and a reduction in the proportion of fixed costs involved in running a processing plant. Thus, processors today are better equipped to manage capacity to fit the livestock supply pattern and therefore minimise the costs of seasonal supply.

##### **Tailoring Marketing**

Companies also tailor their marketing plans to ensure they can realistically service markets from a predicted supply of livestock. If a company cannot supply product when required, this can cause client dissatisfaction, and be detrimental to the company's supply reputation. The company may then lose its initiative and power within that market: "If you can't supply a market then its very hard to get back in".

For these reasons companies may deliberately avoid markets that require continual supply, for example, chilled prime beef markets in Asia, or choose to service markets that are prepared to source product elsewhere during low supply months. While companies admit that this is reducing their potential profit, they are not prepared to take on markets where they cannot guarantee the supply required. A company may instead "concentrate on one or two of the better paying, more stable markets and do a better job. We can supply these markets all year round,

but they will have to settle for less in our winter period. We supply enough to keep our foot in the door".

As part of their marketing strategy, meat companies may also provide product supply forecasts to their customers. This service enables their customers to plan their supply arrangements and organise alternative product sources at times of lower supply.

### **Storage Technologies**

Advancements in meat storage technology have increased the shelf-life of meat products and provided meat companies with more flexibility with respect to selling times. Frozen meat products can be stored for extended periods of time and, therefore, can increase a meat company's ability to supply during periods of low livestock supply. However, meat companies expressed concerns about holding frozen product to supply markets during the off-season. This involves increased storage costs and was generally regarded as risky in terms of price uncertainties, with companies preferring to sell product as soon as practicable after processing.

Frozen storage was commonly associated with commodity beef products, but it was in the markets demanding chilled beef cuts that key informants believed a continual supply of product would be important. Meat chilling storage technology allows a product shelf-life of approximately seven weeks. While this provides meat companies with increased opportunities for marketing their beef products, it is unlikely to enable significant advantages in the general supply pattern of beef that will allow them to target markets requiring product year round.

### **Alternative Product Sources**

On occasions some meat companies source similar product from alternative sources during periods when they are unable satisfy markets. This was seen as a method of addressing the effects of seasonality on marketing opportunities that may become increasingly important. A meat company could align itself with a foreign beef supplier that produces a similar type of product during New Zealand's winter period. The more continual supply pattern which would result from this alliance would enable access into the markets demanding year round product supply.

### **Obtaining More Continual Supply**

Enticing farmers to produce more beef cattle OOS is another method companies employ to reduce the effects of seasonality. Higher schedule prices are currently offered in the winter months, when stock supplies are low. Companies are then competing to maintain throughput, and prices to farmers increase. Companies also may pay higher prices for OOS cattle if they

are "hungry to develop a market or have a customer screaming for product". In some cases companies may even buy and sell livestock at a loss to ensure a market is supplied, but this is not sustainable.

Obtaining more OOS supply of beef from farmers was generally considered by key informants as being an important in order to realising a more uniform slaughter pattern. Encouraging the increased use of OOS beef cattle production systems by farmers was seen as being driven largely by higher prices offered by meat companies for cattle produced OOS relative to those produced in more traditional periods.

However, the feasibility of meat companies paying farmers more for OOS beef cattle appeared uncertain. One meat company key informant suggested that at present, the increased prices they would need to pay farmers to produce significant numbers during the winter would make it unprofitable to run the plant over that period. This raised doubts regarding the potential benefits to processing efficiency accruing from a more continual supply in relation to the costs of obtaining this supply. However, meat company key informants suggested that it is likely that there would be opportunities for companies to pay more for OOS beef cattle if the benefits of more continual product supply to markets are realised.

The method for paying farmers for cattle supplied OOS was seen as important by key informants. It was believed that farmer would require price assurances as part of the incentive for producing cattle OOS, as meat companies would require supply assurances. The use of contracts with farmers was seen as a likely procurement method for OOS cattle. In general, key informants believed that there have been problems with farmer acceptance of, and compliance with contracts. They believed that a relationship of mutual trust and respect would have to be rebuilt between meat companies and farmers in order for these problems to be addressed.

### **4.3.2 On-farm Issues**

Key informants also commented on the issues and constraints related to the use of OOS beef cattle production systems on farms.

#### **4.3.2.1 Bio-physical Issues**

Environmental factors such as climate, pasture production, and soil type limit the profitability of OOS production systems. Key informants believed that some regions, areas within regions and individual farms would have a greater potential to implement OOS production systems than

others. For example, a farm with poorly drained soils and high winter rainfall will be subject to the risk of pasture pugging and will therefore be able to carry limited numbers of cattle to heavy weights during the winter. It was suggested that the majority of the environmental factors that may limit OOS production could be overcome at a cost. These costs of producing beef cattle OOS would vary according to the presence and nature of the environment factors.

It was considered that differences in regional and farm environments could be exploited to reduce the seasonal supply of livestock to individual companies and the industry as a whole. By taking advantage of the strengths of regions for OOS beef finishing and the differing supply patterns, companies who could source livestock from a wide range of environments could flatten their supply curve and reduce their vulnerability to regional effects (e.g. drought, flooding).

#### **4.3.2.2 Price**

The price farmers receive was seen as the major constraint to OOS beef cattle production. In general, the price offered currently does not fairly reflect the cost of production, and until it does, it will not be profitable for the majority of farmers to produce more cattle OOS. Key informants were confident that farmers would respond if the price was right.

It was also suggested that some farmers may be making the decision to produce OOS beef on price alone, without taking the costs of production fully into account. The opportunity cost of feed, or the value of that feed at different times of the year is difficult for farmers to objectively measure. A producer that is aware of his/her costs of production at different times of the year maybe in a better position to make this decision. Profit, not schedule price, should be a criterion for the decision to produce OOS.

#### **4.3.2.3 Payment Structure**

The payment structure, and price certainty in particular, is also important for farmers considering implementing OOS production systems. Farmers "need to see what the margin is for stock produced OOS compared to in-season" in order to make a correct decision. At present this is difficult as a farmer is unable to tell how much of the schedule price is made up of procurement factors or market factors. It was suggested that a "more transparent" pricing structure would send clearer signals to farmers allowing them to make more informed decisions.

Contracts, as discussed above, appear to be an option to ensure that farmers have security of price. This would allow farmers to plan ahead with the knowledge that they are guaranteed a product price. However, depending on the contract specifications, it may also reduce the farmer's flexibility. Some farmers prefer to have the ability to "shop around" to ensure they get the best price on the day.

## 4.4 SUMMARY

Seasonality of beef supply is a problem that has major implications for meat companies. A more continual supply of beef has the potential to increase processing efficiency and marketing opportunities. These advantages could result in higher and less volatile prices for New Zealand beef products, which could benefit both meat companies and farmers through increased returns.

From the perspectives of industry key informants, OOS beef production on farms was seen as an important option to increase the continuity of beef supply, and thus reduce the effects of seasonality on processing efficiency and marketing opportunities. Without exception, all key informants expressed the view that more uniform supply of beef cattle would become increasingly important to the meat industry as it focuses more on servicing higher value markets for chilled beef. The key informant interviews and review of literature also identified the need to investigate other options for addressing the problem of seasonality in the meat industry. However, increasing the use of OOS beef production systems on farm will reduce the industry effects of seasonality by addressing the problem at its source.

It was agreed by key informants that the increased use of OOS will depend largely on the price signal sent to farmers. In general, OOS production systems are less suited to, and more demanding on pastoral farms (Hawkins et al., 1989). The need to modify stock and pasture management and the associated costs impact on the profitability of OOS systems. Thus, the premium paid for OOS beef cattle by meat companies must fully reflect the higher production costs to farmers.

Key informants generally agreed that schedule premiums for cattle produced OOS relative to traditional times would need to be increased in order to encourage a significant increase in OOS beef cattle production. However, the ability of meat companies to pay more for OOS beef was less clear, since it was suggested that it may not be profitable for meat companies to offer more for stock at that time in order to maintain throughput. This highlights the need for research to clarify and quantify the long and short term benefits of a more continual supply of beef in

regard to processing efficiency and marketing opportunities for meat companies and the industry as a whole.

It is likely that the price required by a farmer to implement an OOS production policy is affected by the bio-physical characteristics of the farm, as well as, the individual management preferences and goals of the farmers. The issues and implications relating to the use of OOS beef production systems at the farm and farmer level discussed in this Chapter were the perspectives of the non-farmer key informant and were referred to in the wider context of the beef industry. Chapters Five and Six describe the research phases which focused more directly on the on-farm issues of OOS beef supply.

# Chapter Five: Farmer Interviews

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## 5.1 INTRODUCTION

The ‘farmer interview’ stage of the project focused on the farmer’s perspective of OOS beef production. The key informant interviews (Chapter 4) confirmed the need for more in-depth research at all levels through the “beef chain”. In particular, there was a need to understand the implications of reducing the seasonality of beef supply from the perspective of farmers. This information was obtained from a sample of 14 farmers using a semi-structure interview technique.

The main aim of the farmer interviews was to define and investigate the factors and circumstances that farmers would consider and evaluate when deciding to implement an OOS beef production system on their farms. This required the identification of the constraints, costs, opportunities and benefits associated with OOS systems relative to current farming practice.

The methods used in conducting the farmer interviews, including a description of the study region and farmers, and the structure of the farmer interviews are discussed in this chapter. The first section presents a descriptive summary of the issues raised by farmers in relation to OOS production. These issues are then analysed and compared with the relevant literature to provide a full description of the on-farm implications of OOS production systems. Later in the chapter, the relationship between the circumstances of farmers and the compatibility of OOS production to their farming system is discussed.

## 5.2 METHOD

Fourteen farmers were identified and individually interviewed in order to identify the important factors they associated with OOS production systems. A semi-structured interview procedure, as described in Sections 3.4.1 and 4.2.2, was used.

## **5.2.1 Study Region**

The study area is shown in Map 5-1. The area was divided into three zones (Maps 5-2 and 5-3) based on physical criteria, and five farms were selected from each zone. This ensured that a range of farms with differing physical circumstances were represented by the interviews. The size of the study area, its proximity to Palmerston North, and the number of farmers interviewed, were considered sufficient to provide a good coverage of the circumstances of farmers in the region. The zones were based on known information about the farm types and systems and the physical environment as described in the following Sections:

### **5.2.1.1 Climate**

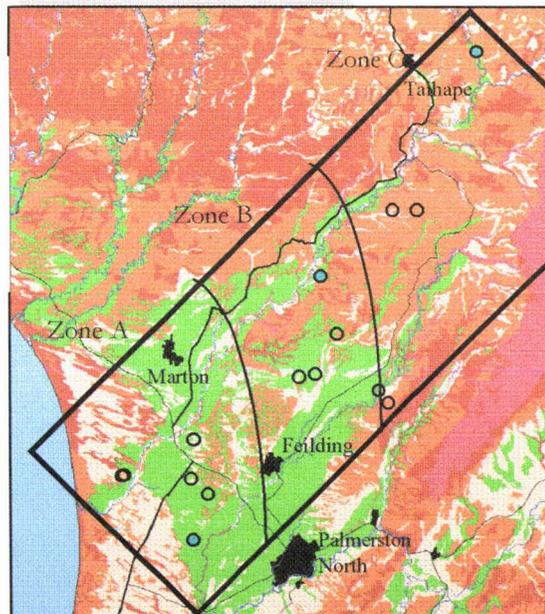
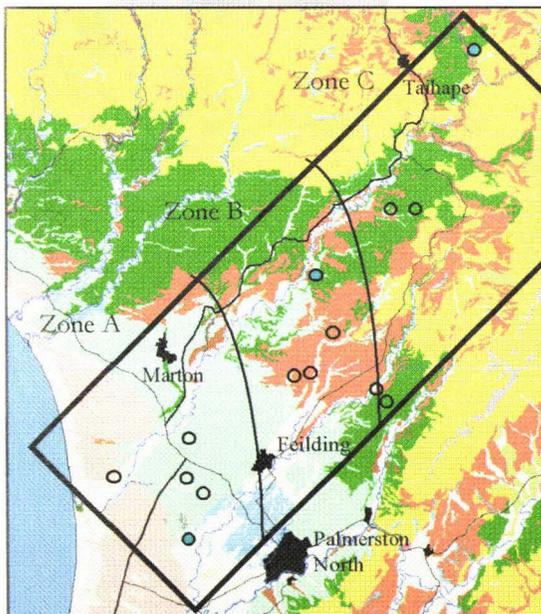
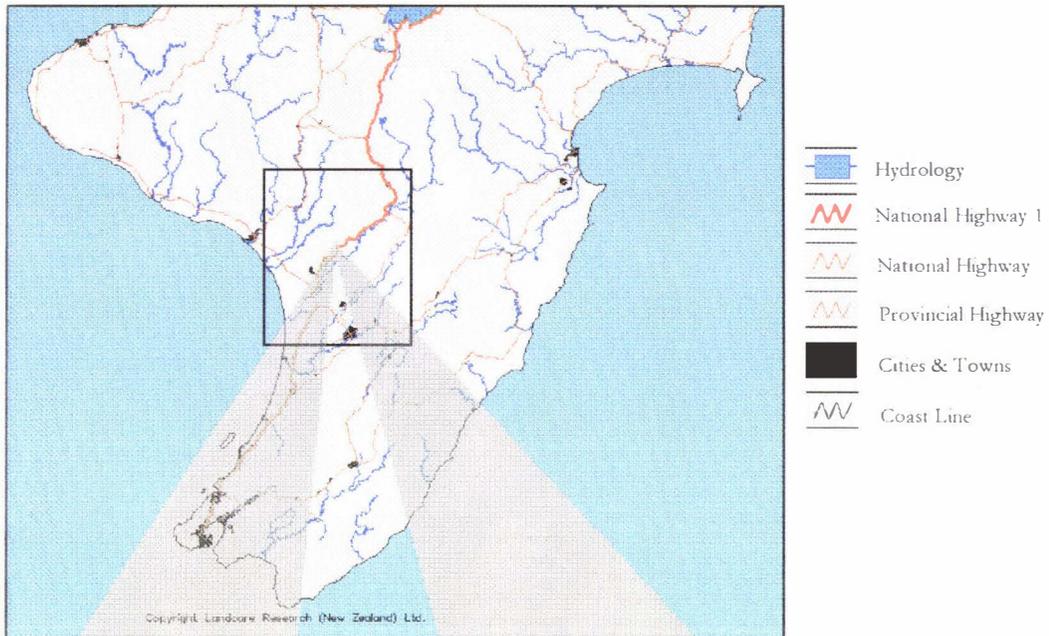
In general the degree of summer moistness and the length and severity of winter increases with altitude and distance from the coast (MAF Policy, 1996). A farm in zone A typically experiences a relatively mild and short winter, as well as a dry period in late summer. In contrast, a typical farm in zone C has a colder and longer winter and a more mild summer than properties in Zone A. Farms located in Zone B are intermediate between these extremes.

### **5.2.1.2 Soils**

The soil sub-groups present in the study area are shown in Map 5-2. The predominant soil types in Zone A are central yellow-brown sands and central yellow-grey earths sub-groups of soils. In general, yellow-brown sands soils are very free draining (less likely pug under wet conditions); of low fertility, because the sandy nature of these soils make them susceptible to leaching and loss of nutrient inputs; and dry in summer because of their good drainage properties (During, 1984).

In general, yellow-grey earth soils have poor drainage due to their high clay content and the presence of a fragipan. They are also more fertile, requiring less nutrient inputs than the yellow-brown sands due to less leaching (During, 1984). The drainage problems mean these soils are typically very wet in winter and are susceptible to pugging. Mole and tile drains are often used to improve drainage.

**Map 5-1: Map of Lower North Island of New Zealand showing location of study region.**



- Yellow-brown earth
- Composite yellow-brown loam on yellow-brown earth
- Intergrade of yellow-grey and yellow-brown earth
- Yellow-grey earth
- Yellow-brown sands
- Gley soils
- Recent soils
- Survey Farm
- Case Farms (refer Chapter 6)

- LUC Class I and II
- LUC Class III and IV
- LUC Class V
- LUC Class VI
- LUC Class VII
- LUC Class VIII

**Map 5-2: Study region showing soil types and location of study zones and survey farms.**

**Map 5-3: Study region showing land use capability and location of study zones and survey farms.**

Soils in Zone C consist predominantly of yellow-brown earths and intergrades of yellow-grey earths and yellow-brown earths. In contrast to the yellow-grey earths, yellow-brown earths are more freely draining and friable, and less fertile (During, 1984). The intergrade soils have medium drainage and fertility properties. Both of these soil groups are usually associated with steep or hilly land and are susceptible to erosion.

Yellow-grey earths (see above) and composite yellow-brown loams on yellow-brown earths are the predominant soils in Zone B. The composite soils are generally less easily pugged (more freely draining), and more friable and fertile than the yellow-brown earths common in Zone C.

### 5.2.1.3 Topography

The general topography of the three zones also varied. The predominant slope classes in each zone are:

- Zone A - Flat to rolling
- Zone B - Rolling to moderately steep
- Zone C - moderately steep to steep

Map 5-3 shows the study area in relation to Land Use Capability (LUC) classification used in the New Zealand Land Resource Inventory maps. The LUC classification assesses the land in terms of its “capacity for sustained productive use” taking into account physical limitations, management requirements and soil conservation needs (Soil Conservation and Rivers Control Council, 1971; Table 5-1). The LUC ‘Class’ category is the broadest grouping of the LUC classification. It provides a broad assessment of how versatile the land is, and gives an indication of its limitations.

**Table 5-1: General interpretation of Land Use Capability Class.**

LUC Class	Cropping Suitability	General Pastoral & Production Forestry Suitability	General Suitability
I	High	High	Multiple Use Land
II			
III	Medium		
IV	Low		
V	Unsuitable	Medium	Pastoral or Forestry Land
VI		Low	
VII		Unsuitable	Catchment Protection Land
VIII	Unsuitable		

Source: (Soil Conservation and Rivers Control Council, 1971)

Map 5-3 indicates that Zone A has the greatest proportion of LUC Classes I-IV land. There is a greater proportion of LUC Classes VI-VIII in Zone C, than Zones B and A, respectively. Land in these classes is generally less suited to cropping and pastoral production, and has more limitations for farming due to erosion, wetness, climate and soils than land with a lower LUC classification.

## 5.2.2 Identification of Farmers

Potential interview farmers were identified during the key informant interviews (see Chapter 4), and through other industry contacts, including livestock buyers and agricultural consultants who had a good knowledge of the study area and the farmers. Farmer participants were also identified by networking with other farmers once the interviews commenced. As much as possible, farms were selected to represent the variation in enterprise type and size within the study region. Selected farmers were contacted by telephone, briefly introduced to the project and invited to participate in an interview. In all cases an affirmative response was obtained and a suitable interview time was established. A general description of each farm is shown in Table 5-2.

## 5.2.3 Interviews

Each semi-structured interview lasted 1½-2 hours. As stated earlier, the primary aim of the interview was to understand the implications and constraints that farmers considered important in relation to the use of OOS production system, given their individual circumstances.

The interview began with the researcher introducing himself, the purpose of the research and the aims of the interview. At this time consent was obtained from the farmer to record the interview on audio tape. Their approval allowed the interviewer more time to listen and evaluate responses, and to pursue in-depth probing of the issues raised. The confidentiality of the interview data was made explicit to the farmer.

**Table 5-2: Summary description of farms involved in interview stage.**

Zone	Area (ha)	Topography	Type
A	160	Flat - Rolling	<ul style="list-style-type: none"> <li>• Cropping</li> <li>• Beef Finishing</li> </ul>
A	1500	Flat	<ul style="list-style-type: none"> <li>• Beef &amp; sheep breeding and finishing</li> <li>• Forestry</li> <li>• Cropping</li> </ul>
A	110	Flat	<ul style="list-style-type: none"> <li>• Cropping</li> <li>• Beef Finishing</li> <li>• Lamb Finishing</li> </ul>
A	180	Flat - Rolling	<ul style="list-style-type: none"> <li>• Sheep &amp; beef breeding and finishing</li> </ul>
A	155	Flat	<ul style="list-style-type: none"> <li>• Sheep breeding and finishing</li> <li>• Beef finishing</li> <li>• Cropping</li> </ul>
B	530	Rolling - Easy Hill	<ul style="list-style-type: none"> <li>• Beef finishing</li> <li>• Sheep breeding and finishing</li> </ul>
B	950	Easy Hill	<ul style="list-style-type: none"> <li>• Sheep breeding and finishing</li> <li>• Beef breeding</li> </ul>
B	480	Easy Hill - Hill	<ul style="list-style-type: none"> <li>• Sheep breeding and finishing</li> <li>• Beef finishing</li> </ul>
B	600	Hill	<ul style="list-style-type: none"> <li>• Sheep &amp; beef breeding and finishing</li> </ul>
B-C	530	Hill-Hard - Hill	<ul style="list-style-type: none"> <li>• Sheep &amp; beef breeding and finishing</li> </ul>
C	450	Hill- Hard - Hill	<ul style="list-style-type: none"> <li>• Sheep breeding and finishing</li> <li>• Beef finishing</li> </ul>
C	810	Easy Hill - Hill	<ul style="list-style-type: none"> <li>• Sheep &amp; beef breeding and finishing</li> </ul>
C		Hill	<ul style="list-style-type: none"> <li>• Sheep &amp; beef breeding and finishing</li> </ul>
C		Hill	<ul style="list-style-type: none"> <li>• Sheep &amp; beef breeding, finishing and stud</li> </ul>

The direction of each interview was dependant on the experiences and perspectives of the farmer. While there was no pre-defined list of questions, topic areas and relevant issues had been developed by the researcher before the interviews. The following list of topics was loosely followed during each interview.

1. Physical farm data

(Information was collected on the farm size, topography, soil type, climate, livestock numbers, breeds, policies and production levels.)

2. Farm family's background, experience and goals
3. Development of current stock polices and management
4. Potential of OOS production on farm
5. Implications, constraints and issues of OOS production
6. Required changes to implement OOS policies

The interviews yielded qualitative data in the form of the taped interviews and written notes. As soon as possible after the interview, summary notes were made from the interview tapes while the issues raised, and their context within the interview were still fresh in the researcher's

mind. The summary notes detailed the issues raised and views of the farmer, as well as supporting dialogue from the interview.

### 5.2.3.1 Rich Pictures

A 'rich picture' (Section 3.4.3.1) was developed for each farm and farmer from the interview summary notes (see examples in Appendix 1). This process highlighted the major activities, issues and people involved. The picture summarised the farm, the farm family, the management policies, and issues related to OOS beef production. During this stage, categorisation and grouping of the implications and constraints of OOS production commenced.

## 5.3 RESULTS/FINDINGS

The farmers' views and opinions on OOS production and its potential application on their properties are summarised in Table 5-3. Each of the issues is described in the following sections.

**Table 5-3: Summary of issues identified by farmers with respect to OOS beef production and examples of comments associated with each issue.**

Issues	Farmer Comments
<b>Feed Management</b> Winter Feed Availability	<ul style="list-style-type: none"> <li>• It's difficult to have enough feed in winter to finish cattle</li> <li>• The cost of feeding the animal at that time of year (OOS) is the major constraint.</li> <li>• It really comes down to the feed issue.</li> </ul>
Feeding Priority	<ul style="list-style-type: none"> <li>• You can't do everything well at that time of the year. Some stock will suffer at their (OOS cattle) expense.</li> <li>• I've got other stock on the property that require feeding at that time. If I don't feed my breeding stock well enough, that can have long term effects.</li> <li>• It just ends up being a 'rob Peter to pay Paul' situation.</li> </ul>
Spring Pasture Control	<ul style="list-style-type: none"> <li>• You'd have to really work to get through the winter, and then get rid of them just as the feed takes off.</li> <li>• It's not making use of the good growth periods</li> <li>• Would definitely lose some summer pasture management which is important for quality pasture, especially on the hills.</li> </ul>
Required Changes	<ul style="list-style-type: none"> <li>• Would have to look at wintering cattle on silage and winter crops, and that starts getting very expensive.</li> <li>• I would have to reduce the number of stock wintered to finish OOS.</li> </ul>
<b>Ground Damage</b>	<ul style="list-style-type: none"> <li>• Cattle, especially heavy cattle, can make a huge mess of paddocks during the winter.</li> <li>• The pasture and soil damage caused by carry more cattle in the winter would be a major constraint on this property.</li> </ul>

<b>Issues</b>	<b>Farmer Comments</b>
<b>Achieving Winter LWGs</b>	<ul style="list-style-type: none"> <li>• It's hard enough to have the feed to hold cattle over the winter, let alone put any weight on them.</li> <li>• I'm not convinced that I could achieve adequate liveweight gains using silage to pay for producing it.</li> <li>• Farmers that appear to be doing the best are the ones who are achieving maximum liveweight gains. That's easier to do in times of the year that allow it.</li> </ul>
<b>Replacements</b>	<ul style="list-style-type: none"> <li>• The conservative approach is to buy and sell stock on the same market so you always get a margin. With an OOS system, you'd be getting a premium for the cattle you sold, but you'd also be paying a premium for replacements on the grass market.</li> </ul>
<b>Management Ease/Workload</b>	<ul style="list-style-type: none"> <li>• That's a busy time of year with lambing and calving. I'm trying to reduce my workload not increase it.</li> </ul>
<b>Risk</b>	
Price Risk & Contracts	<ul style="list-style-type: none"> <li>• Price certainty would be paramount for OOS production. Price is a big risk factor.</li> <li>• You're really guaranteed a premium at that time of the year. It's riskier to sell in the traditional market when everyone is selling stock and killing space is at a premium.</li> </ul>
Production Risk	<ul style="list-style-type: none"> <li>• You're definitely sailing a bit closer to the wind with OOS production. It's hard when you're fighting against the elements all the time.</li> <li>• You would be more vulnerable to a bad winter, like this one.</li> <li>• I think that there's less margin for error.</li> </ul>
<b>Suitability to Property</b>	<ul style="list-style-type: none"> <li>• It would be better suited to areas that are good for finishing cattle, with free draining soils and a longer growing season.</li> <li>• Could easily produce more cattle OOS. I've got good soils for wintering and a good winter growth. But I think it's making more work for little or no gain...its just not worth it.</li> <li>• I really haven't got the scope to do it here.</li> </ul>
<b>Profitability</b>	<ul style="list-style-type: none"> <li>• "I would not hesitate if the premium offered made it economically viable".</li> <li>• "The extra premium is worth the extra work and cost of finishing them OOS. But it depends on the price and feed situation at the time".</li> <li>• "My land and system are set up to handle OOS production right now, but at the current premium its just not worth it".</li> </ul>
<b>Preferences</b>	<ul style="list-style-type: none"> <li>• I'm reluctant to change a system that is working well.</li> <li>• I'm happy with what I'm doing now, so I haven't really thought about it.</li> <li>• With beef prices the way they are, I might be giving the sheep side of things more priority.</li> </ul>

### 5.3.1 Feed Management

The effect of OOS production systems on feed management was considered to be the major constraint to their on-farm implementation. Farmers generally believed that the lower availability of feed during the winter months, caused by the natural pattern of climatic conditions, would make it more difficult to finish cattle OOS. Wintering and growing cattle through the winter would increase feed demands at a time of the year when the supply of pasture is generally low. This would negatively impact on the ability to feed other classes of stock on the property over the winter and early spring.

Winter feed shortages were a commonly raised concern on breeding farms where farmers were rationing pasture to insure adequate feed for breeding ewes and cows approaching lambing/calving. Therefore, increasing feed demand by finishing cattle OOS at this time of the year could jeopardise spring pasture cover targets and the performance of other priority livestock.

As a consequence, many farmers also commented that because the OOS system would require de-stocking in the early spring, their ability to utilise and control the quality of the increased spring pasture growth would be reduced. This lack of control would impact through reduced pasture quality and thus lower subsequent animal performance. In general, farmers held the view that by selling OOS they would be under-utilising the easiest time of the year to grow and finish cattle. They were also concerned about the opportunity cost associated with farming fewer cattle or alternative stock classes.

Farmers identified several management changes that they could implement to reduce the problems associated with feed management and OOS finishing. Increased use of pasture conservation, feed supplements, winter forage crops and autumn saved pasture were all identified as methods of diverting more feed into the winter and early spring periods to facilitate OOS finishing. By conserving spring and summer pasture, or using winter forage crops sown in the spring/summer, farmers pointed out that they would also be able to increase their control of pasture quality. Grazing stock off-farm during the winter, or leasing suitable wintering country were also identified as possible management and policy changes. Farmers were quick to point out the extra costs associated with pasture conservation, purchase of supplements, cropping expenses and off-farm grazing. Some farmers doubted that lower quality feeds such as hay and silage, and autumn saved pasture would enable beef cattle to be successfully finished during the winter-early spring period.

### **5.3.2 Ground Damage**

The soil and pasture damage associated with pugging caused by cattle in the winter months was identified by many farmers as an important constraint to OOS beef finishing. However, farmers acknowledged that there are ways to reduce negative effects of pugging on soil structure and subsequent pasture growth. For example, wintering cattle on drier and better drained areas of the farm such as riverbeds and drier hill slopes, where possible, involved little monetary cost but reduced rather than eliminated ground damage. The use of sacrifice paddocks to localise

ground damage was another alternative. Using paddocks for this purpose that were to be cropped in the spring meant soil structure damage could be restored through cultivation. However, farmers noted that the compaction and soil structure damage caused by pugging could both increase cultivation costs and reduce crop yield. The use of feedpads and the leasing of appropriate wintering land were other options to minimise the effects of ground damage associated with OOS finishing, but both these involve high capital costs.

### **5.3.3 Achieving Winter Liveweight Gains**

Achieving adequate liveweight gains (LWGs) during the winter to finish cattle OOS was widely perceived as a limitation to OOS finishing. Having enough feed in this period to achieve target LWGs was the major concern. Even if adequate feed was available through the tactics identified in Section 5.3.1, for example pasture conservation, some farmers expressed the view that the low winter air temperature also limited the growth of cattle.

### **5.3.4 Buying Cattle Replacements**

The timing of the purchase of replacement cattle for OOS systems where replacements are not bred, was a source of conflict for some farmers. It was considered less risky to buy and sell stock 'on the same market' as this ensures a profit margin. Farmers pointed out that to buy and sell on the same market in an OOS system would mean buying replacements in the early spring. This was considered by most to be the most expensive time of the year, since demand for stock is traditionally strong when spring pasture production is increasing. So, while there would be a premium for selling cattle at that time, there would also be a premium for buying, which some farmers believed would reduce or nullify the advantage of OOS finishing.

At the same time some farmers considered it necessary to purchase replacement cattle in the spring in order to utilise their spring growth and maintain pasture quality. Buying earlier in the late autumn or winter would result in carrying extra stock into the winter-early spring feed 'pinch' period. Buying replacements in late spring or early summer would require other management adjustments, such as increased pasture conservation, to utilise spring growth and maintain pasture quality.

### **5.3.5 Risk**

Farmers generally considered that the risks involved in producing OOS beef were greater than producing beef at traditional times. The higher risk was associated with the view that OOS

cattle finishing was less suited to the natural pasture growing season and climate (i.e. production risk). Cold, wet conditions in winter increase the risk of not achieving cattle finishing liveweights, and the incidence of ground damage relative to other times of the year.

Some farmers believed that the price risk was higher for OOS finishing and this was a major constraint to their adoption of OOS policies. Other farmers, however, believed that a price premium was virtually guaranteed when selling stock OOS.

The use of contracts for OOS supply was also discussed as a way of mitigating price risk. Some stated they would not enter a supply contract for OOS finishing because the contract price would be lower than that of the spot market. This was considered to especially apply in the winter when excess killing space was usually available. Thus contracts were perceived as restricting the flexibility of stock sales, which many believed was an important factor for OOS finishing. Other farmers, however, would require a guaranteed price for OOS cattle before they would consider finishing cattle under this production system, to compensate for the greater production risk.

### **5.3.6 Suitability to Property**

The pasture growing season, soil type and climate experienced on the farm were all considered by farmers to be important factors for OOS cattle finishing policies. The relative importance of these factors varied with the characteristics of individual farms. For example, on a property with good drainage, winter rainfall was seen as a less important constraint than on a farm with poor natural soil drainage.

As could be expected, it was generally considered that farms with free draining soils, good winter pasture growth, and mild winter climates would be the most suited to OOS production. These farms would be able to minimise the costs associated with ground damage and transferring pasture into the winter period.

### **5.3.7 Workload and Management Ease**

Some farmers believed that finishing cattle OOS would involve a higher labour input (e.g. feeding supplements, break feeding) which would limit their ability to implement such a system. This was particularly the case on breeding farms, where OOS finishing would coincide with lambing/calving, when the workload on the farm is traditionally high. Also, OOS systems

involving increased conservation and more cropping were associated with higher labour requirements during the spring-summer period.

Overall, it was generally considered more difficult to produce cattle OOS and more demanding on management. The 'conventional' system of purchasing stock in the spring and selling in the autumn, to de-stock before winter, was viewed as optimal in relation to the natural growing season and climatic conditions, and therefore, the least demanding in terms of workload and management.

### **5.3.8 Profitability**

The likely profitability of OOS production systems versus that of the current system was very important to the farmers. While farmers accepted that premiums offered for cattle finished OOS presented an opportunity for increased income, they also believed that the management problems and changes described above would increase costs. Most farmers believed that the costs and disadvantages of OOS production were not compensated sufficiently by current premiums to warrant a change in management. Only one farmer, who was finishing a proportion of beef cattle OOS, believed that the premiums received exceeded the extra costs involved. Thus, a farmer's perception and calculations of costs versus benefits are major factors affecting his or her decision to adopt, or not adopt, OOS systems.

### **5.3.9 Preferences**

Farmers' preferences were important in their consideration of OOS beef production. Several farmers suggested that even if OOS beef production was shown to be more profitable than their current system, they would be unlikely to change their present management system. These farmers were happy with their current systems and not eager to change from a system that was producing well, and that they had knowledge and experience with, to one which they believed was less suited to their farming environment. One farmer suggested that 'tradition' and 'conservatism' could be factors involved in this decision. Another farmer accepted that he was reluctant to implement OOS production systems because he had no experience in their management and therefore lacked the confidence to make major alterations to his present system.

## 5.4 ANALYSIS AND DISCUSSION

### 5.4.1 On-farm Implications of OOS Production

The perspectives and issues raised by farmers in the interviews were analysed and compared with relevant literature to develop a general summary of the on-farm implications of OOS beef finishing. Figure 5-1 summarises these implications into three major categories: management factors, risk factors and financial factors. These categories are not mutually exclusive because some issues overlap category boundaries.

#### 5.4.1.1 Management Factors

##### Feed Management

A major concern raised by farmers regarding OOS finishing systems was feed management issues. In temperate environments like New Zealand, pasture grazed *in situ* is usually the cheapest and most available source of livestock feed. Therefore, the management of this resource and its allocation to livestock is a fundamental component of farm efficiency and profitability (Gray et al., 1989). In general, efficient low cost grazing systems seek to manage pasture supply and feed demand to avoid feed surpluses/shortages which may be costly in terms of subsequent pasture growth and animal production, pasture quality and the extra expense of feed conservation, and/or supplementation. Stock policy decisions such as buying/selling dates, stocking rate, and calving/lambing dates determine the match between seasonal feed supply and demand. Farmers have attempted to adopt livestock systems that match animal requirements with the local seasonal pattern of pasture growth to minimise these costs. Out-of-season production systems contravene these pasture management principles.

##### Vintering Difficulties

###### *a) Soil/Pasture Damage*

Out-of-season beef production systems may increase soil pugging. This can decrease farm productivity by affecting plant growth, soil properties, feed utilisation, and animal health (Climo et al., 1984). Research in the Manawatu indicates that the short-term losses in pasture production due to pugging range from 7 to 45% of the undamaged sward (Haynes, 1995). Reductions in herbage yields by direct hoof impact are the result of leaf crushing and bruising, plant displacement and burial, and root damage (Edmond, 1963). Pugging increases soil compaction and decreases soil macroporosity, and thereby restricts plant growth and decreases subsurface and surface drainage. The utilisation of available feed can also be seriously

diminished by treading activity that buries and soils pasture (Kellet, 1978). Animal fertility may be affected (McQueen, 1970) and animal health problems are amplified when soils are wet and pugged (Bowler, 1980).

Farmers' concerns about soil damage and associated negative impacts on productivity, therefore, are well founded. Any strategy to increase OOS beef production would have to provide ways for farmers to address this concern. For example, systems finishing smaller numbers of younger stock (e.g. as two versus three year olds) at lower liveweights would help minimise the effects of pugging. Farmers identified several other management options available to them in Section 5.3.2.

*b) Achieving Winter Liveweight Gains (LWGs)*

Several factors make it more difficult to achieve high liveweight gains during winter compared to spring or summer. First, less feed is usually available during the winter. Decreased pasture covers restrict animal intake (Poppi et al., 1987). Second, climatic conditions and low liveweight gains increase the proportion of feed required for maintenance, which lowers the efficiency of animal growth from pasture (Geenty et al., 1987).

In order to achieve target LWGs farmers would need to carefully manage the late autumn and winter feed supply. More conserved pasture or other feed supplements could be used to increase feed supply, but these generally have a lower nutritive value than good quality pasture and, thus, result in lower liveweight gains (Ulyatt et al., 1980; Butler-Hogg et al., 1989). The purchase of high quality supplements and pasture conservation both have associated costs which will reduce the profitability of OOS production. Reducing livestock numbers would also increase feed supply relative to demand. This would reduce the need to purchase feed supplements or conserve pasture and would also help minimise soil treading damage. However, the fewer cattle numbers available for sale will reduce the profitability of the OOS system. The effect of these management options on the profitability of finishing systems is investigated using a modelling analysis in Chapter Six.

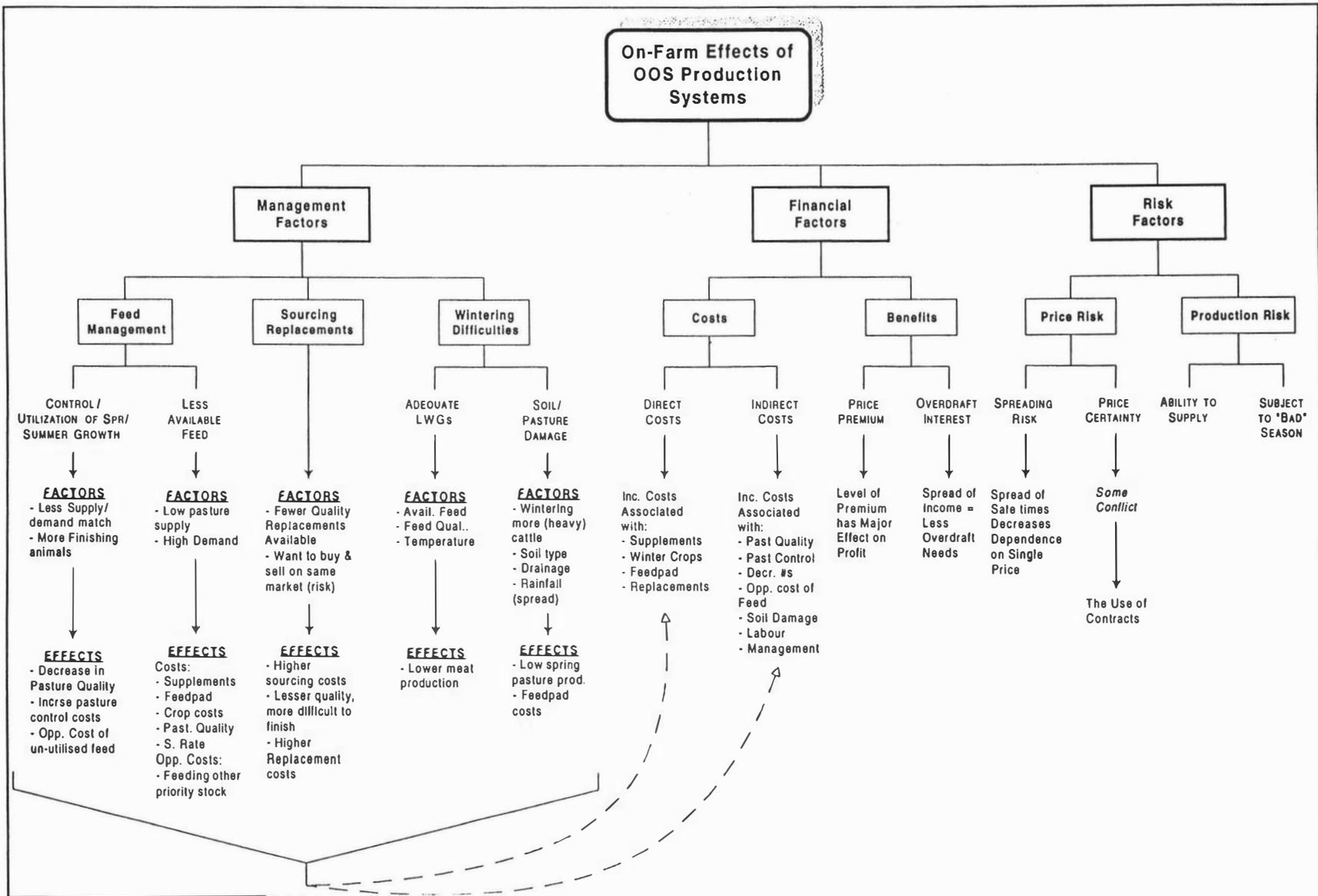


Figure 5-1: On-farm implications of OOS beef production systems.

#### **5.4.1.2 Risk Factors**

When discussing the risk issues related to OOS production systems, farmers appeared to be most concerned with the risk of achieving either lower production or profits compared to their current systems. McCall et al. (1992) explained that OOS systems would be 'riskier' due to the higher levels of feed demand through autumn and early winter when pasture growth rates are most variable.

Appropriate strategies to manage production and price risk are required for OOS production to be more acceptable to farmers. The management options described above (Section 5.3.3), which farmers believed would be required to implement OOS production, address production risk to some extent. For example, decreasing livestock numbers reduces demand for pasture during the autumn and winter, and also lowers the incidence of soil pugging. Both of these issues contributed to perceived risk of OOS systems. Contract agreements that provide some flexibility in LWG targets and/or selling dates, and which guarantee a minimum price would be an acceptable option to some farms concerned about price risk.

#### **5.4.1.3 Financial Factors**

The most important potential benefit to farmers of OOS cattle production is the price premium that would be received for cattle at that time. However, other possible benefits were identified. Some farmers believed that selling a proportion of their stock OOS would spread risk by reducing their dependence on the prices at traditional selling times. A more even cashflow would result from this selling pattern and this was also seen as a benefit of OOS finishing by some farmers.

The above benefits were balanced against the farmers' perceptions of the costs and disadvantages of OOS production. The disadvantages are associated with extra direct and indirect costs. The direct monetary costs associated with the implementation of OOS production systems include those related to: increased pasture conservation and/or supplementation; increased use of winter forage crops; feedpad installation and maintenance; and higher replacement costs if cattle need to be purchased during the early spring.

Farmers also identified non-monetary costs associated with the implementation of OOS production systems. For example, higher winter feed demands related to OOS systems would place pressure on pasture cover levels and the performance of other stock classes on the farm. Thus, OOS systems are likely to involve opportunity costs of reducing of livestock numbers

/or their performance. If increased pugging occurred costs in terms of decreased pasture production and animal performance would also be incurred.

Market factors will affect the premiums received for cattle finished OOS, as well as prices paid for inputs such as cattle replacements and feed costs. These factors will affect the profitability of OOS production systems, and also the farmer's decision to change his or her current management system. To increase the adoption of OOS beef production, most farmers would need to be convinced that the 'natural' disadvantages and costs were more than compensated by better returns. Premiums set by meat companies for OOS beef cattle will need to incorporate a knowledge of these costs and disadvantages if they are to be successful in increasing the proportion of beef produced OOS.

## **5.4.2 Circumstances of Farm Systems in Relation to OOS Beef Production**

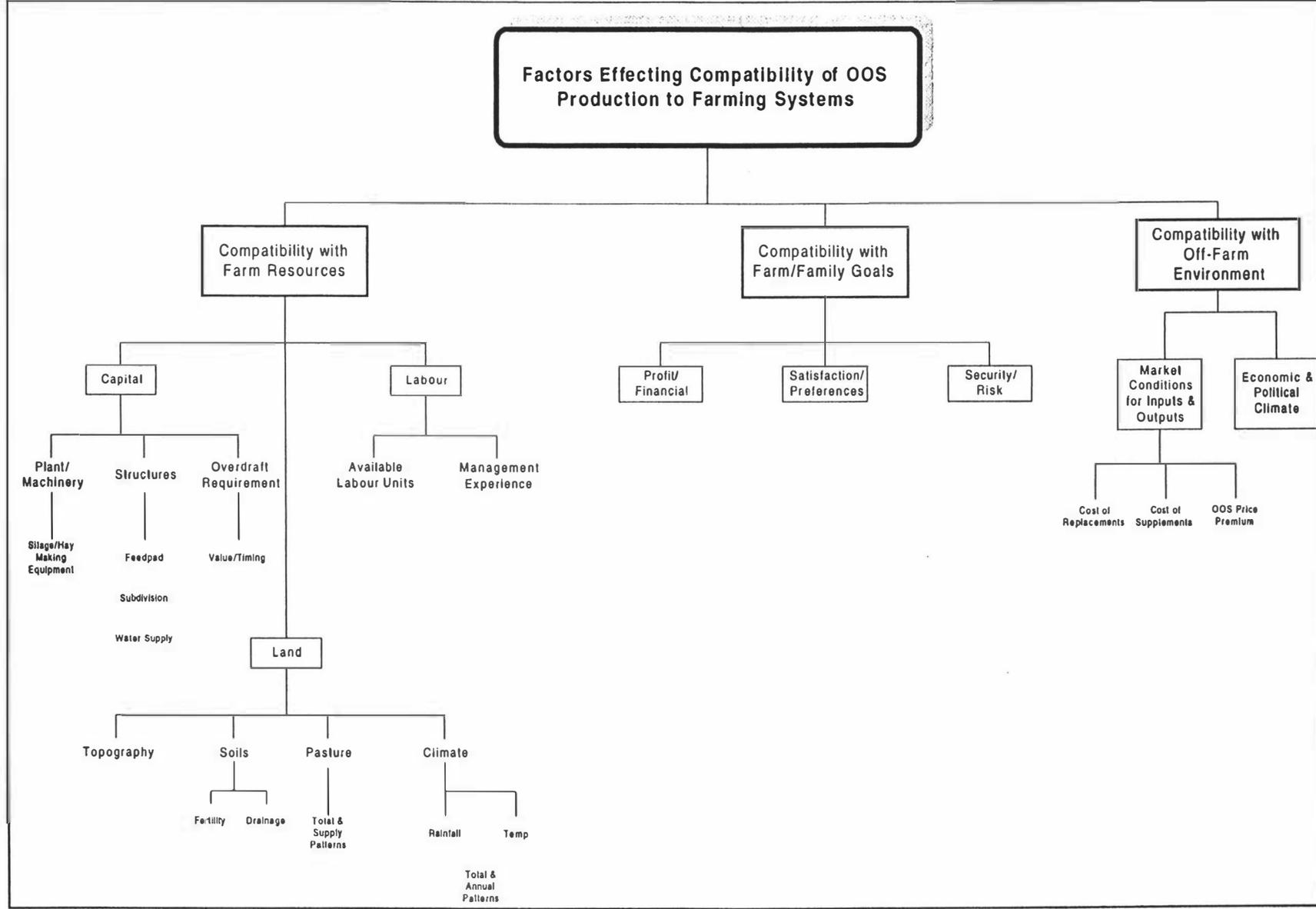
The degree to which the implications of OOS finishing systems affected individual farm systems depended on the circumstances of those farm systems. Farm and farmer circumstances affect the profitability, required returns and attitudes of farmers regarding OOS policies. The circumstances and characteristics of farm systems that affected the compatibility of OOS systems are summarised in Figure 5-2.

### **5.4.2.1 Farm Resources**

A farmer's perception of the suitability of his or her property for OOS beef production was an important factor in his or her consideration of these systems. Farmers related the potential of OOS production to the quality and nature of their farm resources. Many of the management implications discussed in Section 5.4.1 were related to, and affected by, the attributes of individual farm resources.

and

Farmers believed that the natural seasonal pattern of pasture production on a farm was the most significant factor affecting the suitability of the property for OOS production. Areas with climatic and soil conditions which give rise to more even pasture growth throughout the year, such as Zone A, are likely to suit the demand pattern of OOS finishing more than areas that experience extremes of pasture growth rates (e.g. Zone B). Rainfall, in addition to its effects on pasture growth, has implications for OOS finishing systems through its effect on soil water content and potential for pugging (Haynes, 1995). Areas that have high winter rainfall, especially when combined with poorly drained soils with weak structure and low strength, are



**Figure 5-2:** Farm circumstances affecting the compatibility of OOS beef production systems with individual farm systems.

more susceptible to soil and pasture damage from pugging, and therefore would be less suited to OOS beef finishing. Two farms in Zone A were minimally constrained by soil pugging because of their soil types or the presence of loafing or feed pads, while the remaining Zone A farmers, and all the farmers in Zones B and C believed that this was a significant constraint.

This suggests that meat companies seeking OOS suppliers should identify and target beef farmers in eco-zones which have relatively high autumn, winter and early spring pasture production (e.g. northern New Zealand and coastal areas) and free draining soils (e.g. coastal areas). Regions with warmer winter temperatures have greater levels of plant biological levels (Korte et al., 1987) and are less demanding on animals in terms of maintenance requirements (Geenty et al., 1987; Butler-Hogg et al., 1989). Soil fertility also affects the amount and pattern of pasture production on farms (Korte et al., 1987). Winter and early spring pasture growth is significantly higher for farms with high fertility status (Sheath, 1992). On Manawatu hill country, 'improved' pastures show earlier growth in spring, and more sustained growth in summer and autumn (Shannon et al., 1986). Thus, OOS production is also likely to be best matched with well-developed properties that have a record of regular fertiliser applications and/or are in eco-zones with high natural soil fertility.

### **Labour and Management**

The labour resources available to a farmer will have some effect on the farm system's compatibility with OOS production. Although some farmers believed that OOS policies would increase labour requirements at traditionally busy times of the year (Section 5.3.7), few believed this would be a major constraint to the adoption of OOS policies.

However, most farmers believed that a change to OOS finishing policies would increase the demand on management. In particular, more careful pasture management may be required. Thus, the suitability of OOS finishing is likely to be affected by the experience and skills of the farm manager in relation to the farm's bio-physical resources outlined in the above section.

### **Capital**

The capital resources available to individual farmers also impact on their decision to adopt OOS beef production policies. An increase in pasture conservation was considered by farmers as likely in OOS production systems, and the availability of appropriate machinery or contract services affected their willingness to make the necessary management changes. Farmers already conserving pasture considered the need for extra pasture conservation to be less of a constraint. Other farmers, with less scope for pasture conservation due to capital and land

resource limitations considered this factor to be a significant constraint to the implementation of OOS finishing systems.

On the positive side, the overdraft financing costs for farms could be decreased with OOS production systems due to the more even cashflow throughout the year (Section 5.4.1.3). This may partially compensate for the other costs incurred.

#### **5.4.2.2 Farm/Family Goals**

The goals and preferences of the farm and farm family also have an important effect on the decision to implement OOS policies on a particular farm. Figure 5-2 groups the goals that could affect the decision to adopt OOS policies into three broad categories: profit and financial goals; satisfaction and preference goals (non-financial); and security and risk goals. These goal categories are in part derived by Brazendale & Reid (1993) in an analysis of the goals and circumstances of two groups of farmers in the lower North Island. The farmers who participated in the interviews exhibited a wide range of goals and preferences that could affect their attitude towards OOS beef production, and their likelihood of adopting OOS beef finishing systems.

The profit and financial goals relate to strategies designed to increase farm profitability. The required level of profitability is related to the family's desired standard of living and lifestyle goals. Most farmers believed that the profitability of OOS production would play a major role in their decision to change their cattle policy. While other factors would be important, a policy change to OOS production would not be considering if it was not more profitable than their current system.

Satisfaction and preference goals relate to strategies that are most satisfying to or preferred by the farmer but not necessarily the most profitable option. As described in Section 5.3.9, several farmers suggested that even if the profitability of OOS finishing was higher, it was unlikely that they would change their current farming system, which they were satisfied with and enjoyed.

Security goals are concerned with business survival and preserving the farm family's living standard and lifestyle. As described in Section 5.3.5, some farmers believed that OOS production systems would increase risk. Thus, the farmer's attitude to and perception of the amount of risk is an important factor in their decision to adopt OOS beef production. Several farmers believed that there were other opportunities to improve basic farm management, in order to make the property more profitable, without incurring the increased risk of OOS

production systems. More fertiliser, improved subdivision, better grazing management and changing sheep to beef cattle ratio were examples of opportunities identified during the interviews

## 5.5 SUMMARY

Results from the farmer interviews are presented in this Chapter. These enabled the identification of the important issues facing farmers in their consideration of OOS finishing systems. A farmer's decision to adopt OOS finishing policies is influenced by the extent to which stock and pasture management would need to be modified. The effects of OOS on winter feed levels, summer pasture quality, and ground damage were identified by farmers as factors that could limit the use of OOS beef finishing systems. Farmers also identified management changes that would be required to finish a higher proportion of beef cattle during the winter. These management changes included: reducing stock numbers; increased use of pasture conservation, supplement and/or winter forage crops; and increased use of sacrifice paddocks or feedpads to control pugging in winter. Other management disadvantages that were also associated with OOS beef finishing systems included: higher replacement costs; difficulty in achieving winter liveweight gains; and increased vulnerability to adverse winter conditions. In general, farmers associated OOS finishing systems with increased costs and complexity of grazing management, especially during the winter period.

These disadvantages and their associated costs were balanced against the potential to increase income through premiums received for beef cattle produced OOS. While farmers believed that OOS beef finishing was less suited to, and more demanding of their pasture based systems, they accepted it was biologically feasible. Adjustments to management practices would allow at least a proportion of beef cattle to be finished OOS provided the associated extra costs and management disadvantages were outweighed by improved financial returns. In this respect, the current premiums for OOS stock were considered to be the major constraint to the wider adoption of OOS beef production systems by farmers.

Farmers' perception of the viability of OOS production systems related to their circumstances. The land resources of the farm business were important in determining this viability. In general, farms with mild winter temperatures and high soil fertility have pasture and animal growing conditions that are most suited to OOS production systems. Farms with moderate winter rainfall, combined with well drained soils would be less constrained by the risk of increased pugging under an OOS production system. Farmers' goals and objectives relating to

profit, preferences, and security also have an important influence on their willingness and ability to implement OOS production systems.

# Chapter Six: Case Farms Analysis

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## 6.1 INTRODUCTION

The case farm analysis phase of this study involved an in-depth investigation of the potential implications, costs and constraints to OOS production systems at the farm level. These aspects were investigated by modelling alternative OOS beef systems for each case farm, and incorporating information on the farmer's circumstances. The analysis generated estimates of productivity and financial returns for OOS options, and this was interpreted in conjunction with the farmer, who provided comments and reaction to the analysis on each of the potential systems.

The computer simulation model StockPol™ was used to describe the current farm system and to provide a basis against which the productivity and financial returns of potential OOS finishing systems could be compared. The modelling process provided quantitative estimates of constraints to, and costs of, OOS production systems, as well as a focus around which the views of the case farm participants could be discussed.

The first part of this Chapter includes a description of the approach and method used in the case farm analysis. A basic description of each case farm property and the current farming systems are then presented. Next, possible system alternatives involving varying degrees of OOS finishing are outlined. The productivity and financial results of the base and alternative system simulations are then summarised. The farmer's response and reaction to the analysis are presented, prior to a concluding discussion on the simulation modelling process and case farm analysis.

## 6.2 METHOD

Three case farms were identified from the fifteen farmers surveyed in phase two of the study (Chapter Five). One case farm was chosen from each zone within the research area (see Map 5.2). The farms provided a representative example of the physical environments and farming systems in the study area. This is illustrated in Figure 6-3 by the variation between farms in the assumed pattern of monthly pasture production. The enthusiasm of the farmers and their willingness to be actively involved in the case study analysis was also an important element in the selection process. Possible case farmers were contacted by telephone and invited to participate. The preferred three farmers all agreed to become involved in the case farm analysis.

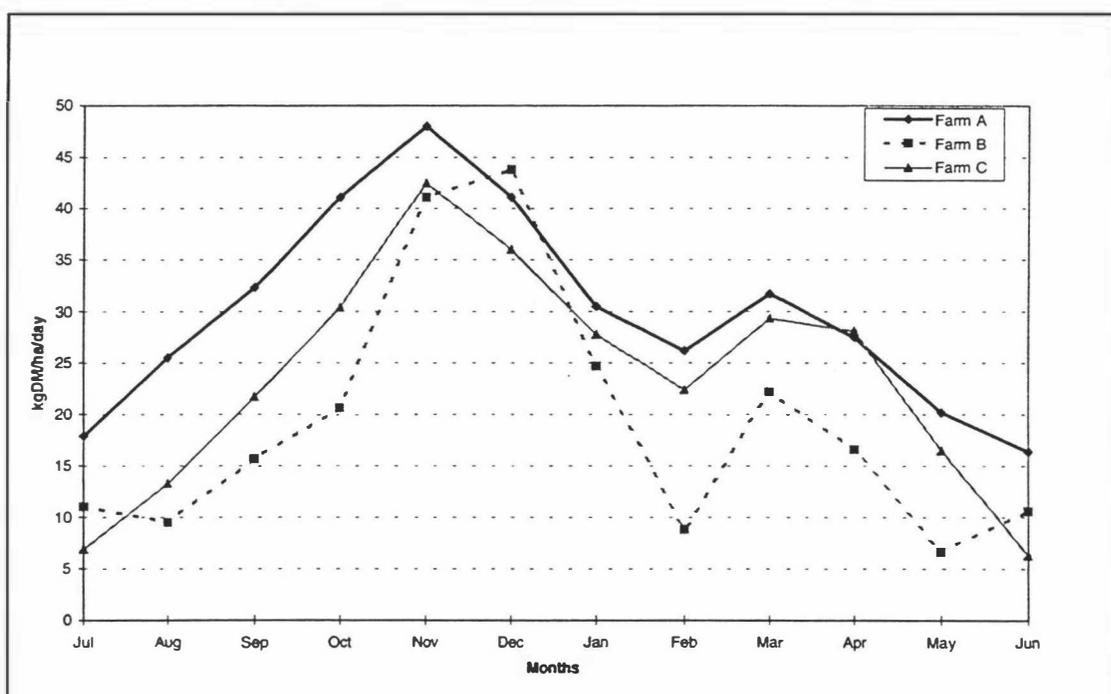


Figure 6-3: Pasture growth rate estimates used for case farms.

### 6.2.1 Modelling Analysis

The modelling analysis of the beef production systems was undertaken using the computer simulation model StockPol™. Current farm systems were simulated using the model. These 'base' systems were then used to answer 'what if' scenarios in relation to OOS finishing. StockPol™ was used to test the biological feasibility of the changes and compare production and management options. The overall aim of the modelling analysis was to investigate how farm productivity and profitability were affected by different cattle growth and selling strategies, and price premiums.

## 6.2.2 StockPol™ Overview

StockPol™ is a decision support computer program that models the biology of New Zealand pastoral farming systems (McCall et al., 1991). The software was developed by the AgResearch Technology Development Group at the Whatawhata Research Centre, near Hamilton. The StockPol™ model was formulated to improve the transfer of information about alternative livestock policies to farmers and to design more effective farming systems (Webby et al., 1994). The central objective of StockPol™ is to provide a decision support tool for pastoral farming consultants. The model indicates the biological feasibility of a livestock system and calculates its gross margin, as well as allowing the user to evaluate alternative modifications to this system.

### 6.2.2.1 Defining Farm Systems

A farm system is described by sub-files within StockPol™. The sub-files represent the following categories of information:

#### **Livestock Sub-files:**

Stock classes can be listed under separate sub-files. Each sub-file contains information for a specific livestock class:

- mating, weaning and shearing dates
- animal breed
- weaning percent
- initial and monthly average animal weights
- daily liveweight gains for growing stock
- animal numbers (wintering, sales, purchases, deaths, and births)
- animal sale and purchase dates

#### **Land Sub-files:**

Distinct areas or blocks of land that comprise the farm system can be defined within separate sub-files. A land sub-file contains information regarding:

- land block area
- monthly pasture growth rates
- topography and aspect
- pasture quality
- pasture conservation dates and areas
- nitrogen applications
- cropping dates and areas

StockPol™ includes a pasture and weather database which can be used to generate local pasture growth rates if suitable on-farm data are not available. The database incorporates monthly data from sites throughout the North Island of New Zealand.

**Feed Sub-files:**

The feed sub-files contain information about conserved and supplementary feeds:

- type and quantity of bought in supplements
- timing and quantity of fed supplements
- specifications of feed (dry matter content, energy content and price, etc.)

**Prices Sub-file:**

This sub-file contains prices and costs for meat and wool production:

- store livestock prices
- schedule livestock prices
- wool prices
- animal health costs
- cropping and re-grassing costs
- feed conservation costs
- interest cost

### 6.2.2.2 Analysing Farm Systems

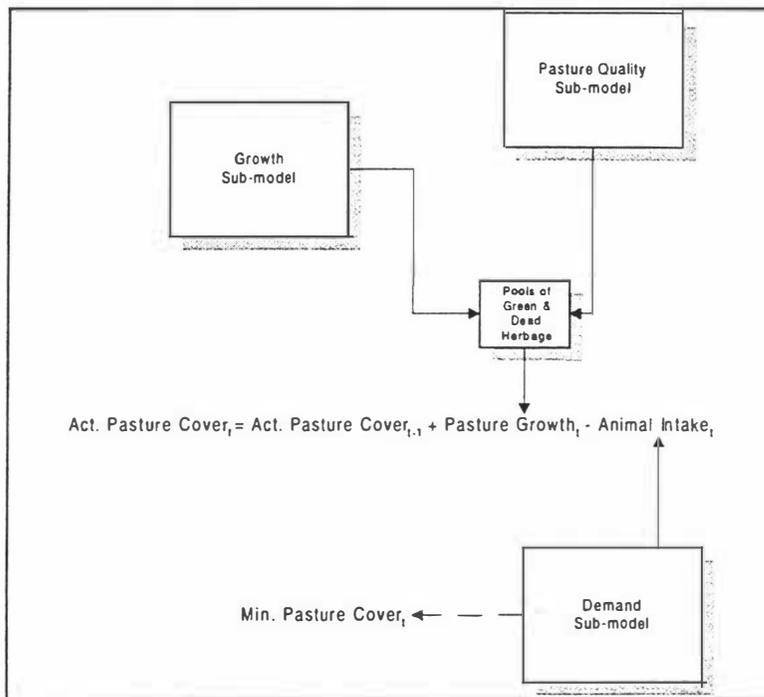
Once the farm system has been defined within the sub-files of StockPol™ its biological feasibility can be tested. StockPol™ calculates the ‘actual’ pasture cover, for the period under study, from the animal demand and pasture data inputted into the stock and land sub-files. The minimum pasture cover required over the time period to satisfy animal performance levels entered by the user is also calculated. If the actual pasture cover is at any time less than the minimum pasture cover required, StockPol™ considers the system to be biologically infeasible.

The basis of StockPol™ is a feed budget equation. This is used to calculate the actual pasture cover (aPC) at time t, by subtracting animal intake and adding pasture growth to the aPC at time t-1:

$$aPC_t = aPC_{t-1} + PG_t - AI_t$$

- where: aPC = actual pasture cover (kgDM/ha) on day t;  
PG = pasture growth (net herbage accumulation, kgDM/ha/day);  
AI = animal intake (kgDM/ha/day).

The components and function of StockPol™ are represented in Figure 6-4. The pasture growth and animal intake components of the feed budget equation are calculated from data inputted by the user. These components are then modified by the sub-models for growth, pasture quality and demand (shown as boxes in Figure 6-4). The demand sub-model is also used to generate the minimum required pasture cover.



**Figure 6-4: Summary flow diagram of the basic components of the StockPol™ model.**

As well as analysing the biological feasibility of a system, StockPol™ generates reports for a wide range of parameters that describe the farm system. These reports include a comparison of revenue and variable costs for alternative farming systems in a gross margin format. This allows a limited financial comparison of different farming systems and enterprises with these systems. Reports on livestock numbers, intake and production are also available, along with whole farm summaries including farm performance indices, and pasture supply and demand relationships.

### 6.2.3 Base Data Collection

The first stage of the case study and modelling process was to collect physical and production data from each property in order to simulate the current farming system (see Section 6.2.4). The current system for each property provided the basis against which alternative OOS systems

were compared. While some base information on the farms had been collected during the initial farmer survey interview, more detail was required from the three case farms to accurately model their systems. The additional data collected was that required for StockPol™ to define a farm system, as summarised in Section 6.2.2.1.

For farms A and B, these data were collected by way of a second farm visit. Where appropriate the StockPol™ model was taken to the farm on a laptop computer and data inputted directly. This sped up the data collection and inputting process and also allowed the capabilities and workings of the model to be introduced to the farmer. A further advantage was that when interpreting the model results the farmer had knowledge of how they were derived, and as a consequence was more comfortable accepting them as reasonable representations of their farming systems.

A different method of data collection was used for farm C. Because of the distance and associated expenses required to travel for a second farm visit, the data was collected using telecommunication methods. A data collection form was sent to farmer C via facsimile. The farmer completed the form and returned this via facsimile. The farm data was inputted into StockPol™ by the researcher and any points that required clarification or additional data were highlighted. The farmer was then contacted by telephone to clarify these issues.

#### **6.2.4 Simulating Base Farm System**

Farm data was entered into the StockPol™ model to define the base systems for each case farm. The first step was to define the land sub-file(s). Monthly pasture growth rate data was not available for any of the case farms. The in-built database in StockPol™ was therefore used to generate approximate pasture growth rates (PGRs). The land sub-files also required details about the use of pasture conservation and cropping.

Animal numbers and performance details were entered into the livestock sub-files. Some data were not available on animal live weights and liveweight gains for the case farms. In these cases the default values were calculated by StockPol™ after providing initial live weights and details of mating management. The derived liveweight gain profiles were adjusted according to a general liveweight pattern for specific stock classes, and the final sale live weights provided by the farmers. The livestock sub-files also included details of stock purchases and sales including dates, live- or carcass weights and drafting information.

The other feed sub-files requiring farm specific data were also completed. Prices and costs for income and variable expense items involved in the farm operation were entered into the prices sub-file. Prices used represented those prevailing during the 1995-96 season (New Zealand Rural Press Ltd, 1995; Burt, 1996).

The biological feasibility of the base system was then tested by running the simulation. Pasture growth rates were calibrated so that each base system was just feasible. This approach was taken because it was assumed, and supported by the farmers' comments, that the current system had been tuned to ensure a close match between feed supply and livestock feed demand in an average season.

## **6.2.5 Alternative OOS Systems**

With the base system defined, changes were able to be made to the beef sub-file(s) to simulate different livestock policies. Adjustments were made mainly to the sale times for finishing cattle in order to investigate the effects of various finishing policies. Three distinct periods of finishing were investigated: OOS; shoulder; and traditional, as defined earlier (Section 2.2.4). The case farmers were involved in the generation of alternative systems to varying degrees. Their views and ideas on appropriate beef policies, and management changes necessary to make the alternative systems feasible, were incorporated into the system changes. Beef livestock numbers and performance parameters (essentially liveweight gain) were modified in order to make the simulation of each new farming system biologically feasible. Thus, the biological, management, and financial implications of OOS, shoulder, and traditional beef production systems on the case farms were estimated.

## **6.2.6 Analysis and Comparison of Alternative Systems**

The alternative beef finishing systems were analysed and compared with respect to both their biological productivity and financial performance using relevant outputs from the StockPol™ model. Systems were compared on the basis of their biological efficiency, profitability and acceptability to the farmer.

### **6.2.6.1 Biological Efficiency**

At the most basic level the primary aim of pastoral farms is to produce output, in the form of meat and wool, from the natural supply of pasture. The efficiency of this production depends on: the proportion of pasture utilised (consumed) by animals; and the conversion of this feed

into animal production. Pasture utilisation and animal conversion efficiency are two important factors determining the efficient use of pasture for meat production.

### **Pasture Utilisation**

For any pastoral system, the stock policy is the major determinant of pasture utilisation. Stock policy includes decisions such as buying/selling dates, stocking rate and calving/lambing dates. These decisions affect the match between seasonal feed supply and demand. Efficient, low cost grazing systems seek to achieve the best match between feed supply and demand, and thus avoid the costs of feed conservation and/or supplementation.

Average pasture cover describes the quantity of pasture on a farm through time and is measured in kilograms of dry matter per hectare (kgDM/ha). It is a key variable in the design of pastoral based systems (Gray et al., 1989), because of its effects on pasture growth rates and the nutritive value and palatability of pasture. Excessive average pasture covers (i.e. greater than 3000 kgDM/ha) in the late spring/summer can reduce subsequent pasture rates in the autumn and winter, through pasture shading and loss of sward density (Sheath et al., 1987; Gray et al., 1989). High pasture covers are also associated with the accumulation of high levels of dead matter and seed head material, both of which reduce the nutritive value of pasture for animal production. Low levels of pasture cover, common in the winter and early spring, are associated with reduced pasture growth rates, reduced animal intake and thus lower animal performance. The relationships between pasture growth, pasture cover, pasture quality and animal performance are modelled within StockPol™ (Marshall et al., 1991; McCall et al., 1991).

### **Meat Production Efficiency**

Beef systems were compared on the basis of feed conversion efficiency, i.e. kilograms of carcass weight produced per 1000kg of pasture. The conversion of feed into carcass weight is affected by the amount of energy used for maintenance versus growth. In general, greater efficiency occurs with faster growing cattle that have higher pasture intakes. Because maintenance requirements for feed are satisfied before growth, the greater the feed intake, the greater the percentage of total feed that can be allocated to growth (McRae et al., 1984). Systems become less biologically efficient as the proportion of feed allocated to maintenance increases (Sheath et al., 1994).

Also younger animals grow more efficiently than mature animals (Butler-Hogg et al., 1989). This is because the conversion of feed to liveweight is greater for lean meat than fat. As an

animal matures, the percentage of fat in the carcass increases and hence conversion efficiency declines.

Total beef production generated by the alternative systems was the measure used to compare the overall biological efficiency of the various cattle finishing options on the case farm. In this study biological efficiency considers the ratio between the total beef production (output) and the total feed available (input). Given that the potential feed available was identical for each alternative system on the same farm, and adjustments were only made to the beef enterprises, then the total meat production of each system represents its efficiency in converting feed to saleable meat.

### 6.2.6.2 Profitability

The profitability of the alternative systems was compared using the gross margin analysis within StockPol™. The gross margin of an enterprise is the difference between the gross income earned and the variable costs incurred. The gross margin is the amount remaining to meet the farm's fixed expenses, capital improvements, a reward to management and profit.

$$GM = \text{Gross Revenue (GR)} - \text{Variable Costs (VC)}$$

where GR consists of the income from stock, wool, and crops, while VC included stock purchases, animal health, shearing costs, cropping costs, and the cost of capital.

The profitability of the beef system in isolation, and the whole farm system were measured in terms of the gross margin per 1000 kg of pasture DM consumed by the beef system, and gross margin per hectare, respectively.

The effects of different beef price patterns on the profitability of the systems were also examined, using the five patterns of beef schedule prices shown in Figure 6-5. The 'Average Data' price pattern was derived from average monthly beef schedule prices received by farmers between 1991 and 1994 (MWBES, 1991-1994). This pattern was generated by calculating the percentage monthly price received relative to the average annual price. The three stepped patterns involved premiums for OOS and shoulder cattle that varied from 5% to 20% of the base price.

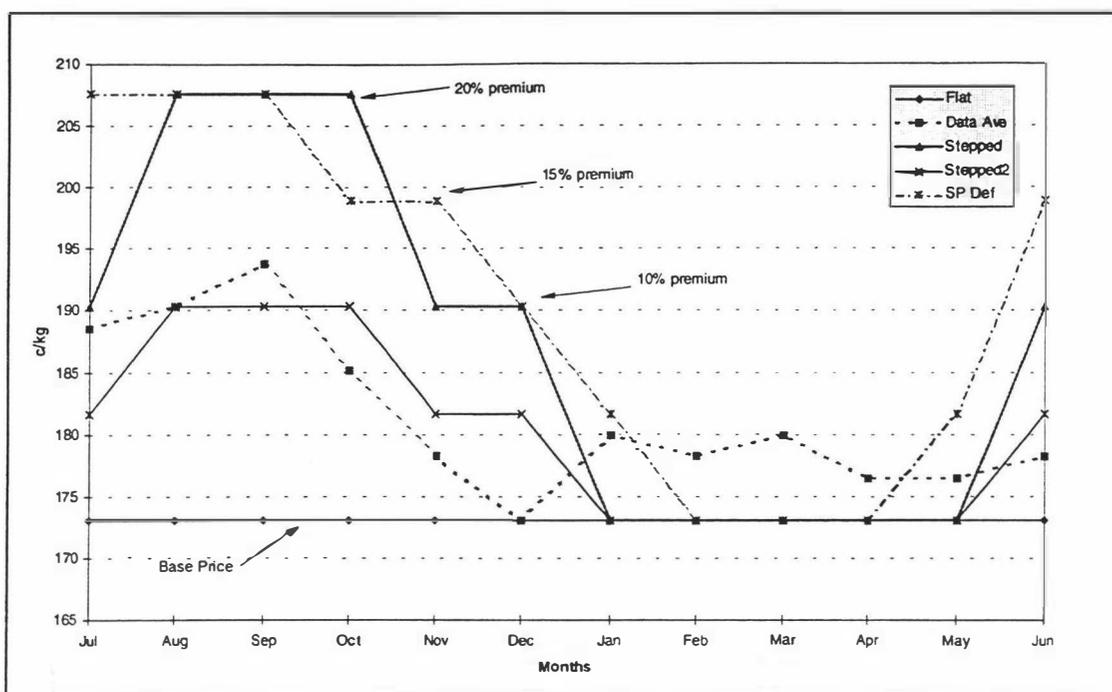


Figure 6-5: Beef schedule price patterns used in the case farm gross margin analysis.

## 6.2.7 Farmer Reaction

The case farmers' participation in, and reaction to the modelling analysis was an essential aspect of the process for case farm analysis. Each case farm participant was interviewed in relation to the outcomes of the modelling analysis. A matrix technique (Section 3.4.2.2) was used to structure the interview. The matrix allowed farmers to compare and rate the simulated farm systems in relation to various factors that they and the researcher had identified, during both the farmer interview and case farm stages of the study. A summary table of matrices completed for the three case farms are shown in Appendix 3.

## 6.3 CASE FARM A

### 6.3.1 Farm Description

Farm A is situated approximately five kilometres (km) south east of Rongotea in Zone A of the research area (Map 5-2). The property runs a mixture of cropping and beef cattle and lamb finishing enterprises. The resource description is as follows:

Total Area: 110 ha  
 Altitude: 20 metres above sea level (asl)  
 Contour: Flat  
 Soils: Kairanga silt loam  
 Poor natural drainage, but reasonable drainage system.  
 Average Rainfall: 900 mm.  
 Climate: Characterised by wet winters and susceptible to dry summers.

### 6.3.1.1 Enterprises

Cropping Policy: Approximately 55 ha of the property is planted in cash crops each year. Table 6-1 summarises the cropping enterprises. Three major crops are grown: peas, sweet corn, and wheat. The period each crop is in the ground and therefore when that land is not available for grazing is also shown in Table 6-1. Approximately 30 hectares of winter forage crops, usually 25 ha of brassica (Choumoellier) and 5 ha of green feed oats, are planted annually.

**Table 6-1: Summary of cropping enterprise on Farm A.**

Crop	Area	Yield	J	A	S	O	N	D	J	F	M	A	M	J
Peas	20	2.0			P	P	P	P	P	P	P			
Sweet Corn	28	18.0						C	C	C	C	C	C	C
Wheat	5	4.0					W	W	W	W	W	W	W	W

Beef Policy: Farm A finishes approximately 70 steers and 70 bulls each year. The majority of the steers are bought in at 18 months of age in the autumn, but some are bought earlier in the year depending on the season. These are wintered once and the majority are sold before Christmas as two-year (2yr) olds. Some bulls are bought in as calves in August and hand-reared, but the majority are bought in as weaners in March. The bulls are finished during or after their second winter from June through to December at approximately two years of age. In summary, 140 beef cattle are sold during the OOS and shoulder periods at an average carcass weight of approximately 310 kilograms (kg).

Sheep Policy: Approximately 700 male lambs are purchased each year in the late summer and autumn and are sold prime through to as late as December, at an average carcass weight of 16.5 kg.

### 6.3.2 Modelling Analysis

The current farming system was modelled on StockPol™, using the process outlined in Section 6.2.1. The effects of different beef finishing policies, involving different sale dates, on farm

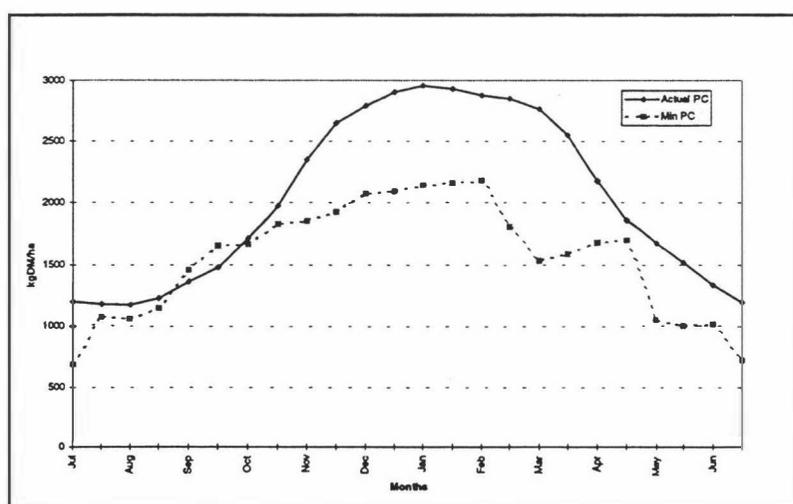
productivity and profitability were examined by adjusting the base system to generate the system alternatives described below.

### 6.3.2.1 Alternative System Descriptions

#### All Out-of-Season ('All OOS 1')

The first alternative system, 'All OOS1', involved adjusting the beef policy so that all cattle were finished OOS during August-October, rather than between August and December. The purchasing policy and liveweight profile of the beef cattle were not altered. The 'All OOS1' option therefore required cattle to be sold earlier (at a younger age), and at lower average carcass weights. The sheep and cropping policies were not adjusted from the base situation.

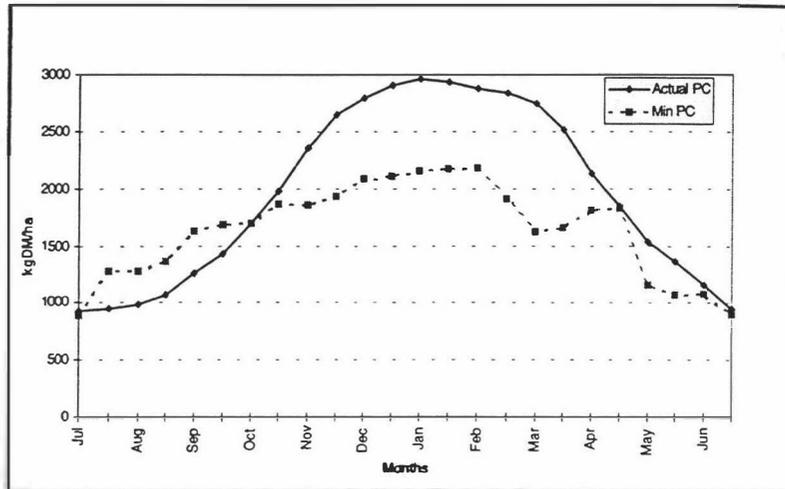
The biological feasibility of 'All OOS1' was tested with StockPol™. Figure 6-6 shows that the change to OOS selling resulted in early spring pasture cover being below the minimum required by the new system. Cattle numbers finished were decreased by 9 head (7%) in order for the system to be just biologically feasible



**Figure 6-6: Actual vs. minimum pasture covers for the 'All OOS1' beef cattle finishing option, case farm A.**

#### All Out-of-Season Option with Increased Liveweight Gains ('All OOS 2')

A variation to the 'All OOS1' system was examined. Under the 'All OOS2' option all cattle were sold OOS, but liveweight gains were increased to finish the cattle at a similar average carcass weight to the base system. This change in beef policy resulted in a biologically infeasible system (Figure 6-7), and in order to make the system feasible, cattle numbers needed to be reduced by 15%.

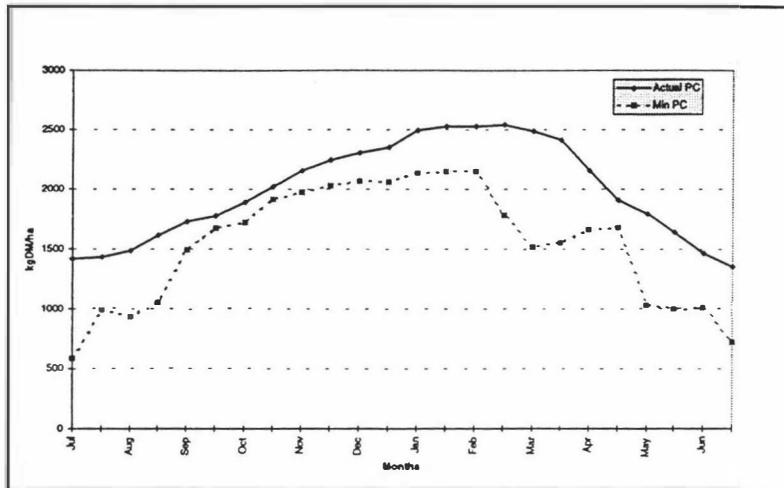


**Figure 6-7: Actual vs. minimum pasture covers for the 'All OOS2' beef cattle finishing option, case farm A.**

#### **All Shoulder Finishing Option ('All Shoulder')**

The 'All Shoulder' system involved finishing all steers for sale during the shoulder period of November and December as two year olds. Half of the bulls were sold as rising two year (R2yr) olds in June and July, and the balance after their second winter as two year olds. As for the All OOS1 system, the purchasing policy and liveweight profiles were identical to the base system. Consequently, the 'All Shoulder' system involved selling the cattle later (at an older age), resulting in higher average carcass weights. The cropping and sheep systems were fixed to the base situation.

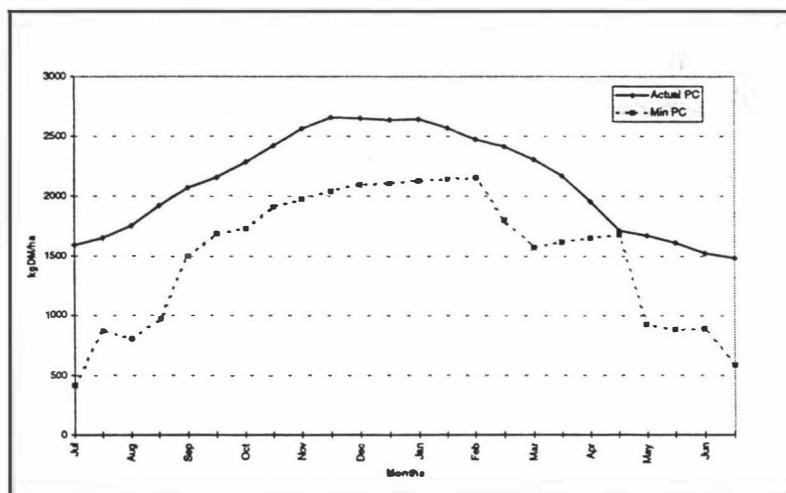
The feasibility of the 'All Shoulder' system is shown in Figure 6-8. The change in beef policy from OOS production to shoulder production allowed beef cattle numbers to be feasibly increased by 3%.



**Figure 6-8: Actual vs. minimum pasture covers for the 'All Shoulder' beef cattle finishing option, case farm A.**

**Shoulder and Traditional Finishing Option ('Shoulder/Traditional')**

This system involved the sale of 50% of the steers during the 'shoulder' months (November-December) and 50% during the 'traditional' periods (March-April). The steers were sold as between 24 and 30 months of age. The bulls were finished before their second winter as R2yr olds, 50% during March-April ('traditional') and 50% during June-July ('shoulder'). This meant some cattle were sold later and some earlier than the current practice. This policy change allowed 19% more cattle to be finished before the system became biologically infeasible (Figure 6-9).



**Figure 6-9: Actual vs. minimum pasture covers for the 'Shoulder/Traditional' beef cattle finishing option, case farm A.**

### 6.3.3 System Comparisons

The alternative farm systems were modelled to assess the implications of finishing cattle at various times of the year. The alternative systems mainly involved changes to the selling times for the beef cattle enterprise, and this resulted in the beef cattle numbers and carcass weights summarised in Table 6-2. In the subsequent sections these farm systems are compared with respect to their biological and financial efficiencies.

**Table 6-2: Summary of comparison of beef policies of systems modelled for case farm A.**

System	Beef Policy
Base (OOS/Shlder)	<ul style="list-style-type: none"> <li>• Finish 135 cattle as 2yr olds @ 316kg</li> <li>• 40% OOS : 60% Shoulders</li> </ul>
All OOS1	<ul style="list-style-type: none"> <li>• Finish 126 cattle as 2yr olds @ 295kg</li> <li>• 100% OOS</li> </ul>
All OOS2	<ul style="list-style-type: none"> <li>• Finish 115 cattle as 2yr olds @ 316kg</li> <li>• 100% OOS</li> </ul>
All Shlder	<ul style="list-style-type: none"> <li>• Finish 139 cattle as R2yr-2yr olds @ 321kg</li> <li>• 100% Shoulders</li> </ul>
Shlder/Trad	<ul style="list-style-type: none"> <li>• Finish 161 cattle as R2yr-2yr olds @ 308kg</li> <li>• 50% Shoulders : 50% Traditional</li> </ul>

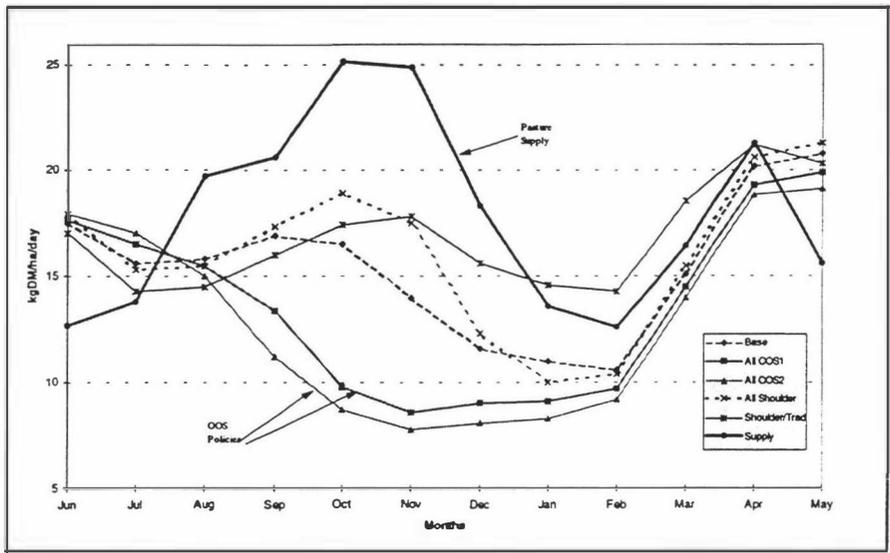
#### 6.3.3.1 Pasture Utilisation

The effect of the different beef cattle policies on pasture utilisation on Farm A is summarised in Table 6-3. Both OOS policies substantially lowered pasture utilisation compared to the more traditional options. The 'All Shoulder' policy resulted in the highest pasture utilisation (90%).

**Table 6-3: Comparisons of pasture utilisation of alternative systems, case farm A.**

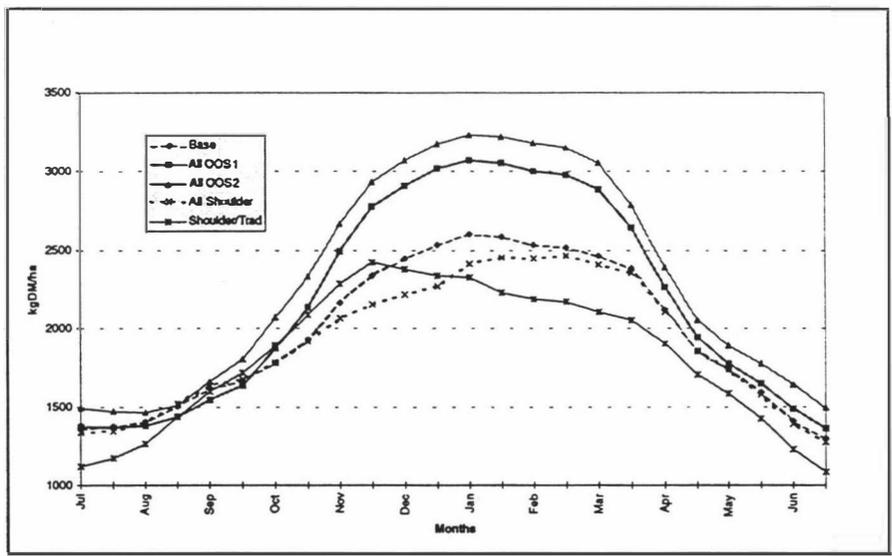
	Base	All OOS1	All OOS2	All Shlder	Shlder/Trad
Pasture Utilisation (% Utilised)	86%	76%	72%	90%	84%

The differences in pasture utilisation are a consequence of the feed demand patterns for the beef policies (Figure 6-10). The two 'All OOS' policies demand less feed during the spring and early summer than the other policies. It is at this time that pasture growth rates are high (Figure 6-3), and thus the match between feed supply and demand is poor compared to systems that require the sale of cattle in the shoulder and traditional periods.



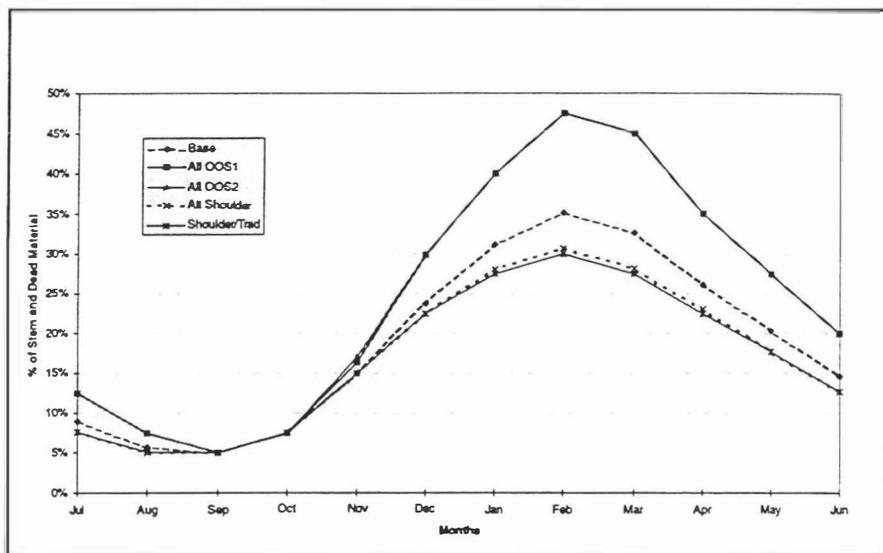
**Figure 6-10: The match between feed demand and supply for alternative beef production systems on case farm A.**

The pasture supply and demand patterns displayed in Figure 6-10 generate the average pasture cover patterns shown in Figure 6-11. The high feed supply relative to the demand of OOS systems during the spring/summer period are represented by the significantly higher average farm pasture covers from the November to March period. Selling all cattle OOS, reduced stock numbers and grazing pressure through the spring and summer months. Thus, these systems are less suited to the effective control of pasture growth over this period, and this has important implications in terms of pasture quality and associated animal performance.



**Figure 6-11: Comparison of monthly pasture covers for alternative beef production systems on case farm A.**

Figure 6-12 illustrates the estimated within season changes in pasture quality for the alternative farming systems in terms of the percentage of stem and dead material (i.e. the higher the percentage the lower the quality). These data are calculated by the pasture quality sub-model in StockPol™ (Figure 6-4). The two OOS systems generate substantially higher proportions of dead and stem material (i.e. lower pasture quality) over the summer, than the traditional or shoulder options for beef production.



**Figure 6-12: Comparison of pasture quality patterns for alternative beef production systems on case farm A.**

Overall, the OOS systems exhibited a poorer match of pasture feed supply and animal demand, and this would result in less control of spring and summer pasture growth and reductions in feed quality. These effects caused the lower utilisation of pasture in the OOS systems, and represent a biological cost (i.e. lower efficiency) for these systems of meat production.

### 6.3.3.2 Meat Production Efficiency

The efficiency of pasture conversion to meat for the alternative systems on Farm A are summarised in Table 6-4. The table outlines the feed conversion efficiency and total meat production of each system. The 'Shoulder/Traditional' system generated the highest feed conversion efficiency, producing 84.1 kg of beef carcass weight per 1000 kg of feed. The 'Base' and 'All Shoulder' finishing options had the lowest feed conversion efficiencies with 79.6 and 79.7 kg of beef carcass weight per 1000kg of feed, respectively. The differences can be explained in terms of the effects of liveweight gains and animal age on feed conversion efficiency as described in Section 6.2.6.1. Compared to the 'Base' option, 'All OOS1' finishes cattle at a younger age and this results in a slightly higher feed conversion efficiency. 'All

OOS2' also finishes cattle at a younger age, and involves higher liveweight gains than 'All OOS1', and therefore greater feed conversion efficiency.

The total meat production figures represent the relationship between the feed conversion efficiencies and the pasture utilisation of the various finishing options. The total meat production is a measure of the efficiency of feed conversion to meat at the whole farm level. The higher pasture utilisation, which results from a better match of feed supply and demand, of the shoulder and traditional finishing options, allows more cattle to be finished in comparison to the OOS systems. Overall, the OOS systems on Farm A are biologically less efficient for meat production.

**Table 6-4: Comparison of meat production and efficiency of alternative beef finishing systems on case farm A.**

	Base	All OOS1	All OOS2	All Shlder	Shlder/ Trad
Feed Conversion Efficiency (kg cwt sold/1000kg pasture)	79.6	80.9	83.8	79.7	84.1
Total Meat Production (kg cwt)	42,648	37,178	36,386	44,610	49,517

### 6.3.3.3 Profitability

Table 6-5 includes measures of profitability for the beef system and for the whole farm system. The beef gross margin is shown per 1000 kg of pasture consumed by the beef cattle, with the total farm gross margin per hectare (ha). The financial values in Table 6-5 are based on a uniform annual schedule for beef prices, i.e. seasonal premiums for cattle supplied at different times of the year are not offered. Thus, the values reflect the biological efficiency of each system, as presented in Table 6-3 and Table 6-4, rather than their relative profitability.

**Table 6-5: Beef enterprise and total farm gross margins of alternative beef production systems for case farm A.**

	Current	All OOS1	All OOS2	All Shoulder	Shoulder/ Trad
Beef GM/1000kg DM	\$48	\$35	\$48	\$50	\$52
Total Farm GM/ha	\$574	\$487	\$530	\$597	\$624

The effects of different beef price patterns (Section 6.2.6.2) on the profitability of the systems were also examined. The gross margin analysis for the different schedule patterns is shown in Table 6-6. The 'All OOS2' option was the most profitable per 1000 kg of feed consumed under

all pricing scenarios. However, at the whole farm level, both OOS systems were significantly less profitable than the other beef cattle finishing systems on Farm A.

**Table 6-6: Gross margin comparison of alternative beef production systems on case farm A, for different beef schedule patterns (see Figure 6-5).**

Price Pattern	Current	All OOS1	All OOS2	All Shoulder	Shoulder/ Trad
<b>Average Data</b>					
Beef GM/1000kg DM	\$55	\$51	\$65	\$55	\$58
Total Farm GM/ha	\$610	\$554	\$597	\$620	\$653
<b>Stepped 1</b>					
Beef GM/1000kg DM	\$69	\$68	\$83	\$67	\$62
Total Farm GM/ha	\$678	\$626	\$668	\$681	\$677
<b>Stepped 2</b>					
Beef GM/1000kg DM	\$58	\$52	\$65	\$59	\$57
Total Farm GM/ha	\$626	\$557	\$599	\$639	\$650
<b>Other</b>					
Beef GM/1000kg DM	\$71	\$65	\$80	\$73	\$67
Total Farm GM/ha	\$685	\$614	\$659	\$714	\$701

### 6.3.4 Farmer Reaction

Farmer A considered the current beef system was better suited to the overall management and other enterprises on the farm than the alternatives modelled with StockPol™. The cropping enterprise is a major component of the farm system with half the total farm area being in crop over the late spring and summer. This reduces feed supply during this period and therefore limits the numbers of stock that can be carried. Thus, the 'Current' option which involves finishing a proportion of cattle OOS and during the spring shoulder period complements the cropping enterprise.

Farmer A believed that OOS beef production was, in general, less suited to the property than shoulder or traditional production, particularly with respect to soil damage and feed availability. The effects on soil structure were of concern with respect to subsequent cropping of land over the summer. Also, with less feed available over the winter and early spring, the farmer's belief that a reduction in cattle numbers and greater use of conserved pasture would be required for OOS production was confirmed. These factors were considered to be the major costs of implementing OOS production.

The analysis confirmed the farmer's concerns to some degree, but suggested the extent of the constraints to OOS production was not as great as Farmer A believed. StockPol™ estimated that in order to finish all cattle OOS, numbers would have to be reduced from 135 finished to

126. However, Farmer A believed that given the limited availability of pasture over the winter, cattle numbers would have to be reduced more significantly (up to 50% reduction), resulting in the 'All OOS' options being even less profitable. This raised doubts in the farmer's mind about the ability of StockPol™ to mimic the farm production system and associated management changes. However, it is possible that the winter pasture growth rates derived for the OOS analysis of farm were over-estimated. Also, StockPol™ estimated that by reducing cattle numbers to 126, no extra feed conservation or supplementation was required for the OOS systems to be feasible.

Overall, Farmer A believed that the current system provided a good balance with other enterprises and that the current premiums justified finishing a proportion of cattle OOS. However, the modelling analysis suggested that for the assumed price scenarios it would be more profitable to finish fewer cattle OOS and more during the shoulder and traditional periods, and in this respect Farmer A had opportunities to improve system performance and profitability.

## 6.4 CASE FARM B

### 6.4.1 Farm Description

Farm B is situated near Rewa, approximately 15 km north of Cheltenham in zone B of the research area (see Map 5-2). This hill country property supports sheep breeding and lamb and beef finishing enterprises. The resource description is as follows:

Total Area:	450 ha
Altitude:	200 - 500 m asl
Contour:	80 ha flats. 370 ha medium to hard hill country.
Soils:	Yellow brown earth Reasonable drainage
Average Rainfall:	900 mm
Climate:	Characterised by reasonable even rainfall spread, cool winters, and mild summers. Longer growing season on flats (at 200 m asl) than on higher country (at 500 m asl).

#### 6.4.1.1 Enterprises

Sheep Policy: The property winters 2000 mainly Romney breeding ewes and flock replacements. All male lambs are sold in the autumn at an average carcass weight of 16 kg. All ewe lambs are wintered, with surplus replacements being sold in the spring at an average

carcass weight of approximately 16 kg. Lambing begins on August 26 and the average lambing percentage is 110%.

Beef Policy ('Base' System): Approximately 100 rising two year (R2yr) steers are bought in April each year. These are generally carried through two winters and sold from December to February as 3yr olds at an average carcass weight of approximately 325 kg.

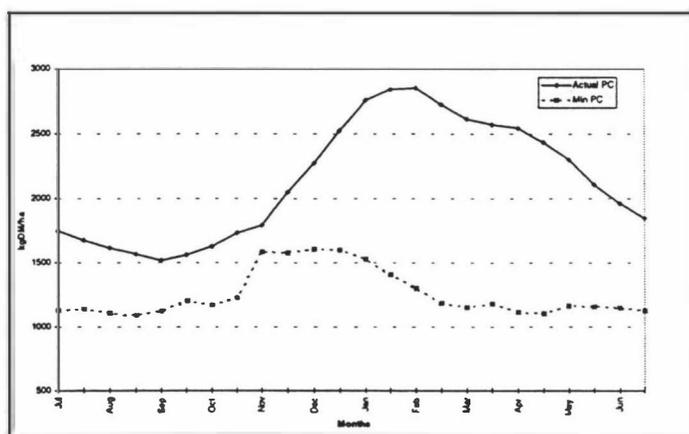
## 6.4.2 Modelling Analysis

### 6.4.2.1 Alternative System Descriptions

#### Alternative Traditional Finishing Option ('Traditional')

The 'Traditional' system involved selling half the steers before their second winter, as 2½ year olds, during March and April, and the balance as three year olds in January and February, as for the 'Base' system. The purchasing policy and liveweight profile of the beef cattle were not altered from the current policy. The 'Traditional' option therefore required cattle to be sold earlier (at a younger age), and at a lower average carcass weight. The sheep policy was not adjusted from the base situation.

The biological feasibility of the 'Traditional' option was tested with StockPol™. Selling half the cattle 6-7 months earlier reduced grazing pressure and resulted in more pasture than the minimum pasture cover required (Figure 6-13). This allowed 53 (+60%) more steers to be finished on the case farm, with the system still remaining biologically feasible.



**Figure 6-13: Actual vs. minimum pasture covers for the 'Traditional' beef cattle finishing option, case farm B.**

### All Out-of-Season Option ('All OOS')

Under the 'All OOS' option, all cattle were finished OOS during August-October, rather than between December and January. The purchasing policy was not altered, however liveweight gains were increased to finish the cattle at a similar average carcass weight to the base system. These changes in beef cattle policy allowed 14 (+14%) more steers to be finished than the base system (Figure 6-14). However, the 'All OOS' option finished 42% less cattle than the 'Traditional' system, due to the different pattern of animal demand relative to feed supply.

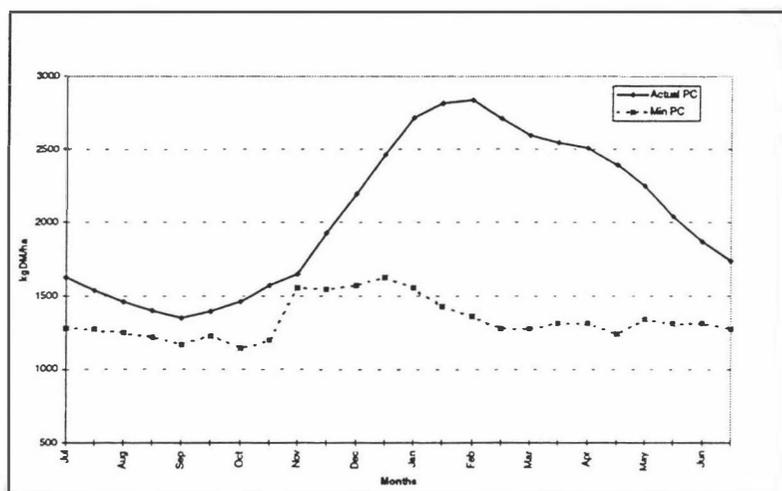
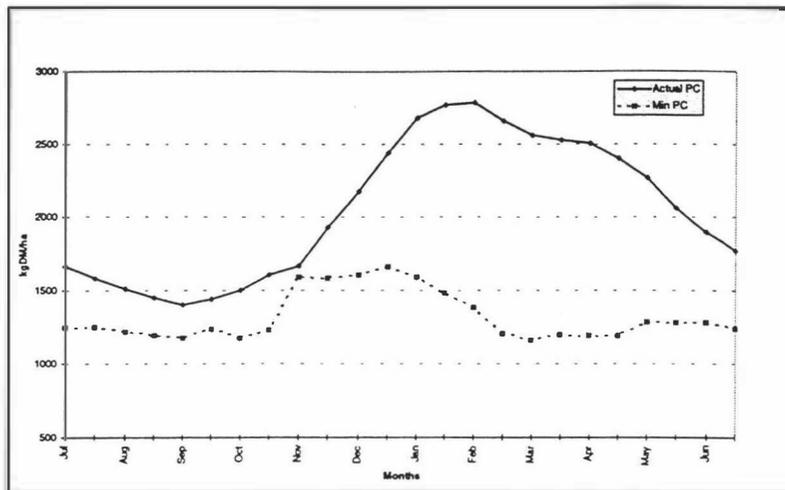


Figure 6-14: Actual vs. minimum pasture covers for the 'All OOS' beef cattle finishing option, case farm B.

### OOS and 50% Traditional Finishing Option ('OOS/Trad')

The 'OOS/Trad' system involved finishing half the steers during the traditional period of January and December as 3½ year olds, and the balance OOS in August and September as three year olds. The purchasing policy and liveweight profiles were the same as those for the base system. Consequently, the 'OOS/Trad' system involved selling cattle earlier (at a younger age). Liveweight gains were increased to finish the cattle at a similar average carcass weight to the base system.

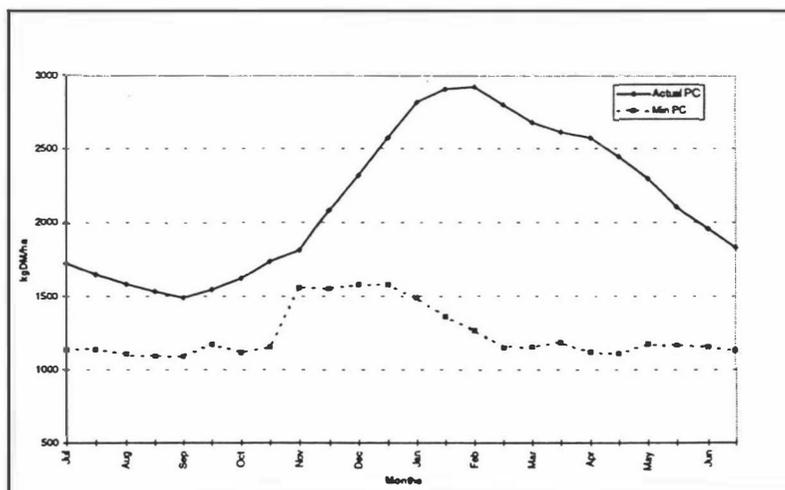
The feasibility of the 'OOS/Trad' system is shown in Figure 6-15. Selling half the steers three months earlier during the OOS period allowed beef cattle numbers to be increased by 13% compared to the base situation.



**Figure 6-15: Actual vs. minimum pasture covers for the 'OOS/Trad' beef cattle finishing option, case farm B.**

### OOS and 50% Traditional Finishing Option ('OOS/Trad 2')

The 'OOS/Trad2' system involved selling 50% of cattle during the 'shoulder' periods and 50% during the 'traditional' periods. Half the steers were sold as 2½ year olds in March and April, and half OOS as three year olds. The purchasing policy and liveweight profiles were the same as those for the base system. Consequently, the 'OOS/Trad2' system involved selling the cattle earlier (at a younger age), and this resulted in lower average carcass weights. Like the 'Traditional' system, the 'OOS/Trad2' option was able to finish 60% more steers than the base system.



**Figure 6-16: Actual vs. minimum pasture covers for 'OOS/Trad2', case farm B.**

### 6.4.3 System Comparisons

The alternative farm systems were modelled to assess the implications of finishing cattle at various times of the year on Farm B. The alternative systems mainly involved changes to the selling times of beef cattle, as summarised in Table 6-7. These farm systems are compared in the ensuing sections with respect to their biological and financial efficiency.

**Table 6-7: Beef cattle policies modelled for case farm B.**

System	Beef Policy
Base	<ul style="list-style-type: none"> <li>• Finish 94 steers as 3½yr olds @ 326kg</li> <li>• 50% Shoulder : 50% Traditional</li> </ul>
Traditional	<ul style="list-style-type: none"> <li>• Finish 153 cattle as 2½ and 3½yr olds @ 307kg</li> <li>• 100% Traditional</li> </ul>
All OOS	<ul style="list-style-type: none"> <li>• Finish 107 cattle as 3yr olds @ 324kg</li> <li>• 100% OOS</li> </ul>
OOS/Trad	<ul style="list-style-type: none"> <li>• Finish 106 cattle as 3-3½yr olds @ 325kg</li> <li>• 50% OOS : 50% Traditional</li> </ul>
OOS/Trad 2	<ul style="list-style-type: none"> <li>• Finish 153 cattle as 2½-3yr olds @ 292kg</li> <li>• 50% OOS : 50% Traditional</li> </ul>

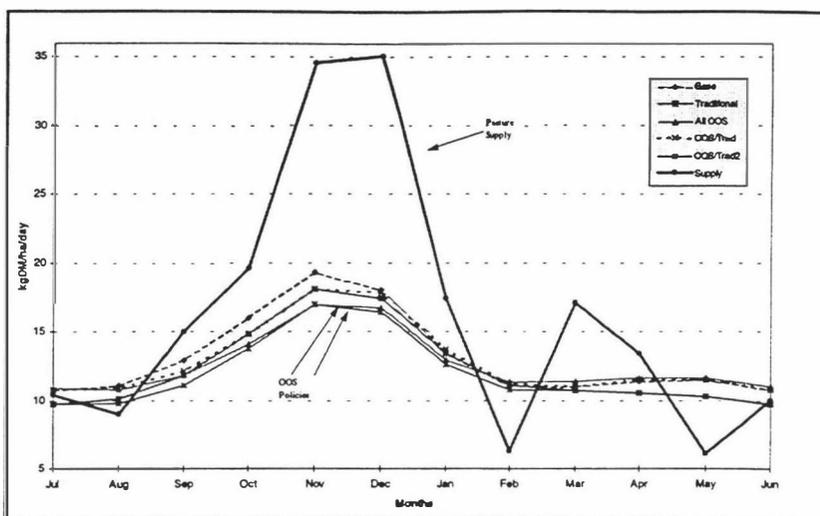
#### 6.4.3.1 Pasture Utilisation

The effect of the different beef cattle policies on pasture utilisation on Farm B is summarised in Table 6-8. Pasture utilisation was greatest for the 'Traditional' finishing system (72%), and least for the 'All OOS' option (67%).

**Table 6-8: Comparisons of pasture utilisation of alternative cattle systems on case farm B.**

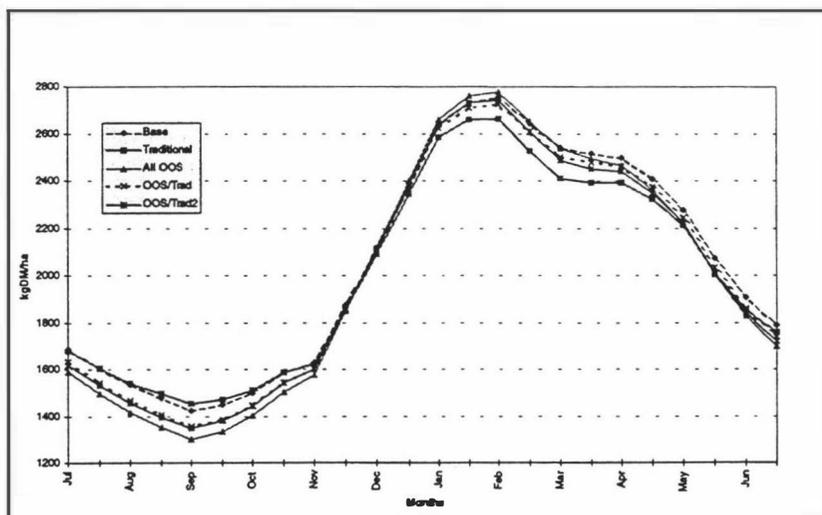
	Base	Traditional	All OOS	OOS/Trad	OOS/Trad 2
Pasture Utilisation (% Utilised)	68%	72%	67%	69%	68%

The differences in pasture utilisation result from changes to the feed demand patterns for the beef cattle policies (Figure 6-17). Compared to Farm A, the changes in the pattern of feed demand for the different systems are less pronounced, primarily because the beef cattle are a proportionately smaller enterprise on Farm B than on Farm A. However, both the 'Traditional' and 'Base' systems feed demand patterns show a better match with pasture supply, with higher demand in the spring-summer, and generally lower demand in the winter periods when pasture growth rates are low.

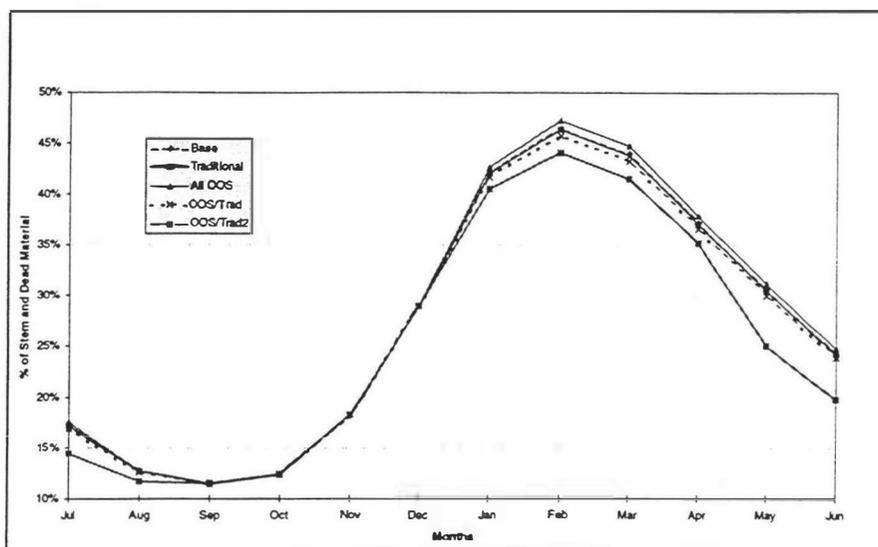


**Figure 6-17: The match between feed demand and supply for alternative beef production systems on case farm B.**

The pasture supply and demand patterns displayed in Figure 6-17 generated the average pasture cover patterns shown in Figure 6-18. The higher feed demand for the traditional systems, compared to the OOS systems, during the spring-summer are reflected by lower average farm pasture covers in the summer and autumn. Selling all cattle OOS, reduced livestock numbers and grazing pressure, through the spring and summer months. Thus, these systems were marginally less suited to the effective control of pasture growth over this period, and this had implications in terms of pasture quality (Figure 6-19) and associated animal performance. The 'Traditional' system generated lower proportions of dead and stem material (i.e. higher pasture quality) over the summer and autumn, compared to the other options for beef production.



**Figure 6-18: Comparison of monthly pasture covers for alternative beef production systems on case farm B.**



**Figure 6-19: Comparison of pasture quality patterns for alternative beef production systems on case farm B.**

Overall, the ‘Traditional’ system exhibited a better match between feed demand and pasture supply, and this resulted in better control of spring and summer pasture growth, and hence maintenance of feed quality, greater pasture utilisation and more efficient meat production.

#### 6.4.3.2 Meat Production Efficiency

The efficiency of pasture conversion to meat for the alternative systems on Farm B are summarised in Table 6-9. The ‘OOS/Trad2’ and ‘Traditional’ systems have the highest efficiencies in terms of carcass weight produced per 1000 kg feed dry matter (76.4 and 67.5 respectively). The differences between systems can be explained in terms of the effects of growth rates and animal age on feed conversion efficiency as described in Section 6.2.6.1. Both ‘OOS/Trad2’ and ‘Traditional’ involve selling cattle at a younger average age. The ‘Base’ system has the lowest efficiency for beef production because all cattle are sold as 3½ year olds, after being wintered twice.

The ‘Traditional’ system had the greatest biological efficiency in terms of converting pasture to beef. While this option generated a lower feed conversion efficiency compared to the ‘OOS/Trad2’ system, its higher pasture utilisation resulted in higher meat production overall. The ‘Base’ system produced the least meat and also had a low feed conversion and pasture utilisation efficiency.

**Table 6-9: Comparison of meat production and efficiency of alternative beef production systems on case farm B.**

	Base	Traditional	All OOS	OOS/Trad	OOS/Trad2
Feed Conversion Eff. (kg cwt sold/1000kg pasture)	53.8	67.5	62.9	58.1	76.4
Total Meat Production (kg cwt)	30,653	46,971	34,668	34,514	44,676

### 6.4.3.3 Profitability

Table 6-10 includes measures of profitability for the beef system and for the whole farm system, assuming a uniform annual beef schedule, i.e. seasonal premiums for cattle are not offered. Thus, the gross margin values reflect the biological efficiency of each system, as presented in Table 6-8 and Table 6-9, rather than their relative profitability.

**Table 6-10: Beef enterprise and total farm gross margins of alternative beef production systems for case farm B.**

	Base	Trad	All OOS	OOS/Trad	OOS/Trad2
Beef GM/1000kg DM	\$41	\$47	\$48	\$44	\$44
Total Farm GM/ha	\$254	\$274	\$260	\$260	\$259

The effects of different beef price patterns (Section 6.2.6.2) on the profitability of the systems were also examined (Table 6-11). In terms of the beef enterprise only, the OOS options were the most profitable per 1000 kg of feed consumed under all pricing scenarios. On a whole farm basis, the 'All OOS' option was also the most profitable, except under the 'Average' pricing scenario, when the 'Traditional' system generated an extra \$4/ha. In this case the 'All OOS' option involves higher cattle liveweight gains (Section 6.4.2.1) compared to the other finishing options which increased the efficiency and profitability of the system. For this reason the gross margin results of this case farm need to be interpreted carefully.

**Table 6-11: Gross margin comparison of alternative beef production systems on case farm B given different beef schedule patterns.**

<b>Price Pattern</b>	<b>Base</b>	<b>Trad</b>	<b>All OOS</b>	<b>OOS/Trad</b>	<b>OOS/Trad2</b>
<b>Average Data</b>					
Beef GM/1000kg DM	\$42	\$51	\$61	\$53	\$54
Total Farm GM/ha	\$256	\$281	\$277	\$272	\$272
<b>Stepped 1</b>					
Beef GM/1000kg DM	\$47	\$47	\$74	\$57	\$57
Total Farm GM/ha	\$262	\$274	\$293	\$277	\$276
<b>Stepped 2</b>					
Beef GM/1000kg DM	\$44	\$47	\$61	\$51	\$51
Total Farm GM/ha	\$258	\$274	\$277	\$269	\$268
<b>Other</b>					
Beef GM/1000kg DM	\$48	\$48	\$73	\$58	\$57
Total Farm GM/ha	\$263	\$277	\$291	\$279	\$276

#### **6.4.4 Farmer Reaction**

While Farmer B believed that all of the alternative beef systems modelled could be implemented on the property, he also believed that his farming system was biologically better suited to beef finishing during the traditional and shoulder periods. He believed that OOS production was constrained by the pattern of pasture growth which affected the availability of winter feed. Pugging and its effects on pasture production was also a concern, as was the ability to maintain pasture quality over the summer period. Thus, OOS production would require a reduction in stock numbers which would be an opportunity cost, particularly if this meant "...buying replacements on the grass market, at higher prices".

However, the modelling analysis suggested that the 'All OOS' cattle finishing policy was the most profitable of the options tested under most schedule pattern scenarios. While Farmer B, believed that this confirmed the potential to increase profits by finishing cattle OOS and taking advantage of price premiums at that time, he was reluctant to implement such a policy. He suggested that the decision "...comes down to management preferences and how you [individual farmers] perceive the difficulties of producing OOS and the premium at that time of year". Farmer B believed that finishing cattle on the shoulders would a good balance - "You still receive a decent premium and avoid peak kill times if you sell cattle in November/December and June/July. It's a lot easier to have cattle ready at that time than during the winter."

## 6.5 CASE FARM C

### 6.5.1 Farm Description

Farm C is situated approximately 20 km north-east of Taihape in zone C of the research area (see Map 5-2). The easy hill country property supports a sheep and beef cattle breeding and finishing unit. The resource description is as follows:

Total Area:	500 ha
Altitude:	620 m asl.
Contour:	80 ha flats. 420 ha easy hill country.
Soils:	Some ash country Medium drainage qualities.
Average Rainfall:	800 mm
Climate:	Characterised by cold and reasonably wet winters. Can also have dry summers.

#### 6.5.1.1 Enterprises

Sheep Policy: The property wintered 2500 mainly Romney breeding ewes and 870 ewe hoggets replacements in 1996. All non-replacement lambs are sold from January to April at an average carcass weight of approximately 16.5 kg. Lambing begins September 8 and the average lambing percentage is 115%.

Beef Policy: The beef enterprise is based on 156 breeding cows. Calving begins August 30 and heifers are mated at 14 months. The calving percentage averages approximately 90%. All non-replacement progeny are wintered once and finished at 18 months of age the following autumn. These steers and heifers typically reach average carcass weights of 305 kg and 225 kg, respectively. Approximately 170 steers are also bought in and finished each year. The majority are bought as 2yr olds in the late spring and finished as R3yr olds from February to June at an average carcass weight of 335 kg.

Cropping Policy: Approximately 16 ha of the flats are cultivated for a barley crop. Another 8 ha is planted each year in a winter fodder crop such as Choumoellier.

### 6.5.2 Modelling Analysis

The current farming system was modelled on StockPol™, using the process outlined in Section 6.2.1. The effects of different beef finishing policies, involving different sale dates, on farm productivity and profitability were examined by adjusting the base system to generate the system alternatives described below.

### 6.5.2.1 Alternative System Descriptions

#### All Out-of-Season Finishing Option ('OOS')

Under the 'OOS' system all cattle were finished OOS during August-October. Relative to the base situation the progeny from the breeding herd were sold approximately three months later as two year olds, and the bought-in cattle were also held into the winter and sold as 3 year olds. The purchasing policy and liveweight profile of the beef cattle were not altered. Overall, the 'OOS' option required cattle to be sold later (at an older age), and at heavier average carcass weights. The sheep and cropping policies were not adjusted from the base situation.

The biological feasibility of the 'OOS' option was tested with StockPol™. Figure 6-20 shows that the change to an OOS selling pattern resulted in early spring pasture cover falling well below the minimum required by the new system. Cattle numbers finished were decreased by 84 head (32%) in order for the system to be just biologically feasible.

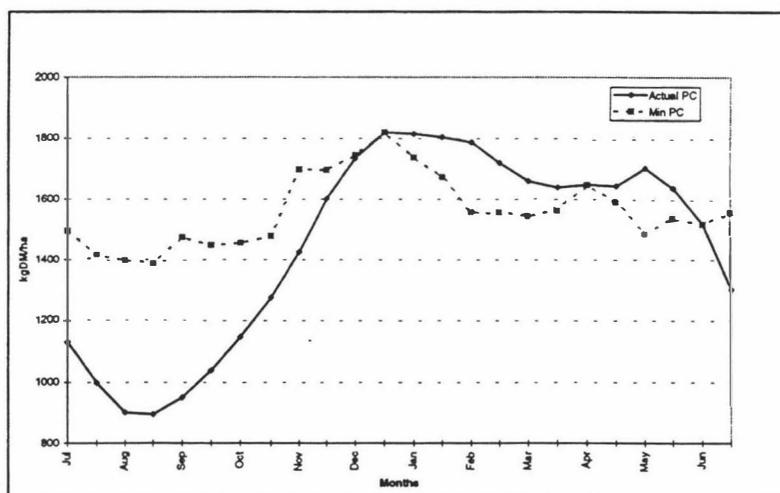


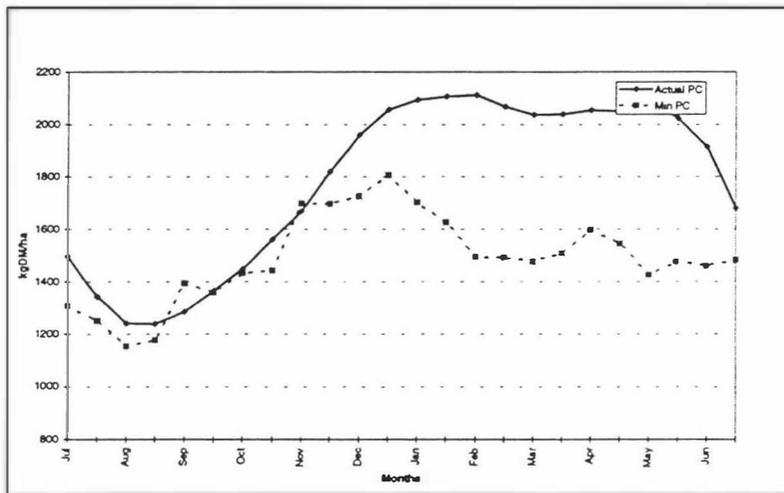
Figure 6-20: Actual vs. minimum pasture covers for the 'OOS' beef cattle finishing option on case farm C.

#### All Shoulder Production Option ('Shoulder')

The 'Shoulder' system involved finishing all progeny of the breeding herd for sale during the shoulder period of June and July as rising two year olds. The bought-in steers were sold in November and December at approximately 27 months of age, and in June and July as rising 3 year olds. As for the 'All OOS' system, the purchasing policy and liveweight profiles remained the same as those for the base system. Overall, the 'Shoulder' system involved selling the

cattle earlier (at a younger age), resulting in lower average carcass weights. The cropping and sheep systems were as for the base situation.

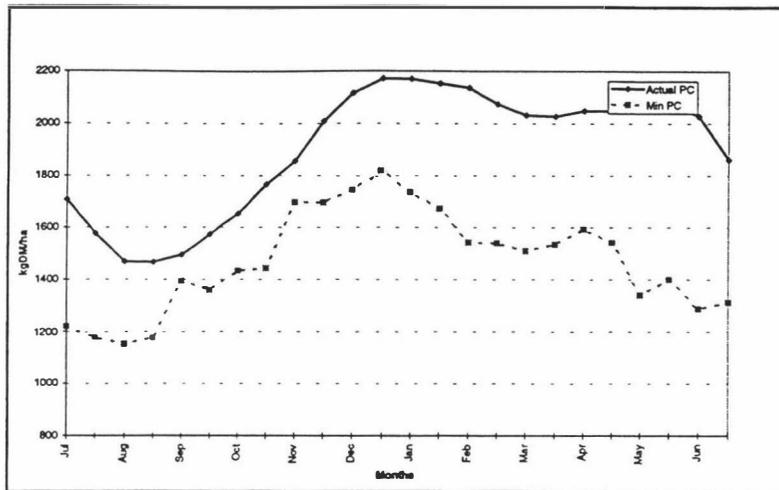
Changing the beef cattle policy to all shoulder production resulted in an infeasible system as shown in Figure 6-21. Cattle numbers had to be decreased by 8% in order for the system to be biologically feasible.



**Figure 6-21: Actual vs. minimum pasture covers for the ‘Shoulder’ beef cattle finishing option for case farm C.**

#### **All Traditional Production Option (‘Traditional’)**

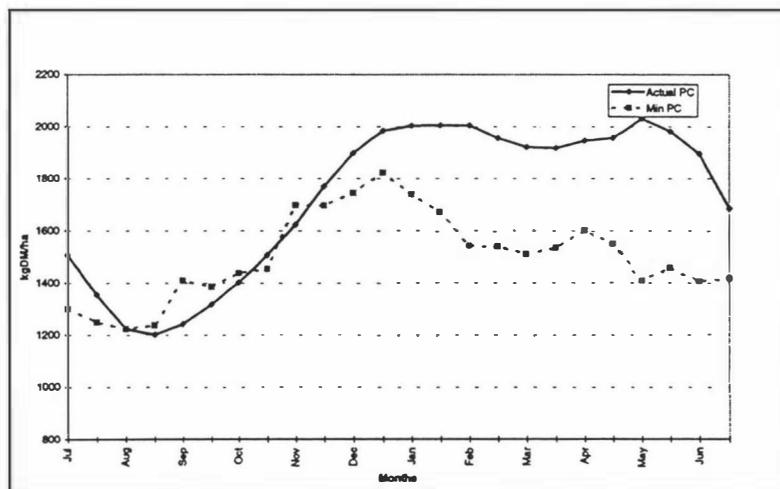
The ‘Traditional’ system involved finishing all steers for sale between January and May. The breeding herd’s progeny were sold at 18 months of age between March and May, and the bought-in steers were sold between January and May as two year olds. The purchasing policy and liveweight profiles were the same as those for the base system. Overall, the ‘Traditional’ system involved selling the cattle earlier (at a younger age), and at lower average carcass weights. The feasibility of the ‘Traditional’ system is shown in Figure 6-22. Beef cattle numbers were able to be feasibly increased by 8%.



**Figure 6-22: Actual vs. minimum pasture covers for the 'Traditional' beef cattle finishing option for case farm C.**

#### **Combined OOS, Shoulder and Traditional Finishing Option ('Combined')**

This system involved the sale of all of the non-replacement breeding herd's progeny as two year olds during the OOS period from August to October. The bought-in steers were sold as rising three year olds, from January to June, during both the traditional and shoulder selling periods. In general, cattle were sold later (at an older age), resulting in higher average carcass weights. This system was biologically infeasible (Figure 6-23) and required a 6% reduction in cattle numbers.



**Figure 6-23: Actual vs. minimum pasture covers for the 'Combined' beef cattle finishing option for case farm C.**

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### 6.5.3 System Comparisons

The alternative farm systems modelled to assess the implications of finishing cattle at various times of the year on Farm C are summarised in Table 6-12. These farm systems are compared with respect to their biological and financial efficiencies.

**Table 6-12: Comparison of beef policies of systems modelled for case farm C.**

System	Beef Policy
<b>Base (Shoulder/Trad)</b>	<ul style="list-style-type: none"> <li>. Finish 261 cattle as R2yr olds and 2½yr @ 312kg</li> <li>. 40% Shoulders: 60% Traditional</li> </ul>
<b>OOS</b>	<ul style="list-style-type: none"> <li>. Finish 177 cattle as 2 and 3yr olds @ 326kg</li> <li>. 100% OOS</li> </ul>
<b>Shoulder</b>	<ul style="list-style-type: none"> <li>. Finish 241 cattle as R2 and R3yr olds @ 307kg</li> <li>. 100% Shoulders</li> </ul>
<b>Traditional</b>	<ul style="list-style-type: none"> <li>. Finish 283 cattle as R2 and R3yr olds @ 307kg</li> <li>. 100% Traditional</li> </ul>
<b>Combined</b>	<ul style="list-style-type: none"> <li>. Finish 245 cattle as 2 - R3yr olds @ 319kg</li> <li>. 30% OOS : 20% Shoulders : 50% Trad</li> </ul>

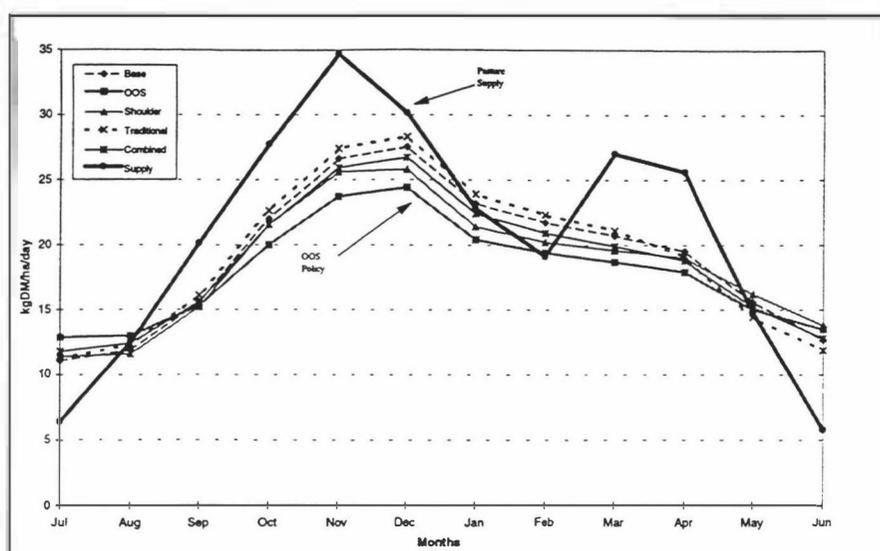
#### 6.5.3.1 Pasture Utilisation

The effect of the different beef cattle policies on pasture utilisation on Farm C is summarised in Table 6-13. The systems with the higher proportions of cattle sold OOS and during the shoulders had the lowest levels of pasture utilisation.

**Table 6-13: Comparisons of pasture utilisation of alternative systems for case farm C.**

	Base	OOS	Shoulder	Trad	Combined
Pasture Utilisation (% Utilised)	84%	79%	82%	85%	83%

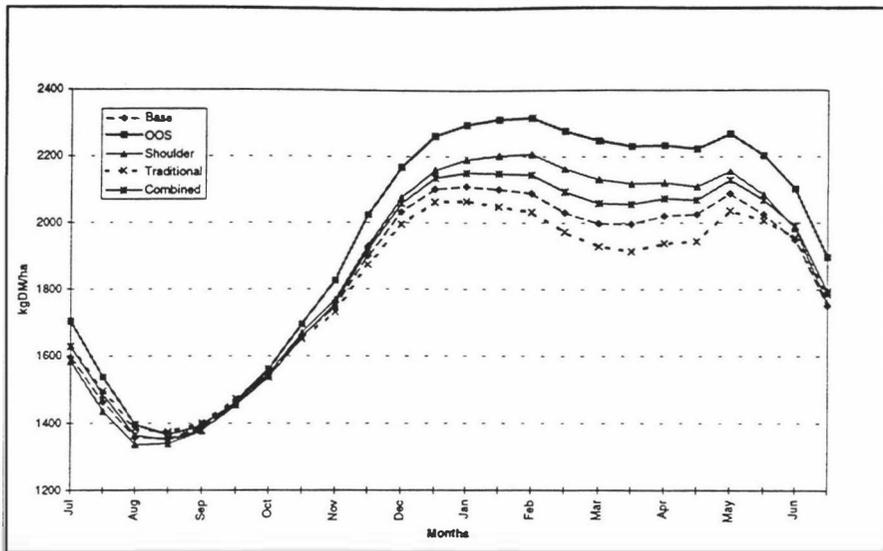
The differences in pasture utilisation result from the feed demand patterns of the beef policies (Figure 6-24). Of all the systems, the 'Traditional' and 'Base' systems showed the best match between feed supply and demand, with peak demand occurring during spring and early summer when pasture growth rates are high.



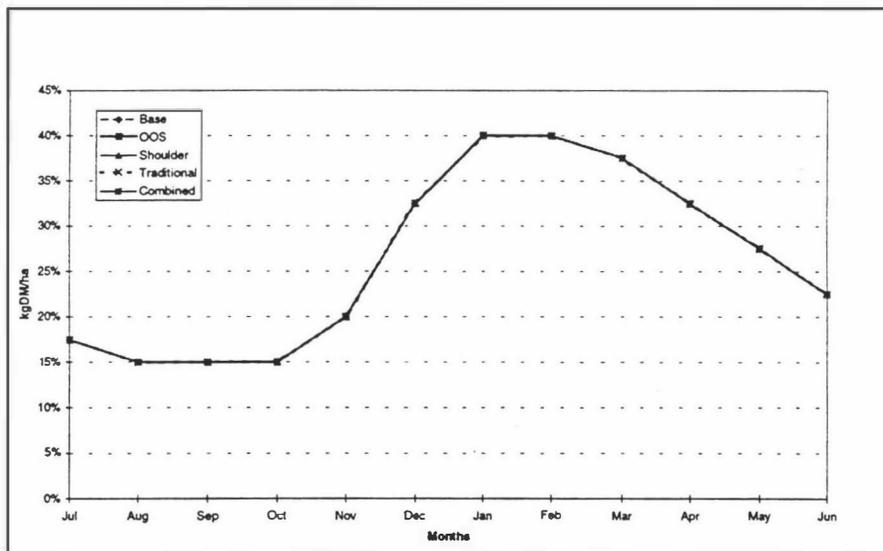
**Figure 6-24: The match between feed demand and supply for alternative beef production systems on case farm C.**

The pasture supply and demand patterns displayed in Figure 6-24 generated the average pasture cover patterns shown in Figure 6-25. The higher feed supply relative to the demand of OOS and shoulder finishing systems during the spring/summer period increased the average farm pasture cover, particularly from November to May. Selling all cattle in non-traditional periods required stock numbers to be reduced and thus less grazing pressure was available through the spring and summer months. Thus, these systems are less suited to the effective control of pasture growth over this period, which has associated implications for pasture quality and animal performance. However the StockPol™ analysis suggested that there would be no differences in pasture quality between the alternative finishing options (Figure 6-26). StockPol™ assumed that at the pasture cover levels displayed in Figure 6-25, pasture is fully controlled and therefore pasture quality is maintained.

Overall, the OOS systems exhibited a poorer match between feed demand and supply, and while this did not directly affect pasture quality, pasture utilisation was reduced. This lower pasture utilisation represents a biological cost (i.e. lower efficiency) for the OOS meat production options.



**Figure 6-25:** Comparison of monthly pasture covers for alternative beef production systems on case farm C.



**Figure 6-26:** Comparison of pasture quality patterns for alternative beef production systems on case farm C.

### 6.5.3.2 Meat Production Efficiency

The efficiency of pasture conversion to meat for the alternative systems on Farm C are summarised in Table 6-14. The 'Traditional' and 'Base' systems generated the highest feed conversion efficiencies, producing 26.3 and 25.9 kg of beef carcass weight per 1000 kg of pasture dry matter respectively. The 'Combined' finishing option had the lowest feed conversion efficiency with 24.0 kg of beef carcass weight produced per 1000 kg of pasture dry matter.

The higher pasture utilisation combined with the higher feed conversion efficiencies for the 'Traditional' and 'Base' systems generated more meat production compared to the less traditional beef finishing options (Table 6-14). On Farm C, systems that involve finishing a higher proportion of cattle during OOS and shoulder periods are less biologically efficient for beef production.

**Table 6-14: Comparison of meat production and efficiency of alternative beef production systems on case farm C.**

	Base	OOS	Shoulder	Trad	Combined
Feed Conversion Efficiency (kg cwt sold/1000kg pasture)	25.9	25.1	25.5	26.3	24.0
Total Meat Production (kg cwt)	25,032	17,864	23,219	26,512	21,675

### 6.5.3.3 Profitability

Table 6-15 includes measures of profitability for the beef system and for the whole farm system assuming a uniform annual schedule for beef prices. The values therefore reflect the biological efficiency of each system, as presented in Table 6-13 and Table 6-14, rather than their relative profitability.

**Table 6-15: Beef enterprise and total farm gross margins of alternative beef production systems for case farm C.**

	Base	OOS	Shoulder	Trad	Combined
Beef GM/1000kg DM	\$67	\$58	\$64	\$68	\$64
Total Farm GM/ha	\$439	\$391	\$419	\$448	\$425

The gross margin (GM) analysis for the different schedule patterns is shown in Table 6-16. The 'OOS' finishing option was the most profitable enterprise under the 'Stepped 1' schedule and was comparable in terms of its GM to the alternative options under other schedule patterns. At the whole farm level, however, the 'OOS' option was the least profitable system for all pricing patterns. The 'Traditional' or 'Base' system generated the highest total gross margins per hectare under all price patterns except 'Other', where the 'Shoulder' finishing system was the most profitable option.

**Table 6-16: Gross margin comparison of alternative beef production systems on case farm C for different beef schedule patterns.**

<b>Price Pattern</b>	<b>Base</b>	<b>OOS</b>	<b>Shoulder</b>	<b>Trad</b>	<b>Combined</b>
<b>Average Data</b>					
Beef GM/1000kg DM	\$70	\$68	\$70	\$71	\$70
Total Farm GM/ha	\$449	\$415	\$433	\$457	\$440
<b>Stepped 1</b>					
Beef GM/1000kg DM	\$71	\$79	\$76	\$68	\$73
Total Farm GM/ha	\$450	\$439	\$449	\$448	\$448
<b>Stepped 2</b>					
Beef GM/1000kg DM	\$69	\$68	\$70	\$68	\$69
Total Farm GM/ha	\$445	\$415	\$434	\$448	\$436
<b>Other</b>					
Beef GM/1000kg DM	\$75	\$78	\$84	\$71	\$76
Total Farm GM/ha	\$463	\$436	\$468	\$455	\$454

### 6.5.4 Farmer Reaction

Farmer C believed that the 'Base' system, which involved finishing 60% of the cattle traditionally and 40% during the shoulders, was best suited to the current farming environment. While, Farmer C believed that all of the alternative systems could be implemented on the property with varying adaptations of management, he considered OOS production to be better suited to farming systems where winter feed shortages and ground damage were less likely. The pattern of pasture growth on his property made it more difficult to have feed available over the winter and early spring period for finishing livestock OOS. An OOS system would need to transfer more feed into that period, and this would require reducing stock numbers and increase the need for pasture conservation, supplementation, and winter forage crops. The analysis confirmed that the poorer match between feed demand and supply on the property would require the reduction of livestock numbers and/or the more pasture conservation or supplementation.

Farmer C also suggested that the control and budgeting of feed would be more important for OOS systems, and would thus be better suited to more intensive farming systems with good subdivision, compared to his property which was run under a more expensive system of management. This would allow for better control of pasture intake by cattle at different times of the year. Pasture quality was also a concern for Farmer C who believed that OOS systems would be less able to maintain pasture quality over the summer, which was a major reason for carrying cattle. The analysis, however, showed that the alternative cattle finishing systems would have no effect on pasture quality of the farming system, despite the higher pasture cover in the spring and summer for the OOS option.

The possibility of increased ground damage resulting from OOS production was also an issue for Farmer C. However, he believed that pugging and its effects could be minimised through management. By finishing the younger breeding cow progeny (finished at 18 months of age) OOS rather than the larger bought-in cattle which are finished as three year olds, Farmer C believed soil damage could be minimised. Also the use of areas, due to be cultivated in the spring, as sacrifice paddocks was identified as a method to minimise soil pugging.

While Farmer C generally believed that the risk of finishing cattle OOS would be higher, these risks could be reduced through management changes. For example, reducing livestock number for an OOS finishing would enable the system to cope better with a cold wet winter. However, these management changes also represented a cost to the base system.

Overall, Farmer C believed that it would not be profitable to produce a higher proportion of cattle OOS given the constraints and costs involved. This view was supported by the modelling analysis. He believed the 'Combination' cattle finishing option would provide a good compromise between OOS, shoulder and traditional production which would spread risk, improve cashflow, and also take advantage of schedule premiums available for OOS and shoulder cattle finishing. However, in order to implement such a system Farmer C believed the property would need to be managed more intensively with better subdivision to facilitate greater control of cattle feed intake.

## **6.6 DISCUSSION**

### **6.6.1 Biological Efficiency**

The total beef production generated by the alternative systems was used to compare the overall biological efficiency of the cattle finishing options. In general, the beef cattle production options that involved greater proportions of OOS finishing were less biologically efficient than systems involving traditional finishing policies.

Total beef output was affected by the pasture utilisation and feed conversion efficiency of the system. Systems that generated higher levels of pasture utilisation had more feed available for beef production. Pasture utilisation was largely determined by the match between feed supply and demand, and in this respect the OOS systems were poor.

Feed conversion efficiency affected beef production and, as discussed in Section 6.2.6.1, this is determined by the relationship between the energy requirements of the cattle for maintenance and growth. Systems with high maintenance requirements relative to growth had lower feed conversion efficiencies, particularly when low animal growth rates were combined with heavy liveweights. Thus, OOS finishing systems were less efficient at converting pasture to beef if they involved selling cattle later and at heavier liveweights. Conversely, OOS finishing systems that involved selling cattle earlier, and at lower liveweights, commonly increased the feed conversion efficiency compared to the current beef cattle policy. However, as OOS systems involved selling cattle during periods when pasture is often in short supply and the climate is cold, they tend to have greater maintenance feed requirements than the traditional 'in-season' options.

## 6.6.2 Profitability

If a static schedule applied throughout the year, OOS beef cattle finishing systems were generally less profitable than the traditional selling policies, reflecting their lower biological efficiency. The effect of schedules with varying levels of premiums for cattle produced OOS and during shoulder periods was also investigated. On case farms A and C finishing options that involved the highest proportions of OOS production were consistently the least profitable, even assuming price premiums of 20% for OOS cattle. On these farms the finishing options that involved shoulder and traditional production returned total farm gross margins that were between \$11/ha and \$101/ha more than the OOS cattle finishing options. On case farm B, while the OOS option appeared to be the most profitable on a whole farm basis, this finishing system grew cattle more quickly (higher cattle liveweight gain profile) than the other options, making it difficult to compare them.

The generally lower profitability of the OOS cattle finishing options resulted from the lower biological efficiency of these systems, as discussed in Section 6.6.1, and increased costs. Schedule premiums would need to be in the region of 20% before OOS production would become more profitable than traditional and shoulder beef cattle production. Average schedule prices between 1991 and 1994 showed that prices in August to October averaged 5-10% more than the schedule in April, however this data did not include premiums offered by individual companies.

The large variation in results between case farms also suggested that the efficiency and profitability of the OOS options were closely related to the physical characteristics and

circumstances of the individual farm systems (see also Section 5.4.2). A variety of farming environments and circumstances exist in New Zealand agriculture which will result in variations in the profitability of OOS production. Thus, the premiums required to encourage the uptake of OOS production will vary between farms and regions. Obviously, meat companies should target identified regions or districts with lower OOS costs to minimise premium payments.

It is also important to note that the modelling analysis did not include all of the factors that influence the use and profitability of OOS production systems on farms. A major issue and concern discussed by farmers was the increased likelihood and effects of pugging which they associated with OOS beef production. The StockPol™ model was unable to simulate the effects and likely costs of soil damage which, as outlined earlier in Section 5.4.1.1, can be significant.

### **6.6.3 Farmer Reaction**

Each case farmer agreed that OOS beef production was 'less suited' to their farm. The poorer match between feed supply and animal demand was the major factor reducing the suitability of OOS systems. Also, the increased potential of soil damage (as discussed above) was an important concern. Nevertheless, all three farmers expressed the desire to decrease the proportion of cattle they sold during peak kill times, in order to improve cattle returns. However, increased production costs and risk meant farmers were only prepared to make marginal management changes towards OOS production. Finishing a higher proportion of cattle during the shoulder periods was preferred compared to OOS. Shoulder production was considered to have medium costs and risks relative to OOS and traditional finishing, whilst also reducing exposure to low cattle prices during peak kill. The modelling analysis confirmed that, in general, shoulder finishing involved fewer costs and, assuming the same schedule pattern applied, was more profitable than OOS finishing. At the higher premium levels for OOS and shoulder finished cattle, the shoulder finishing options were often more profitable than traditional finishing. This confirmed that farmers could potentially increase returns by finishing less stock during traditional periods.

It was also clear from both the case studies and the earlier farmer interviews (Chapter Five) that factors other than profitability are important in farmers' consideration of OOS production. In particular, farmers associated OOS cattle finishing with increased risk and more demands on

management. Thus, farmer acceptance of OOS finishing is affected by their attitudes, circumstances and goals, as well as a required level of profitability.

#### **6.6.4 The StockPol™ Model**

The computer model StockPol™ provided the basis for a quantitative analysis of case farm beef production systems. During the case studies some issues were raised regarding the simulation of farm systems by StockPol™. The analysis showed that OOS production systems were less able to control late spring and summer pasture cover which in turn resulted in a reduction of pasture quality. Farmers believed this could reduce animal performance and thus was a cost of OOS finishing systems. On case farm A the modelling analysis estimated that the OOS finishing options had significantly higher average farm pasture covers (>3000 kgDM/ha) over the spring and summer periods (Figure 6-11). There was also a correspondingly significant decrease in pasture quality (Figure 6-12). Despite this lack of control of summer pasture growth, animal performance was maintained and the system remained biologically feasible when cattle numbers were decreased by 7-15%. In contrast, Farmer A believed, on the basis of on farm experience, that the implementation of a system finishing all cattle OOS would require a more substantial decrease in numbers of closer to 50%, and this was associated with much greater problems with pasture quality.

Overall StockPol™ provided a useful medium for estimating the financial and feed effects of OOS production systems on the case farms. It also proved useful in providing a medium for communicating and focusing the discussion between the farmer and researcher.

### **6.7 CHAPTER CONCLUSION**

The results of the case farms analysis are comparable to other studies of OOS beef finishing. McCall (1992), in modelling cattle finishing systems on a hypothetical property found that OOS systems exhibited a poorer match between feed supply and demand which reduced their biological efficiency. The same study estimated that cattle numbers would have to be reduced by 77%, the area of pasture conserved for silage would need to be increased and 10% of the farm would need to be topped. Overall, McCall (1992) estimated, that for the property modelled, schedule prices needed to be 20% higher for cattle supplied OOS to break-even with the traditional systems.

OOS cattle finishing was also investigated by Taylor (1982) on a property in Northland using a linear programming model. Increased levels of OOS finishing were shown to increase production costs per head. On this farm OOS production was limited by the seasonal feed constraints during the autumn and early winter. Taylor suggested the increased use of pasture conservation, nitrogen fertiliser and improved pasture species as methods to increase pasture availability during this period. Overall, premiums of up to 30% were required for OOS finishing to break-even. The level of premium required was strongly influenced by autumn and winter pasture supply levels.

The modelling analysis presented in this chapter confirmed that OOS beef finishing systems exhibit decreased biological efficiency compared to traditional beef systems. The lower biological efficiency results largely from the seasonal nature of the pasture based farming systems that dominate New Zealand agriculture. This lower efficiency of OOS systems has, and will continue to strongly contribute to the existence of a seasonal pattern of beef production in the New Zealand meat industry. Despite this, opportunities, as shown in this study, exist for farmers to produce higher proportions of stock OOS or during the shoulder periods, than at present.

Greater use of OOS beef finishing on farms has the potential to increase the continuity of supply of beef cattle for slaughter, with consequent advantages at the processing and marketing levels of the beef industry (Section 2.2.3). As confirmed by this study, profitability will be an important factor in farmers' consideration OOS systems. Premiums of at least 20%, depending on farm circumstances, appear to be required to offset the lower efficiency and increased costs of OOS finishing systems in the western, lower North Island study region. While premiums already exist for OOS cattle (as discussed earlier), these are insufficient to significantly increase the uptake of OOS finishing systems.

# Chapter Seven: Conclusions

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## 7.1 INTRODUCTION

First, this chapter revisits the primary objectives of the study (Section 1.1.3) and summarises the findings of the research within the context of the problem of seasonal beef supply in the New Zealand meat industry. Next, the use of FSR methods to investigate OOS production systems that could improve the continuity of beef supply is discussed.

## 7.2 THE USE OF OOS PRODUCTION TO INCREASE THE CONTINUITY OF BEEF SUPPLY

The primary objectives of the study were to develop an understanding of the factors that would influence the on-farm implementation and adoption of OOS production systems by farmers, and to estimate some of the associated costs and constraints. Before these objectives were addressed directly, the problem of the seasonal pattern of beef supply to the New Zealand beef industry was investigated.

### 7.2.1 Importance of a More Uniform Beef Supply - Industry Perspective

A more uniform pattern of beef supply would provide the NZ meat industry with the opportunity to compete more effectively in the higher value market for meat. A more continual supply would provide direct benefits to the beef marketing and processing stakeholders in the industry. These benefits would be in the form of a wider range of market opportunities, particularly in the high priced chilled segment of the beef market; and increased processing efficiency and therefore lower processing costs. Industry stakeholders believed that these benefits were very important to the future of the meat industry as a whole. Also, industry stakeholders confirmed that the increased use of OOS beef finishing systems on farms was an important and realistic option for achieving the more uniform supply pattern that was necessary to secure these benefits.

It was also clear that increasing the continuity of supply would involve sending 'price signals' to farmers in the form of larger premiums for beef cattle finished OOS compared to those finished during traditional periods. Stakeholders believed that OOS production systems would generally increase the cost of beef production for farmers, and that the level of premium incentive offered for OOS production would need to reflect the constraints and associated costs faced by farmers.

### **7.2.2 On-farm Implications of OOS Production Systems**

A farmer's decision to adopt an OOS finishing system is influenced by the costs and constraints of such a change, as well as his/her individual circumstances and attitudes. An understanding of the implications and issues regarding the use of OOS systems faced by farmers was developed through this study.

Farmers identified a number of factors which could affect and limit the use of OOS beef finishing on their properties. Winter feed levels, summer pasture quality, and soil damage were major concerns of farmers with respect to OOS systems. In general, farmers associated OOS finishing systems with increased production costs, higher levels of risk and greater complexity of grazing management. Case farm analysis confirmed that OOS production generally had a lower biological efficiency compared to traditional beef finishing systems, due to the poorer overall match between pasture feed supply and animal demand.

The disadvantages and costs of OOS finishing were balanced against the potential to increase farm income through premiums on OOS beef cattle. While farmers considered OOS beef finishing less suited to, and therefore more demanding of their pasture-based farming systems, they believed that adjustments to management practices would allow at least a proportion of cattle to be finished OOS. However, the related costs and the perceived management disadvantages would have to be outweighed by improved financial returns associated with premiums offered for OOS beef cattle. Simulation modelling of three case farms suggested that OOS finishing systems were less profitable than the existing cattle policies on a whole farm basis, even when assuming price premiums of up to 20% were available for OOS cattle. Thus, for the pattern of beef supply to become more uniform, meat companies will have to re-think their pricing strategies and offer significantly larger premiums than present for cattle finished OOS.

It was also clear that the viability of OOS production systems varied between farms and regions. The individual circumstances of farms affected the profitability of OOS finishing. The land resources of the farm were important in determining the potential of OOS finishing and as expected, farmers suggested that properties with good winter pasture and animal growth conditions (i.e. mild temperatures, high soil fertility, moderate rainfall), and free draining soil types are most suited to OOS production. Farmer attitudes and goals related to profit, preferences and risk have an important influence on their willingness and ability to implement OOS finishing systems. Thus, there are opportunities for meat companies to target particular regions, farm types and farmers that are suited to, and likely to adopt to some degree, OOS beef finishing systems.

### 7.2.3 Further Research

The extent to which the advantages of a more uniform beef supply arising from wider adoption of OOS production would benefit the processing and marketing sectors of the industry was not established in this research. All stakeholders believed that increased premiums for cattle produced OOS would be required to increase supply continuity, but some were unsure whether this would outweigh the processing and marketing benefits obtained from a more uniform beef supply. More research is required at the marketing and processing levels of the beef industry to clarify and quantify the costs and benefits of a more continual supply. This research is vital for determining the feasible level of price premiums that can be offered for OOS beef cattle.

At the same time, research should continue into OOS production at the farm level. This research should be aimed at obtaining a better understanding of the costs and constraints of OOS production under a wider range of biophysical conditions and farm types than represented in the present study. Investigation is also required into management practices to minimise OOS production costs and which are acceptable to farmers in differing circumstances. Also, the use of other production options such as alternative pasture species with more even growth rates, and various supplementation alternatives, could be researched. Continued farmer involvement in this research is necessary to ensure that the research outputs remain relevant them. Ultimately, on-farm research could be used to develop and test OOS finishing systems under commercial farming conditions. Thus, farmers would have the opportunity to actively participate in the development of systems that would be acceptable to them. This may also increase farmer awareness of the technologies and management practices, and thereby enhance the adoption of OOS systems.

As described in Section 3.2, this study represents the investigation of one option for addressing the beef industry problem of seasonal supply. Other options may exist to reduce the effects of this seasonality. For example, as discussed in Section 4.3.1.4, an alliance with a similar beef producing nation with a complementary supply pattern could potentially increase marketing opportunities for New Zealand beef products and those of the other partnering nation. This, and other methods of reducing the negative effects of seasonal production on beef marketing and processing should be investigated.

### **7.3 THE USE OF FSR TO INVESTIGATE OOS PRODUCTION**

The secondary objective of this study was to investigate the use of Farming Systems Research to obtain an improved understanding of the on-farm constraints to, and impacts of, the use of OOS production systems. The FSR methods used were aimed at ensuring the circumstances and views of farmers, and other stakeholders, were directly incorporated into the investigation of OOS production systems. This emphasis on stakeholder participation allowed the perspectives of various stakeholders to be included in the description of the problem situation. It was hoped that this would aid in the development of actions to improve the situation by ensuring that solutions were more relevant and acceptable to all parties than those derived by a “top-down” approach.

It is difficult to evaluate the success of the use of the FSR approach in this study because it represents only part of the process of developing solutions or actions to address the problem of seasonal beef production and the use of OOS systems. Also, the study had no ‘control’ methods with which the FSR approach could be compared. Other studies based on a ‘traditional’ approach to research have reached similar conclusions regarding the potential of on-farm use of OOS finishing systems (Taylor, 1982b; McCall, 1992), which suggests that, in these cases, researchers had an appreciation of on-farm conditions and the environment in which farmers operate. However, the FSR methods used in this study resulted in the collection of detailed qualitative data which would not have been possible with less participatory methods. This resulted in a ‘richer’ description of the on-farm implications of OOS production systems, which may be important in developing actions relevant to the stakeholders that address the problem of seasonal beef supply.

However, the unstructured nature of this ‘rich’ data meant its collection and analysis was demanding and time consuming. The techniques involved in collecting and processing the data

relied heavily on the skills and ability of the researcher. Formal training in interviewing, for example, would be advantageous to ensure the successful collection of data with a high utility.

Clearly, the FSR methods aided in achieving the primary objectives of the study. The key informant and farmer interviews helped describe and define the problem of seasonal beef production, as well as the implications of OOS finishing, from the perspective of both farmers and meat companies. The extensive knowledge and expertise of the participants in their respective fields was able to be utilised through this process.

Overall, it is concluded that FSR methods can be used in New Zealand agricultural research to ensure that participating stakeholders are involved in the description and development of research opportunities. This participation should improve the relevance and subsequent uptake of research outputs by the intended end-users, although this was not able to be determined in this study. In New Zealand, research funders are increasingly emphasising the importance of improving the adoption of research outputs and are, therefore, urging researchers to identify the end-users of their research and incorporate them into the processes of research (FoRST, 1995); in this respect FSR methods have a useful role.

## **7.4 CONCLUSION**

A FSR approach was successfully used to investigate the implications of the seasonal pattern of beef production, and the increased use of OOS beef finishing systems to improve the continuity of beef supply. An understanding of the issues was elicited through the participation of farmers and other industry stakeholders in interviews and case studies. The study showed that while there are costs and constraints to the implementation of OOS beef production systems, opportunities do exist to improve the continuity of beef production in New Zealand through the increased use of OOS systems on farms.

# Appendices

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## **Appendix One: Examples of Rich Pictures Developed from Farmer Interviews**

See overleaf.

Tony farms property in partnership with brother & David.

Renovated since 1977

**FARM'S FAMILY CIRCUMSTANCES**

- No major changes
- Good level of profit

Rain with families 35ish young kids.

3 labor units (temporarily) + seasonal.

**LAND**

- Home lake 700 ha
- Easy till 1115
- Level slope 250 ha
- Flat (kettle hole)

**BIO-PHYSICAL FARM FEATURES**

**SOILS**

- YLE - relative free drainage
- light soils - easily damaged

**CLIMATE**

- Summer "soft"
- Cold winters
- not early (1400-1700 Oct)
- Rainfall 1000-1500 mm
- Frost even spread
- Soft wet July/Aug.

**FARMER**

ZONE: B AREA: unknown

**CURRENT ENTERPRISES**

- Summary**
- 250 FH breeding cows
  - Dairy heifers
  - 5000 lambs
  - 2000 ewe lambs

**BEEF POLICY**

- Breeding cows
- Buy in Dec
- 3 months (Dec)
- Dairy farm
- progeny Angus cross
- Culling after Sept 1.

**ENTERPRISE CRITERIA**

- Moved into combined cows
- Feasibility of cattle
- "product"
- Breeding vs finishing
- Financing
- Labor suited to land
- pasture capability
- New Fertilizer
- Selling policy
- Moved to - stores from B&B
- Market
- Good money in speculators
- 1st finishing Dec
- need to finish everything
- New store option
- suited to ice stores
- Better divided - 7th water policy

**SHEEP POLICY**

- 1000 Romney
- 1000 BL cross
- removal on
- "product"
- All progeny finish
- lambing Sept
- Finishing
- Sold Dec - using
- All B's gone by Feb
- Cwt = 17kg
- 18 kg lam

**OOS PRODUCTION**

**General Attitudes**

- not working
- no real advantage!
- OOS finding better suited to specialized finishing units.
- Aim is to produce quality animals - this is more difficult if producing OOS
- would be viable if culler guarantees adequate premium to make up for costs:
- £150
- £200

**PRICING/INCENTIVE**

- Main incentive = \$9
- OOS would require major policy change & consulting supply
- used contracted incentive i.e. contracts.
- would look at contract
- Premium would need to be substantial to take cattle into water works (Aug/Sept/Oct)
- If 92:00 week-end prod = \$250 - \$330. required.

**Required Changes**

- 1 SR or #1
- Rain more feed in period (Mum sound)
- Specificity for 2.5 months beyond culling changes.
- Take cattle that using water crops etc -> maximum until early spring growth kills in.

**Conclusions**

- 1. Quality OOS:**
- tried to get the cows thru water + barge into cwt.
  - Push more feed into water works
  - Feed quarterly
  - Return to SR

**2. Finishing OOS**

- Having quality feed in water to finish
- Costs of getting feed
- Cost of finishing
- Conservation costs
- Reduce demand associated with taking heavy cattle into water
- Annual growth potentials higher than the finishing potential
- Raising weight on cow water
- would look same summer weight

**Opportunities**

- In culture to system
- need black would help
- in some more Athorn problem
- but to quality
- could use finishing pond - but difficult to put weight on
- 1st easier to take to 1st/1st
- 1st/1st easy taking to Aug - Oct
- would not finish all cattle then
- management
- risk

**OTHER FEATURES**

- Balance between breeding
- Finishing
- More farms finishing breeding cows
- Most will probably need to run breeding cows or cattle

**FINISHING**

- Use a bit heavy/light
- Cows off milk -> finishing
- 7 days -> culling
- Can give some on level stock
- write some on level stock

**WEANING**

- Use a bit heavy/light
- Cows off milk -> finishing
- 7 days -> culling
- Can give some on level stock
- write some on level stock

On own side 1974

### FARM FAMILY CIRCUMSTANCES

Autism Coloni  
- not supported  
- difficult management

Order Sols  
Doubtful  
waiting

LAND  
- 530 ha  
- 420 ha rangeland (bushes)  
- 110 FIELDS

### BIO-PHYSICAL FARM FEATURES

(Climate)  
- Cool water  
- late season (high)  
- Fairly wet winters  
- Rainfall = 1200mm

2015  
- Sand based - not good  
- Top Soils in water, difficult  
- Re bottom slips  
- Soil on FIELDS = kitchen silt bank  
- personally see erosion  
- big cattle sheds made 4 years

### FARMER

ZONE: RIC  
AREA: Kintana

Regional Circumstances  
- # of probably cows and maybe buy more Steers

### CONSTRAINTS

Annual feed supply system  
something else would suffer -> ewes/steers (opportunity cost of feed)  
Would want to have 2 #s  
systems with cattle on hills  
- self pasture change  
- later on flats  
- already water cows then more risky - using dwindling feed supplies  
- Not making use of good growth periods (winter/summer)  
- watered at busy time (winter/summer)

### OOS PRODUCTION

General Attitude  
- there un-ambitious  
- Autism colour  
- bad experience impact  
- Comes back to financial incentive

Rice/Onion  
- Need financial incentive  
- Premiums not sufficient  
- would not want to do it as a gamble  
- add guaranteed price too much risk

Finishing stage  
- instead offer in 1st year + late after themselves in 2nd

### BEE CATTLE

- 140 Murray Grey  
- Shred head  
- Finish all progeny  
- sell as 2 1/2 yrs (winters 2 yrs)  
- sold April - July  
- in excess of 3000  
- 18 shed breeding bulls  
- Calving Sept

### DIVERSE ENTERPRISES

- Usually really similar  
- Owns hives  
- Dairy goats  
- buy in sheep  
- buy in goats/bulls  
- only 1 other breeder

### CURRENT ENTERPRISES

ENTERPRISE (CHANGES)

- used to sell woolly  
- sell cattle: sheep  
- ie finability  
- when selling as weaners used to get weaners  
- Own people making profit  
- Price driven profitability changes

### SHEEP

- 2000 Ewes  
- Romney  
- finish most in  
- lambs not off till July

### SUMMARY

1400 Murray Grey  
breeders only  
- 2100 Ewes

### OPPORTUNITIES

Always taking steps  
-> to write how  
if partners have them  
- would hold them  
- need "massive" incentive  
would feed way into system by degrees  
Feed-feeding system better set up

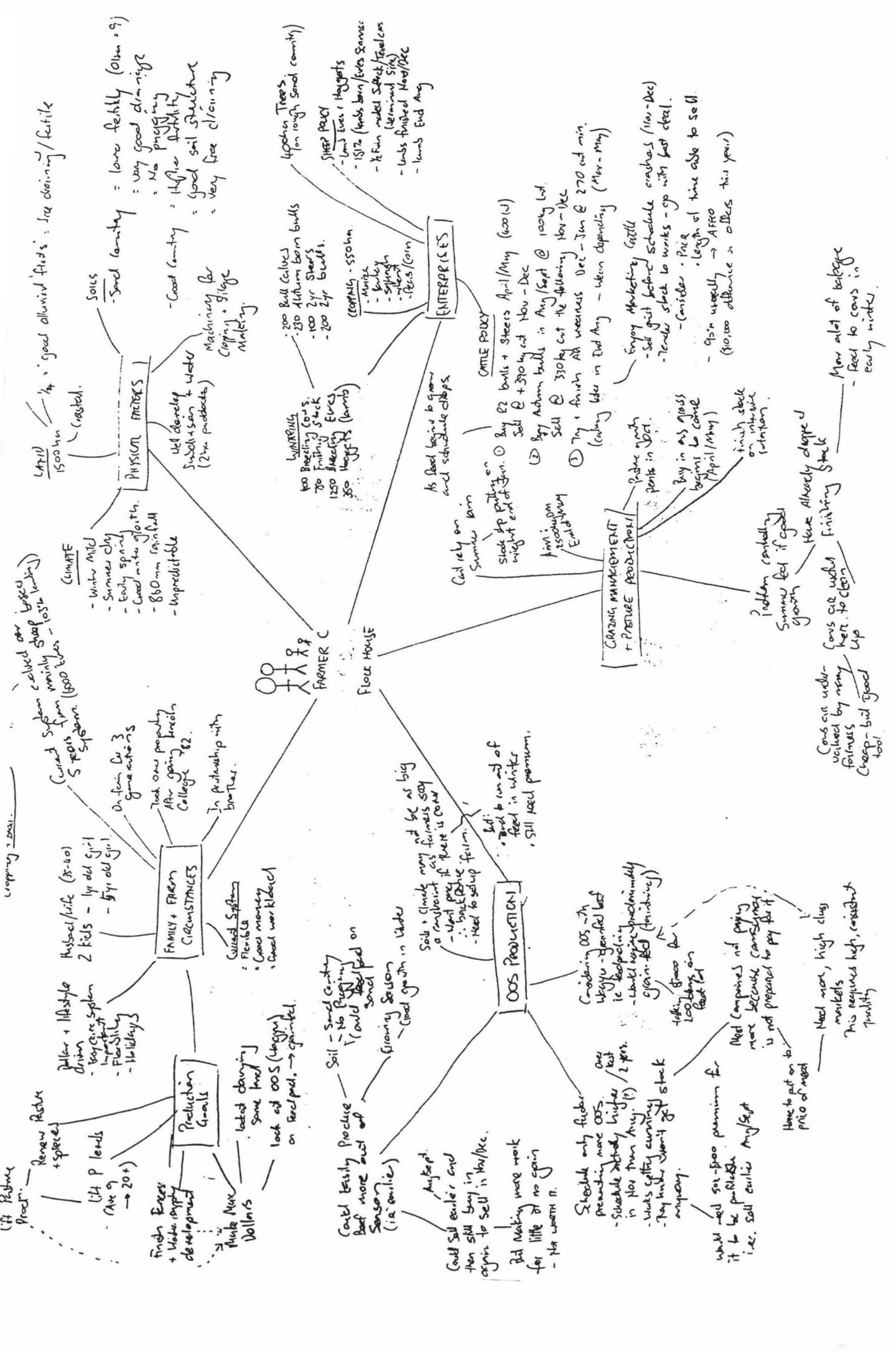
### ALIGNMENTS

- would need financing to get out of feed section (price or feed)

"Should you shut out the other end... how much can companies pay"

Difficult to supply at fixed times for breeders  
- easier for finishing  
- hard systems  
- would like to see fixed price -> needs to move with market  
- need ongoing incentive  
- \$2.00 in April/May needs to be \$3.00 in OOS

Future  
- No real reason for change  
- haven't got all eggs in 1 basket  
- System doesn't seem easy to change  
- Some farmers are just behind the trend = running to keep up in changing markets  
- "Innovation" would have something to do with it



## Appendix Two: Example of Matrix Completed during Interviews with Case Farmers

	Current.	All OOS	SHL	TRAD	Comb.
	<del>Base System</del>	<del>Alternative Base</del>	<del>OOS System 1</del>	<del>OOS System 2</del>	<del>OOS System 3</del>
• Feed Supply.	4	2	2	5	3
• Girand change.	4	1	2	5	4
• Pasture Quality	4	1	3	5	3
Type of Country.	5	3	3	5	3
Ease of Management.	5	2	2	<del>5</del>	<del>3</del>
Risk.	Prod / Price 5 / 2	2 / 5	2 / 3	5 / 1	4 / 3
Financial Advantage.	5	2	3	5	3

Rating each factor from 1-5 in terms of its effect on the use of the given system.

For every factor: 1 = negative, bad

5 = positive, good

## Appendix Three: Summary of Matrices Completed during Interviews with Case Farmers

### Matrix Interview Summary - Farmer A:

Factor	System	Rating	Comments
Feed Issue	Current OOS/Shlder	4	The feed implications would be major factor. Would simply run out of feed if finishing all OOS. Would have to reduce numbers by a lot more (than calculated using S.P). Likely to have to conserve more pasture as silage which is a big cost, have to have the machinery too. The easiest time to carry stock is over the spring/summer period, its better suited to pasture supply.
	All OOS	1	
	All Shoulder	3	
	Shder/Trad	5	
Compatibility with Cropping System	Current OOS/Shlder	4	Cropping and wintering cattle do not go well together because cattle destroy soil structure. At the same time the current cropping system requires that numbers are decreased by Nov/Dec. Half the property is in crops over the summer therefore this requires to have cattle off early.
	All OOS	2	
	All Shoulder	3	
	Shder/Trad	3	
Ground Damage	Current OOS/Shlder	2.5	This is a major factor on this country. Cattle can easily pug the ground given the soil type and wetness during winter. This has adverse effects on cropping and spring pasture production. Used to have a runoff on some sand country which meant we could winter more cattle.
	All OOS	1	
	All Shoulder	4	
	Shder/Trad	5	
Type of Country	Current OOS/Shlder	3	This is not good cattle wintering country. Probably already finishing too many OOS. Cattle can do a lot of damage in winter to soil structure. Would be better on a more free draining soil or where it does not get as wet during the winter. Also it is difficult to have enough feed at that time, this is also affected by wet conditions. Even if you do have the feed it is easily tramped into the mud at that time of year. This country would be more suited to shoulder or traditional production but that just doesn't fit in with cropping system.
	All OOS	1	
	All Shoulder	2?	
	Shder/Trad	2?	

Factor	System	Rating	Comments
Financial Advantage	Current OOS/Shlder	4	While money is better for OOS, with all the changes required for All OOS would not be as profitable. Would have to reduce numbers etc., and it would also affect cropping system. Current beef system fits in better with cropping system and benefits from some of the OOS premiums. A traditional system would require reducing cropping and would have lower cattle returns because selling in peak.
	All OOS	2	
	All Shoulder	3	
	Shder/Trad	2	
Price Risk	Current OOS/Shlder	3	Risk of getting a bad price is higher during traditional periods. Really guaranteed a premium during OOS.
	All OOS	3	
	All Shoulder	2	
	Shder/Trad	1	
Production Risk	Current OOS/Shlder	3	Production risk gets higher to more you finish OOS. Its more difficult to finish at this time of year, and you are more prone to adverse conditions like a wet or very cold winter.
	All OOS	2	
	All Shoulder	4	
	Shder/Trad	4	
Preferences/Goals	Current OOS/Shlder	3	Overall current beef system is most preferred. Fits in better with the rest of the enterprises (crops) as it not as harsh on soil structure than All OOS, and gets cattle off early to allow for cropping system. An all OOS system just isn't practical for this property. A more traditional system would be easier to do. The easiest time to carry stock is through the spring and summer, but that is why prices are lowest in the autumn and high in the spring.
	All OOS	1	
	All Shoulder	2	
	Shder/Trad	3	

## Matrix Interview Summary - Farmer B:

Factor	System	Rating	Comments
Winter Feed Supply	Traditional	4	The more beef you sell OOS the more pressure there is over the pinch period. Will also eat into sheep feed. Would have to reduce stock numbers to finish more over this period. Overall the traditional systems would be better suited to feed supply.
	All OOS	2	
	½ OOS	3	
Pasture Quality	Traditional	4	Selling all beef OOS would mean it would be difficult to control and utilise spring flush. Would need cattle on at that time which would mean buying in on the grass market if not careful. The need to save more pasture to feed OOS stock in winter would also decrease pasture quality.
	All OOS	2	
	½ OOS	3	
Ground Damage	Traditional	3	Carrying big cattle in the winter can make a big mess (ground damage). The more cattle wintered, especially at higher weights, the bigger the mess. This can really effect subsequent pasture production.
	All OOS	1	
	½ OOS	2	
Type of Country	Traditional	4	A lot of it comes down to the type country you have and how suitable it is to finishing cattle OOS. Areas with dry, mild winters and good drainage are likely to find it easier.
	All OOS	1	
	½ OOS	3	
Ease of Management	Traditional	5	Not great differences in management. There is more need to transfer pasture to the winter and control summer quality which would increase feed management required.
	All OOS	3	
	½ OOS	4	
Financial Advantage	Traditional		The more stock you can carry over a pinch period the higher your potential profit. But there are feed and ground damage constraints to balance against this. Would be good for cashflow to be selling stock OOS.
	All OOS		
	½ OOS		
Risk	Traditional	4	Not any more price risk selling OOS, in fact probably guaranteed higher price. But would be more risky to sell all stock at one time. Would want to spread risk by selling at more traditional times as well. More prone to wet, cold winters if wanting to finish OOS. Would need to have some flexibility.
	All OOS	3	
	½ OOS	4	
Preferences/Goals	Traditional	4	A lot of it comes down to management preferences and how you perceive the difficulties of producing OOS and the premium at that time of the year. Overall it is a balancing act (potential profit vs. constraints). My preference is to aim to finish cattle on shoulders. That way you still get a decent premium and its a lot easier to have cattle ready in Nov/Dec or Jun/Jul than OOS. Will avoid peak kill times when prices very low. Its a good compromise which suits my preferences and this type of country.
	All OOS	2	
	½ OOS	3	

### Matrix Interview Summary - Farmer C:

Factor	System	Rating	Comments
Winter Feed Supply	Current	4	It is more difficult to have feed available during the winter, therefore its harder to carry and finish stock at that time. Would need to set up system to budget feed into that period. This would be suited to a more intensive (better subdivision) system that can control feed intakes better. Would also tighten feed for ewes. Would look at getting lambs off earlier, and increase priority to cattle. Also likely to require use of more supplements which increases costs. A traditional selling system definitely fits best with feed supply.
	All OOS.	2	
	All Shoulder	2	
	All Trad.	5	
	Combination	3	
Pasture Quality	Current	4	The more OOS systems which sell stock earlier would result in less control of spring flush which would reduce overall pasture quality. A major reason for having cattle is to control pasture quality.
	All OOS.	1	
	All Shoulder	3	
	All Trad.	5	
	Combination	3	
Ground Damage	Current	4	The OOS systems will cause worse pugging, especially with the heavier cattle (i.e. 3ys vs. 2yrs). Ground damage would be a big consideration. Would have to concentrate on finishing progeny as 2yr olds.
	All OOS.	1	
	All Shoulder	2	
	All Trad.	5	
	Combination	4	
Type of Country	Current	5	Any of the systems could be done on my country as its reasonably easy. Would just involve adaptation of management. Overall this would not be a big factor compared to others on harder hill country. However the systems finishing at more traditional times would be more suited to country given feed supply and quality, and pugging issues discussed above.
	All OOS.	3	
	All Shoulder	3	
	All Trad.	5	
	Combination	3	
Ease of Management	Current	5	All would be as easy to manage if you set up a good management system. In general the OOS systems would involve more careful feed management and budgeting. Have to 'make' feed for the winter. More traditional systems would not need to be as intensive.
	All OOS.	2	
	All Shoulder	2	
	All Trad.	5	
	Combination	3	
Financial Advantage	Current	5	Would not be financially worth it to produce all OOS given the costs and constraints (above). While money is not good for cattle in traditional months it is better suited to the current set up (intensity etc.).
	All OOS.	2	
	All Shoulder	3	
	All Trad.	5?	
	Combination	3	
Risk - Production	Current	5	OOS systems require making feed available at a time when the environment is against you. You are more prone to a bad winter (wet, cold). There is more chance of not having the feed at that time of year.
	All OOS.	2	
	All Shoulder	2	
	All Trad.	5	
	Combination	4	
Risk - Price	Current	2	The more OOS systems have an advantage here. You are almost guaranteed a premium. The problem with selling in the autumn is that you are competing with a lot of other sellers, so the schedule is hopeless.
	All OOS.	5	
	All Shoulder	3	
	All Trad.	1	
	Combination	3	

Factor	System	Rating	Comments
Preferences/Goals	Current	3	The current option suits at the moment given its ease of management with an extensive system. The money is potentially better the more OOS you go but with the management implications it would not be worth doing All OOS. Overall I would aim to move to the Combination system with only a proportion being sold OOS and the rest sold on the shoulders and traditionally. This covers all options, spreads risk, and improve cash flow. At the moment selling far too much stock traditionally. Starting to intensify system now which is make more shoulder and OOS production more achievable.
	All OOS.	2	
	All Shoulder	3	
	All Trad.	2	
	Combination	5	

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