IMPLEMENTING A QUALITY PROGRAMME

ON A SEASONAL SUPPLY DAIRY FARM

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ABSTRACT

As the dairy industry becomes more customer-focused dairy farmers are being encouraged to adopt a formal approach to quality management. At the same time milk processing companies are examining the procedures used to ensure milk collected from farms is of the "finest" standard as part of their strategy to move from commodity sales to added-value products. In addition, milk quality and milk payment parameters have changed over the last decade to reflect the more valuable components of milk (protein versus fat), the pattern of production through the year (shoulder milk premiums) and the absence of quality faults (grades). Animal welfare and resource management are also important quality 'factors' in the dairy industry. As New Zealand seeks to enhance its "clean green" image, farmers are coming under the scrutiny of quality conscious customers seeking to ensure that the highest standards of animal husbandry, land management and food production are practiced.

Parameters for milk quality at the vat (farm-gate) are well documented and strict testing procedures are in place at milk processing sites. However, procedures and practices necessary to consistently produce finest quality milk are not so obvious. To address this shortcoming a study was conducted to design and implement a Total Quality Management (TQM) programme at Massey University's No.4 dairy farm, a 450 cow seasonal supply dairy farm. A monthly management calendar was developed to aid in consistently achieving key farm management activities. A supplementary monthly diary sheet was also designed to allow comprehensive recording of farm and herd data that are pertinent to the assurance of product quality. Computer software was utilised to model, record and monitor farm physical and financial performance.

The key attribute of the TQM programme was to ensure that staff were willing and able to implement the management systems put in place for assuring quality milk production. This required staff training and development, and recognition for tasks completed well.

The implementation of a TQM programme can lead to measurable rewards in improved physical and financial performance. The programme also ensures compliance with the legislation governing animal welfare, resource management, employment and occupational safety and health. Job satisfaction for staff and assured milk quality are seen as a key benefits.

Keywords: Total Quality Management (TQM); milk quality; dairy farm management; Quality Assurance (QA).

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Special thanks to my partner Sue and children Amy-Jane and Ben who have put up with the mood swings, frustrations and sometimes unreasonableness of an adult student.

This is not a definitive study but merely the basis for an ongoing refinement of the TQM philosophy for the farm's objective of "***Excellence in the Production of Seasonal Milk***"

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LIST OF ABBREVIATIONS

AGMARDT	Agricultural and Marketing Research and Development Trust
AI	Artificial insemination
APA	Animal Protection Act
AWA	Animal Welfare Act
BW	Breeding Worth
CAG	Commercial Activities Group
CCCM	Computer Concepts Cash Manager
CIDR	Controlled Internal Drug Release
CS	Condition score
DM	Dry matter
ECA	Employment Contracts Act
EEC	European Economic Community
EFS	Effective farm surplus
GIB	Game Industry Board
HASE	Health and Safety in Employment
HT	Herd test
ISO	International Standards Organisation
LIC	Livestock Improvement Corporation
LW	Liveweight
MAF	Ministry of Agriculture and Fisheries
MF	Milk fat
MQA	Milk quality assurance
MS	Milk solids
NZ	New Zealand
NZDB	NZ Dairy Board
NZOQ	NZ Organisation for Quality
OSH	Occupational Safety and Health
PGR	Pasture growth rate
PSC	Planned start of calving
QA	Quality assurance

QM	Quality Management
RMA	Resource Management Act
SAMM	Seasonal approach to managing mastitis
SCC	Somatic cell count
SGS	Societe Generale de Surveillance
SNF	Solids non fat
SR	Stocking rate
TELARC	Testing Laboratory Registration Council
TMP	Tui Milk Products
TQM	Total quality management

Chapter One

1.0 INTRODUCTION

During the past decade New Zealand (NZ) farmers have been exposed to a `Free Market Economy'. This has included the removal of subsidies and tariffs, and the floating of the currency exchange (Sandrey *et al.* 1990). Other major changes have included the introduction of the: Resource Management Act (RMA), Animal Welfare Act (AWA), Employment Contracts Act (ECA) and Health and Safety in Employment Act (HASE). All of these economic and legislative changes have impacted on the management of dairy farms (see for example, Gardner, 1996; Morriss, 1995). The Porter Report (Crocombe *et al.*, 1991), commissioned by NZ Government, promoted strategies to increase NZ's competitive advantage in the global market place. In the dairy industry section of the report, an acceleration in the shift from commodity to differentiated products was recommended.

The New Zealand Dairy Board's (NZDB) strategy has been to lessen dependence on uncertain lower value commodity markets and direct as much product as possible into higher value consumer products by using branding and specialised industrial markets that require sophisticated products with specific functional properties (Laugh, 1994). The rapid escalation of product diversification and niche marketing, particularly of value-added product *versus* commodity product, has created the need to provide greater `Quality Assurance'; a guarantee that the product supplied is to specification. As customers, through the major supermarkets, set more rigorous standards of product specification, audit procedures required for compliance become more exact.

The NZ Dairy Industry produces 20% of NZ's exports by earnings (NZDB, 1994). Thus, strategies employed by the NZDB are important not only for the industry itself, but also for the NZ economy. The industry is continuing to "sharpen" its customer focus and is requiring farmers to ensure the milk they supply is consistently of the highest quality. Implementing an on-farm quality programme is a means of ensuring that these high quality standards are met, legislation is complied with and profitable production is encouraged.

1.1. PROBLEM STATEMENT

Market demand for "quality assurance" for dairy products requires that every dairy farm activity be arranged in a cost effective way which ensures that a product (milk) is designed, built and delivered to meet the final customer needs and expectations (Dahlgaard, *et al.*, 1994 cited by Londono, P.G. 1996). Quality management will be a success and of positive benefit to the industry if all dairy suppliers are prepared to accept full responsibility for the quality of their work, are dedicated to their role in the milk production and harvesting process, and always consider the customer's requirements as paramount. Quality Management requires planning, quality control and the documentation of the important aspects of milk production and harvesting. The supplier must always follow the documented procedures. The fact that this is done is confirmed by an independent auditing body (Farm Dairy Code of Practice, 1994 P1.1 paragraphs 2,3 verbatim). The standards farmers are expected to meet are specified, but the process for achieving them and the documentation to show that the processes have been correctly followed is not.

1.2 PROJECT PROPOSAL

The purpose of this study was to develop a Total Quality Management (TQM) programme for a seasonal supply dairy farm. The overall aim was to put systems and procedures in place on a case farm to assist management achieve its goal of "Excellence in the production of seasonal milk".

1.3 OBJECTIVES

This thesis reports on the process involved in introduction of a TQM programme on a seasonal supply dairy farm. The specific objective of introducing it is to ensure farm milk production is of the highest standard and that this is achieved by "best" method and practice. A literature review, Chapter 2, of relevant dairy industry components was undertaken to establish a background for the study. A detailed description of the case farm used in the study is presented in Chapter 3. Systems and procedures, either existing, introduced or modified for controlling TQM on farm, are presented in Chapter 4.

Chapter Two

QUALITY IN THE NZ DAIRY INDUSTRY

In this chapter the NZ dairy industry is backgrounded. Industry structure, milk production and price are reviewed, as well as factors affecting 'Milk Quality'. Legislation affecting on-farm production and practice is also examined.

2.0 THE NEW ZEALAND DAIRY INDUSTRY

The NZ dairy industry is primarily based on milk production from pasture (Holmes and Wilson, 1987). The dairy farm systems have been developed to match seasonal pasture growth. Ninety percent of dairy cows in NZ calve in early spring (August-September), conceive in late spring (October-November) and are dried off in late autumn-early winter (April-May) (Bryant, 1982). Accordingly, milk production is closely related to the seasonal pattern of pasture growth (Livestock Improvement Corporation, 1994). Maintenance of a 12 month production cycle is critical for maintaining the pasture demand and supply balance. Per hectare (ha) milk production is governed by the strategic decisions: calving date, stocking rate (SR) and drying off date (Holmes, 1987).

2.1. INDUSTRY STRUCTURE

From its origins last century, the NZ dairy industry has evolved to its present vertically integrated structure of independent land ownership (14,700 farms, 2.9 million cows) with a co-operative structure for product processing (15 companies in 1996; Figure 2.1). The industry is controlled by a statutory body, the New Zealand Dairy Board (NZDB) established under the Dairy Board Act of 1961. The NZDB's primary function is to undertake the export marketing of all dairy products from NZ (NZDB, 1994).

Ninety percent of NZ's milk production is exported, although this represents only 1.5% of world milk production. NZ has access to only 5% of world trade in milk products. As an exporter/marketer, NZ is second only to the European Economic

Community (EEC). The NZDB has a policy of controlling nearly all the value links in the milk chain from cow to customer ('Tit to Lip') (vertical integration) (NZDB, 1995).

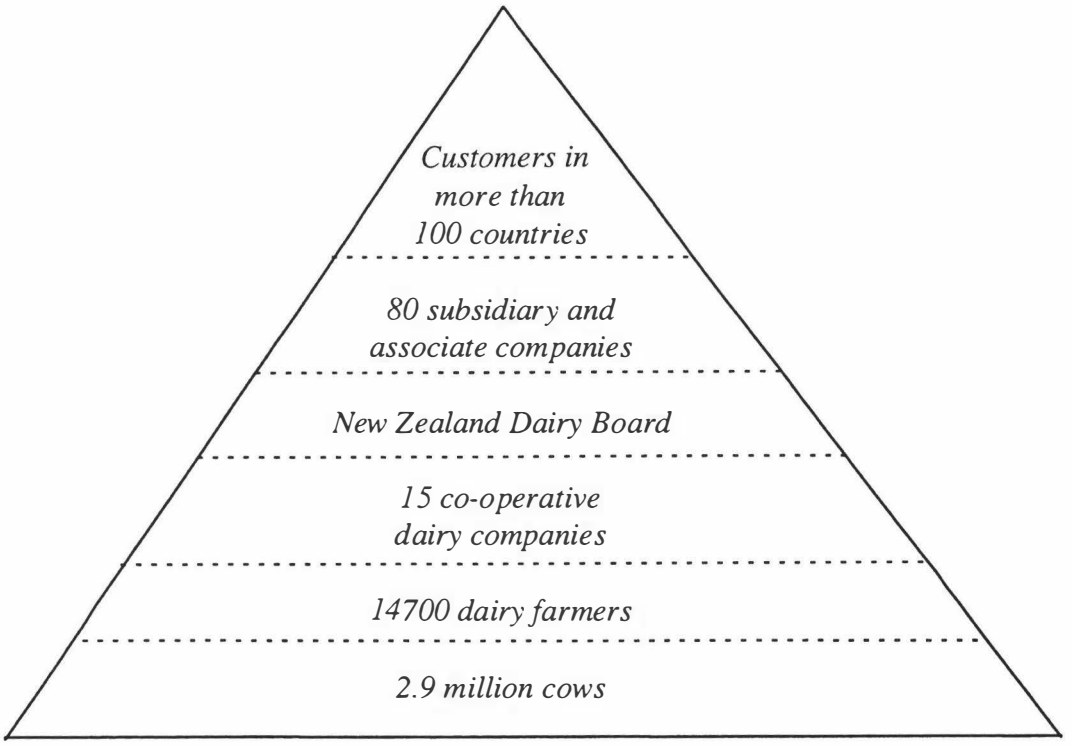

Figure 2.1 *Structure of the NZ Dairy Industry (NZDB, 1994) modified to show 1996 statistics*

Since 1971 the number of dairy companies has decreased from 100 to 15, yet more milk is now processed than previously (Table 2.1). Amalgamation and rationalisation have created larger and more efficient manufacturing operations and NZ now has some of the largest and most technically advanced plants in the world (NZDB Public Affairs, 1996). In the period from 1974 to 1996 total NZ milk production increased from 425 million kilograms milksolids (kgMS) to 788 million kgMS. In the same period, cow numbers increased from just over 2 million to almost 3 million. The number of herds decreased from 18,540 to 14,736 (Table 2.1, Figure 2.2).

Crocombe *et al.* (1991) illustrated the decline in the real value of milkfat for the period 1973-1989 (Figure 2.3). These trends have forced the NZDB to implement strategies aimed at product and market diversification to increase product returns (ie. an added-value strategy). Declining real returns have also encouraged farmers to

increase production, both through improved management and increases in farm and herd size (LIC, 1996)

Table 2.1 *NZ milk production 1974/75 to 1995/96, number of herds and cow numbers (LIC, 1996).*

Summary of milk production and herd statistics since 1974/75

Season	*Milksolids processed (Million Kg's)*	*Herds*	*Total Cows (000's)*
1974/75	425	18540	2080
1975/76	466	18442	2091
1976/77	479	17924	2074
1977/78	437	17363	2052
1978/79	477	16907	2040
1979/80	506	16506	2046
1980/81	491	16089	2027
1981/82	491	15821	2061
1982/83	505	15816	2128
1983/84	564	15932	2210
1984/85	578	15881	2280
1985/86	609	15753	2321
1986/87	524	15315	2282
1987/88	579	14818	2236
1988/89	541	14744	2269
1089/90	572	14595	2314
1990/91	599	14685	2402
1991/92	637	14452	2439
1992/93	651	14458	2603
1993/94	736	14597	2736
1994/95	733	14649	2831
1995/96	788	14736	2936

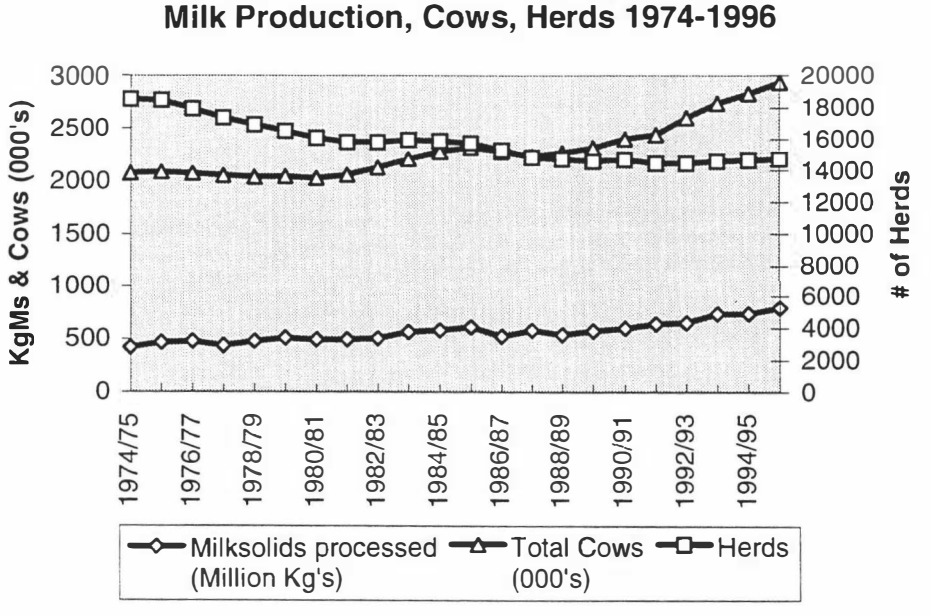

Figure 2.2 *Milk production, cows and herds 1974/75 to 1995/96 (LIC, 1996).*

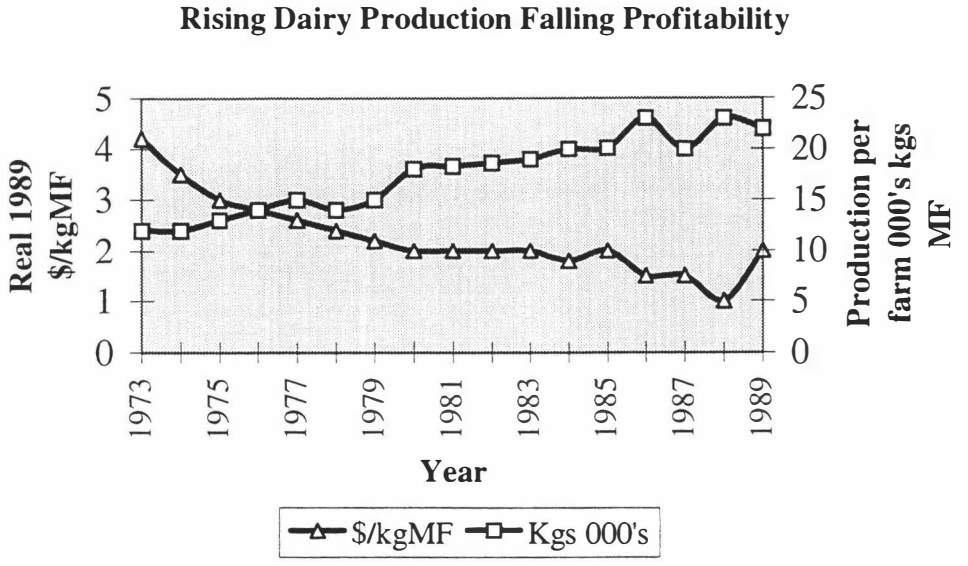

Figure 2.3 *Dairy production (note kg milkfat (MF) in real (1989) $ value/kgMF. (NZDB as cited by Crocombe et al., 1991).*

As reported earlier, 90% of milk produced is manufactured and exported from NZ. The NZDB purchases dairy product from the co-operative dairy companies and sells it through a world-wide marketing network of associate and subsidiary companies, distributors and agents. The NZDB is essentially a 'monopoly' business within NZ (but not internationally) with the Board's export control (statutory) ensuring critical mass to the export marketing business. Competition between the dairy companies under the NZDB's influence ensures that they lower manufacturing costs, improve quality and invest in new technology (NZDB, 1994).

The NZDB's formal marketing 'vision' is:

> "To be the world's best dairy marketing organisation, achieving superior and sustainable returns from NZ milk products by:
> Pursuing an aggressive consumer strategy to position branded products in selected high return and fast growing markets.
> Focusing on a selective ingredient strategy to achieve high profits" *(NZDB, 1994).*

Mitchell (1995) stated that "The strategic aims of the Board will remain fruitless without a total commitment to quality. As our mission statement suggests, quality essentially begins at the farm gate...". The Board therefore oversees quality control in all areas of the industry. This includes on the farm (e.g. through milking shed inspections and random checks on milk quality), in the dairy factories, and within the NZDB. The aim is to implement the principles of 'TQM'. Certification for ISO 9000 (the Quality System Standard) is being pursued.

2.2. PROCESSING INDUSTRY

Fifteen co-operative dairy companies process NZ's total milk production which in 1995/96 was 786 million kgMS. Kiwi Dairies Ltd is the second largest group of the processing companies operating in NZ since its merger with Tui Milk Products (TMP) Ltd. in August 1996. The latter company was supplied by 1306 farms that produced 869,047,058 litres of milk in the 1994/95 season.

The TMP's mission statement was: " To maximise the sustainable income of TMP shareholders by being a preferred supplier of dairy products to its customers" (Murdoch 1994). In 1995 TMP Ltd. implemented a formal quality system in accordance with the ISO 9000 service standard . This was in response to the company's increased emphasis on food quality and quality assurance. TMP's philosophy was to ensure its customers received product of the highest quality. "The company must not only maintain its own processing standards, but also ensure that product received from its suppliers is also of the `highest quality' " (TMP, 1995). The company insisted that some of its suppliers were also ISO 9000 accredited, for example, packaging suppliers, transport and shipping services (Murdoch, 1994). Most other milk processing companies have similar formal quality systems.

The main component of the milk processing industry (in this instance, TMP) is raw milk purchased at the farm gate. Already subject to certain quality standards, it seems almost certain that a greater measure of Quality Assurance will be required in the

future as the NZDB, through the individual companies, endeavours to seek a greater market share through guaranteeing the customers a quality product.

Murdoch (1994) suggested that, in future, systems must be in place to provide assurance to customers of continued excellence in the supply of milk product. Standards for dairy facilities and their surrounds must improve over time. There will be an increasing focus on producing 'true milk'. There will be a requirement to demonstrate that systems are in place to prevent the occurrence of grades. Quality systems will feature documented plant cleaning routines, animal health programmes and staff training programmes.

Adoption of a formal approach to on-farm 'quality assurance' is seen as benefiting the farm business, as well as meeting the processing companies objectives for milk quality. The TQM approach was adopted because its philosophies best meet the requirements for quality auditing .

2.3. MILK PRICE

Payment for product by the NZDB is governed by the Dairy Board Act (1961). Through the Act the NZDB is required to pay the processing companies a base price for milk, plus average milk collection and manufacturing costs. As well, an allowance is paid for interest and depreciation on processing plant. Larking (1988) described the payment system as follows:

"The milk price announced by the NZDB is determined from the basket of product realisation less selling and administration costs etc. incurred by the NZDB and may include an amount for transfer to its own reserve. The milk price is then converted by measured yield to arrive at the cost of milk solids (MS) per product. These figures assume a standard composition for milk. In practice this varies between geographic areas and breeds of cows" .

A company may pay for its milk supply as it chooses but there is an increasing tendency to follow a standardised system. "The ideal payment system should

recognise variations in milkfat, protein and lactose supplied in the milk as well as the pattern of supply during the season" (Paul, 1987/88). Most companies have adopted the (A + B) - C payment policy where A is the milkfat value, B the protein component value and C the volume processing charge (Storey, 1992). Some companies have introduced "cost of production" or "shoulder milk" payments to reflect the seasonal variation in milk production and greater cost of processing peak milk supply (Watters, 1995; Brookes, 1996). To shift the present pattern of milk production, it will be necessary to change farm feeding strategies for milking cows. A Livestock Improvement Corporation (LIC) study suggests that seasonal payments of less than 8 cents / kgMS for shoulder month production (outside the peak months of October-November) would not drive a change in farm management practices (Byles, 1995).

Currently the industry obtains 45% of its income from milkfat, and 55% of its income from protein and other non-fat solids. About 30% of gross returns are generated by products containing predominantly milkfat (butter and anhydrous milkfat), 33% by products containing predominantly protein or SNF (skim milk powder, casein, whey) and 37% by products containing significant quantities of both components (cheese, whole milk powder, butter, milk powder) (NZDB, 1949).

"Each farmer has an expectation of receiving revenue which reflects as far as is possible the true value of his/her milk to the company. The milk pricing system should provide farmers with an equitable method of payment, encourage farmers to make farm management decisions which will work to their advantage, provide market signals which reflect the market trends in milk component values and encourage farmers to modify the composition of milk, making it more suitable for modern dairy products" (Marshall, 1989).

2.4. MILK QUALITY

Regulations 4-10 of the Dairy Industry Regulations (1990) require that milk be produced in accordance with an approved product safety programme, and the Director-General of Agriculture must be satisfied that the product safety programmes meet certain minimum requirements before they are approved. The New Zealand dairy industry's quality management programme has three fundamental components. These are:

- compliance with food, safety and regulatory requirements;
- implementation of ISO 9000, an internationally recognised quality standard against which the New Zealand dairy industry's quality management system can be assessed ; and
- commitment to Total Quality Management (TQM), the continuous improvement of all business processes in relation to products, services and customers (NZDB Quality Handbook, 1995).

The farm dairy code of practice emphasises the concept of 'Quality Management' (QM) in the dairy industry. " The QM approach leads to increased efficiency and product quality through the prevention of quality failure, rather than reliance on finished product inspection. QM consists of doing the right thing, right first time at the least possible cost. It extends the 'Quality Assurance' (QA) systems already being put in place in the manufacturing area back to milk harvesting" (NZDB 1994).

Milk quality parameters typically examined for milk collected at the farm gate for factory supply are illustrated in Figure 2.4.

TEST	TEST OF MILK FOR	COMPANY STANDARD
SENSES	Any contamination detectable by sight smell or taste	Finest; First; Second Target = no contamination
BACTOSCAN	Bacterial contamination	Finest; First; Second A,B,C,D&E
THERMODEURIC PLATE COUNT	Contamination by thermodeuric (heat resistant) bacteria	Finest; First; Second Target < 100
SEDIMENT	Any physical contamination of milk- dust, manure	Finest; First; Second Target = no contamination
INHIBITORY SUBSTANCES	All things that inhibit bacterial growth • antibiotics • sanitisers • detergents	Finest; Target = no contamination
SOMATIC CELL COUNT	Measures the number of white blood cells or leucocytes in milk. Indicates mastitis and the milk quality	Finest; First; Second Target < 150,000
COLOSTRUM	Immune proteins - present in initial milk after calving and at the end of lactation	Finest; Second Target = no penalty
FREEZING POINT TEST	Excess water	Finest; Second Target = no excess water
PRIMARY COOLING	Temperature of milk at entry to bulk milk tank	Less than 18° C Target < 18° C the lower the better
TOXIC SUBSTANCES	Reduce the risk factor	Milk collection suspended if a hazardous condition exists Target = no hazardous goods stored at the farm dairy
REFRIGERATION	Temperature control	18° C to 7° C after 3 hours
CONTROL CHECKS	Supplier responsibility Must ensure that the company equipment is or has cooled the milk to the standard	As above

Figure 2.4 *Milk harvesting guide, tests and parameters for milk quality (TMP, 1995).*

In many cases dairy companies rely on dilution of an individual farmer's errors in the bulk of good milk sourced from other farmers (Bleaken, 1989). The milk pricing system is geared to satisfy the company's objective of receiving quality milk. The dairy company approach to ensuring a quality supply of milk from farm gate has generally been to penalise product failure. Payment for milk failing to pass the standard grade tests is reduced. A positive attitude toward quality should be enhanced, however, through a "carrot not stick" approach. The premium for protein can be seen as one of reward ("carrot"), though most other qualities are sought through a penalty ("stick") rather than a premium system.

It has been estimated that only 6% of NZ dairy farms supplied grade free (ie. received no penalty grades) milk in the 1995/96 season (Alfa-Laval, 1997). Dairy company policies referring to changes in somatic cell count limits and residues, especially DDT and antibiotics, forecast an even greater requirement for dairy farmers to meet strict quality criteria for milk supply. Implementation of an on-farm TQM programme is one way to meet this challenge.

2.5 QUALITY SYSTEMS

The purpose of any quality system is to demonstrate that products and services conform to agreed specifications. In order to obtain the quality required of product, management has to specify its objective, establish policies and a system of procedures to accomplish objectives, assign duties, delegate authority, set up adequate methods and standards of performance, and evaluate the results objectively (Australian Standards Authority, 1994).

Quality system auditing in New Zealand is relatively new. In fact, programmes for the implementation of quality systems and the training of auditors were not introduced until the early 1980's (Standards NZ, 1995). New Zealand now has two main bodies involved in the implementation and (certification) accreditation of quality systems namely the Testing Laboratory Registration Council (TELARC) and the Standards Association of New Zealand. In 1988, the New Zealand Organisation for Quality (NZOQ) led to the initiation of a project to develop criteria for an auditor registration

programme. This programme for "The Certification in Quality Systems and Auditing Principle and the Registration of Quality Systems Auditors" was implemented in 1988 (Minchin, 1994).

Quality is defined by the Standards Association of New Zealand as "The totality of features and characteristics of a product or services that bear on its ability to satisfy stated and implied needs", or more simply as, "Meeting the customer's requirements." Essential to the point of giving the customer quality, is the proposition that the customer not only exists outside the organisation but also within it. This is an important concept for the NZ dairy industry because, although the components (farmers, dairy companies, NZDB) are stand alone, the co-operative structure effectively makes it one industry. Registration for ISO 9000 accreditation must be obtained through one of the registered authorities. This was been done by Kiwi Dairies Ltd. in 1995. It is unlikely that farms will be required to register for ISO 9000, though standards required for the company's registration are likely to be passed on to the suppliers.

The Societe Generale de Surveillance (SGS) operates an international certification service for the wool industry (SGS Wool Testing Services) and an Agri-Division involved with grain, seed and horticultural certification . This Swiss-based group is the world's largest organisation in the field of quality assurance, verification and inspection (SGS International Certification Services, 1995). They specify that a successful on-farm quality assurance programme must:

- be simple and practical;
- be low cost with definable benefits;
- keep paper trails to a minimum;
- address the important issues not the extraneous ones;
- have associated training programmes;
- be capable of verification or audit; and
- address the key quality issues as defined by the purchaser.

Not surprisingly given their role, SGS believes that New Zealand producers need to move quickly towards development of on-farm QA programmes. Bradley (1995) argued that if this was done using the appropriate models, the basic building blocks

for introducing environmental management programmes would exist and this in turn would lead to certification of sustainable production systems .

2.6 TOTAL QUALITY MANAGEMENT

Total Quality Management (TQM) is "a total organisational approach for meeting customer needs and expectations that involves all managers and employers in using quantitative methods to improve continuously the organisation's processes, products and services" (Minkovich, 1991). The TQM approach is a management philosophy that leads to a structured system involving every employee in planning, running and improving an organisation. Employee involvement at every level is predicted on the needs and wants of the customer, which, in turn, form the basis of a commonly shared strategic plan that integrates business and quality goals. Rao (1996) outlines the basic principles of TQM as:

- "A value added ethic - continually strive to provide the best value to others.
- An external focus - listen to the customer and study the competition.
- Co-operation - be willing to work with other functions and in teams and respect the people with whom you work ".

The co-operative structure of the NZ dairy industry means that farmers are both owners and employees (ie. outside suppliers within the company). In most cases the farmer has only one customer, the local dairy company. However, through this company the farmer has many customers, predominantly located in a wide range of overseas markets. It is important that the farmers are treated by the company as being part of the overall "business" as opposed to being outside of it.

Though quality systems are well documented at the processing and marketing levels, there is little evidence of a "quality systems" approach at the farmer-or producer-level in the NZ dairy industry, or elsewhere in the international farming community for that matter. The notable exception is the NZ Game Industry Board (NZGIB) which has introduced a voluntary Quality Assurance (QA) accreditation system for its member farmers. The purpose of the programme is to underpin the quality branding of

'Cervena', the GIB's generic name for venison. The programme supports the GIB's "pasture to plate" quality strategy to ensure that NZ venison is recognised as a high quality premium product in the international market place (NZGIB, 1996). The Deer QA Farm Accreditation scheme is based on standards published in the Deer QA Farm Manual (NZGIB, 1993). The standards define desired outcomes for facilities, animal health, welfare and production, velvet and transport. "Industry quality programmes work at two levels - for the industry as a whole (what could be called the "Team NZ" approach) and for individual farms" (Riddiford, 1996; Figure 2.5).

TEAM NEW ZEALAND Quality Assurance	**YOUR FARM** Quality Improvement
Industry Insurance	Individual Improvement
Market Access • animal welfare • animal health • environmental issues	**Reducing waste** • bruising • hide damage
Food Safety • human health • residues	**Animal production** • growth rates • fawning • losses and deaths • velvet yields • genetic improvement • animal health
Animal welfare • velveting • outdoor wintering • transport	**Animal welfare** • velveting • "Five Freedoms"
Environment • sustainability	**Environment** • sustainability

Figure 2.5 *A Paradigm for industry ("Team NZ") and farm. Total Quality Management in the deer industry. Quality assurance strategy (source NZGIB, 1996).*

Stevens (1996) stated "All QA schemes are designed to ensure that farms, businesses or industries get it right, on time, every time. The Deer QA programme is no exception". This philosophy is applicable to the NZ dairy industry.
In 1994 the New Zealand Society of Farm Management (Inc.) undertook the task of developing quality guidelines for agricultural consultants. A comprehensive manual was developed with funding from the Agriculture and Marketing Research and Development Trust (AGMARDT) and Hodder and Tolley (N.Z. grain and seed merchants). Although a manual was developed and presented to the Society's Farm Management Seminar at Flock House in August 1994, no published evidence of its on-farm application has yet appeared.

Davidson (1994) stated " Quality in agriculture production systems will require a major effort by consultants and farmers alike. We do not envisage each farmer being registered to ISO 9000 in the short term, but we do see systems being put in place which reflect the spirit of total quality management". The introduction of a TQM programme is consistent with this statement.

Bay Milk Products Ltd. has a milk quality assurance (MQA) programme for its suppliers, though this is primarily concerned with milk harvest and storage compliance. Statistics recently released show that the programme has successfully reduced the incidence of first, second and poorer grades of milk. The MQA programme is based on the "Achiever Programme" (MAF Quality Management, 1995). Training and accrediting 47% of Bay Milk's suppliers resulted in 92% of accredited suppliers achieving "A" classification for sanitation of milking plant, compared with 62% for the non-accredited (untrained) group. Of the suppliers in the Achiever Programme, 39% supplied grade free (100% finest grade) milk during the 1992/93 season, compared with 19% for the balance of suppliers (Pitchers, 1995).

The Bay Milk Products Ltd. MQA programme is based on a reference manual (1992) developed by the Ministry of Agriculture and Fisheries (MAF) and is Crown Copyright. The approach has been to encourage milk suppliers to join the scheme for a fee which entitles them to a copy of the manual and additional support from a milk quality advisor. The manual emphasises a Quality Management (QM) approach.

Listed benefits are:

- the system will improve;
- penalties will be eliminated;
- costs will be reduced;
- time will be saved;
- job satisfaction will increase; and
- Bay Milk Products will benefit which will in turn benefit the supplier.

Although the manual covers 11 areas that affect milk quality, these do not include land, pasture/crop (other than milk taint) or labour. The 11 areas are all covered in the 'Farm Dairy Code of Practice' (NZDB, 1994) and are mainly concerned with components that come under the direct control of the dairy company. In implementing a TQM programme for Massey University's No.4 dairy farm, it was proposed that the coverage be extended beyond the farm dairy.

2.7 OTHER COMPONENTS OF QUALITY IN THE DAIRY SYSTEM

Farm production and practice in NZ is governed by a number of legislative requirements. These requirements are administered at both a Government and local body level. Increasingly, there is a demand for transparency of the procedures used to comply with these regulations. Morriss (1995) stated that "As the world becomes increasingly committed to environmental issues, the number of 'green' products may gain a competitive edge. Competitive environmental advantage for NZ's agricultural produce would then come largely from the quality of our production processes, proof of the natural farming conditions in which products are produced and the relatively low levels of inputs required over the whole process from paddock to plate. Differences between NZ's farming systems - our climate, pastures, soils and animal care - and those of our competitors can be compared to NZ's advantage".

2.7.1 The 1991 Resource Management Act

The main components of the Resource Management Act (RMA) concerning New Zealand dairy farms relate to:

- effluent disposal;
- nutrient supply;
- chemicals - (weed and pest control); and
- water rights.

There is also a local requirement that industry should nor `pollute' or compromise the long-term viability of New Zealand's natural resource (Resource Management Act, 1991). The RMA differs from existing legislation in that it has a single, clear and over-riding purpose: to promote the sustainable management of natural and physical resources. Section 5 (2) of the Act defines sustainable management as "the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and committees to provide for their social, economic and cultured well-being and for their health and safety while:

- sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations;
- safeguarding the life supporting capacity of air, water and soil ecosystems; and
- avoiding, remedying, or mitigating any adverse effects of activities on the environment" (Guide to the Resource Management Act, 1991).

An important aspect of the Act in relation to the NZDB marketing strategy is the promotion of New Zealand's `clean green' image in the international market place. Fostering consumer demand based on an increasing demand for `natural' products is an important strategy for the NZDB to diversify NZ product from that of competitors (NZDB, 1996). "Quality" in environmental terms will extend beyond product specification to the way in which it has been produced and in the way lapses are detected and put right (Morriss *et al.*, 1995).

As a consequence, any QA programme must account for the requirements of the RMA. The most notable effect of the RMA for No.4 dairy farm has been on the way dairy shed effluent is discharged (see Chapter 4).

2.7.2. Animal Welfare

The farming of dairy livestock in New Zealand is governed by the Animal Protection Act (APA) (1960). Since the passage of the Act, animal welfare considerations have become increasingly important both within New Zealand and internationally. Practices once deemed acceptable (e.g. induction of dairy cows, tail docking (NZSAP, 1995), and dehorning (NZSAP, 1996)) are now being reassessed and modified according to new knowledge and changing attitudes. A high standard of animal welfare is not only important legally, but also has direct economic benefits because it is necessary for continued international market access (Animal Welfare Advisory Committee, 1994).

Of major concern to the New Zealand dairy industry is the activities of the `Animal Welfare Lobby', particularly the animal rights activists in Britain and the EC. In recent years, their activities against such practices as tail docking, dehorning and live shipment of animals have become more public and in many cases, the law has upheld their protests (Anonymous, 1994). There are a number of issues for NZ dairy farmers in relation to the APA.

The practice of tail docking first became common when herringbone "pit" sheds were introduced, as a means of reducing urine and faeces splash to the milking staff. It is now less common, though still prevalent in many New Zealand herds (Matthews *et al.*, 1995). A recent survey of attitudes to farm animal welfare issues indicated that about 60% of the general (non-farming) public had concerns about tail docking (Matthews *et al.*, 1994). Worker health consideration is now less of a factor with the control in herds of particularly leptospirosis and brucellosis, both communicable animal/man diseases (zoonoses).

Where dehorning is performed on cattle under 20 months of age, the method used must not now cause unnecessary pain, suffering or distress. For animals over 20 months of age an effective anaesthetic must be used. The effect of dehorning on young animals is currently being evaluated (Stafford, 1996).

Live shipment of animals is not as yet a concern to the New Zealand dairy industry although transport of calves (particularly 4 day old bobby calves) is covered by regulation (APA, 1960).

Induction of calving however, is of major concern in the NZ dairy industry. This involves the use of hormones to induce calving prior to the end of the normal gestation period (MacMillan, 1992). While this provides for a compact calving and a likely increase in lactation length in most cases, it is usually at the expense of a live calf. Veterinarians are already concerned by the increase in demand for this practice. Its use may increase as the milk/meat value ratio increases. In the future, limitations may be placed on the number of cows in a herd that can be induced in any one season (e.g. 5%), and then only as a planned response to mating difficulties outside the control of the farmer. Consequently, farmers may have to choose between a shorter lactation length (spread calving) and/or carrying a higher number of replacement heifers to enable the culling of cows not conceiving within the desired mating period. In most cases the latter is usually the more expensive. Alternatively, and probably less expensively, farmers can improve the feeding level of their herd leading up to mating to ensure a high conception and submission rate (Bryant, 1990).

The case farm in this study has a policy of reducing inductions by limiting the mating period to give a 2 month calving spread and carrying sufficient replacements for cows not in calf.

2.7.3. Labour and the Employment Contracts Act

An essential component of any farm business is labour whether it is provided by the farm owner, hired or contract labour. With the increase in herd size, notwithstanding increases in efficiency and the increase in corporate investment in dairy farming, the reliance on skilled dairy farm workers is increasing (Ellis, 1997). There is a perceived shortage of skilled labour either through increased demand or reduced availability due to competition from other industries (Reid, 1997). The demand/supply imbalance for good farm staff means employees are able to demand employment standards in line

with their desire for quality employment. The case study farm (No.4 Dairy Farm) offers staff salaries that are in line with industry standards. Conditions of employment, especially with regard to weekend time off, are believed to be more favourable than the industry in general (see Chapter 4.3).

2.7.4 OCCUPATIONAL SAFETY AND HEALTH

Health and safety in the workplace (in this case the NZ dairy farm) is governed by the Health and Safety in Employment Act (HASE) 1992. The general duties for employers under HASE are to take all practicable steps to:

- provide and maintain a safe working environment;
- include employees in the development of health and safety procedures;
- identify hazards and apply practical controls to significant hazards;
- provide and maintain facilities for the safety and health of employees;
- ensure that any machinery or plant that employees use is safe;
- ensure that any processes that employees are involved in will not adversely affect their health or safety;
- provide employees with information on workplace hazards, and ensure that employees are trained and supervised;
- record and investigate workplace accidents and illness, and report any that constitute serious harm; and
- develop procedures to deal with emergencies which may arise at work (OSH, 1996).

Currently the requirements for provision of a 'safe' environment extend to all visitors to the farm. This provision is currently being appealed (Federated Farmers, 1996). To comply with the legislation, farmers need to implement a programme to identify hazards and assess their significance. The programme should be on-going. These actions need to be documented. OSH inspectors will seek evidence that an employer has a compliance programme in place (Gardner, 1996).

2.8 CONCLUSION

The literature review indicates that on farm "quality assurance" in production and practice is becoming increasingly important and an essential element in obtaining market share and access. Compliance with current legislation and regulations in the dairy industry is likely to be more closely monitored in the future. The ability to present documented evidence of the practices and procedures used for milk production are a requirement of any quality programme. These requirements will not only provide the dairy farm customer with "proof of product", but should also enhance the overall performance of the dairy farm business. The business at the centre of this study (No.4 Dairy Farm) is described in Chapter 3, and the implementation of a TQM programme on this farm is outlined in Chapter 4.

Chapter Three

3.0 INTRODUCTION

In this chapter the case farm (Massey University's Number Four Dairy Farm (No.4)) used for the study is described. Much of the relevant information is summarised in tables. The property was selected because the University-owned farm is well suited to the needs of research and theory development (Eisenhardt, (1989) as cited by Crawford, 1996). Research involving a single case is used when the case : can test a well formulated theory; represents an extreme or unique situation; may reveal facts about a phenomenon previously unable to be studied; or, can be used as a lead-in to further research (Yin, 1994). The advantages of using No.4 as a case study for implementing a TQM programme were its system (seasonal supply dairying), size (450 cow), proximity to the University, and importantly, the comprehensive monitoring systems and associated database that had been established since 1975. The case farm was 'representative' of many of the features of a NZ seasonal supply dairy farm (e.g. pastoral based, crossbred cows, seasonal Spring calving) but with advantages for the study of being a 'teaching, research and extension' facility.

3.1 DESCRIPTION OF NO. 4 DAIRY FARM

The No.4. farm is located 3 km south west of Palmerston North, adjacent to the Massey University campus. Massey University purchased the property of W.J. Brogden (111.3 ha) in April 1973, and the property of L.L. Lovelock (50.6 ha) in July 1973. These two properties were amalgamated and developed by the University to create a large seasonal supply dairy farm. In May 1988 the adjoining property of G.W. Perry (58.24 ha) was purchased and amalgamated with No. 4. The main physical features of No.4 are summarised in Table 3.1.

Table 3. 1 *Summary of the key parameters for No.4 dairy farm (Farm Services, 1996).*

Area	180 hectares effective.
Altitude	80 meters above sea level.
Rainfall	1000 mm annually.
Temperature	7° C July, 18.5° C January (monthly 10cm soil temp.).
Soils	Predominantly Tokomaru Silt Loam. Compact clay loams with compact subsoils, poor natural drainage and with a tendency to dry out in summer. Moderate natural fertility.
Facilities	36 bail turn-style rotary cowshed. Concrete feeding/stand-off pad (300 cow capacity).
Subdivision	The farm is subdivided into approximately 70 two hectare paddocks all with race access.

The No.4 herd consists of predominantly Friesian and Friesian cross cows with a breeding worth (BW) of 30. The BW is a measure of genetic 'earning' potential relative to the average NZ dairy cow in 1985 (i.e. the No.4 herd has a 30 unit genetic potential earning advantage). Units are expressed in 1996 NZ dollars. The number of cows and heifers farmed by No.4 dairy is shown in Table 3.2

Table 3. 2 *Livestock classes and numbers wintered (1 July) and milked (1 Dec., 1 Feb.) by No.4 during the 1992/93 to 1995/96 seasons (Farm Services 1996).*

Stock Type	1992/93	1993/94	1994/95	1995/96
MA Cows 1 July	356	434	433	374
R 2yr Hfrs. 1 July	70	110	89	128
R 1yr Hfrs. 1 July	110	89	138	122
Milkers 1 Dec.	396	483	474	456
Milkers 1 Feb.	394	437	396	445

The planned start of calving (PSC) is 1 August and the mean calving date is 20 August. Thus, the planned start of mating is 22 October and mating is confined to a period of 90 days. Artificial insemination (AI) is used for the first 42 days after which bulls are introduced to tail-up the herd. The target submission rate (SR) and conception rate for this period is 100% and 90 %, respectively (MacMillan, 1982). Actual performance has averaged 90% and 80 % over the past 5 years. The 42 day period of AI ensures sufficient heifer calves of known genetic merit are available to meet a 25% annual herd replacement policy.

Annual milk production has ranged from 758 kgMS/ha (1993/94) to 888 kgMS/ha (1994/95) over the past four seasons (Table 3.3). Variable pasture growth (Figure 3.1) has the greatest effect on seasonal milk production.

Table 3. 3 *Annual milk production No.4 for the 1992/93 to 1995/96 seasons. Milk production includes supply to factory and calf milk (Farm Services, 1996).*

	1992/93	**1993/94**	**1994/95**	**1995/96**
Farm Area (ha)	148	183	183	180
Cows Peak Milked	396	483	474	460
Cows/ha	2.68	2.64	2.59	2.56
Total MS (kg)	117,406	138,631	162,464	149,664
MS/cow (kg)	296	287	343	325
MS/ha (kg)	793	758	888	831
Total Litres	1,412,788	1,701,360	1,995,905	1,847,224
Total Milk Fat (kg)	67,547	78,262	92,034	85,324

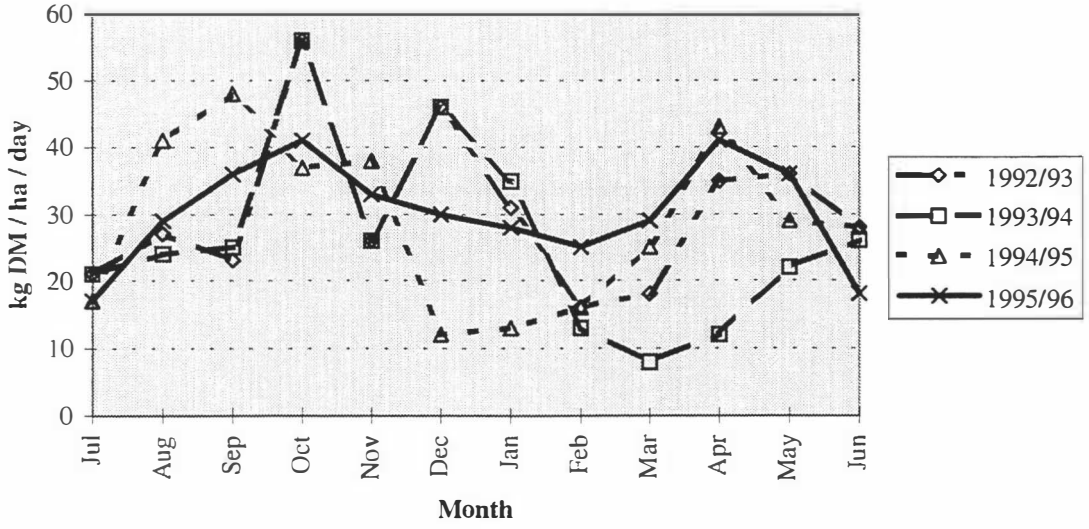

Figure 3. 1 *Pasture growth rate (kgDM / ha /day) for the 1992/93 to 1995/96 seasons at No.4 (Farm Services, 1996).*

Table 3. 4 *Pasture Production (kgDM/ha/day) for No.4 from 1992/93 to 1995/96. The 21 year average daily pasture production by month and annual total DM production is also shown (Farm Services, 1996).*

Month	1992/93	1993/94	1994/95	1995/96	21 yr Average
July	21	21	17	17	17
August	27	24	41	29	28
September	23	25	48	36	39
October	56	56	37	41	49
November	26	26	38	33	45
December	46	46	12	30	35
January	31	35	13	28	24
February	16	13	16	25	22
March	18	8	25	29	20
April	35	12	43	41	23
May	36	22	29	36	28
June	28	26	28	18	23
Total DM Production (tonne/ha)	12.7	9.6	10.4	11	10.1

The main elements for production from the pasture-base at No.4 have been to set the stocking rate (SR) (cows per hectare), calving (PSC) date and drying off date which have been set as follows:

- SR 2.6 cows/ha
- PSC 1 August
- Drying off is subject to cow Condition Score (CS) (a scale of 1-10 where 4 is 'thin' and 6 is 'fat') and pasture cover, but is normally around 30 April each year. Individual cows will normally be dried off when CS is < 4 or production is < 10 litres/day.

Supplements, crop and Nitrogen (N) are used to buffer seasonal shortfalls or variations in pasture availability (Table 3.4). In extreme circumstances, once per day milking may be employed in the spring to reduce demand and ensure animals are fully fed.

Table 3. 5 *Supplementary feed (tonnes dry matter) conserved, purchased and utilised at No.4 for the 1992/93 to 1995/96 seasons (Farm Services, 1996).*

	1992/93	1993/94	1994/95	1995/96
Conserved on Farm				
Grass Silage	100	100	35	22.5
Maize Silage	140			
Hay/Haylage	36			18.2
Purchased				
Grass Silage			30	56.7
Maize Silage		75	130	170
Hay/Haylage		110		20
Brewers Grain			45	63
Carrots				13
Crop				
Turnips				48 (6.2 ha)
Green Feed Maize		90 (11 ha)	40 (8ha)	
Other				
Urea (Tonnes)	20	33	25	30
Cow Grazing DM Equiv.		42	67	50
Total Tonnes DM	276	417	347	461.4
Tonnes DM/ha	1.9	2.3	1.9	2.56

Table 3. 6 *Conversion of available DM to milksolids on No.4 for the 1992/93 to 1995/96 seasons (Farm Services, 1996).*

	1992/93	1993/94	1994/95	1995/96
Feed Grown (Incl. grass silage) (kgDM/ha)	12738	9606	10433	11050
Feed Purchased (Incl. Crop, cow grazing) (kgDM/ha)	946	1732	1705	2337
Total Feed Available (kgDM/ha)	13684	11338	12138	13387
(kg milksolids/ha)	793	758	887	831
Conversion rate (kgDM : kgMS)	17 : 1	15 : 1	13.7 : 1	16 : 1

The soils at No. 4 are predominantly Tokomaru silt loam (heavy clays) with medium fertility and poor natural drainage . The farm has a good history of above maintenance fertiliser applications and soil tests indicate a good nutrient status for dairy pastures (Table 3.7).

Table 3. 7 *Fertiliser application (tonnes/ha) and units N,P,K and S supplied per hectare at No.4 for the 1992/93 to 1995/96 seasons (Farm Services, 1996).*

Tonnes	N:P:K:S	1992/93	1993/94	1994/95	1995/96
30%K Super	00:06:15:08	63	52.5	64	23
15% K Super	00:08:08:10				23
Crop 15	15:10:10:08			5	46
DAP 13S	13:16:00:13			8	
Lime				290	
Urea	46:00:00:00	20	33	25	30

Units/ha	1992/93	1993/94	1994/95	1995/96
N	63	83	73	115
P	26	17	31	40
K	65	43	55	55
S	35	23	36	43

Chapter Four

4.0 THE ON FARM APPLICATION OF TQM

In the preceding Chapters, the need for the New Zealand dairy farmer to be more 'Quality conscious' in farm practices and production has been outlined. There is little published evidence of the design and application of quality systems on farms, so the basic principles of TQM have been used in writing a programme for application at Massey University's No.4 Dairy Farm (No.4). In this Chapter the process for, and implications of, implementation of a TQM programme for a seasonal supply dairy farm are described. It should be noted that TQM is an on-going process so the elements described here are always open for review, alteration, addition and refinement. This is part of the on-going process to ensure No.4 remains a "profitable preferred supplier" to the dairy company.

Management has set objectives for the farm which are:

- to be managed as a profitable, large scale, commercial seasonal supply dairy farm;
- to study the problems inherent in large scale dairying and to provide a teaching resource for undergraduate and postgraduate programmes; and
- to provide a link between the University and agribusiness.

The procedure for the introduction of the TQM programme was to prepare, establish the system content and create an implementation and maintenance process, as described by Mahoney and Thor (1994) in the TQM Trilogy. Mahoney and Thor also outlined seven preparatory steps to be performed before completion of the system design. These require management to:

- establish a strategic plan;
- develop quality management and mission statement;
- assess the management (staff) quality;
- ensure integration with existing plans;
- identify cross functioned task force opportunities;
- develop input/feed back from those to be involved; and
- integrate evergreen system elements; it must last.

4.1 THE INTRODUCTION OF TQM ON FARM.

The preparation of the TQM plan involved studying the No.4 business and establishing where and how TQM could be applied to enhance management's ability to attain the goal of 'excellence in the profitable production of seasonal milk'. Although much of the content for a TQM system existed, there were few clear structured processes in place to ensure procedures were followed in a consistent and systematic way in order to assure milk quality in a manner that was considerate of animals, labour and resources. The farm system was broken down into the major components as outlined pictorially in Figure 4.1.1. Each component was described with respect to processes in place to ensure all components contributed fully and effectively to the overall system (Sections 4.2 to 4.6).

One of the requirements for TQM is to document the processes used in the production system. With the large number of variables involved in the production of milk (land, labour, animals and plant) it was important to develop documentation that was simple, concise, and easy to use but comprehensive enough to cover all of the key elements in the production process. To achieve these aims a dairy farm management calendar was developed that contained all the key activities and processes pertinent to the No.4 production system. The generic layout for the 12 page (laminated card), one month per page, calendar is shown in Figure 4.1.2. The full (plain paper) 12 month calendar is presented in Appendix 1.

A number of people were involved in developing the calendar, including farm staff, veterinarians, and Farms Services' personnel, especially the farm's technician. The calendar has proved to be simple yet effective in providing farm staff, including management, with a ready reference to the 'farm management plan'. Subsequent to development of the 'No.4 calendar' a similar document was found to contain comparable content and format (Ruakura, undated). The synthesis of two similar documents from independent dairy industry personnel lends weight to the calendar's usefulness.

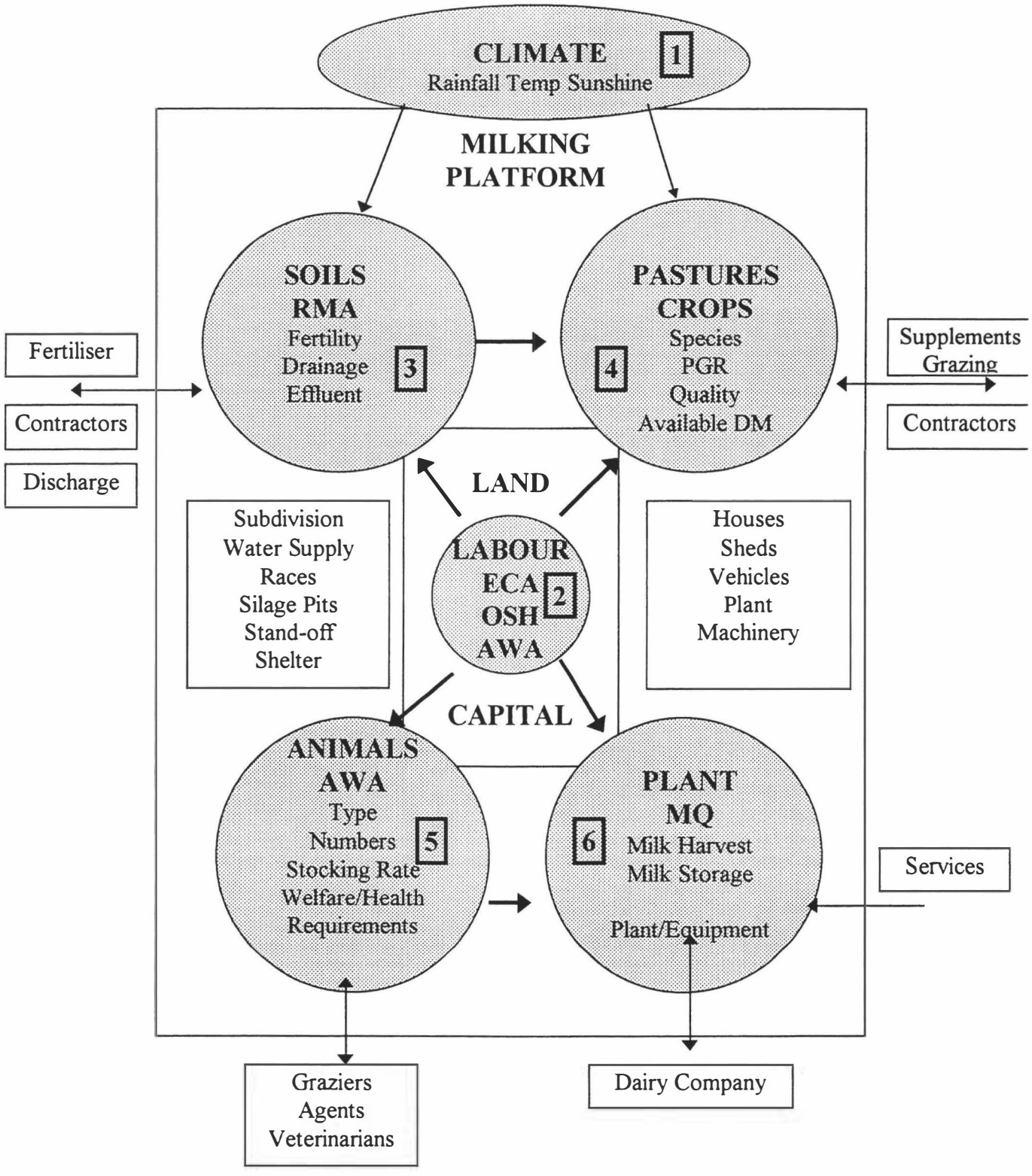

Figure 4.1 *Components of the No.4 dairy farm system (MacDonald, 1996).*

(Abbreviations: RMA = Resource Management Act; PGR = pasture growth rate; DM = dry matter; ECA = Employment Contracts Act; OSH = occupational safety and health; AWA = Animal Welfare Act; MQ = milk quality).

MONTH

STOCK

This section typically contains planned targets for the herd and replacement stock (milk production, CS, liveweight, mob structure and feed intakes).

A major component of the stock section is **Animal Health**. Typical 'reminders' will be drench programmes, vaccinations, blood sampling, mineral supplements, bull soundness, SCC triggers, preg. tests, bloat facial eczema and other herd/animal risks/protections/remedies.

PASTURE

Pasture cover is a key element of the strategic plan with target levels given for each month and planned responses for unacceptable deviation from the plan. Pasture management is integrated with stock management.

SOILS

Soil fertility (tests, recommendations, time/quantity of application), drainage and management are covered in this "box".

FEED

The feed section is aimed at ensuring all supplementary feeding activities are planned. Silage, crop, meal and pasture renewal are the main elements covered. Planning is critical for timeliness of operations.

MAINTENANCE

This section provides schedules for plant, machinery and vehicle maintenance as well as reminders for checks on water supply, races, fences and other capital items. Weed and pest control are included.

Figure 4.2 ***Generic farm management calendar page describing some of the elements contained in the working version (Appendix 1).***

Another important component of TQM is the requirement to document the 'processes' involved in product manufacture (in this instance milk production). Farm diary sheets have been developed to detail information on livestock, climate, management, production (herd and pasture) and other activities (Figure 4.1.3) (Appendix 2). The farm manager is required to complete these on a monthly basis. Particular components of the diary sheets are referred to in later sections. The detailed diary sheets have become a valuable reference for management.

Stock Weights:

Date	Number	Class	Mean Weight (kg/hd)	Range (kg)	Days (1)	ADG

(1) Days since last weight

Condition Score: (10% of herd)

Date	Number	Mean Score	Range	Mean Weight (kg)	Range (kg)

Milk Production: (10 Day Periods)

Date	Cows	Milk		Fat			Protein			MS		
		litre	l/c/d	%	kg	kg/c/d	%	kg	kg/c/d	%	kg	kg/c/d
1-10												
11-20												
21-31												
TOTAL												

Figure 4.3 *Example of diary sheet monthly data page. The full diary sheet format is shown in Appendix 2 (Farm Services, 1996).*

A number of other documents have been developed/refined as part of the TQM programme on No.4. These are discussed, and references given, in later sections of this Chapter.

4.2 Climate

Climate is beyond management's control, although historical records provide a basis for future predictions in terms of likely pasture growth. The daily recording of rainfall and grass minimum temperature give rise to a database that can be used to aid planning. This information is compiled in the monthly diary sheet (Appendix 2 p ii).

Irrigation of pastures and crops is not viable at No. 4 at this stage due to the low MS price relative to irrigation development and maintenance costs. Instead, a summer crop and stored supplement provide cover for feed deficits associated with "dry" summer weather.

Farm shelter has been established to give some protection from inclement south westerly winds and also provide some summer shade for the animals. Some of the shelter is in the form of wood-lots which can be capitalised in future years. Aesthetic factors have also been taken into account with plantings (green-belting).

4.3 Labour

A manager and two full-time workers are employed to milk and care for the 450 cow herd and the farm. An additional worker is employed for relief milkings. Workers are responsible to the Manager with the Farm Manager responsible to the Farm Supervisor. As shown in Figure 4.1.1, labour is central to any TQM plan. One of the key objectives typically associated with TQM is employee or associate acceptance of new performance initiatives (Mahony and Thor, 1991).

All employees are on individual work contracts in compliance with the ECA (Appendix 4) and have been given specific job descriptions (Appendix 5). Rates of pay have been set in line with Industry Standards. A monthly record is kept of days worked and monthly/annual leave due (Appendix 2 p xi).

All staff are involved in management decisions, but the Farm Manager has overall responsibility to ensure all duties are carried out. A key to the successful 'team' approach has been to give all workers responsibility and titles that reflect this, such as "herdsmen" as opposed to "milkers".

A regular weekly meeting is held to discuss farm management issues (Appendix 3). A regular monthly meeting is held to discuss general issues. This is an important part of the monitoring and implementation process. Any unacceptable variations from the strategic plan can initiate a tactical response in a timely manner (eg. nitrogen application in response to low pasture cover).

Grievance procedures are in place for staff concerns. Management must also follow due procedure as outlined in the ECA for any disciplinary actions. Although staff turnover is high at No.4 , this is primarily due to a policy of employing young workers eager to progress in the dairy industry, rather than dissatisfaction with working conditions. All exiting staff are interviewed by the personnel department of the University. Establishing a motive for the staff member leaving is part of the interview process.

All new staff are made aware of Occupational Safety and Health (OSH) requirements from the first interview. Existing staff members have also been instructed in the requirements and implications of OSH. As outlined in Chapter 2.7.4 the key elements of OSH are to: identify; eliminate; isolate; and/or minimise any hazards. Farm staff have been involved in the process of hazard identification. Also, staff have been encouraged to attend:

- annual farm safety workshops;
- first aid courses;
- Growsafe courses;
- chainsaw operation courses;
- farm bike safety courses;
- stock handling courses; and other related training opportunities.

Experienced staff members are encouraged to assist junior staff in gaining 'farm skills'. No staff member is permitted to operate vehicles, plant or machinery in a

manner likely to cause injury/harm to himself or others. Failure to comply with regulations will result in a written warning. Further non-compliance will result in dismissal. Gross negligence is punishable by instant dismissal.

4.4 Soils

Long term fertility trends are monitored through annual soil test results. The main soil tests are for pH, P, K and S status. This enables management to analyse the main fertility changes over time and seek recommendations for maintenance or capital fertiliser dressings. Having set production goals, recommendation is sought from the Department of Soil Science (Massey University) and the local fertiliser company (Ravensdown Ltd.) as to the annual application requirements for sustainable production. The main fertility objectives are to have a pH of 6 and an Olsen P greater than 35 leading to optimal conditions for pasture production. A plan has been established to monitor, maintain and improve the nutrient status of the soils on No.4 Dairy Farm which is outlined as follows:

- soil tests are taken in February each year (the lowest nutritional status point);
- recommendation for the annual fertiliser application is sought in early March;
- autumn fertiliser is applied late March;
- spring fertiliser is applied from October once ground conditions allow;
- all applications are recorded in the diary sheet (Appendix 2 p xii) as well as marked on a farm map and entries are made to a computer spreadsheet database for future reference.; also,
- Nitrogen use is discussed under pasture (Section 4.4).

The winter-wet nature of the heavy soils on No.4 make them vulnerable to pugging damage from livestock during periods of soil saturation. The natural infiltration rate of saturated soils is only 2mm in 24 hours. The farm was extensively tile and mole drained during development. Detailed maps of the drainage system are kept and an annual inspection of tile outlets is carried out to ensure tile lines are running (July). Moling gives surface water access to the tile lines. Spearing through mole lines at the junction above any underground tile line forms the drainage link between tile and mole lines. As mole lines tend to break down after 7-10 years, a maintenance plan has

been established to ensure the farm is covered on a cyclical basis. A database is kept of any work undertaken. The annual plan for maintenance of the drainage system is:

- an annual outlet check and maintenance if required (July); and
- annual moling plan (November) followed immediately by spearing.

Extensive use is made of stand-off facilities in winter when pugging of the soil surface is likely until excess moisture drains away. Stock are stood off pasture if ground conditions reach, or are likely to reach, saturation point. On-off grazing (maximum 3 hours) can be used to ensure stock are fed adequately. Any supplement should be fed prior to stock grazing pasture to minimise "hoof" damage to the soils. In addition, up to half the herd is grazed off the farm in winter (1/07 to 20/07) to reduce grazing pressure.

Dairy shed effluent is currently put through a 2 pond treatment system with regular regional council monitoring of the discharge to watercourse to ensure compliance with minimum pollutant requirements. An increase in herd size and an increased area of concrete catchment from stand-off pads, coupled with likely more stringent Regional Council discharge consents, have necessitated the planning for alternative means of effluent discharge. A spray irrigation system for discharge to pasture has been designed but not yet installed. This will eliminate water course discharge, and also return valuable nutrients to the soil . The aerobic/anaerobic ponds will still be required for buffer storage when ground conditions are too wet for spray irrigation. Guidelines for operation of the spray irrigation system will be established when installation is completed.

4.5 Pasture

A key objective of No.4 is "profitable production from pasture". Historical data give comprehensive information on monthly pasture growth rates (PGR) (Table 3.4). PGR data are obtained fortnightly using an Ellenbank Rising Plate Meter to measure the cover change in ungrazed pastures. The management plan is to match animal demand as closely as possible to seasonal growth patterns, based on an average year (Figure 4.4).

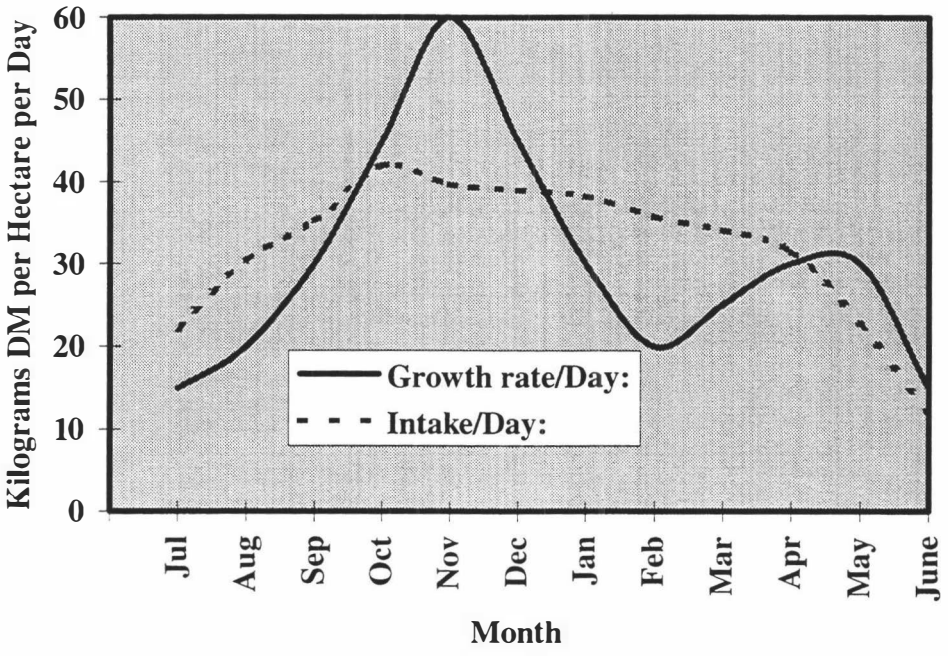

Figure 4.4 *Pasture growth vs feed demand (kgDM/ha) for an average year at No.4 (19 yr. average PGR, stocking rate of 2.6 cows per hectare).*

Regular pasture and herd monitoring (fortnightly pasture cover readings; monthly cow CS; daily milk production) enable tactical responses, for example, supplement in/out, N applied, to bring average pasture cover back in line with the strategic plan.

Key pasture management targets are laid out in the monthly calendar (Appendix 1). Pasture management is based on: maximising growth; maintaining quality; and maximising conversion of pasture to milk (high utilisation). A seasonal feed budget is drawn up (Table 4.1) for a twelve month period to represent the strategic plan. Regular revision (fortnightly) accounts for measured variation from the plan and enables timely tactical responses to correct unacceptable deviations. This proactive approach to pasture management helps to prevent crisis situations arising (e.g. insufficient feed for animals at mating). The latter are usually more expensive to rectify than planned preventative expenditure.

Table 4. 1 *Example of a No.4 feed budget (note: 6 months only shown)*

		DAIRY FARM FEED BUDGET					
FARM NAME:		**No.4 Dairy 1997/98**	**Forecast**				
EFFECTIVE AREA:		174	174	174	174	174	174
INITIAL COVER:		2000					
Month		Jul	Aug	Sep	Oct	Nov	Dec
Growth rate/Day:		15	20	30	45	60	45
Intake/Day:		22	30	35	42	40	39
Difference/Day:		-7	-10	-5	3	20	6
Supplements-Hay:							
Grass Silage						-80000	-40000
Maize Silage		15000	15000	15000			
Brewers		6000	6000	6000	6000		
Other/Crop		20000	40000				
Nitrogen:							
FINAL COVER:		2016	2047	2012	2138	2289	2246
ANIMAL REQ. MjME/Day							
Milking Cows	Start	30	250	375	440	440	440
Liveweight kg	480	480	480	480	480	480	480
Milk Production litres/day		15	18	20	24	22	20
ME for Maintenance	0.6*lwt^.7	61.53	61.53	61.53	61.53	61.53	61.53
ME for Milk	5.4	81.00	97.20	108.00	129.60	118.80	108.00
ME for Weight gain/Loss	53	0.00	0.00	0.00	0.00	0.00	0.00
	35						
Daily ME Requirement/Head		142.53	158.73	169.53	191.13	180.33	169.53
kgDM/Head/Day		12.96	14.43	14.74	16.62	15.68	15.41
Dry Cows		350	200	75	0	0	0
Liveweight	470	480	480	480	480	480	480
ME for Maintenance		61.53	61.53	61.53	61.53	61.53	61.53
ME for Weight gain/Loss		17.10	0.00	0.00	0.00	0.00	0.00
ME for Pregnancy		30	30	30	30	30	30
Daily ME Requirement/Head		108.63	91.53	91.53	91.53	91.53	91.53
kgDM/Head/Day		9.88	8.32	7.96	7.96	7.96	8.32

A high quality ryegrass/clover pasture sward is maintained on No.4 Dairy Farm. Regular pasture renewal is carried out by incorporating a crop rotation in the pasture development plan. The pasture renewal rotation is usually pasture-summer turnips or maize-pasture. Up to 15% of the farm can be in a renewal programme in any one year. The monthly calendar (Appendix 1) sets out critical cultivation and sowing dates. As with fertiliser applications, any soil cultivation is recorded on a farm map and in the diary sheet. A database is kept of pasture renewal including the sowing date, variety

mix and sowing rate. This enables pasture productivity to be matched with pasture type.

4.6 Animals

As described in Chapter 3 the No.4 herd consists of predominantly Friesian, Friesian x Jersey cows with a current (1996) Breeding Worth (BW) of 30. The objective is to maximise milk production (daily milk solids (MS) and lactation length) whilst ensuring animal health and welfare are prioritised. Key elements of animal health; production; welfare; are listed in the monthly calendar (Appendix 1).

All animals are recorded on the Livestock Improvement Corporation (LIC) register. The farm has a policy of rearing replacements for up to 25% of the herd each year. To ensure replacements are of high generic merit, artificial insemination (AI) with semen from sires of proven elite genetic merit is used for 2 oestrous cycles (6 weeks) from the start of mating (22/10). Only AI bred heifers are considered for breed replacement. Mating is probably the most important aspect of the dairy production system. To maintain a 12 month cycle (seasonal) a cow must be in-calf again within 83 days of parturition (Brightling, 1985). Allowing for a 42 day post-calving anoestrus, the animal must conceive within 2 oestrous cycles (42 days). Accurate detection of cows on heat is essential if they are to be put up for AI. The main method of detecting heat is through the use of tail painting of cows (MacMillan, 1985). Paddock and yard activity indicating oestrus of individual cows is recorded at all times through the season. A mating/animal health plan has been established which requires that:

- pre-mating heats be recorded from 1/10;
- LIC diaries be provided to all staff for recordings/observations of cows in 'heat';
- LIC shed sheets be provided for recording all detections/matings/returns;
- LIC books be provided for recording all inseminations; and
- all new treatments, whether breeding or animal health, be recorded in the animal health register.

Identification of anoestrous cows is made using mating/detection information and treatment undertaken using Controlled Internal Drug Release Systems (CIDR) and

Prostoglandin treatment. Cows to be treated must be 42 days post calving. As the CIDR treatment is a 7 day programme, first treatment must commence on 5/11 to allow 2 cycles of AI. Hereford bulls are run with the herd from the finish of AI (3/12) and are removed after 4 weeks (10/1) for the calving spread to be maintained at less than 2 months and inductions to be less than 5%. All bulls are examined for soundness 2 months prior to mating and they are observed while with the cows for mating activity, lameness and bullying of cows, especially around the feed bins.

Calving is the most labour intensive period of the season. All calves are recorded in the register by dam, sex and breed. All AI bred heifer calves are identified by brass ear tag at birth. Heifer rearing objectives have been set as follows:

- minimum liveweight (LW) of 95 kilograms (kg) at weaning (12weeks);
- 220 kg LW at 9 months of age;
- 320 kg LW at mating (15 months of age); and
- 480 kg LW pre calving (2 years of age).

Bull calves as well as surplus heifer calves are sold at 4 days of age either for rearing or slaughter.

Cows are herd tested (HT) a minimum of 4 times through the season. The main information obtained is used on a regular basis to identify poor producers (culled) and to identify high somatic cell count (SCC) cows (treated/culled). No.4 staff follow the 'Seasonal Approach to Managing Mastitis' (SAMM) plan for mastitis treatment and control.

All breeding/animal health treatment details are recorded on the animal health shed register. The data, along with herd test information, are entered into the computerised dairy herd management programme 'Dairyman'. The comprehensive data base can then be used to generate reports used in herd management (Breeding/treating/culling). Production records (daily shed dockets, monthly company summaries) can be used to gauge the herd's performance at any time.

All staff must practice "good" animal husbandry, as detailed in their job descriptions. This not only complies with AWA requirements but is part of the TQM programme for maximising returns from milk produced on farm.

4.7 Plant and Milk Quality

The overriding control of the dairy facility is based on the NZ Dairy Industry Farm Dairy Code of Practice *(NZDB, 1994).* All dairy farms have strict controls on dairy shed procedures for milk harvest and milk quality. These controls/procedures are well documented and the local dairy company plays a strong role through shed inspections and milk quality tests to ensure the standards are adhered to. The LIC through its field officers and consultancy branch also offer support. The main goals of MQ on No.4 Dairy are to: maximise the harvest of quality milk; be grade free; and have a bulk somatic cell count (SCC) < 150,000. Annual grade free milk and SCC < 150,000 have not been achieved although improvement has been significant since introduction of the TQM programme in 1995 (Table 4.2 ; Table 4.3).

Table 4. 2 *Incidence of milk quality grades and cost of penalty No.4 for the seasons 1993/94 to 1996/97 (Farm Services, 1997).*

Season	1993/94	1994/95	1995/96	1996/97
Number of grades	11	4	3	2
Cost of penalties	$2817-35	$489-28	$1046-59	$204-67

Table 4. 3 *Bulk milk SCC (thousands) from LIC herd test results at No.4 for the seasons 1992/93 to 1996/97 (Farm Services, 1997).*

	1992/93	1993/94	1994/95	1995/96	1996/97
August	238	460	220		
September	313	317	185	253	
October	288	253	128	247	256
November	329	223	233	232	203
December	283	288	163	238	195
January	234	295	247	200	198
February	293	306	284	227	
March	253	424	240	252	
Season Average	281	304	201	235	213

The farm operates a standard Waikato Milking Systems plant on a 36 bale rotary turnstile. Milking is twice daily at split intervals, 5.30-7.30 am and 3.00-5.00pm. On average, at peak lactation, 450 cows are milked at each session producing 10,000 litres of milk daily. The milking routine involves ensuring all cows are fully milked (not overmilked) and only finest quality milk is harvested. Staff must observe for signs of clinical mastitis at milking and identify sub-clinical mastitis from HT results. Treatment of affected cows is undertaken on the advice of a veterinary surgeon from the University's veterinary clinic. Also, colostrum and/or antibiotic treated cows must be milked separately and the milk kept separate. Colostrum milk is fed to calves and milk from treated cows is discarded. Any treatments are recorded and treated cows identified (legband, marker dye). The plant is operated to strict company specifications with regular checks ensuring compliance. Milk must meet the standard requirements as laid down by the company. An ice bank has been installed to ensure compliance with the milk temperature requirements for entry to (18° C) and storage in the vat (7° C after 2 hours). Efficient primary cooling enhances milk quality and reduces the risk of grades (Alfa Laval, 1987).

All staff are trained in milking technique and have instructions to ensure the plant is clean and free of any contamination (Appendix 6). "There's nobody more important than the person in the milking parlour. They need to be recognised, complimented and paid well for their skills" *(Alfa Laval 1997).*

4.8 Financial

As stated earlier the primary goal of No.4 Dairy Farm is the "profitable production of seasonal supply milk".

The main target is to be in the top 10% of producers with a similar land type on an effective farm surplus (EFS) basis. Annual financial budgets are prepared in June and these are reviewed in January. The No.4 manager is involved with the farm supervisor in preparing the budget and once this has been approved by the University Council appointed Commercial Activities Group (CAG), takes responsibility for implementing the financial plan. The manager has control over all expenditure and sale of produce and livestock. All financial transactions are entered onto a computerised accounting package (Computer Concepts Cash Manager) which enables the production of

comprehensive reports. It lists accrued expenditure by category; expenditure to date; provides a comparison of actual *versus* budgeted expenditure; generates a cash-flow profile and other reports that help to describe the state of the business at any point in time.

Reports are made available to the manager on a monthly basis, first to ensure payments are accurate and correct and second, to track expenditure with budget. Annual accounts are prepared by the farm accountant in conjunction with the University's finance section. Production and financial outcomes are compared with statistics from MAF to gauge the farm's performance (Table 4.4). Figures are taken from the relevant section of the MAF Farming Monitoring Report for comparative purposes.

Table 4. 4 *No.4 farm working account forecast with MAF comparison for the year ending 30 June 1997.*

	No.4 Dairy	$ per Cow		$ per Ha	
Revenue	**1996/97**	**No.4**	**MAF**	**No.4**	**MAF**
Milkfat Sales	511200	1124	924	2938	2119
Dairy Cattle Sales	35330	78	52	203	120
Other (Rent etc.)	5200	11	8	30	18
Less:					
Cattle Purchases	3200	7	4	18	8
Gross Farm Revenue	548530	1206	980	3152	2248
Expenditure					
Wages Incl Drawings	100500	221	187	578	429
Animal Health	15000	33	38	86	88
Breeding	19046	42	28	109	65
Dairy Shed Expenses	9000	20	15	52	35
Electricity	2750	6	20	16	46
Feed	146000	321	99	839	226
Fertiliser	50000	110	103	287	237
Contracting/Cultivating	5000	11	5	29	18
Freight	100	0	4	1	10
Weed & Pest	2000	4	6	11	14
Vehicles	19550	43	51	112	118
Repairs & Maintenance	36700	81	64	211	147
Administration (Incl Supv)	25842	57	62	149	141
Other (Insurance,Rates)	12751	28	21	73	48
				0	0
Cash Farm Expenses	444239	976	704	2553	1616
Cash Farm Surplus	104291	229	276	599	632
Development	16686	37	15	96	35
Capital Purchase	23583	52	26	136	59
Mortgage Int + Prin.		0	169	0	388
Rent/Lease	30000	66	0	172	0
Change in Current Account	34022	75	65	196	150

Physical Performance Data	**NO 4**	**MAF**
Milking Area (ha)	174	85
Cows Peak Milked	455	195
MilkSolids to Factory	142000	53000
MilkSolids per Hectare (kg/ha)	816	645
MilkSolids Production per Cow	312	272
Stocking Rate (cows/ha)	2.6	2.3

4.9 CONCLUDING COMMENTS

A between-year comparison of No.4 physical and financial performance shows little evidence of tangible rewards or benefits from the introduction of a TQM programme. However, because TQM is an on-going process and the farm programme has only been operational for a short period, most of the benefits are forecast for the future. Benefits are likely to be enhanced if the industry adopts the philosophies discussed in Chapter 2 (ie. rewarding the supplier for quality). Since the introduction of TQM milk production has lifted an average 80 kg MS per hectare but a number of other factors have contributed to this. While total pasture production has not improved this is more likely to be the result of poor seasonal growth patterns (climatic) rather than a lack of response to inputs. Much of the increase in milk production has come as the result of grazing cows off the farm in the winter and purchasing additional supplement. As detailed earlier in Table 4.2 the incidence of grades has reduced but the farm has yet to go "grade free" in a season.

Because of the permanent variation which exists in many of the factors contributing to milk production and quality, it is difficult to model what the physical and financial results might have been had a TQM programme not been in place. This creates a problem in systematically evaluating the benefits of TQM. The costs of developing and implementing a TQM programme can be determined more easily, but even they are not independent of other farm activities. Although implementation of a TQM programme has not yet shown significant rewards in improved physical and financial performance a key benefit is knowing that what is being done presently is good for the animals, soils, pasture and staff resource in producing quality milk that consumers can have confidence in as being "safe and wholesome". The programme also ensures compliance with the legislation governing animal welfare, resource management, employment and occupational safety and health. Job satisfaction for staff was seen as a key benefit.

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Appendices

Appendix 1. Farm Management Calendar

MONTHLY MANAGEMENT PLAN

NO 4 DAIRY FARM

MASSEY UNIVERSITY

Appendix 1 ii

JULY

STOCK

C/S Minimum 5

Split herd early/late calvers

Intake minimum 8kg/hd/day
Pasture and/or supplement

100 day round

Animal Health

Commence Mg supplementation

Induce maximum 5% late calvers
20/07 first injection
30/07 second injection

Drench MA cows returned from grazing
Ivomectin

PASTURE

2200kgDM/Ha avge cover at 31/07

1200kgDM/ha residual cover

SOILS

Minimise pugging
Stand off during heavy rain/waterlogging

On/Off grazing with supplement on pad

Check tile lines flowing

FEED

All grazers return home 20/07

Balance any Maize Silage ration

Bulk dressing 30kg N/Ha 50% of farm if cover < 2000kgDM/ha at 15/07

Order calf meal

MAINTENANCE

Daily scrape feed pad

Finish calf shed preparation
Bedding
Equipment
Sterilisation

Final milk plant check

Appendix 1 iii

AUGUST

STOCK

PSC 1/08

Dries intake 8kgDM/hd/day
Separate springers at 10kgDM/hd/day
Milkers at 15kgDM/hd/day 31/08
Target milkers at 20l/hd/day

Calvers minimum 4 days colostrum herd

Milkers on 30 day round unless supplement up to 4kgDM/hd/day enabling 40 day round

Dries maintained with supplement if necessary

Animal Health

Continue Mg Supplementation
Spray, dust or drench

Follow up inductions

Maintain calving/cow health records

Monitor mastitis SAMM plan

Teat spray every milking

Blood test monitor cows Mg Ca Se

FEED

Apply 30kg/ha N behind cows and or feed supplement if cover falls below 2000kg/DM/ha

Calves on 4 - 6 litres colostrum
Introduce meal at 2 weeks

PASTURE

Maintain average cover above 2000kgDM/ha

Residual cover above 1600 kgDM/ha

Feed supplement on pad prior to grazing

SOILS

Minimise pugging as per July

MAINTENANCE

Daily scrape feed pads

All dead stock removed within 24 hours

Slinks off roadside and covered

Top up calf shed bedding

Shed plant weekly/monthly schedules

Service Tractor Bikes Feed wagon Plant

Appendix 1 iv

SEPTEMBER

STOCK

Dry cow intake 8-10kgDM/hd/day
Springers 12kgDM/hd/day
Milkers 16-18kgDM/hd/day

Target milkers at 24l/cow/day

Milkers on 25 day round with up to 4kgDM/hd/day maize silage supplement

Maintain CS >4, 4.5 avge
Cows below 4 once per day milking

Calving finished by 30/09

Herd Test

SCC < 150000 Identify and treat subclinical mastitis (Herd test results) SAMM Plan

Mg supplementation continues

Calves reared under cover for four weeks or earlier to pasture if weather fine and mild

Dehorn all calves pre weaning

Arrange replacement bull purchase

Vet check for Retained membranes or

PASTURE

Maintain pasture cover above 2000kgDM/ha

Pregrazing 2500-2800kgDM/ha
Postgrazing 1600-1800kgDM/ha

If cows on 25 day round (450cows 175ha)
64 cows/ha/day harvesting 1000kgDM
15.6kgDMpasture/hd/day

SOILS

Identify crop paddocks (pugged or poor pasture)

Identify wettest paddocks to mole
Notify contractor

FEED

Apply 30kg/ha N behind cows and or feed supplement if cover falls below 2000kg/DM/ha

Negotiate contracts for Maize and grass silage, and crop cultivation
Order crop seed

MAINTENANCE

Plant test especially vacuums

Daily scrape feed pads

All dead stock removed within 24 hrs

Top up calf shed bedding

Service all plant and machinery

OCTOBER

STOCK

Milkers 18kgDM/hd/day

Target 24l/hd/day peak milk

15-29 day round dependant on PGR

Planned Start of Mating 22/10

Tailpaint 1/10 for premating heat detection and record in animal health book

Vet check bulls

Monitor for bloat and commence treatment if necessary

Wean calves from late October provided a 85kg liveweight minimum off milk and 95kg liveweight minimum off meal

Maintain cow health/mating records

PASTURE

Identify developing feed surplus and shut paddocks for silage to maintain average cover no greater than 2200kgDM/ha

Post grazing residuals greater than 1600kgDM /ha

If cover less than 2000kgDM/ha apply 50kg N/ha to 50% of farm

Spray new grass for weeds

SOILS

Apply Lime

Apply maintenance NPK to grazing round

FEED

Discontinue supplement if PGR exceeding demand and cover greater than 2000kgDM/ha

Continue meal to calves less than 95kgLWT

Plough crop paddocks by 10/10 or dessicate by 26/10 if ground conditions too wet for ploughing

MAINTENANCE

Commence weed control
No aerial spraying

Book contractor for race maintenance

Maintenance on silage pits. Ensure tyres and wrap on hand

Service plant and machinery

Appendix 1 vi

NOVEMBER

STOCK

Milkers 18kgDM/hd/day ad lib

15-20 day round dependant on PGR

Target >20l/hd/day

Vet check non cycling cows
CIDR non cycling cows 5/11

First cycle AI finishes 12/11

Monitor for bloat

Wean balance of calves at target weights
Continue meal to meet target liveweight as necessary

Drench calves

Vaccinate calves 5 in 1

Maintain cow health/mating records

PASTURE

Maintain milking round pastures
2200kgDM/ha average cover.
Pregrazing 2800kgDM/ha
Postgrazing 1600kgDM/ha

Take pasture samples for mineral analysis

SOILS

Apply lime

Apply maintenance PKS

Mole from late November
Ensure moles speared

Aerate compacted/pugged soils

FEED

Harvest Silage at less than 10% flowering

Buy in grass silage if available/required

Crops sown by 10/11

Duck control license Fish and Game Council

MAINTENANCE

Continue/commence ragwort gorse control

Monitor Milk to vat temperature and turn on ice bank if greater than 18° C

Clean water troughs and check all ballcocks

DECEMBER

STOCK

Milkers 16kgDM/hd/day

Target 18-20 litres

Extend round from 15-20 days start of month to 25-30 days end of month

Monitor for bloat

2nd cycle AI finishes 3/12
Vet check unmated cows

Bulls out for two cycles

Identify cull cows

Final calf wean

Drench weaner calves at 30 day intervals

5 in 1 Booster vaccination for calves

PASTURE

Average cover 2000kgDM/ha

Control phase

Pregraze 3000kgDM/ha max
Postgraze 1400kgDM/ha

Top paddocks with postgrazing residuals greater than 1600kgDM/ha or take late silage/hay

SOILS

300kg/ha 50%K Super to silage paddocks

Continue moling including spearing

FEED

Harvest silage

Weed spray crops by 7/12 if required

Duck control on crops

Organise winter grazing for 225 cows 1/06-20/07

MAINTENANCE

Continue weed control

Replace cup liners

Service vehicles plant equipment

JANUARY

STOCK

Milkers 15kgDM/hd/day

Target 17 litres/cow/day

25-30 day grazing round

Average CS 4.5 and lifting

Assess drying off strategies

Dry off hfrs or cows producing less than 10l/hd/day and/or CS < 4

S CC < 100,000. Identify high SCC cows and treat or cull

Remove bulls 14/01

Monitor facial eczema spore counts
Zn dose if required

Drench weaner calves

Maintain cow health book

PASTURE

Control Phase continues

Average cover > 1800kgDM/ha

Top paddocks if residuals > 1400kgDM/ha

If cover < 1800kgDM/ha supplement up to 8kgDM/hd/day with silage and crop

SOILS

Apply replacement PKS to late silage and hay paddocks

FEED

Plan crop feeding

MAINTENANCE

Continue weed control

Inspect all water troughs

Service vehicles plant machinery

Ice bank on if milk to vat > 18° C

Appendix 1 x

MARCH

STOCK

Milkers 14kgDM/hd/day

Target 15 litres

30 day round

Dry off hfrs or cows producing less than 10l/hd/day and/or CS < 4

Average CS 4.5 and lifting

Monitor facial eczema

Second pregnancy test

Lepto double vaccinate calves

Apply Dry Cow Therapy to any retained cows with SCC > 200,000 and dry off
Cull any cow SCC > 500,000

Blood test sample cows

PASTURE

Average cover 1900kgDM/ha
Lifting with Autumn rain

If cover < 1900kgDM/ha finish feeding crop and dry off more cows.
Apply N @ 30kg/ha with rain

SOILS

Maintenance fertiliser 300kg 30% K Super /ha over whole farm

FEED

Finish feeding crop

Sow new grass before 15/03

No more supplement than 4kgDM/hd/day

Harvest maize silage at 35% whole plant DM
Inoculate at harvest

MAINTENANCE

Turn off ice bank if milk to vat > 18° C

Race/Fence maintenance

Service vehicles plant machinery

APRIL

STOCK

Milkers 14kgDM/hd/day

Target 15 litres

30 day round

CS average whole herd 4.8

Plan to dry off 30/04-15/05 depending on CS and pasture cover

Dry off onto 100% grass silage/hay for 7 day period

Final cull

Dry Cow Therapy any cow > 200,000 SCC
Cull any cow SCC > 500,000

Drench all cows Ivermectin at drying off

PASTURE

Average cover 2000kgDM/ha
If cover < 2000kgDM/ha put herd on once per day milking prior to drying off
Apply N at 30kg/ha whole farm

SOILS

FEED

Check new grass for slug damage

MAINTENANCE

Milk plant full check by certified person

List all major maintenance/Capital replacement required

Order new rubberware and spare parts for plant

Fully service all vehicles plant machinery

MAY

STOCK

Dry off onto 100% grass silage/hay for 7 day period

Split herd on CS 4.5
Fully feed low CS herd at 12kgDM/hd/day to gain 1 CS in 30 days
Feed high CS herd 9kgDM/hd/day to gain .5 CS in 30 days

Dry Cow Therapy any cow > 200,000 SCC
Cull any cow SCC > 500,000

Replacement heifers home 1/05 450kg LWT

PASTURE

Average cover 2000kgDM/ha

Apply N 30kg/ha if cover < 2000kgDM/ha or feed supplement up to 6KgDM/hd/day

SOILS

FEED

Confirm winter grazing

Confirm TB status of graziers property

Quotes for transport

Yearling heifers to grazing 220kg LWT

MAINTENANCE

Milk plant overhaul
New rubberware

Pre winter service all vehicles plant machinery

JUNE

STOCK

Herd dry

Fat cows graze off up to half herd CS 5.5

Thin cows plus 2yr Heifers at home CS 5.5

60 day round with 50% supplement

Draft off any cow < CS 5 and graze ahead of dries at 12kgDM/hd/day

Blood test cows

PASTURE

Cover 2200kgDM/ha

If cover < 2200kgDM/ha feed more supplement up to 8kgDM/hd/day

From mid June may have 24 hour stand-off if wet

SOILS

FEED

Cows to grazing 1/06-20/07

MAINTENANCE

Holiday

Appendix 2. Dairy Farms Diary Sheet

N0.4 DAIRY FARM

MONTH ENDING:

		INCREASES				DECREASES				
	OPENING BALANCE	**PURCHASES**	**CHANGE OF CLASS**	**BIRTHS**	**RE-MUSTERED**	**SALES**	**CHANGE OF CLASS**	**DEATHS**	**MISSING**	**CLOSING BALANCE**
CATTLE										
R 1yr Hfrs										
R 2yr Hfrs										
R 3 Hfrs										
MA Cows										
Bulls										
Calves										
Total Cattle										

No. of cows milking at end of month: ..... No. of cows calved at end of month: .....

Tag No. of stock dead/culled: .....

.....

.....

Appendix 2 ii

RAINFALL AND SOIL TEMPERATURE (10 cm) RECORD

FARM: ..... **MONTH:** .....

DATE	RAINFALL (mm)	SOIL TEMP. (°c)	TIME OF READING	COMMENTS
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				

Stock Sales:

Date	Number	Herd	Class	Buyer	LW kg	$/hd [1]

[1] Price nett of all costs.

Stock Purchases:

Date	Number	Class	Seller	kg/hd	$/hd [2]

[2] All costs included

Stock Transfers:

Date	Number	Class	kg/hd	Transferred to

Stock Losses:

Date	Paddock	Class	Number	Cause

Stock Weights:

Date	Number	Class	Mean Weight (kg/hd)	Range (kg)	Days (1)	ADG

(1) Days since last weight

Condition Score: (10% of herd)

Date	Number	Mean Score	Range	Mean Weight (kg)	Range (kg)

Milk Production: (10 Day Periods)

Date	Cows in Milk	Milk		Fat			Protein			MS		
		litres	l/c/d	%	kg	kg/c/d	%	kg	kg/c/d	%	kg	kg/c/d
1-10												
11-20												
21-31												
TOTAL												

Somatic Cell Counts:
Herd Test Date:
Number of Cows in Cell Count ranges (000)

	0-149	150-249	250-499	500+
Number				
%				

Animal Health: (Pregnancy tests, Vet visits, drenching - only herd details

Date	Number	Class	Job Done	Chemical/Result

Veterinary Laboratory Test Results: (specify average and range)

Test Date	Stock	Test	Results

Animal Health Notes:
(outbreaks of disease, bloat, staggers etc.)

Animal breeding notes:
(dates sires joined/withdrawn, AI, premating heats etc.)

Research Trials performed/ongoing:

Fertiliser Applied:

Date	Analysis	Tonnes	Paddock Nos.	Area	kg/ha

Conservation: (hay or silage made)

Date	Area	Paddock Nos.	Bale Size	Bale No.	Tonnes (wet)

Renovation/Crop: (enter start of cultivation date and sowing date separately)

Date	Area	Paddock Nos.	Seed mix components kg/ha

Supplementary Feed: (include grazing off)

Start/Finish Date	Stock	No.	Feed Type	Quantity Fed	Area

PASTURE GROWTH:

Date	Area (ha)	Av. Farm cover (kg DM/ha)	PGR (kg DM/ha/d)	Pregrazing cover	Postgrazing cover	Area in crop (ha)

Reproductive Reports:

Technician to provide at due date from Dairyman.

* Calving performance
* Submission rate
* Non return rate
* Pregnancy/herd in-calf rate

Stock Management Programme for Past Month:
(including rotation length, anticipated feeding levels (kg/ha/day) for all stock classes, crops planted/harvested/yields etc.).

Stock Management Programme for next month:
(including rotation length, anticipated feeding levels (kg/ha/day) for all stock classes, crops planted/harvested/yields etc.).

Maintenance and Development work done:

Visitors and Field days:

Coming Events:

LEAVE RECORD

UNIT: **YEAR:**

MONTH:

Date	Staff On	Staff Off	Relief Employed
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
Monthly Due			

Note:

1. Use staff initials to designate when people are on leave.
2. Calculate monthly due = 1¼ days/week for dairy farms or 1½ days week for other farms, plus statutory holidays.
3. Transfer records to summary table at months end.

Monthly Farm Staff Work Record (Days/½ days)

Name	Opening figures		Monthly	Annual	Time Taken			Time Owed		Sick
	Annual	TIL[1]	Owed	Due	TIL	Monthly	Annual	TIL	Annual	Leave

[1] TIL = Time in lieu.

Notes:

* Dairy farm staff work are entitled to 1¼ days off/week on average
  Other farm staff 1½ days off/week.

*	Each year	Dairy Farms	Other Farms
	Annual	15	15
	Statutory	11	11
	Normal days off	65	78
	Total	**91**	**104**

* Extra time worked counts as a whole day if minimum of 6 hours are worked or as a half day
  if a minimum of 3 hours are worked.

* Each year three weeks annual leave plus statutory holidays. Credit 5 days sick leave per year
  accumulating up to 35 days. 3 days bereavement leave.

* This form is to be filled out at the end of each month and returned with diary sheets.

* Annual and sick leave are to be recorded also in month taken on MU " Application for Leave" forms and submitted with the diary sheets.

Appendix 4 Conditions of employment for Farm Staff on salary

1. DUTIES

The Employee agrees to carry out the work and duties that the University or its agent require appropriate to the business of operating a Massey University farm. The duties consist of all husbandry, maintenance and development of the land, improvements and plant, and such other necessary management functions. A detailed job description is attached.

2. HOURS OF WORK

The hours of work will be those necessary to fulfil the responsibilities of the position in accordance with normal farming expectations.

Excluding holidays, time off will be granted as follows:

- one full day and three part days per fortnight totalling 62 days per year for dairy farm employees

- two full days and two part days per fortnight totalling 74 days per year for employees on other farms

Additional time worked will be compensated for by time off in lieu on a give and take basis.

Time off may be delayed in periods of peak seasonal work load. If delayed then due time shall be taken at the nearest convenient date within 12 months. Time off in lieu will not be paid out on a monetary basis.

Where possible the University will arrange for time off to coincide with weekends.

Weekend work shall only consist of husbandry and essential work which could not normally be performed during normal hours.

Where the parties fail to agree as to days free of work and part days, the University or its agent shall decide.

The Employee shall not take up any work for an outside employer, or on their own account, which in the opinion of the University, interferes with their duties.

3. REMUNERATION

The University shall pay to the Employee an annual salary of .....

$456 per year to the Employee, and shall meet work related call costs of this telephone. (Private telephone call costs must be met by the Employee).

Wet Weather Gear and Protective Clothing

The Employee is responsible for provision and maintenance of adequate wet weather gear (including gumboots, oilskins and leggings) and protective clothing.

Dog Expenses

Where working dogs are required, the University shall pay normal registration and statutory fees and veterinary expenses which are work related and reasonable for the Employee's working dogs. The number of working dogs covered shall be .....

4. SALARY AND TIME RECORD

The University shall at all times keep salary and time records pursuant to the Employment Contracts Act 1991.

Employees shall submit a leave application form to cover all leave and a fortnightly time sheet showing time off.

5. PAYMENT OF SALARY

Salary shall be paid in full at fortnightly or monthly intervals as agreed upon. A written statement detailing how salary has been determined shall accompany the salary on each instance the salary payment is altered.

All payments shall be made by cheque or direct credit.

Apart from statutory provision, no deductions shall be made from the salary except for time lost through sickness as provided for in Clause 8 of the contract, accident or default, or at the Employee's written request.

6. HOLIDAYS

Holidays shall be provided pursuant to the Holidays Act 1981,

In part explanation the following holidays shall be allowed to the Employee without deduction of wages: Christmas Day, Boxing Day, New Years Day, 2nd January, Wellington Anniversary Day, Waitangi Day, Good Friday, Easter Monday, Anzac Day, Queens Birthday and Labour Day.

Where the Employee is required to work on any of the above mentioned statutory holidays, a day off in lieu will be granted by the University to be taken within twelve months.

The University may meet the costs of tuition for up to two papers in any one year for an Employee enrolled for a course of study at Massey University and which has been approved by the University.

12. SAFETY HEALTH AND WELFARE

Attention is drawn to the requirements of the Health and Safety in Employment Act 1992.

13. PERSONAL GRIEVANCES

Personal grievances shall be settled as described in the First Schedule of the Employment Contracts Act 1991 until such time as new procedures are agreed.

14. DISPUTES

Disputes between the University and Employee shall be settled as described in the Second Schedule of the Employment Contracts Act 1991 until such time as new procedures are agreed.

15. DISCIPLINARY PROCEDURE AND TERMINATION OF CONTRACT

Where the University is dissatisfied with the conduct or performance of the Employee, the University shall advise the Employee orally of the matter, indicate how the Employee may improve and that the disciplinary procedure as specified in the contract is being followed.

After allowing reasonable time for improvement to be forthcoming, if the University remains dissatisfied with the conduct or performance of the Employee, it shall advise the Employee in writing, setting our the details of the unsatisfactory performance or conduct and that the situation remains unresolved and the Employee's employment is at risk.

After allowing a further reasonable time for improvement to be forthcoming, if the University remains dissatisfied with the conduct or performance of the Employee, the Employee shall be liable to dismissal.

In the case of termination of this contact the University may terminate this contract at any time by notification in writing if the Employee shall:

Be guilty of gross misconduct of breach or non observance of the conditions contained in this contract or;

Neglect or refuse to carry out the duties and responsibilities for the position or accountabilities for the appointment.

If the Employee desires to terminate this contract, one months notice in writing to the University shall be given or one months wages forfeited.

I HEREBY ACCEPT THE FOREGOING CONDITIONS

.....

SIGNATURE

.....

NAME IN BLOCK LETTERS

.....

Appendix 5 Job Description

Position: Farm Manager

Property No. 4 Dairy Farm

Responsible to: Farm Supervisor/Director of Farm Services

Responsible for: All staff employed on No. 4 Dairy Farm

FUNCTION:

To ensure continued operation of the No. 4 Dairy Farm as a commercial dairy farm incorporating research and extension teaching objectives.

JOB SPECIFICATIONS:

General:

- Sound base of agricultural skills, preferably in commercial dairying.
- Ability to lead, take initiative and have a sound decision making ability
- Good communication skills.
- A tertiary qualification in agriculture.

KEY TASKS:

- Responsible for the day to day management of livestock and to implement decisions on management practices which have been discussed and agreed upon with the supervisor. The manager will ensure contact with the supervisor is maintained at least on a weekly basis.
- Responsible for seasonal management of stock, particularly with regard to animal health and the planning and management of pasture and supplements to meet animal requirements. Regular feed budgets to be prepared.
- To communicate with academic staff, research personnel, students and others as requested, and to assist with teaching, research and extension projects.
- Responsible for supervision of permanent and casual staff and maintenance of time and leave records, and accident reports.

The farm is a showpiece for the University and as such weed control and general maintenance of fences and buildings and farm tidiness has the highest priority.

- Quantitative monitoring of pasture cover and livestock performance.

- Stock tallies to be regularly checked and a complete monthly stock reconciliation to be provided by the manager.

- A written schedule of planned work activities to be provided to the farm supervisor on a weekly basis.

- A farm diary will be kept recording daily activities.

- A monthly diary sheet will be provided to the farm supervisor. This shall provide the information requested in the standard form within 5 working days from end of the month.

- Stock selling and purchasing only in conjunction with the supervisor.

- All maintenance and capital purchases to be discussed with the supervisor. A farm working budget will be provided.

Appendix 6 ii

DESCRIPTION OF WASH ROUTINE AND CLEANING ROUTINE

Dependant on the chemical used the basic quantities recommended should be as follows (Always check with the Chemical Company)

MILKING MACHINE

MORNINGS

Flush plant with enough cold water so discharge runs clear.(At Least 360 Litres)
Hot Water wash the plant with 550mls Acid Detergent (80°C water)

EVENINGS

Flush plant with enough cold water so discharge runs clear.(At Least 360 Litres)
Recycle 300 Litres cold water with 550mls Sanitiser (Iodophor)

TWICE PER WEEK (Monday And Friday)

Flush plant with enough cold water so discharge runs clear.(At Least 360 Litres)
Hot Wash the plant with 700mls Alkaline detergent and recycle for 5-10 minutes so long as Temperature stays above 65°C
Rinse the plant with 300 litres of cold water with 500mls Sanitiser

VAT

AFTER COLLECTION

Flush with 200 Litres cold water

Hot Wash with 200 Litres Hot water and 250mls Acid Detergent
Always rinse with cold water to drop the internal temperature prior to milking

TWICE PER WEEK (Monday And Friday)

Flush the vat with 200 Litres cold water
Hot Wash the vat with 150 Litres hot water and 300mls Alkaline Detergent and recycle (65°C min Temp)
Rinse with 150 Litres cold water and 225mls Sanitiser

NOTES ON CLEANING

The chemicals used for cleaning can be dangerous if splashed on skin or eyes therefore avoid all contact. Use gloves and protective eye wear as provided. Never drink, sniff or taste the wash chemicals.
Never mix the chemicals together. The result could be lethal. This is why the chemicals are not put next to each other. Clean the jug between chemicals.
NO CHILDREN ARE ALLOWED IN THE PUMP ROOM OR CHEMICAL AREA UNDER ANY CIRCUMSTANCE. THIS IS NO PLACE FOR KIDS.
STAY AWAY FROM THE PUMPS. DO NOT TOUCH PUMPS OR BELTS WITH THE MACHINES RUNNING. THE SHROUDS ARE FOR YOUR PROTECTION, DO NOT REMOVE THEM.
ANY CHEMICALS NOT IN USE MUST BE PLACED UNDER LOCK IN THE CHEMICAL ROOM

DESCRIPTION OF CLEANING ROUTINE

Any discoloration or deposit or greasiness is a sign of some form of contamination regardless of how small Problems tend to build up over time. If any deposit is found note it down so we know and then clean it. Its best to use a torch when checking milk lines and is best done when the plant has had time to dry. NOTE ANYTHING FOUND OR NEEDED !!!!

Sanitary Trap Clean the bowl and check the drain line at the pump end. It should have clean wash water in it. Inspect the lid if needed then clean.

Main Milk Elbows Remove the two elbows off the end of the main receiver inspect them and the line with torch

Main Receiver Remove lids and check inside and clean lids externally. Remove seals and soak.

Washdown Valve Can be checked at the same time for any grass caught which may trap a deposit. Remove grass etc. Check injector and hose for holes and ensure functioning.

Discard End Plugs These can be removed and checked as well as looking up the lines with a torch.

Discard Receiver This has two parts i.e. vacuum and milk/wash. The vacuum system can be slightly dirty due to pulsators pulling in grime but must be dry. If wet or milky then likely a liner is split. The milk side should be clean as. Check the seals and soak.

Inspect Vat Critically Get in the vat and check it is clean. Check the fins and thermometer channel as well as the inlet channel, ensure rose head is not blocked(watch cold rinse).Check the outlets to ensure are clean, remove if necessary.

Dig Sump Do this regularly as it keeps the smell down and doesn't give it a chance to pack down. Replace grate always for safety reasons.

Empty Rubbish bins Keeps smell down. Also collect any rubbish from inside the shed and remove

Clean Toilet./Office It wont take long and its a lot nicer when its clean. Everyone will do this job!!. Sweep the office and tidy up.

Tidy Shed Surrounds... Pick up any Rubbish around the shed and put things where they belong.

VAT INLET/COOLER Open and clean both coolers. Remove inlet valve into vat and disassemble and clean. Check the drain plug between the coolers. Tighten and ensure no milk leakage at the next milking.

UNIONS/GLAND INLET OUTLET/FILTER ELBOW Check for air leaks in plant whilst plant running. Tighten unions paying attention to commonly undone

unions. Check all unions from centre to the vat. Remove gland inlet and outlet and check. Regrease inlet and carefully tighten. Remove filter elbow and check, as well as the filter drain.

GREASE/WATERBLAST Remove door in side platform grease main beam and top up oil in reservoir. As you grease look for damaged rollers. Waterblast the platform including bails, also do the floor of the shed and any slip areas that are known. Do Not Waterblast Walls Or Any Painted Areas!!!!

PULSATION Check all the pulsators are clean inside, soak filters and check ratios are within 55ppm.Adjust as needed. Milk in caps equals split liners equals time to change liners.

JETTERS/HOTWATER TEMP Strip and clean all jetters check valves and springs. Listen to ensure no leaks. Check Temp hot water is 80`C.Check for splits in rubber.

BOWLS/LINERS Strip all clusters clean inside and out. Check around fins for sign. Inspect all liners for wear and build up, use stainless rod. Also check mouth of liner and jetter

Appendix 7 Machinery maintenance sheet

Date: Cleaned by:

This is to be done every Friday and is for your safety as much as the on going function of the farm machinery and implements. Clean all gear on a regular basis when it is in use. It must be cleaned every Friday and the following, check off. If you don't know what you are doing, then stop and ask before going any further.

Motorbikes:

	Weekly						Monthly			
	Hours	Clean	Oil	Boots	Brakes	Tyres	C/Saw	Filter	Oil	Spark
TRX 300										
TRX 300										
Tf 125										
DF 125										

Parts/Problems:

Tractor and Silage Wagon (Include any other tractors as well)

Ford 6640 Hours: ..... Other: ..... Hours: .....

Weekly

- Engine Oil ☐
- Hydraulic Oil ☐
- Clutch ☐
- Water/Coolant ☐
- Grease 12 Nipples ☐
- General Check ☐
- Tyres ☐
- Clean Inside/Out ☐
- FEL Grease ☐
- FEL Pins/General ☐

Parts/Problems

Monthly

- Battery ☐
- Brake/Clutch Oil ☐
- Front Axle ☐
- Fuel Filter ☐

Silage Wagon

- Tension Floor Chains ☐
- Tension Beaters ☐
- Grease 15 Nipples ☐
- Inspect Stand ☐
- Inspect Tyres ☐
- General Check ☐
- Clean ☐
- Adjust Conveyor ☐

Parts/Problems