EXPLORING THE CONVERSION PROCESS IN ORGANIC DAIRY FARMS:

The case study of organic dairy farmers in New Zealand

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EXPLORING THE CONVERSION PROCESS IN ORGANIC DAIRY FARMS: THE CASE OF ORGANIC DAIRY FARMERS IN NEW ZEALAND

A thesis presented in partial fulfilment of the requirements for the degree of Master Applied Science in Natural Resource Management at Massey University, New Zealand

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Errata sheet for:

***Exploring the Coversion Process in Organic Dairy Farms: the case study of organic dairy farmers in New Zealand*, by Carolina Schweikart Vial**

p.12 line 7 of the last paragraph: should read "1 million litres **per day** at the peak of the season."

p. 38 line 3 of paragraph 2: should read: "whereas **no** nitrogen was applied..."

p. 42 line 6 of the third paragraph: should read "yield **after** 305 days **lactation** was..."

p. 52 line 11 of paragraph 3: should read "ammonium-N, nitrate-N or mineralizable-**N**, but..."

p. 106 line 1: should read "we maybe **gross** $300,000..." and line 2: should read "Our premium based on **50,000** kgMS..."

ABSTRACT

This research explores how organic dairy farmers manage the process of conversion. In particular, it identifies the main problems that dairy farmers face during conversion and the strategies that they employ to overcome them. Further, this research examines farmers' perceptions of the implications of conversion for the social, environmental, and financial performance of the farm. An initial mail survey was sent to 65 certified and uncertified organic dairy farmers to provide a general picture of the impacts of conversion at the farm level and to generate an initial description of organic dairy systems in New Zealand. Secondly, semi-structured interviews were conducted with eight respondents of the survey in order to investigate in more depth their experiences with conversion and capture their practical knowledge of the conversion process. Interviewees were selected based on a range of criteria (e.g., diversity of location, stage in the conversion process, and farming system characteristics), with the intention of increasing the applicability of the findings. Results suggest that organic dairy farmers conceive of conversion as a learning process, in which by capturing information and then by building experience, farmers are able to utilize external information sources for the development of personal skills and effective management practices that aim at preventing potential problems. In particular, observation of the cows' appearance and behaviour, together with providing a favourable environment for the animals appears fundamental in preventing animal health problems. Analyses of the survey indicated that sourcing organic inputs is the only significantly important problem for organic dairy farmers. However, mastitis, feed shortfalls and weed control are also concerns expressed in the interviews. Common recommendations for managing conversion include applying organic fertilisers in advance, having extra supplements on hand, increasing the rotation length, delaying calving dates, and reducing stocking rates. Organic dairy farms are mostly grass, spring calving and self contained operations. Milk production per cow in organic systems appears to be similar to the average values for the district. However, milk production per hectare on organic farms was significantly lower than average values for the respective district ($p<0.1$). This probably resulted from a decline in pasture production requiring farmers to reduce their stocking rates. In general, milk production, both per cow and per hectare, declined in early stages of conversion but rebounded as conversion progressed. Finally, it is expected that New Zealand pastoral-based seasonal dairy systems to follow a relatively easy transition to organic farming, without experiencing as much of a reduction in productivity.

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CHAPTER 1: INTRODUCTION

1.1 BACKGROUND TO THE RESEARCH

It is beyond question that the organic market worldwide has increased enormously over the last few years and is the fastest growing food sector in the world (Scialabba, 2001). In 2002, the global market of organic food was valued at $23 USD billion (Yussefi, 2003) with an estimated annual growth rate of 20% – 30% (BIO-GRO, 2003). The great development of the organic food sector is also reflected in the fast increase of conversion at the farm level (Geier, 2004). World wide, the total area farmed under the organic principles is approximately 24 million hectares, with more than 460,000 organic farms. The booming development of organic farming provides an opportunity to revitalize traditional agricultural systems, and brings new challenges of research in this area.

While organic agriculture emerged as a response to multidisciplinary matters such as environmental concerns, food safety issues, and rural livelihood strategies, it is still quite a new area of study where the lack of knowledge has sometimes limited its further development (Scialabba, 2001). Therefore, the process of conversion, rather than being based on scientific research, is often carried out by experimentation, a trial-and-error approach that slows down the adoption of organic farming (Morisset and Gilbert, 2000, Lampkin, 1999). In New Zealand, organic production is currently valued at over $120 million, which is largely attributed to kiwifruit and pip fruit exports (OPENZ, 2003). However, the opportunity for the development of organic agriculture remains almost unexplored in other sectors, such as the dairying and meat sectors (Mason, 2004).

New Zealand has evident advantages for the development of an organic sector. Relative to external advantages, New Zealand's "clean and green" image is well recognized in overseas markets, whereas the counter seasonality with major markets and the world-leading position of the dairy industry are additional strengths for the development of an organic dairy sector (Lawrey, 1999). On the other hand, one of the most important local advantages for organic milk production is the dominance of pasture based and low input dairy systems, which are closer to the organic approach than are intensive production systems (Condron et al., 2000).

Nevertheless, the growth of the organic dairy sector in New Zealand is constrained by the lack of experience in organic production methods in the country (MAF, 2002). The lack of advisors, knowledge networks and access to information at the farm level increases the risk, difficulties and expenses when converting to an organic dairy farm (Christensen and Saunders, 2003). There is a need to gather the experience of organic dairy farmers in New Zealand and expand their knowledge to new participants interested in this field. The generation of more knowledge about management of organic dairy systems is essential to reduce the costs, risks and uncertainties during conversion and thus help to expand the organic dairy sector in New Zealand.

1.2 PROBLEM STATEMENT

The lack of available and reliable information, together with the inexperience of farmers about best management practices for organic dairying, makes conversion to organic farming a risky process and constrains the expansion of the organic dairy sector in New Zealand. There is a need to identify the successful strategies that can guide the planning and decision making during the transition period for dairy farmers.

1.3 RESEARCH QUESTIONS

The research reported here is guided by the following research questions:

1. What are farmers' perceptions of the conversion process?
2. What are the main problems that dairy farmers face in the process of conversion to an organic system of production?
3. What strategies do different organic dairy farmers use to manage the conversion process?
4. What are the social, environmental and financial implications of conversion?

1.4 AIM AND OBJECTIVES

The aim of this research is to identify the impact that transition to organic dairying has on the agronomic, environmental, social and financial performance of the farm and to examine how organic dairy farmers manage the process of conversion. According to this, the main objectives for this research are:

1. to describe the farmers' visions of the conversion process;
2. to identify the main problems that organic dairy farmers experienced during conversion;
3. to determine the main strategies that organic dairy farmers employed during conversion;
4. to describe the implications of conversion on the social, environmental and financial performance of the farm.

1.5 METHODOLOGICAL APPROACH

In order to achieve the objectives mentioned above, two types of research strategies were used: exploratory survey and multiple case study. The *exploratory survey* consisted on a written questionnaire that was administered to 65 organic dairy farmers. The objective of the exploratory research was to characterize the population of organic dairy farmers in New Zealand in terms of their farming enterprises, the breadth and severity of management issues faced during conversion, the success of the strategies applied, and their appreciation of the organic approach. In addition, a *multiple case study* was selected, intended to gather the experiences of organic dairy farmers and gain a better understanding of the transition process. Accordingly, semi-structured interviews were conducted with eight organic dairy farmers in New Zealand.

1.5 THESIS LAYOUT

This thesis is divided into seven chapters. The first chapter provides a brief explanation of the importance of this research and outlines the research statement, questions, aim, objectives and methodology. Chapter two sets the context of the present research, providing an overview of the organic sector in New Zealand, with particular emphasis on organic dairying. The third chapter is a review of previous research; it covers the concept and principles of organic agriculture, then provides a brief description of the current state of the organic market, regulations and trade in the world, and finally explores the agronomic, environmental, social and financial implications of conversion at the farm level. Chapter four presents the methodology used in this research. It justifies the research strategies chosen, describes the research instruments employed and the analysis of the data obtained.

Chapter five reports the findings of this research about the contextual issues affecting conversion and the farmers' personal perceptions of the conversion process. Chapter six presents the results regarding the farming system. The main characteristics of organic dairy operations are outlined, followed by a description of the problems experienced and strategies employed in conversion, and an assessment of the productivity of organic dairy systems. Findings in Chapter five and Chapter six are discussed in relation to previous literature. Finally, Chapter seven provides the conclusions from this research, and attempts to answer the research questions established at the beginning of this research.

CHAPTER 2: ORGANIC AGRICULTURE IN NEW ZEALAND

2.1 INTRODUCTION

Organic dairy production in New Zealand is in its infancy. However, well established certification agencies, favourable governmental policies and industry support are hastening the development of the organic dairy sector. This chapter provides information on the organisational network related to organic agriculture, particularly certification agencies, gives an overview of the market, production and trade of organic goods and outlines the current state of the organic dairy sector in New Zealand.

2.2 ORGANISATIONS INVOLVED IN THE ORGANIC SECTOR IN NEW ZEALAND

The organic movement in New Zealand emerged as early as 1950 from small groups of farmers with different motivations. Liepins and Campbell (1998) suggest that the organic agriculture movements appeared in New Zealand as a result of four consecutive historical events. The first one was the establishment, in the 1930's, of small associations aimed at preserving traditional agricultural practices. Then, the American Environmental Movement of the 1960s influenced New Zealand agriculture. During the 1950s to the 1970s the arrival to New Zealand of European immigrants committed to the organic movement and later the development of alternative land-use patterns in peri-urban areas influenced national agricultural practices. However, it was not until 1983 that a more formalised structure of organic agriculture was established, when three major organizations - Soil and Health Assoc., the Biodynamic Farming and Gardening Assoc. and the NZ Doubleday Assoc. – joined to form the NZ Biological Producers Council (NZBPC). This organization was later known as BioGro, which has from then on administered production standards under the BioGro certification system.

In 1995, The New Zealand Organic Products Exporters Group Inc. (OPENZ) was formed as a network of business, research institutions, consultancies and certifying agencies with support from New Zealand Trade Development Board. Their activities are focused on strengthening the industry through export growth, including initiatives to build the integrity of organic products and domestic infrastructure to support organic food production. OPENZ has 61 members that range from large, multi product food companies to small exclusively organic producers (OPENZ, 2003). In 2001, Organic Growers NZ Incorporated was formed to represent all of the 16 commercial organic organisations at a national level (MAF, 2003a).

The organic sector in New Zealand is represented by three organizations: the Organic Federation of Aotearoa New Zealand (OFANZ), the National Maori Organic Authority (Te Waka Kai Ora) and Agriquality (See figure 2.1). OFANZ represents all the organizations described above to the government, other industry bodies, consumers, educators, researchers and growers. Te Waka Kai Ora is the Maori national organic authority that provides support to Maori organic growers and encourages the development of farming practices according the traditional organic Maori philosophy. Agriquality is the government organization for food safety and biosecurity and it provides certification of organic products through its certification business CERTENZ.

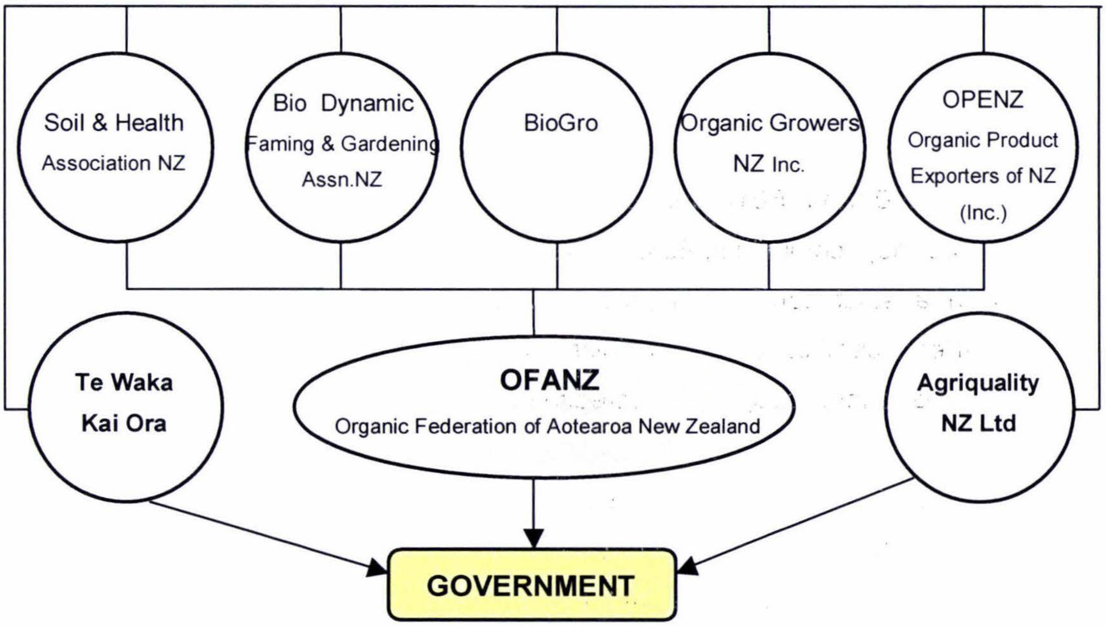

Figure 2.1. Organisations involved in the organic sector in New Zealand
(Adapted from: MAF, 2003a).

As reflected in this section, at the moment, there are many separate organizations representing the variety of stakeholders in the organic sector in New Zealand. However there is a lack of a leading national organisation that looks after the interests and operates on behalf of all the participants involved (MAF, 2003a). In addition, the inadequate knowledge on sustainable organic systems in New Zealand is preventing the development of the organic sector, stressing the need for technical information, research and extension (MAF, 2003a). The government is aware of the weaknesses and potential of the organic sector and has adopted policies to aid its further development. In fact, the Ministry of Agriculture and Forestry (MAF) has prepared a 20-year strategy for the development of the organic sector in New Zealand. The vision for the Organic Sector in New Zealand is to "be recognized internationally as a world leader in organic systems and products" (MAF, 2003a, p.i) and a target of $1 billion total sector sales has been set up for the year 2013. In addition, an Organic Sector Board is being set up as a leadership organisation to coordinate the organic sector and oversee the implementation of the Organic Sector Strategy.

2.3. NEW ZEALAND ORGANIC CERTIFICATION AGENCIES

At the moment, there are three organic certification agencies in New Zealand: Demeter, BioGro and Agriquality, all of them members of OPENZ. Demeter is mainly related with biodynamic farming and its certification requires the use of biodynamic preparations (500 and 501) and compost preparations. BioGro is the largest certification agency, comprising 80% of the total certification in New Zealand (MAF, 2003a), with a strict certification process and good market positioning (BioGro, 2004a). Certenz certification is administered by Agriquality, an organisation that provides internationally recognised accreditations for food.

Until recently, Demeter and BioGro have been considered "conservative organizations", whereas Certenz has been regarded as "liberal" in relation to the strictness level of the standards that these organisations command (Stafford & Mellor, 2003). In addition, it has been suggested that "several certifiers exist without clear recognition in domestic or export markets" (MAF, 2003a), thus a need has been identified for certifications schemes to meet agreed criteria (MAF, 2003a). In the last two years, Certenz have moved closer to BioGro standards in order to gain IFOAM accreditation and be qualified to certify organic products suitable for the USA market. At the moment, BioGro and Certenz are both accredited under IFOAM and are Third Party Agencies (TPAs) under the New Zealand Food Safety Authority (NZFSA), expanding the market opportunities for the organic sector in New Zealand. Therefore, Certenz has launched supplementary requirements for operators producing for the

USA market, which are often more rigorous than the basic standards for organic production.

Organic farmers who are not producing for the USA market should follow different standards under BioGro and Agriquality which may have important management implications. The certification process with BioGro takes normally 36 months for primary producers, while the normal conversion period with Agriquality for farmers not producing for the USA market is 24 months (BioGro, 2001; Agriquality, 2003a). For both standards there is a retrospective registration period. In relation to animal health, both standards stress the importance of treating disease situations and avoiding unnecessary pain and suffering. However, animals treated with chemical remedies loose certification for double the withholding period under Agriquality (Agriquality 2003a), whereas the same restriction *plus* 12 months applies under BioGro standards (BioGro, 2001). Calves should be reared in milk for at least 3 months and the use of vaccination is not normally permitted. In relation to feeds, Both organizations acknowledge organic dairy farming as a pasture base livestock farming, however, in the absence of organic feed, uncertified supplementary feed is permitted up to 10% per of the total annual DM intake (Agriquality 2003a; BioGro, 2001).

2.5 ACCESS TO OVERSEAS MARKETS

As a consequence of the global increase in the consumption of organic food, the many countries are developing national standards for the production of organic products, which apply to both domestic and imported organic products. Given this situation, the New Zealand Food Safety Authority (NZFSA) established an Official Organic Assurance Program (OOAP) (NZFSA, 2004) in order to guarantee the access of New Zealand organic products to export markets. Through this program, organic products exported to EU have official guarantees that they comply with the European Regulation 2092/91. In addition, BioGro and Certenz have been accredited as Third Party Agencies (TPAs') by the NZFSA to certify organic products that comply with the USA standards (NZFSA, 2004).

The recent opportunity to access the US market for organic food has put up new challenges for New Zealand organic farmers and certification agencies. All organic products exported to USA must meet the requirements of the USDA National Organic Standards, which in some cases have much stricter rules than BioGro or Agriquality standards. For instance, animals must be fed on 100% organic feed and animals treated with antibiotics in converted herds lose certification status for life. The supplementary requirements for organic operators producing for the USA markets are compiled in the NZFSA Technical Rules for Organic Production AND appendices and are summarized in Appendix one.

The access opportunity of New Zealand products to the USA market has provoked a change of preference towards certification agencies accredited as TPA, which has impacted on Demeter:

> The number of Demeter dairy farms has declined since NZFSA required only auditors registered with them by a recognised TPA to audit farms for the US and EU export programmes (D. Wright, 12 August, 2004, personal communication).

Japan has strict food safety standards and the acceptance of the OOAP for access the Japanese market is being negotiated by NZFSA and the Japanese Ministry of Agriculture MAFF. However, the frequent changes in the supplementary requirements for meeting the USA standards and the ongoing negotiations between NZFSA and Japan reflect an effort from the government to open new markets for organic products but at the same confuses organic producers in terms of the management practices permitted.

2.4 ORGANIC MARKET AND PRODUCTION IN NEW ZEALAND

In the past, the development of the organic sector in New Zealand has been based on export markets. From small beginnings in the early 1990's, exports of New Zealand organic products have increased by 775% to reach export sales of around NZ$70 million in 2001/2002 (OPENZ, 2003). In the same period, 41% of the organic products were exported to Europe, 26% to Japan and 15% to North America (OPENZ, 2003). It is estimated that exports will grow to NZ$500 million by 2006 (BIOGRO, 2004b).

Nevertheless, in the last few years, growth rates of exports have flattened to 10% per year due to a flourishing domestic market which grew 100% annually over the years 2000 to 2002 and is currently growing at 20% per annum. **The general aversion against genetic engineering amongst New Zealanders is one of the main reasons for the sudden growth of the domestic market** (Mason, 2004).

At present, sales of organic products in New Zealand are worth NZ$100 million, of which half are imported organic products (Mason, 2004). The main organic products exported from New Zealand are organic kiwifruit and organic apples, which represent more than 5% of the total production in those categories and greatly contribute to the 77% of the total exports for which fresh fruit accounts. The pastoral sector has been slow to embrace organics (MAF, 2002) but is now responding to the increasing demand for organic milk and is expected to contribute largely to the forecasted figures for 2006.

New Zealand has approximately 1100 certified organic operations, of which 900 are primary producers, 100 are processors and exporters and 100 are certified suppliers of inputs. This is equivalent to 40,000 hectares under organic management, a very small fraction, only 0.34%, of all agricultural land (Mason, 2004). **Even so, New Zealand's low level of pollution, extensive grass based livestock systems and benign climate are natural conditions for the further development of the organic sector. In addition, New Zealand's "clean and green" image is well respected in overseas markets and the demand for exports of organic products far exceeds supply** (Mason, 2004). **Consequently, there is room for further expansion of the organic sector in New Zealand.**

2.6 THE ORGANIC DAIRY SECTOR

Even though the New Zealand dairy industry is leading the world market, the development of an organic sector has been slow. Stevenson (2000) stated that the New Zealand Dairy Board started encouraging farmers to produce organic milk in 2000. This was the consequence of a forecast of a $200 million market per year for organic dairy products in ten years (Stevenson, 2000). At this stage, the Dairy Board considered that organic milk was unlikely to exceed 5% of its total business and was targeting a critical volume of 1 million litres at the peak of the season. To sustain this production level, Fonterra set up a target of 250 certified organic suppliers for 2007

(Massey University, 2004). In 2001, it was further proposed that conversions should be approached in a series of waves or steps in order to manage risk (Smith, 2001). An optimistic projection from, at that time, the New Zealand dairy Board, forecasted an organic dairy market for 2004/2005 with the first wave or activity stream starting in 2001 (Smith, 2001). A tentative time-line for the development of the organic dairy sector in New Zealand is shown in Figure 2.2.

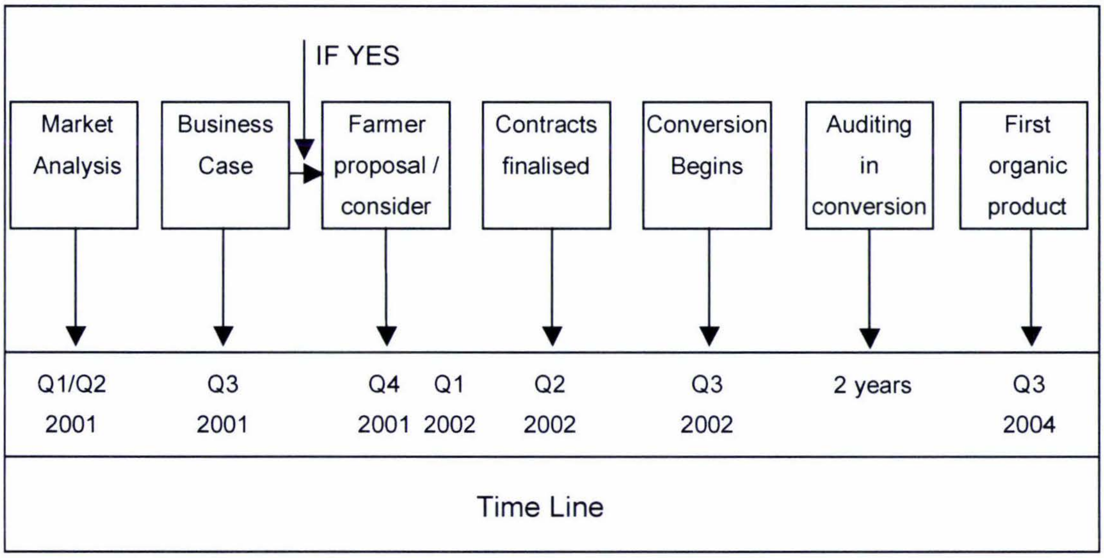

Figure 2.2. Time-line for the development of the organic dairy sector in New Zealand
(Adapted from: Smith, 2001).

However, in 2001 there were less than 20 organic dairy farms certified in New Zealand (Smith, 2001) and two years later, in December 2003, only 27 farms were contracted to supply organic milk to Fonterra (AgraEurope,2004; Fonterra, 2003). This suggests that conversion to organic dairying has been slower than predicted and goals are not being achieved. In effect, Fonterra has reformulated its organic plan in order to encourage conversion and meet market demands. Fonterra is targeting to have 200 organic farms supplying 170 million litres of organic milk per year by 2013 (Fonterra, 2004). In addition, to stimulate conversion, farmers are now offered a six years contract based on premiums of 7% during the first three years of conversion and 20% for fully certified operations, provided they comply with the NZFSA Technical Rules for Organic Production AND appendices. (Fonterra, 2004). Fonterra has developed a managed and measured growth strategy for its organic business, aiming at 50 farms per year coming into production in the next three seasons (Fonterra Shareholders Services, 2005). This plan is targeting farmers in the

Waikato, whom will be exempt of the transport surcharges that other organic farmers located outside the Waikato will have to assume if they want to supply milk for the USA market. For instance, farmers in the South Waikato /Bay of Plenty and in Taranaki will have to pay transport surcharges of $0.08 and $0.16 per kg of milk solids respectively, while surcharges in other areas are set to negotiation (Fonterra Shareholders Services, 2005). Finally, Fonterra is now committed to provide support and advice for organic suppliers, through workshops, information reference sources and regular farm visits (Fonterra Shareholders Services, 2005).

2.7 THE CONVENTIONAL DAIRY SECTOR IN NEW ZEALAND

As explained previously, New Zealand has real advantages for the development of a strong organic dairy sector, derived from the existent dairy industry and the traditional pastoral dairy systems of production. The dairy industry in New Zealand is based on co-operative principles and it is integrated by research institutions, genetic corporations and processing plants. One third of all dairy farmers are sharemilkers, in which the landowner is associated with the owner of the herd and both share the total income (Holmes, 2002).

Over the last 20 years, there has been a trend toward a reduction of the number of dairy herds in New Zealand (LIC, 2003). However, this tendency has been accompanied with an increase in the total population of cows (3.7million cows in 2002/03) and in the average herd size (285 cows/herd in 2002/03), indicating that the dairy sector in New Zealand is still expanding. In 2003, annual production reached 1.19 billion kilograms of milk solids or 13.9 million litres, of which 90% is exported to overseas markets (LIC, 2003). Production and exports are free of subsidies or incentives, thus "the reliance on world market prices imposes tight economic constraints on the production systems and methods that can be profitable on farms in New Zealand" (Holmes et al., 2002, p.5).

In effect, traditional New Zealand dairy systems follow the seasonality of pasture growth. Two factors explain the predominance of seasonal pastoral systems. First, favourable environmental conditions such as temperate climate and fertile soils allow for the growth of grass-clover pastures of high feeding values. Second and from a macro-economic perspective, New Zealand's unsubsidized economy is subjected to variations in world market prices, restricting profitable milk production options to low cost grazing systems. As Holmes (2002, p.3) explains: "the simple low-cost pastoral systems are *necessary* because of the world market milk price and they are *possible* because of the temperate climatic conditions"

Following the seasonality of pasture growth allows producers to avoid dependence on supplementary feed and, thus, to remain competitive by maintaining low production costs. The aim is to synchronize the supply of pasture and the feed demand of the herd by using appropriate stocking rates and a spring calving pattern. The average stocking rate is 2.75 cows/ha (LIC, 2004), whereas 95% of all dairy farms in New Zealand are spring calving, in which cows calve in July to September and are dried off before winter after a short lactation of 220 to 240 days (Holmes et al, 2003).

The advantages and disadvantages of the New Zealand dairy system of production have been explained as follows:

> Cows remain outdoors through the year, they harvest their own feed and they spread most of their own dung and urine. This creates large savings in buildings, machinery, labour and feeding costs when compared with farm systems in which cows must be housed for at least part of the year.........However, the reliance on grazed pastures, the high stocking rates (average 2.5 cows per hectare) required to ensure efficient harvesting of pasture, and the resultant short lactations combine to restrict milk yield per cow (3500 litres; 160 kg fat and 126 kg protein per cow in 224 days) to levels much lower than in the northern Hemisphere countries (Holmes, 2003, p. 4)

The characteristics of the traditional dairy system mentioned above suggest that New Zealand offers favourable opportunities to develop organic dairy systems in a cost effective and sustainable manner. It has been argued that New Zealand traditional clover-based pasture systems are closer to the organic farming concept than the intensive production systems found in Europe and USA (Condron et al., 2000). Therefore it is expected that organic systems derived from conventional dairy systems in New Zealand can follow a relatively easy transition.

CHAPTER 3: LITERATURE REVIEW

3.1 INTRODUCTION

The potential for the development of organic dairy farming in New Zealand suggests a further need to review the implications of the conversion process. This chapter outlines the principles of organic farming and the state of organic agriculture in the world. The changes and practical implications of organic farming, with particular emphasis on dairy production, are explored. Environmental, social and economic impacts of organic farming are further discussed.

3.2 CONCEPT AND PRINCIPLES OF ORGANIC AGRICULTURE

There are many definitions for organic agriculture which, together with a better understanding of the organic principles, have evolved to produce the current school of thought. In general, people tend to think of organic agriculture only as a production method that bans the use of synthetic fertilizers and pesticides. This simplistic perception emerged perhaps from the need of certification agencies to define a set of farm practices to protect and differentiate the organic market, without emphasizing the principles behind organic production. It has been argued that "organic agriculture is the most regulated form of ecological agriculture" (Scialabba, 2000). In effect, the importance of organic farming relies on the principles of sustainable production.

Organic agriculture is a system that strives for production of quality food together with the protection of natural resources and social values in the long term. In practice, organic farming is based on ecological principles, thus "organic farmers attempt to incorporate the laws of natural ecosystems in both the farm design and their approach in problem solving" (COG, 1992). The Canadian Organic Growers (COG) association exemplifies how an organic farm works within an ecological framework based on the following principles:

Principle of interdependency

Within nature every process is interconnected with another, as part of a whole. Organic farmers consider the farm unit as an ecosystem and acknowledge that every change made to one part of the system has an effect on other units of the farm, such as the effect that high nitrogen applications have on groundwater contamination (COG, 1992).

Principle of diversity

In nature, ecosystems are balanced by an intricate "web of life" (COG, 1992). In organic farming, the idea is to maintain and promote diversity by incorporating rotations, maintaining natural habitats, and balancing crop and livestock numbers. Diversity in the farm prevents pest outbreaks and weed infestations, while reducing financial risks (COG, 1992).

Principle of recycling

In nature, nutrients are being continuously recycled through the food chain. Organic farmers work towards self sufficiency by recycling plant residues to build up soil fertility (COG, 1992).

In general, these principles and others have been adopted and developed by international organizations to set base-line criteria for the creation of organic standards in individual countries. The International Federation of Organic Agriculture Movements (IFOAM), a non governmental organization established in the early 70s, provides authoritative information about organic agriculture and safeguards the quality of organic produce. In IFOAM's Basic Standards (IBS), organic agriculture is defined as:

> A whole system approach based upon a set of processes resulting in a sustainable ecosystem, safe food, good nutrition, animal welfare and social justice. Organic production therefore is more than a system of production that includes or excludes certain inputs (IFOAM, 2002, p. 4).

The intended goals of organic production as defined by IFOAM are described in the "Principle Aims of Organic Production and Processing" (see Appendix two).

Even when these principles serve as a guideline for the establishment of organic standards, regulations for organic production are subjected to local circumstances in each individual country. In this sense, organic agriculture has been regarded as "process oriented" rather than "product oriented" (FAO, 1998), in which management practices are directed to maintain the health and productivity of the farm as a whole. As explained earlier, organic farming relies on ecosystem management, and thus on the knowledge of natural processes to stimulate biological processes and sustain the productive capacity of natural resources through time. As FAO (1998) explains:

> Although many single techniques used in organic agriculture are used in a wide range of agricultural management systems, what differentiates organic agriculture is the focus of the management. Under the organic system, the focus is on maintaining the overall health of the individual farm's soil-microbe-plant-animal system (FAO, 1998, p. 2).

As illustrated in the definitions mentioned above, the concept of 'wholeness' is one of the fundamentals of organic agriculture and it has been incorporated in many of the modern definitions. For instance, the Codex Alimentarius Commission (FAO/WHO) defines:

> Organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasises the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system (FAO, 1999, P. 4).

In New Zealand, the principles of organic production set by IFOAM have been summarized in practical terms by BioGro, as follows:

> Organic agriculture is based on appropriate stocking rates, consideration of animal welfare, sound rotations using diverse stock and cropping strategies with the extensive but rational use of animal manure and other vegetative residues, and the use of appropriate cultivation techniques. It avoids the use of soluble mineral salt fertilisers, nearly all chemical pesticides and all genetically modified organisms (BioGro, 2001, p. 3).

In summary, all the definitions of organic agriculture suggest a production system that works intimately with biological processes and strives for social, environmental and financial sustainability.

3.3 ORGANIC AGRICULTURE WORLDWIDE: CURRENT SITUATION AND FUTURE PERSPECTIVES

The growth of the organic sector has been driven by political, social and economic forces. In Europe, the gradual removal of subsidies on agricultural inputs and the introduction of policy instruments, which provide financial compensation during conversion or even subsidize organic production without being certified, have encouraged farmers to adopt organic production. On the other hand, depletion of natural resources and environmental degradation has awakened a strong social conscience towards sustainable production methods. Moreover, consumers are increasingly concerned about the way in which food is produced. Concerns about food safety have arisen as a reaction to livestock diseases and genetically modified foods in developed countries. Finally, the profitability of agriculture, particularity in subsidies economies, is suffering due to a sharp decline in the prices of commodities clarifying the need to diversify and add value to agricultural products.

Scialabba and Hattam (2002) pointed out some relevant characteristics of organic production that have shaped the growth of the organic market over the last years.

1. Since organic principles are focused on the production process, it is difficult for consumers to see the benefits of organic food in the product itself. Therefore, consumers may be inclined to buy non-organic products of similar characteristics but at cheaper prices.

2. Organic farming is subjected to significant restrictions in the production process that affect production levels and increase the costs of marketing (i.e. the need of segregation to preserve the organic identity, certification costs and low scale of distribution). These effects need to be compensated for by premium prices.

3. Even when some of the benefits of organic food haven't yet been proven, consumers buy organic product mainly for the perceived health, food safety and environmental benefits.

3.3.1 LAND AREA UNDER ORGANIC PRODUCTION

Precise information and figures on the state of organic agriculture are difficult to find. In some cases products from certified organic farms is sold as conventional produce and, in other cases, land that is farmed under organic principles may not be certified.

The figures presented in this section were obtained from two authoritative institutions in the organic world. The first set of data is an annual report on statistics and trends on organic agriculture produced by The Foundation for Ecology & Agriculture (SOEL), the Research Institute of Organic Agriculture (FiBL) and IFOAM. The second data sources are publications regarding the current situation and outlook of certified organic agriculture produced by the FAO.

Yussefi (2004) indicates that the total area managed under organic principles in 2004 was 24 million hectares, an increase of 6.2 million hectares compared to the land under organic certification in 2002. Organic agriculture is practiced in almost all the countries but the major part of the total organic land is located in Australia (approx. 10 million hectares), Argentina (approx. 3 million hectares) and Italy (approx. 1.2 million hectares). This trend is also reflected in the continents that these countries represent, with Oceania comprising the largest percentage of area under organic management in the world, followed by Latin America , Europe, North America, Asia and Africa (see figure 3.1).

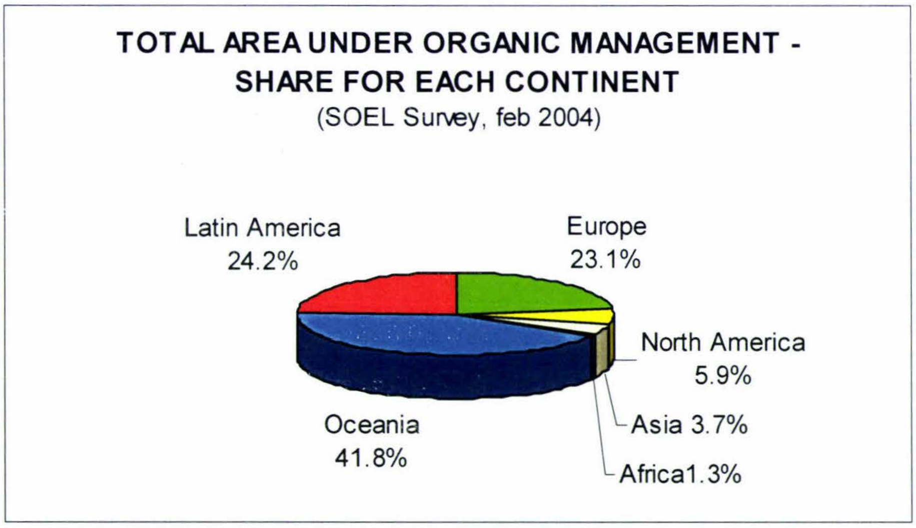

Figure 3.1. Contribution of each continent to the total global land under organic management

(Source SOEL Survey, 2004)

Generally, the land under organic management has increased in every country over the last few years. The average annual increase of certified organic land in Europe was estimated to be 24.5% between 1995 and 2000, and it is today the continent with the highest percentage of land under organic management (2% of the total agricultural land) (Yussefi, 2004). In United States, the organic farmland area increased by 44% from 1992 to 1997, with cropland and dairy being the areas of major expansion. In developing countries, land area under organic management is increasing rapidly (Yussefi, 2004). For instance, in Argentina, organic production grew 90% per year from 1997 to 2001 (Yussefi, 2004). The development of the organic sector is also reflected in the fast increase of farms being converted to organic. Table 3.1 shows the current number of farms and the area managed under organic principles.

Table 3.1. Land area under organic management and number of farms on each continent. Fully converted land and in-conversion land in 2004
(Adapted from SOEL Survey, 2004)

CONTINENT	LAND AREA UNDER ORGANIC MANAGEMENT (hectares)	NUMBER OF FARMS
Australia/Oceania	10,000,000	2,000
Latin America	5,800,000	150,000
Europe	5,500,000	170,000
North America	1,500,000	10,5000
Asia	880,000	61,000
Africa	320,000	71,000
TOTAL	**24,000,000**	**464,500**

Regarding land use, Yussefi (2004) noted: "Probably less than half of the global organic land area is dedicated to arable land since, in Australia and Argentina, most of the organic land area is extensive grazing land" (p.13). In these countries, the extensive nature of livestock systems is the most suitable management option in the vast areas of the Argentinean Patagonia and the Australian drylands (Scialabba & Hattam, 2002). However, in Australia, most of the organic land is dedicated to extensive beef enterprises, while in Argentina, a great proportion of the certified organic land are natural pastures for sheep and cattle and forest areas for apiculture.

3.3.2 THE ORGANIC GLOBAL MARKET

The organic food sector is today one of the fastest growing food sectors in the world. The organic market has grown at 20-25% per year over the last decade (Scialabba & Hattam, 2002). In 2002, the market for organic products was valued at US$23 billion

(Sahota, 2004), US$7 billion more than what was estimated for 2000. In spite of these figures, organic sales only represent between 1% to 2% of the global food and beverages world trade.

The North American market for organic food and drinks is today the largest in the world. Sales have expanded by 12% to US$11.75 billion in 2002, largely after the introduction of the National Organic Program (NOP) in October 2002 (Sahota, 2004). In contrast, the European market is now reporting a slower growth compared to the rapid expansions of the 1990's as certain sectors approach maturity. In 2002 it showed an expansion of 8% to reach US$10.5 billion. The Japanese market for organic food is the most important in Asia, while Brazil and Argentina are the leading countries for organic production in South America (Sahota, 2004), with about 90% of the organic produce being exported mainly to USA and Europe. The Australian and the New Zealand organic food industry are also export-oriented to northern hemisphere countries (Sahota, 2004).

On the whole, the characteristics of the current market of organic products in the world have been summarized in following points (Scialabba & Hattam, 2002):

1. Variations in market shares: the market share of particular organic products varies widely between countries.
2. Instability in sales: in spite of the global growth of the organic market, organic sales have shrunk in some markets or for some products due to unfavourable policies, demand inconsistencies, etc.
3. Lack of market transparency: the insufficient flow of information is reflected in a large variation amongst commodities prices. There is a need to establish reliable sources of information on which to base market decisions.
4. High marketing margins: the fact that organic producers are dispersed, far from consumers and dependant on traders, increases the margins for organic products. Margins are payments for storage, transport, handling, packing, processing and insurance.
5. Small economies of scale: as the organic market grows and matures, it is expected that economies of scale should reduce marketing costs nearly to those in conventional products.

6. Minimal processing of food: the degree of processing in organic food, with the exception of dairy products, beverage and cereals, is low. This reflects a strong commitment with the organic philosophy from the consumer's side, who value the absence of additives and preservatives in their food.

The fact that organic produce enjoys premium prices restricts their sale to developed countries, such as North America and Western Europe, where people have higher education and greater purchasing power. In countries like Canada, organic horticulture represents around 9% of commercial sales, and some commodities such as organic milk have over 10% of the market share in Germany. It is likely that as more countries develop economically and their populations become increasingly educated, demand for organic products will rise (Scialabba & Hattam, 2002).

As the organic market matures and achieves economies of scale, it is expected that prices amongst organic commodities will stabilise, marketing margins (transport, storage and processing costs) will decrease and final consumer prices will become similar to conventional products. In addition, as the organic industry develops, the level of processing of organic foods is expected to increase, gaining a stronger position in supermarket chains and mainstream markets.

3.3.3 REGULATIONS AND TRADE OF ORGANIC PRODUCTION

The increasing trade of organic products requires the establishment of reliable certification systems and international equivalence of organic standards to ensure flexibility for exporters and conformity for consumers. In 1980, IFOAM first published the Basic Standards for Organic Production and Processing (IBS) to define how organic products should be grown, produced, processed and handled, and reflect the current state of organic production and processing methods. IBS is used as a guideline of the "minimum requirements" for setting standards in individual countries. As mentioned previously, certification is given to the production process, rather than to the product itself, allowing for specific local conditions in terms of needs and availability of resources. However, standards should never contain requirements lower than IFOAM's guidelines. In developing countries, where the establishment of local certifying organizations is restricted by cost, certification can be carried out by an international organization authorized by the IFOAM Accreditation Program (FAO, 1999).

United Nation's organizations, such as the FAO and the WHO, consider international guidelines on organic products as essential for consumer protection, trade facilitation and assistance in the creation of national regulations. The Codex Alimentarius Comission, a joint FAO/WHO Food Standards Program, began producing guidelines for the production, processing, labelling and marketing of organic food in 1991 (Kilcher et al., 2004). These guidelines are aligned with IBS and are considered an "important step in the harmonization of international rules in order to build up consumer trust" (Kilcher et al., 2004, p. 29).

The EU regulations for labelling organic plant products (2092/91) and organic livestock products (1804/99) protect organic producers from unfair competition and consumers from fake organic products. Any agricultural good imported in the EU may only be labelled as organic if it satisfies EU regulations (Kilcher et al., 2004). Each country is responsible for the implementation and monitoring of the EU regulations according to its national context. Of the 39 countries with fully implemented organic regulations in the world, 15 countries are part of the EU and 13 countries are in the rest of Europe.

In the USA, the implementation of the National Organic Program (NOP) in October 2002 reinforced the national organic sector. The NOP only allows organic products that *fully meet* the USDA regulations to be marketed as organic in USA. At the moment there are 53 accredited agencies in the USA and 36 companies outside the country operating the national certification program, reflecting the interest of other countries in exporting organic products to the USA market (Haumann, 2004, p. 152). In addition, to facilitate international trade, equivalency agreements between countries are being negotiated to accept foreign accreditation procedures and allow products certified by them to be labelled and sold as organic in the US. As explained in the previous chapter, the USDA has recently accepted the NZFSA Official Organic Assurance Programme (OOAP) for recognition of organic certifying bodies (NZFSA, 2004). This implies that New Zealand organic products certified by a Third Party Agency (TPA) (i.e. BioGro, Certenz, QCONZ) to the USDA standards can be sold directly in the USA market (NZFSA, 2004).

In comparing the EU and USA requirements for trading organic food, the EU regulations specify that organic foods imported must have been produced, processed and certified in accordance with *equivalent* standards. This stipulation implies a retroactive assessment on equivalency for imported goods that seems to be more flexible but less precise than the US procedure. Therefore, New Zealand organic products may access the USA market when certified by a TPA to the USDA standards, and the European market via the list of third countries. However, the recent and booming development of the organic market exposes standards to frequent changes as research progresses in improving organic practices and performance. This interferes in the trade of organic products and is particularly relevant to export-oriented countries as New Zealand.

3.4 THE CONVERSION PROCESS

The conversion process, understood as the time required to change a farm from conventional to organic management, will vary according to the physical environment of the farm (e.g., soil type, climate), previous management and local regulations on organic farming. In the present research, the term conversion and transition will be used synonymously to describe the process of change from a conventional to an organic system and not specifically in regard to the certification period.

3.4.1 MOTIVATIONS FOR THE CONVERSION TO ORGANIC FARMING

Understanding the characteristics and motivations of organic farmers is important in order to understand the type of farming system that originates as a result of conversion. Presumably, the motivations of early converters for transforming their conventional operations into organic systems were influenced by altruistic ideals and, perhaps, more aligned with the central philosophy of organic farming. As organic farming becomes more mainstream, it is likely that conversion will be driven more by economic reasons and market demands. However, it is not less probable that conversion arises as a consequence of a thorough decision-making process in which the farmer evaluates the pros and cons of adopting the organic principles according to his or her future goals and, thus, one particular farmer may have several reasons for conversion.

As early as 1981, Fischer grouped the motivations of organic farmers into external and internal factors. External factors were described as negative experiences in applying conventional methods, diseases in humans and animals on the farm, and contacts with organic farmers doing well. Internal factors were related to psychological predisposition or the search for a new way of life.

In an attempt to apply the adoption/diffusion model to the process of conversion to organic farming, Padel (2001) extensively reviewed the different motivations for the conversion to organic farming and categorized them in two groups: farming-related motives and personal motives. Farm-related motives include husbandry and financial motives, whereas personal motives are divided into personal health and general concerns. Each of these categories comprise more specific issues, as illustrated in table 3.2

Table 3.2. Motives for conversion to organic farming.
(Source: Padel, 2001)

FARM RELATED MOTIVES	PERSONAL MOTIVES
Husbandry and technical reasons	**Personal Health**
Animal health problems	Own and family health problems
Soil fertility and erosion problems	Ergonomic reasons (e.g. heath risk from applying chemical)
Financial motives	**General concerns**
Solve existing financial problems	Stewardship
Secure future of the farm	Food quality
Cost saving	Conservation
Premium market	Environmental
	Rural development

In relation to how these motives for conversion change through time, it was suggested that "early organic farmers were more strongly motivated by husbandry problems and religious concerns, whereas 'newer' organic farmers are concerned about environment, have economic reasons and increasingly see organic farming as a professional challenge" (Padel, 2001, p. 47).

In New Zealand, Fairweather (1999) highlighted the diversity of motivations for organic farming. Fairweather's report is based on the results of 2 separate studies, one of a variety of farmers in Canterbury and the other of kiwifruit growers in Bay of Plenty, both including organic and conventional farmers. Fairweather's study highlighted the diversity of motivations for organic farming. The study identified 7 motivational criteria for conversion, as part of a decision tree to identify the reasons and constraints for the conversion to organic production. The first 5 criteria induce farmers to grow organic products while the last 2 lead them to seriously consider organic production. The motivational criteria and the frequency of respondents are as follows:

1. Adhere to an organic philosophy and/or concerned for the environment (8)
2. Interest in organic farming as a consumer: don't want chemicals in food (5)
3. Experience ill health from the use of chemicals (10)
4. Attracted to premiums or need higher valued products (10)
5. Experience basic problems with conventional production (1)
6. Use chemicals but see them as expensive and/or dubious value; prefer not to use them; don't like sprays (12)
7. Concerned with soil and/or increasing humus level (3)

3.4.2 PERSONAL CHARACTERITICS OF ORGANIC DAIRY FARMERS

As reported before, conversion to organic farming has been studied using the adoption/diffusion model. According to the adoption/diffusion model, the adoption of innovations follows an S-curve through time. The first adopters in implementing the innovation are called *innovators*, followed by the *early adopters*, the *early and late majority*, and finally the *laggards* (Padel, 2001). Padel (2001) suggests that first organic farmers show the typical characteristics of innovators: they are highly educated people and have wide social networks. On the other hand, later converters share the characteristics of early adopters: they are more integrated into their local community, have a degree of opinion leadership and have intense contact with information sources (Padel, 2001).

Organic innovators suffered social opposition and isolation as a consequence of conversion (Padel & Lampkin, 1994; Padel, 2001). In effect, organic and conventional productions are based on different principles. Hill (2000) stated that modern agriculture is subjected to psychological barriers for change, which are finally reduced to compensatory behaviours that include a range of consumptive, stimulatory and distractive activities as well as attraction to symbols and illusions of power control. In agricultural systems, the desire for control is materialized in dominating the environment through the simplification of designs (e.g. monocultures).

Under this argument, conversion to organic farming is a proposal of change that brings up fear, criticism and a diverse range of defensive behaviours (Hill, 2000). However, "once the decision to adopt organic faming has been taken, the farmers became fully committed, seeing further problems as challenges and no longer as barriers" (Fisher, 1989, p. 298, cited in Padel & Lampkin, 1994).

In effect, it has been argued that organic farmers are proactive, thrive on being unique and on trying new methods. "They enjoy the challenge of organic farming because it demands individual initiative, acceptance of risk and innovative farming techniques" (Duram, 1999, p.9). Similarly, Schneeberger et al., (2002) reported that long term organic farmers are more committed to organic farming and, if premium prices are removed, they are less likely to desert than late converters. Padel (2001) and Duram (1999) agree in that many organic farmers are younger and better educated than average farmers, although most of them have no formal agricultural education and have less farming experience.

In New Zealand, MAF (2002) conducted a series of workshops with organic and conventional livestock producers to find out their perceptions of the costs and risks of conversion to organic production. The study revealed that, due to the adoption of organic systems, producers expect a change in the constitution of the agriculture service industry in rural areas and an increase in the labour requirements, which may bring more families into rural communities. Organic producers believe that organics may develop a sense of pride in the community and will open a window for other businesses, such as ecotourism. Another social impact of organic agriculture implementation in rural areas is the enhancement of Maori culture. In fact, the organic sector is providing sustainable livelihoods and ways of life that are grounded in Maori customs (MAF, 2003b).

3.4.3 THE INSTITUTIONAL ENVIRONMENT AFFECTING CONVERSION TO ORGANIC FARMING

Although the adoption of organic farming is a personal decision largely influenced by experiences and beliefs of each individual farmer, short term and external events that are not under the control of the farmer may impact on the conversion process. Changes in market price premiums, agricultural policies, organic standards and education could encourage or discourage farmers from conversion (Duram, 1999; Padel, 2001; Feiden et al., 2002).

In Denmark, Vaarst et al. (2003) found that for organic dairy farmers, regulations were perceived as difficult to understand and self-contradictory. A connection was observed between herd problems and the perception that legislation resulted in problems or was considered as 'illogical' or 'irrelevant to organic farming' (Vaarst et al., 2003). In New Zealand, it has been argued that the multiplicity of certification schemes is often confusing (MAF, 2003a). However, from all the institutional aspects constraining conversion, the lack of commitment by the dairy industry in developing the necessary processing and marketing capability has been identified as the single biggest factor limiting the growth of the organic dairy sector in New Zealand (MAF, 2002). The relative importance of institutional issues for the organic dairy sector in New Zealand is presented in figure 3.2.

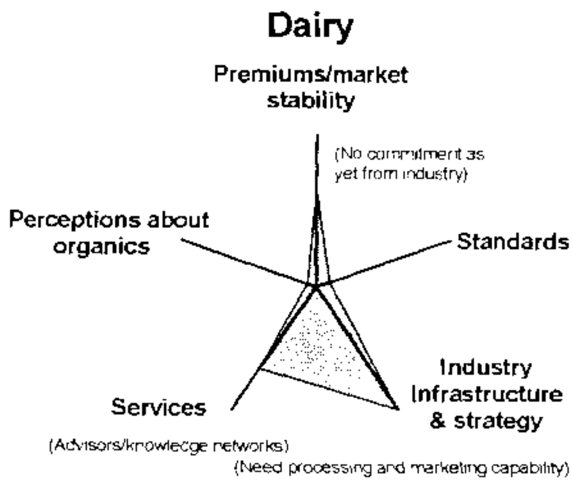

Figure 3.2. Relative importance of institutional issues for organic dairy farming in New Zealand.
(Source: MAF, 2002)

In MAF's research, industry support was related to the lack of advisers and knowledge networks in assisting conversion to organic farming. In effect, organic dairy farmers do not enjoy the strong support that conventional dairy farmers receive from the industry and other research institutions in New Zealand. This causes uncertainties and delays the growth of the sector (MAF, 2002). To be able to overcome these uncertainties, farmers should have a strong commitment to the organic approach (Lampkin, 1999). In fact, it has been argued that "the first step in the conversion of a farm is the conversion of the farmer" (Blake, 1990, p.46) in terms of attitudes and approach to farming. In relation to attitude changes, farmers need to believe and be positive about this new direction, and count on the support of family and friends (Blake, 1990). In relation to changes in the farming approach, farmers should aim at confronting problems at a causal level (Hill, 2001) and look at the farm as a whole (Blake, 1990). Farmers have to leave behind the conventional approach of fixing problems and develop a preventative one. Further, it has been argued that unlike conventional farmers “who can err on the side of caution”, organic farmers must take a more considered view (Stockdale et al., 2000):

> With less emphasis on a prescriptive, blueprint approach, observation of the farming system, and of the behaviour and performance of the animals within that system, play an important role in the development and refinement of an organic livestock system (Boehncke, 1998, cited in Stockdale et al., 2000, p.279).

3.4.3 CONCEPTUAL FRAMEWORKS FOR THE CNVERSION TO ORGANIC FARMING

Padel and Lampkin (1994) have proposed conversion to organic farming in four stages:

1. Initial knowledge
2. Acceptance as a good idea
3. Acceptance on a trial basis
4. Adoption

The first two stages involve interacting with other organic farmers, attendance at seminars and conferences, discussion with extension agents and reading available literature (Padel & Lampkin, 1994). Stage three allows farmers to gain direct experience on organic practices but it diverts from the principle of interdependency explained earlier on this chapter. In this sense, some authors have recommended converting sections of the farm in stages, in order to maintain production and minimizing financial risk (Brusko, et al., 1985; Preuschen, 1985; Wookey, 1987, cited in MacRae, 1990). However, it has been argued that suitable rotation systems cannot be developed in small sections of the farm, thus biological process and interactions may fail to become established and provide reliable results (Lampkin, 1999). For that reason, stage three is sometimes replaced by conversion planning, which aims at assessing the feasibility of conversion for the individual farm (Padel & Lampkin, 1994).

Finally, the adoption phase can be approached from three angles: *staged conversion* (successive conversion on parts of the farm), *single-step conversion* (conversion of all the farmland at one time) and *gradual de-intensification* (slowly reducing inputs and redesigning organic systems) (Padel & Lampkin, 1994). Each of these approaches have different benefits and disadvantages; however, it has been suggested that gradual de-intensification is the most successful way to convert to an organic farming system (Hill, 1995). Further, Hill (1985) has proposed a model for the gradual transition to sustainable agricultural systems which involves moving from the present situation of the farm to redesigning the whole farming system. This model is proposed in three consecutive steps: efficiency, substitution, and redesign.

Efficiency

This stage involves increasing the efficiency of conventional methods to reduce the use of costly inputs and scarce resources. As a result, farm inputs are minimized and adverse impacts on the environment are reduced. Some examples are as follows: using less spray and fossil fuel, banding fertilisers, applying integrated pest management (IPM), arranging crop patterns and densities for maximum production and optimal operation timing.

Substitution

Substitution involves replacing conventional inputs with their environmentally sound alternatives. Substitution implies adopting less invasive cultivating techniques like chisels or discs, using biological pest and weed controls, using compost and organic sources to maintain fertility levels, etc.

Redesign

The redesign stage is achieved when farmers are able to recognize the cause of problems and adopt a "preventive" approach rather than focusing on solving specific issues. In doing so, farmers redesign the farming system to encourage ecological processes and diversity. Examples are rotations, agro forestry, companion planting, and intercropping.

Strategies of efficiency and substitution are considered by Hill (2000) as only shallow approaches to sustainable agriculture, while redesign is a deep approach that "underlines issues by changing the structure and functioning of the systems" (Hill, 2000, p.2). Figure 3.3 highlights different approaches to farming in the light of Hill's model.

Figure 3.3. Comparison of three approaches to sustainable agriculture.

(Source: Hill & MacRae, 1995)

UNSUSTAINABLE	SHALLOW SUSTAINABILITY		DEEP SUSTAINABILITY
CONVENTIONAL	**EFFICIENCY**	**SUBSTITUTION**	**REDESIGN**
EXAMPLES			
Factory farm	Low input and resource efficiency agriculture	Eco-Agriculture	Permaculture, Natural and Ecological Farming
APPROACHES			
High power, imported, non renewable	Conservation	Solar and renewable	Integrated use of local inputs, reduced demand
physical/chemical (soluble fertiliser, pesticides, biotechnology)	Physical/chemical/biological (slow release, band)	Biological and natural materials	Bio-ecological
Imported input-intensive	Efficient use	Alternative inputs	Knowledge/skill intensive
Narrow focus, farm as a factory (linear, design and management)	Efficient factory	Benign factory	Broad focus, farm as ecosystem (integrated design and management)
Problems as enemies to eliminate and control directly with products and devices	Efficient control (monitor pest, integrated pest management)	Biocontrols and more benign alternative interventions	Prevention, selective and ecological controls (pests as indicators)
GOALS			
Maximize production (neglects maintenance over short term	Maintain production while improving maintenance	Improved maintenance	Optimise production (emphasizes maintenance and systems "health") over long term
Create demand, manipulate wants, global marketing			Meet real needs; mostly local distribution

In discussing features of the model illustrated in figure 3.3 further, it is common to find farming systems locked in the two first stages on their path to sustainability. In fact, conventional systems that have reached the efficiency stage or organic systems that have reached the substitution stage only achieve a low to medium degree of sustainability (Hill, 2000). Substitution, particularly, can be a barrier to achieving the redesign stage. Farmers as "consumers of agricultural goods" are constantly stimulated to purchase products, especially in the field of organics where new products are continuously being developed and released to the market. Nevertheless, even the benefits of organic inputs are temporary so "a system dependant on them can never be sustainable" (Hill, 2000, p.2). The main advantage in following the efficiency/substitution/redesign progression in the transition to sustainable farming practices is that the farmer has the opportunity to learn by experience and develop new management skills before moving to the next stage: "we have observed the most successful conversions follow, in a flexible way, an efficiency – substitution – redesign progression" (Hill, 1995, p.82).

3.5 IMPLICATIONS OF CONVERSION FOR THE FARMING SYSTEM

It has been argued that changes in the farming system for the adoption of organic principles are directly proportional to the degree of intensification and specialization of the conventional system prior to conversion (Lampkin, 1999). Similarly, a review of organic dairy farming in Europe concluded that the relative low cost of extensive farms encourages conversion to organics and that conversion in those farming systems can be achieved with little difficulty (Rosati & Aumaitre, 2004). Changes in conversion also vary according to the goals that the farmer has set up for his or her new enterprise, the biophysical environment of the farm and resources available.

Vaarst et al., (2003) observed that only a few routines and management choices changed following conversion of organic dairy systems in Denmark, yet changes related to conversion were primarily linked to the land, crops and the farming system. In this case building a new housing system, which was always a loose housing system, was often a direct consequence of the conversion and was associated to an increase in herd size. However, these changes were related to specific regulations on organic farming in Denmark, making it unlikely to observe the same effects in countries with a predominance of low input dairy systems. In fact, being most New Zealand dairy farms pastoral systems with a seasonal calving pattern and a long grazing tradition, it is expected conversion to organic farming to be relatively easy for New Zealand dairy farmers, and the resultant dairy system not far different from the conventional ones.

At the moment, little research has been conducted in New Zealand in relation to the implications of conversion in dairy systems. In an attempt to identify the main constraints to conversion in different agricultural sectors in New Zealand, MAF (2002) conducted a series of facilitated workshops with representatives (e.g., farmers, consultants, researchers) of the sheep and beef, deer, arable, and dairying sector. The relative importance of technical issues for the expansion of the organic dairy sector in New Zealand is illustrated in figure 3.4.

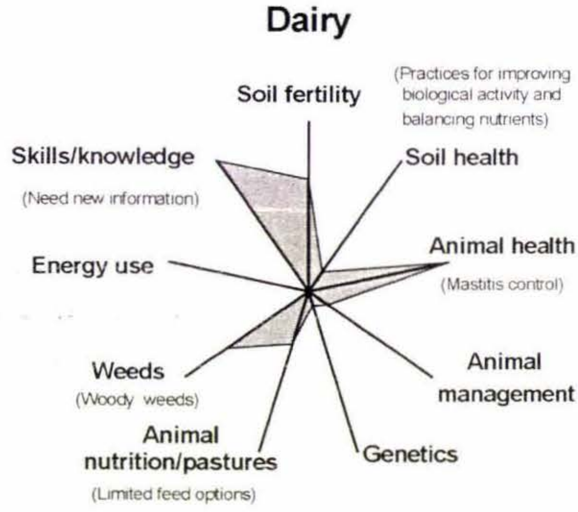

Figure 3.4. Relative importance of technical issues for organic dairy farming in New Zealand.
(Source: MAF, 2002).

Figure 3.4 shows that, from a series of technical issues, the dairy group considered animal health, particularly mastitis control, as a major threat in organic dairy systems. In addition, Weed control, particularly woody weeds, was also considered as an important constraint to conversion to organic dairy production. Maintaining soil fertility and understanding more about how the biological activity of the soil could be improved was identified as important to develop a viable organic system (MAF, 2002). Finally, a further limitation for conversion was the lack of skills and knowledge in organic practices. Conversely, the physical health of the soil, plant pests, animal nutrition, genetic selection and sourcing replacement stock were considered important only by few participants.

On the other hand, Lampkin (1990) reported that some of the main issues affecting conversion in Europe are: shortage of forage, excess of protein in the rations (leading to health problems), weed control (especially docks, couch and thistles), unexpectedly high workloads in peak periods and financial difficulties. As can be seen from the studies mentioned above, the most significant issues in conversion are context-specific and greatly depend on the type of farming system on which the organic farm originates from. For instance, from all the issues affecting conversion mentioned by Lampkin (1990), probably the most relevant to the New Zealand context is a decline in forage supply. The next sections will review the implication of conversion to organic dairy farming in different aspects of the farm, particularly those relevant to pastoral systems.

3.5.1 PASTURE PRODUCTION AND COMPOSITION

PASTURE PRODUCTIVITY

Since much of the research in the northern hemisphere is focused on the effects of changing feeding regimes in conversion, few studies assess the implications of conversion on pasture production and composition, which is relevant to pastoral dairy systems like the ones found New Zealand. European literature has suggested:

> Forage crops is the one area where conversion-specific yield decline may be inevitable, with production lost as a result of reseeding grassland with new mixtures containing legumes, or waiting for clover to establish naturally following the withdrawal of nitrogen fertilizer.........these issue has not been investigated in detail in other studies and further research is needed to quantify the effects (p. 302, Padel & Lampkin, 1994)

In Denmark, Halberg and Kristensen (1997) estimated the losses in crop yield when converting to organic dairy farming comparing 36 conventional and organic farms. Organic dairy farms had slightly more land (average area 76 ha vs. 63 ha), a higher proportion of jersey cows but a lower livestock intensity (1.06 LU[1]/ha vs. 1.44 LU/ha) than conventional farms. The area of permanent pasture was similar for both systems, whereas the area with fodder beets and whole crop silage from small grains was higher in conventional farms, and organic farms had more grass/clover in the rotation. The authors found 24% lower total crop yield (grains, fodder beets, grass/clover) on organic farms and 12-17% lower yields in grass/clover crops (included alfalfa) on organic farms.

Fairweather and Campbell (2001) cited a Swedish study that reported a decrease of 14% in the average herbage yield in organic dairy herds, compared to conventional herds. Similarly, an unfinished farm-pair study conducted in New Zealand showed that, in the Te Kopuru site, annual dry matter production of herbage was 26% lower in the transition farm (16 tonnes/ha in the transition farm compared with 21.5 tonnes/ha in the conventional farm) (Macgregor et al., 2002). In addition, the Massey dairy system study currently being conducted in New Zealand has already shown some differences in pasture production.

Although in the first year of the Massey trial grass growing conditions were favourable for both herds, bad weather conditions in the second year resulted in low pasture growth rates (Kelly et al., 2004a). In the third year of the trial, the organic farm consistently grew slightly less grass than the conventional farm (11 t DM/ha vs. 13.5 t DM/ha, respectively) (Kelly et al., 2004b). This difference represented a reduction of 18.5% in pasture growth in the organic farm. However, a guide that gathers the experiences of New Zealand organic farmers reported that after the first few years of conversion, pastures regain their productivity (Gillat & Coats, 2003). In addition, pastoral organic farmers they have noticed that, as time in conversion progresses, pasture cover is more even and the sward becomes denser and thicker. This is believed to protect soil life and hold nutrients in the sward to prevent leaching (Gillat & Coats, 2003).

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[1] LU or LSU: Livestock unit. Also Stock Unit (SU) or Ewe Equivalent (EE). Feed (energy) requirements of different categories of livestock expressed in terms of a single type of livestock. There are no commonly agreed standards of equivalency between different types of livestock though most assessments would approximate the relationship that one LSU equals on large animal (cow, bullock, horse, mule) equals six sheep or goats equals three pigs, with appropriate adjustment made for lactating, pregnant and young animals (Agroweb Network, 2003).

SEASONALITY OF PASTURE GROWTH

In relation to the seasonal pattern of pasture growth, the experience of organic pastoral dairy farmers in New Zealand shows that spring growth may be delayed over that achieved by using nitrogen artificial fertilisers (Gillat & Coats, 2003). In an unfinished paired farm study conducted in New Zealand, Macgregor et al. (2002) recorded the greatest pasture growth rates on the organic farm in mid spring, (during September-October at 80 kg DM/ha/day). In this period conventional pasture growth rate was about half lower in the conventional farm. In contrast, the conventional farm had a significant rise of pasture production during late-season (April-May) that considerably boosted annual DM values.

In the Massey trial, the differences in pasture growth for the two first seasons were due to application of nitrogen on the conventional farm (about 30 kg N/ha per month in spring), whereas non source of nitrogen was applied in the organic farm. This contributed to a pasture deficit in early and mid spring in the organic farm (Kelly et al., 2004a). Figure 3.5 illustrates monthly pasture production for the third season of the Massey trial.

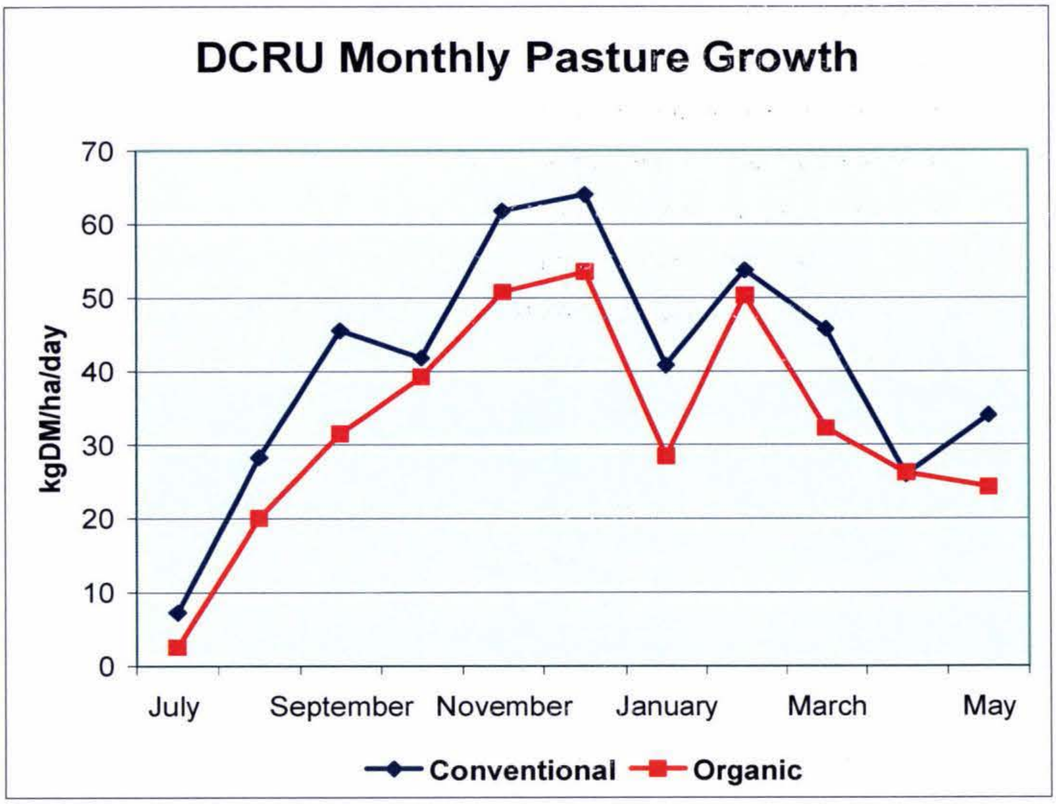


Figure 3.5. Comparative pasture growth rates in the 2003/2004 season.
(Source: Kelly et al., 2004a)

Low pasture growth rates in early spring may be particularly marked in the southern regions of New Zealand, where cold winters delay the soil to warm up and stimulate biological activity (Gillat & Coats, 2003). In effect, differences in pasture growth rates in the Massey trail were associated with the absence of nitrogen and exacerbated by the cool weather (Kelly et al., 2004a). On the other hand, it has been argued that the benefit of biological farming becomes apparent during the summer dry period, when organic pastures continue to perform long after conventional pasture has slowed down (Gillat & Coats, 2003). This effect could be seen in pastures of high clover content because clover remains active during the summer whereas grasses start seeding and resting. Also the greater humus content of organic dairy pastures is expected to improve soil's moisture retention. However, these effects have not been proven yet.

On the whole, researchers agree that the prohibition of using synthetic and soluble forms of nitrogen compromise pasture production in organic farming. Specific evidence in pastoral dairy systems suggests that pasture production tend to decline on approximately 20% following conversion to organics (Macgregor et al., 2002; Kelly et al., 2004b). In addition, pasture growth in organic systems may be delayed causing a feed deficit in early spring. These two effects suggest that organic farmers should be aware of adjusting herd's feed demand to the new patterns of feed supply. In particular, it has been argued that a decline in forage production can place significant pressure on stocking rates for livestock on predominantly grassland farms (Padel & Lampkin, 1994). A reduction in stocking rates may be complemented with other management strategies such as using supplementary feed in early spring (e.g., conserved forage or fodder crops) or delaying calving dates if pasture growth is extended during summer.

PASTURE COMPOSITION

In pastoral dairy systems, animal-pasture interaction is managed carefully to achieve reciprocal benefits. Pasture is grazed to enhance the existence of new material and prevent the accumulation of dead matter, as well as to supply the cows with adequate nutrients for growth, maintenance, pregnancy and production. Similarly, organic farmers seek a high diversity of plant species in their pastures with a twofold objective: utilising the soil profile more efficiently and providing a wide range of minerals and micronutrients for the livestock to graze on. In addition, the inclusion of herbs with medicinal properties, such as chicory and plantain, has been recommended for organic pastures (Gillat & Coats, 2003). However, farmers have reported on difficulties associated with the incorporation of some new species to the pasture, such as are lack of organic seeds sources, low fertility requirements and low persistence under high grazing pressure (Gillat & Coats, 2003).

Clear changes in both pasture species number and density can be attributed to organic management (Fairweather & Campbell, 2001). For instance, Halberg and Kristensen (1997) found higher content of white clover (50% vs. 21%) in the grass/clover crops in organic dairy farms. Likewise, significantly higher percentages of clover were found in organically grown leys in Sweden (Patterson, 1998 cited in Fairweather & Campbell, 2001). Potch (2000, cited in Fairweather & Campbell, 2001) found higher incidence of docks in organic pasture. In the New Zealand study, the herb component (all pasture species not being rye grass, kikuyu or clover) accounted for 10-15% of the DM production in the Te Kopuru site during Spring, and 20% of the DM produced during January-March in the and Te Aroha site (Macgregor et al., 2002).

Regarding weeds, preliminary results from the Massey trial show that organic pastures are no more weed-infested than conventional pastures, and weeds do not comprise a major part of the pasture in either of the farming systems (nearly 3% of weed cover in both systems) (Kelly et al., 2004b). Main weed species appear to be buttercup, docks, daisy and dandelion, and all weed species appear to be grazed by the cows suggesting a nutritional benefit from them. Keeping a good thick sward of grass at all times or topping at pre-flowering is recommended to prevent weed seeds from germinating (Gillat & Coats, 2003). Cultivation, followed by nurturing and liming can help poorly drained soils. Rotation of grazing pastures and winter-forage paddocks is also recommended for weed control on organic pastoral farms (Gillat & Coats, 2003). In New Zealand, successful experiences have been documented using biological control of weeds. For instance the ragwort flea beetle (*Longitarsus jacobaeae*), has dramatically reduced ragwort population at many sites, including organic dairy farms (Landcare Research, 2004).

3.5.2 CHANGES IN STOCKING RATE IN ORGANIC DAIRY SYSTEMS

Stocking rates is one of the most important management tools to adjusting feed demand and feed supply in pastoral systems. High stocking rates in pastoral dairy systems have the benefit of an increase in pasture consumption and thus, higher levels of pasture utilization efficiency (Macdonald, 2001). Consequently, high stocking rates are commonly associated with high levels of milk production per hectare but low levels of milk production per cow. In addition, the influence of stocking rate on feed intake levels of individual cows affects their milk production, live weight and fertility. MacDougall et al. (1995) observed that, regardless the breed, increased stocking rates were associated with longer periods of postpartum anoestrum, which in turn was associated with a reduction in intake levels, condition score, liveweight and milk production.

The effect of stocking rate on the reproductive performance of the herd is particularly important in organic systems, where the farmer is unable to use hormones or synthetic products to enhance reproduction. Therefore organic farmers should favour cow intake through slightly lower stocking rates rather than maximising production by maintaining high stocking rates. Under this circumstances, reduced stocking rates on organic dairy farms is not only a means of adjusting feed demand to a reduced pasture productivity, but has the objective of improving nutrition for better animal health and fertility. In addition, lower stocking rates have beneficial implications for the soil, since grazing pressure is lower and compactation is reduced. "A substantial reduction in stocking rates should reduce health problems, improve nutrition and allow for change in the sward composition, all of which may improve animal welfare" (Stafford & Mellor, 2003, p.1). At the same time, reducing stocking rates allows for selection of healthier animals and to remove those animals with high somatic cell counts (SCC), low fertility or low producers.

In New Zealand, comparative studies show that conventional farms are more highly stocked (2.2 and 2.3 cows per hectare) than transitional farms (1.8 and 1.5 cows per hectare) (Macgregor et al., 2002). Nevertheless, European systems, which are more dependent on concentrates and supplementary feed for milk production, do not always show a decline in stocking rates following conversion. For instance, a Danish study reported that conventional farmers with low stocked farms are usually interested in expanding milk production when converting, while owners of high stocked farms seek to establish a new balance between farm area and livestock enterprises, mainly by reducing other livestock units such as meat cattle or pigs.

> The planned change in livestock intensity after conversion was inversely dependent on the intensity before conversion, meaning that low-intensity dairy farms tend to increase in intensity, whereas dairy farms with intensities above 1.2 LU/ha decrease (Langer, 2002, p.77).

Interestingly, other authors in Europe have reported the same critical value (i.e., 1.2 LU/ha) for stocking rates in order to achieve the best balance between livestock, crops and nutrient cycling capacity (Blake, 1990; Lampkin, 1999). In general, the organic herds in Denmark are approx. 20% larger than conventional herds (Enemark & Kjeldsen, 1999, cited in Bennedsgaard et al., 2003). The tendency for larger organic herds in Europe is perhaps a consequence of the combination between greater land use needs for the production of pasture and crops and lower milk yields in organic dairy farms (Boer, 2003).

3.5.3 MILK PRODUCTION IN ORGANIC DAIRY SYSTEMS

It is widely accepted that milk production during conversion is affected. However, European literature suggests that, when EU regulations for organic farming are applied to extensive systems, dairy cows should not reduce production performance as much as in intensive systems (Rosati & Aumaître, 2004). In Denmark, organic milk represented approximately 25% of the total milk produced for direct consumption in 2001 (Vaarst et al., 2001) and, compared to other European countries, milk production levels in organic herds are high (Sehested, 2003). Average milk production per cow on organic dairy herds is 7500 kg (4% fat content) for dual purpose breeds (500 kg lower than that of conventional herds) and 6500 kg (4% fat content) for Jersey cows.

In Sweden, a study conducted in 1997 in the southern region of Sweden showed that annual milk production, expressed on kilos of energy corrected milk (ECM), was significantly lower in organic herds (6721 ± SD 1056 kg ECM) compared to conventional herds (7729 ± SD 1367 kg ECM) (Svensson, 2000). The same results were reported by Hardeng and Edge (2001) in Norway. The authors found that milk yield at 305 days was 22% lower in the organic than in the conventional herds (4784 kg ECM compared to 6129 kg ECM). This is consistent with the studies reported by Stockdale et al (2000) in which milk yield per cow declined up to 20% under organic management.

Bennedsgaard et al. (2003) conducted a study that allows for the comparison of important parameters between organic dairy herds converted in different years (1990, 1995 and 1999/2000) and between organic and conventional herds. The author not only found that the persistency (from day 60 to 305) of the lactation curve has improved for both organic and conventional herds over a 11-year period, but also found a reduction in the difference in persistency between both production systems (except for herds converted in 1990). For herds converted in 1995 or in 1999/2000 milk production after conversion was lower by 2 kg/cow/day ECM than before conversion and when compared to conventional herds.

Hardeng and Hedge's study, as well as Bennedsgaard's study, explained the lower production in organic herds as a result of a reduction in the use of concentrates. Certainly, the fact that organic standards demand ruminant diets based on forage cause a greater impact on northern-hemisphere farming systems, where concentrates and supplements are traditionally used to maintain good productive levels in high genetic merit cows. Sehested et al. (2003) found that the total exclusion of concentrates from the diet of high genetic merit cows reduce their feed intake to 4770 kg DM/cow/year and milk production to 5090 kg ECM/cow/year, which are respectively 1456 kg DM/cow/year and 1633 kg ECM/cow/year lower than the intake and production levels obtained for the group receiving normal supplementation (38% of the diet). In addition to restricted feed intake compromising productivity in high genetic merit cows, health and fertility performance appeared negatively affected by suboptimal energy status. Hardarson (2001) suggests that, being bovine ketosis the most important disease resulting from insufficient energy intake in early lactation, high yielding cows in organic systems fed mostly on roughage may be particularly susceptible to this disease. Regarding fertility, a New Zealand study showed that overseas cows had 62% empty rate when fed on pasture (Kolver, 2002). The implications of these issues on selection and type of cow on organic dairy farms will be discussed later.

In New Zealand a great proportion of the cows are jersey (16%) or Frisian X Jersey crossbreed (19%) and the majority of the dairy farms are pastoral systems (Holmes, 2002), suggesting that dairy systems will not required such drastic changes in feeding regime in order to convert to organics. Considering only the effect that feed has on milk production, it is likely that any difference in production between organic and conventional dairy farms is caused by poor pasture production in the former system. In effect, lower milk production figures for Massey's organic farm during the 2003-04 season were explained by lower pasture production figures on the organic farm (Kelly et al., 2004 a). For the first two seasons of the trial, milksolids production in the organic and conventional herds was similar. The 2002-03 season was characterised by unusual climatic conditions (wet winter, long cool periods in spring and summer and long, dry summer) which resulted in low production figures. (See table 3.3). Modelling studies in New Zealand have identified a decrease in milk production of 7% per hectare (MAF, 2002) and 10% per hectare (Bauer-Eden, 2001).

Table 3.3: Milk production in the three first seasons of the Massey trial
(Source: Kelly et al., 2004a; Kelly et al., 2005)

SEASON	Conventional MS/ha	Organic MS/ha	Conventional MS/cow	Organic MS/cow
2001-02	993	959	451	436
2002-03	723	745	314	315
2003-04	1094	925	457	410

Finally, it is also expected that, as the new system is well stabilised, milk production would at least partially recover (Bani & Sandrucci, 2003). However, international research has been focused on comparing productive levels of organic and conventional systems rather than following the trend in milk production in organic farms through conversion. In Denmark, data on organic milk production before and after conversion showed that daily milk yields per cow slightly decreased in the first year of conversion but returned to the original levels in the second year (Vaarst et al., 2003).

In summary, overseas literature indicates that milk production under organic management is approximately 20% lower than in conventional dairy farms (Stockdale et al., 2000; Hardeng & Edge 2001). However, these figures have commonly been explained as a result of a reduction in the use of concentrates (Hardeng & Edge 2001; Bennedsgaard et al., 2003), thus it is expected that the effect of conversion in New Zealand dairy systems in milk production will be less severe.

3.5.4 ANIMAL HEALTH IN ORGANIC DAIRY HERDS

The health status of the herd is function of a complex set of interrelated causal factors (Enevoldsen & Gröhn, 1996, cited in Sundrum, 2001). Management plays an important role in animal health, thus it is difficult to associate the higher incidence of a particular disease to a particular production system without taking into account possible differences in management-related factors (Sundrum, 2001).

In organic systems, management is shaped by particular regulations at the national level, and by different approaches to organic agriculture at the farm level. The prohibition of drugs and treatments for disease control under the organic standards means that farmers must develop a health program based on prevention and animal resistance. Prevention is mainly addressed by good farm practices and should include all the aspects of livestock management. Stockdale et al. (2000) found that previous research have summarized animal health strategies on organic farms into three approaches: nutritional strategies, housing strategies and breeding strategies.

Nutrition is related to feeding animals on balanced diets designed to meet the minimum requirements of the livestock enterprise rather than force intensive production (Stockdale et al., 2000). Certainly, European livestock systems will experience greater changes in nutritional regimes when converting to an organic system of production than those expected in New Zealand. In contrast, nutritional strategies for animal health in organic dairy systems in New Zealand would be more related to routine grazing management practices and to ensuring the availability of forage relative to the cow's demand.

On the other hand, housing strategies to prevent animal health issues are related to animal welfare. Housing must be appropriate to allow animals express their natural behaviours and assume all natural postures (Stockdale et al., 2000). Obviously, the requirement for loose housing systems, access to outdoors areas and maximum stocking rates under organic standards have had a major impact on intensive livestock systems (Stockdale et al., 2000) and is of minor relevance to New Zealand dairy systems.

Finally, "the judicious use of breed is seen as an important strategy to improve disease resistance, reduce metabolic problems and retain genetic diversity" (p. 275, Stockdale et al., 2001). In this sense, breeding objectives in organic farming take a different connotation than breeding aims in conventional systems. Conventional breeding goals are based on conventional management systems, which in Europe area characterised by high production, high concentrates diets, and curative disease control (Nauta & Baars, 2000). In contrast, breeding programs in organic systems have to divert from selection for high yields as the main goal, to a more emphasis on a flatter lactation curve, less production diseases and longevity (Hardarson, 2001). Breeding livestock for enhanced disease resistance is possible and relatively simple as the hereditability of traits associated with many diseases is often high and there is great variation amongst animals (Stear et al., 2001, cited in Stafford and Mellor, 2003). However, selecting for disease resistance may be associated with reduced productivity and the farmer should evaluate the consequences.

In New Zealand there is a general perception that animal health is the main problematic aspect affecting organic dairy systems (MAF, 2002). However, Stafford and Mellor (2003), after reviewing scientific literature, conclude that health problems appear to be no worse on organic dairy farms than on conventional farms in NZ or internationally.

A Swedish study that assessed the health, condition, cleanliness, feeding routine and housing condition of dairy cows, calves and young stock, conclude that good standards of health and welfare can be achieved in organic dairy herds (Hamilton et al., 2002). In addition, a recent literature search in organic animal health and welfare (mainly on dairying) found that, except for parasite related diseases, there are no indications that health is worse in organic than in conventional livestock farming (Lund & Algers, 2003). Hardeng and Edge (2001) demonstrate better health performance of the organic herds as compared to conventional herds in terms of ketosis, mastitis and milk fever.

Despite these results, one has to keep in mind that research conditions are context-specific and conclusions may not be generalized to all farming systems. For instance, in the conventional New Zealand dairy systems, the cows have free access to pasture so housing conditions are less relevant in welfare considerations. Information regarding conversion year, time since conversion, country where the study took place and the particular set of standards applied should be provided for a better evaluation of organic research (Lund & Algers, 2003).

ALTERNATIVE REMEDIES

When preventative measures fail and disease conditions arise, organic farmers rely on alternative remedies. Alternative remedies include a range of natural substances and practices (acupuncture, phytotherapy, homeopathy, etc). Even though modern science of pharmacology derives from herbalism, the effectiveness of alternative remedies has not been scientifically proven and many are sceptical of their use. The preliminary results of an Italian study that compared the performance of dairy farms utilising unconventional medicines (homeopathy and phytotherapy) and conventional medicine, indicate that the utilization of unconventional medicines resulted in the same production levels as conventional medicines (Martini et al., 2000).

In addition, a specific study that compared the used of phytomedicine and conventional treatments to control neonatal calf diarrhoea found that phytomedicine was much more effective than standard medications (Ponepal & Riedel-Caspari, 2000). In the case of homeopathy, Andersson and Leon (2000) reported that most veterinarians who were users of homeopathic remedies observed a clinical therapeutic efficacy in healing conditions and that clients were satisfied with the treatment. From the homeopathic treatments used in productive livestock, 40.4% were used in milk herds; most of them against mastitis (36.8%), fertility disorders (14%) and locomotor disorders (12.3%).

The measures that farmers take to prevent or control diseases are influenced by their own ideals and knowledge (Cabaret, 2003). In the case of mastitis, contradictory results have been found in terms of treatment preferences. Hovi and Roderick (2000) found that, from all treatments for mastitis, homeopathy was the most commonly used amongst English organic producers. In contrast, Vaarst et al. (2003) found that antibiotic treatment was the most used and perceived as the best prognosis method for curing mastitis amongst recently converted dairy farmers in Denmark. The use of antibiotics was related to severe, acute mastitis cases and was seen as an animal welfare consideration. In the case of mild mastitis the choice of treatment was related with the goals, ideas and strategies of the entire herd (e.g., size, age distribution, calving patterns and milk yield). Surprisingly, very few farmers used homeopathy, either because it was considered difficult to diagnose and apply in loose housing systems or due to a lack of knowledge and scepticism. Ointments, like peppermint oil, were mainly applied in mild or chronic cases and seemed to remove the symptoms and prevent the development of more systemic symptoms. Stripping out by hand was done rarely because it was considered time consuming and was not believed to have an effect (Vaarst et al., 2003).

Klocke et al. (2000) showed that whilst homeopathy treatment of clinical cases was less successful than antibiotic treatment, post-treatment parameters like somatic cell counts (SCC), new infections, milk yield and culling, indicate no significant economic disadvantages with homeopathic treatment. No significant economic disadvantages (e.g. SCC, new infections, milk yield, culling, etc) in homeopathic treatment were registered in mastitis cases caused by E. Coli, but economic disadvantages from the use of homeopathies were greater in mastitis caused by *Staphylococcus Aureus* and *Streptococcus ssp*. (Klocke et al., 2000)

In New Zealand, the preliminary results of a survey suggested that the most popular method to treat clinical mastitis was the use of homeopathies and apple cider vinegar (Thatcher, 2004). In addition, multiple stripping was also a common but labour intensive treatment for clinical mastitis (Thatcher, 2004). Culling or selling constantly infected cows has been suggested as a way of keeping the most resistant cows in the herd and avoid health problems in the future (Gillat & Coats, 2003; Stafford & Mellor, 2003). However, culling was found to be a minor component of the successful mastitis control strategy used by dairy farmers in New Zealand (Thatcher, 2004).

MASTITIS INCIDENCE

In the current high producing systems of northern hemisphere countries, exhaustive selection for high yielding animals and intensive production systems are challenging the capacity of the cow to maintain strong immune systems and cope with infections. Udder infections are perhaps the greatest threat to milk production, especially in organic systems where the farmer cannot rely on antibiotics. "In the organic dairy herd, mastitis is definitely the dominant disease problem" (Vaarst et al., 2003, p. 110).

Nevertheless, there is no consensus on whether mastitis is a more frequent disease in organic or in conventional herds. After reviewing comparative studies, Sundrum (2001) found some studies showing that the importance of mastitis was similar or greater in organic herds, while other studies showed a lower incidence of clinical mastitis on organic farms. Cabaret (2003) reported that the incidence of mastitis on organic farms is often lower than or similar to the levels recorded on conventional farms, thus its importance in organic farms should not be overstressed. Accordingly, Hovi and Rederick (2000) found that the overall incidence of mastitis was lower in organic herds (36.4%) than in conventional herds (48.9%) in Britain. However, the incidence rates during the dry period were significantly higher in organic herds (28.9%), compared to conventional herds (9.2%). This was explained by the lack of an effective drying off therapy and poor management of organic cows. In addition, average SCC per cow was significantly lower in the conventional herds (84,000 cells/ml) than in the organic herds (135,000 cells/ml), resulting in high sub-clinical mastitis levels in the organic herds. Higher SCC in organic herds was related to a deficient drying off therapy, lack of financial incentives to maintain lower SCC in the herd and the belief that low SCC cows are susceptible to environmental mastitis (Hovi & Rederick, 2000).

In New Zealand, no research has yet found significant differences in the levels of SCC between the organic and conventional herds through the season (Macgregor et al., 2002; Kelly et al., 2004 a). In contrast, New Zealand organic dairy farmers have reported that mastitis cases and their associated treatment costs were lower under organic than before conversion (Douglas & Stafford, 1997 cited in Stafford & Mellor, 2003).

METABOLIC DISEASES

Even though there is still debate on the incidence of mastitis in organic dairy systems, scientific research agrees that metabolic problems appear less frequently in organic cows than in conventional cows (Hardeng & Edge, 2001; Sundrum, 2001; Bennedsgaard et al.,2003; Vaarst et al., 2003). For instance, Hardeng and Edge (2001) found that organic cows have lower risk of ketosis and milk fever compared to conventional cows, while Bennedsgaard et al. (2003) found fewer treatments for ketosis in that organic herds than in the conventional herds. Similarly, Sundrum (2001) reported that many authors found a decrease in the incidence of metabolic disorders on organic as compared to conventional farms, mainly due to lower levels of milk production and limited use of concentrates in the organic herds.

Indeed, the common hypothesis is that lower levels of milk production and limited use of concentrates reduce the incidence of metabolic diseases in organic herds. Hardeng and Edge (2001) found that for each kilogram increase in peak milk production, the risk of milk fever increases by 5%.The authors deduced that, since the maximum average of milk yield in organic herds was 4.6 kg lower than in conventional herds, calcium depletion through milking was reduced.

Because of the importance of feeding and production levels in metabolic disorders, these findings have limited applicability to the New Zealand context. In New Zealand, diets are based on pasture and production levels are comparatively lower, thus it is expected that metabolic problems would be less frequent in New Zealand conventional dairy systems than in overseas conventional systems with high genetic merit cows fed on balanced rations.

REPRODUCTIVE PERFORMANCE

In the modern cow, reproduction performance has been traded for milk production. High yielding cows often show reproductive problems. Scientific research has detected an inverse relation between milk production and reproductive parameters (Lucy, 2001; Macmillan et al., 1996). However, it has been suggested that this relationship is weaker under pastoral conditions (Garcia & Holmes, 1999). McDougall *et al.* (1995; cited in Garcia & Holmes, 1999) reported a positive relationship between daily milk yields and conception rates to the first service for cows fed pasture alone or pasture supplemented with grass silage.

On the other hand, the reproductive performance of the herd is linked to its nutritional and health conditions. When assessing reproductive parameters such as days open, calving interval, calving to first artificial insemination (AI) interval, calving to last AI and AI per cow, Reksen et al. (1999) found no significant differences in reproductive performance between organic and conventional herds. However, the reproductive performance of organic cows in winter was poor, probably due to a failure to meet their energy requirements. In New Zealand, Macgregor et al (2002), based on liver biopsy analyses, found no dietary deficiencies of selenium, cobalt or copper that could have an impact in reproductive performance of the transitional herd. Similar results have been reported in the Massey trial (Kelly et al., 2004a). Therefore, as the great majority of organic dairy farms in New Zealand are pastoral seasonal systems, an acceptable reproductive performance it is expected in organic herds.

CALF DISEASES

Successful calf rearing is fundamental to ensure the early growth and reproductive development of the animals, particularly in an organic herd, where regulations restrict the introduction of non-certified replacements into the herd.

After conducting interviews with veterinarians and advisors, focus groups with farmers, and an expert panel, Vaarst et al. (2001) conclude that the most problematic area in Danish organic dairies was calf rearing. This was specifically in relation to cow-calf relationship (colostrum supply), group housing and grazing of young animals. These three aspects of calf rearing are regulated by governmental policies, thus regulations were considered an obstruction to improve calf health in situations of crisis. However, the study showed that poor management (e.g. bad housing conditions, poor hygiene, lack of surveillance) and adjustments to unknown practices, when converting to an organic system of production which are more demanding in terms of labour and time, were also related to calf rearing problems (Vaarst et al, 2001).

In relation to management strategies to improve calf health and welfare diseases, Vaarst et al. (2001) recommended the formation of stable groups of calves of the same age, supplementation of the calves on grass with feed, minerals, vitamins and water, and a closer supervision of the animals. Similarly, Kelly's study has emphasized the importance of management, and particularly good nutrition, in calf rearing in organic systems. In this research, calves were run on a large area with good cover including chicory, plantain and clover mix. Early in the winter calves were transferred to another property where a part of the diet was made up of carrots discarded from a commercial operation. Preliminary results show no cause for concern regarding the parasite status of organic calves (Kelly et al., 2004a).

Svensson et al. (2000) found significant differences in the parasite control methods on calves during the first grazing season on conventional and on organic dairy farms. Conventional producers relied mainly on prophylactic treatment with anthelmintics, whereas organic producers employed an integrated approach to prevent parasites. The most common strategy for parasite control on organic farms was nutritional supplementation and grazing management. Nutritional supplementation of the calves with concentrates or forage in the spring or in the autumn aimed to boost their immune system. In relation to grazing management, the most common strategy is to change grazing areas between seasons or to change pasture within the grazing season. In addition the use of aftermaths, (fields where hay or silage was harvested previously in the season) was reported more commonly by organic farmers. Finally, the use of mixed grazing or alternate grazing with other species was also more frequently practice amongst organic farmers (p. 67, Svensson et al., 2000).

3.5.5 SOIL QUALITY IN ORGANIC DAIRY SYSTEMS

Organic farmers identify themselves as "soil farmers". Revitalizing soil biology is one of the cornerstones of converting to organic farming. Much attention is paid to conserving and increasing soil organic matter. Organic matter (OM) in the soil comprises carbon-rich materials such as plants, animals and microbial residues in various stages of decomposition (USDA, 2001) and it is a vital component of soil health through its contribution to the physical, chemical and biological functions of the soil. Organic matter binds soil particles in stable aggregates improving porosity, water infiltration and retention, and root penetration; it is also a major source of cation exchange capacity (CEC) and ph buffering and, finally, OM provides food for soil organisms and a reservoir of plant nutrients. Many studies have shown an increase in OM for soils under organic management and, in general, biological, physical and chemical properties seem to improve (Stockdale et al., 2000). Nevertheless, there is evidence of lower levels of Olsen P and total S in biodynamic farms compared to conventional farms in New Zealand (Condron et al., 2000; Stockdale et al., 2000).

Reganold et al. (1993) conducted the first scientific paired study in comparing soil properties of biodynamic and conventional farms in New Zealand. The farm pairs included a range of representative farming enterprises in New Zealand, from which two pairs were dairy farms. When the data set was aggregated, OM content, soil respiration, mineralizable nitrogen and the ratio of mineralizable nitrogen to organic carbon were significantly higher in the biodynamic farms as compared to the conventional farms. Greater levels of soil OM on the biodynamic farms were associated with better soil structure, consistency, bulk density and soil penetration, whereas higher values of soil respiration and mineralizable N to organic C ratio gave an indication of the enhanced microbiological activity of the biodynamic soil. In addition, CEC was higher on biodynamic farms, while pH tends to be lower.

In relation to nutrient availability, Reganold et al. (1993) found higher levels of mineralizable nitrogen but lower extractable P in organic dairy farms than in their conventional farm pairs. This latter result is consistent with the findings of an unfinished study carried out on two pairs of organic and conventional dairy farms in New Zealand. Soil analysis showed no significant differences in the level of plant-available soil nutrients but the levels of soil sulphate and Olsen P were three times greater in conventional farms (Macgregor, 2001). These results are similar to those obtained for the first fully certified season on the organic farm of a trial being currently conducted at Massey University, New Zealand. In the Massey trial, no differences were detected between conventional and organically managed paddocks for ammonium-N, nitrate-N or mineralizable, but Olsen P and sulphate-S levels were higher under conventional management (Kelly et al., 2004b). In both studies, these results were explained by continuous applications of fertilisers in the conventional system.

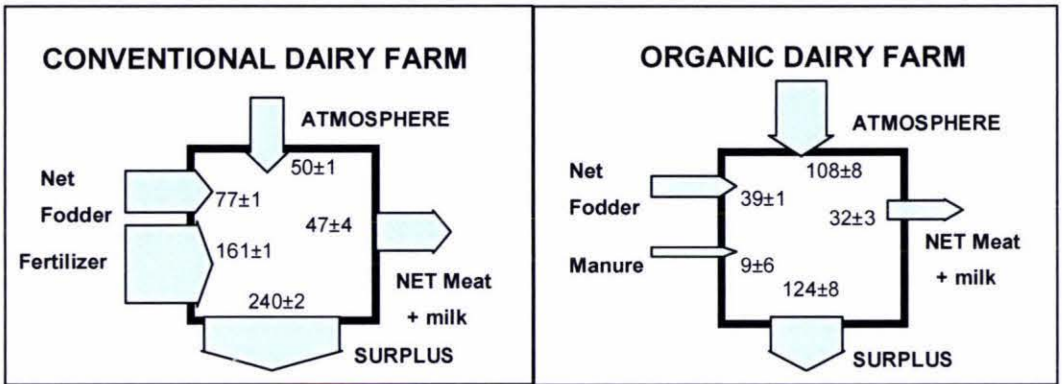
In relation to soil biology, most of the studies reviewed by Stockdale et al. (2000) showed a higher diversity and/or abundance of microbes, bacteria, fungi, nematodes and earthworms in organic systems. The same results were found by Biao et al.

(2003). In New Zealand, Reganold et al. (1993) found more earth worm counts on two biodynamic market gardens (vegetables) compared to their equivalent conventional farms (175 vs. 21 worms per square metre).

NUTRIENT BALANCE

In any agricultural system, organic or conventional, it is important to replace the nutrients removed from the farm in order to maintain soil fertility. Nutrients are exported from the farm in the form of products such as milk, meat or crops. Nutrients are imported into the farm in the form of imported feeds, seeds, fertilisers, manures and animals, atmospheric inputs and symbiotic fixation. However, since organic standards do not allow for the use of soluble fertilisers, "there is inevitably a lot less precision in the management of soil fertility conditions" (Turner & Hedley, 2002, p.68). Nutrient balance is useful to detect failures in farming systems and avoid nutrient losses. Most of the arguments suggesting that organic farming may help to reduce nitrogen losses rely on the fact that organic systems have lower N-inputs and lower livestock density (Dalagaard et al., 1998; Biao, 2003).

In Denmark, Dalgaard et al. (1998) assessed the losses of nitrogen for conventional and organic pig and dairy farms, compared organic and conventional dairy systems by modelling for different management strategies, and studied N surplus in different scenarios for the conversion to organic dairy farming at a national scale. In the first part of the study, both conventional pig and dairy farms had higher inputs and surplus (N inputs – N outputs) of nitrogen than organic farms. In particular, the organic dairy farms showed higher nitrogen efficiency (Net N exported/Net N imported) and lower nitrogen surplus per kg milk than conventional dairy farms (See figure 3.6).



N-surplus	Kg ha $^{-1}$ yr^{-1}	240	N-surplus	Kg ha $^{-1}$ yr^{-1}	124
N-surplus	Kg LSU^{-1} yr^{-1}	160	N-surplus	Kg LSU^{-1} yr^{-1}	112
N-surplus [a]	Kg (t milk)$^{-1}$	29	N-surplus [a]	Kg (t milk)$^{-1}$	22
N efficiency	%	16	N efficiency	%	21

Figure 3.6. Farm N turnover (kg N/ha/yr), N-Surplus and N-Efficiency in conventional and organic dairy farms in Denmark.
(Adapted from Dalgaard et al., 1998)

In the second part of the study, when modelling different conditions of livestock density, feeding intensity and soil type, organic dairy systems showed to have a lower nitrogen surplus per unit of milk than the conventional systems. Finally, national scenarios showed that the same level of milk can be produced in Denmark with 24% less total N-surplus if dairy farms are converted to organic farming. In addition, N-surplus per hectare and N-surplus per ton of milk could be lower by 50% and 25% respectively. However, this can only be achieved at the expense of lower production on the present dairy farm area or with an increase of 47% in the total dairy farm area (Dalgaard et al., 1998).

N-surplus reported in Dalgaard's research can be nitrogen lost by volatilization, denitrification or leaching, depending on soil conditions. Leaching is the major cause of nitrogen loss in intensive production systems where the frequency and intensity of rainfall is high and the structure of soils is poor. Condron et al. (2000) use the nitrogen leaching estimation model (NLE) to compare nitrogen losses in organic and conventional dairy farms in New Zealand. Basically, organic farms were featured by lower stocking rates, no fertilizer inputs and higher nitrogen fixation than conventional farms and two scenarios of different stocking rate levels were modelled for each farming system. The model predicted that organic dairying is likely to result in lower N leaching losses than their comparable conventional system (9 and 12 kgN/ha/yr compared to 19 and 46 kgN/ha/yr for low stocked and high stocked farms, respectively). The lower leaching losses in organic systems are due to the lower stocking rates and consequently fewer numbers of urine patches (Condron et al., 2000). This hypothesis is consistent with Turner and Hedley (2002), who after a nutrient balance calculation for nitrogen in a typical New Zealand conventional dairy farm, conclude that "the amount of nitrate leached is probably proportional to the number of urine patches per hectare and the rainfall pattern and drainage volumes" (Turner & Hedley, 2002, p. 137).

In relation to micronutrients, deficiencies affect plant growth as well as animal health. Under the organic standards in New Zealand, farmers should avoid the use of drenches and topdressing the pasture. Therefore, the only alternatives to ensure an adequate level of trace elements in the system is to apply organic fertilizers, such as seaweed or manure, modify pasture composition or use homeopathic remedies (Condron et al., 2000). Condron et al. (2000) cited a study that found very variable values of trace elements in seaweed: B (15 - 910 mg/kg), Cu (0.6 – 80 mg/kg), Fe (90 – 1500 mg/kg), Mn (4 - 240 mg/kg) and Zn (2 – 680 mg/kg). On the other hand, using a variety of pasture species can ensure more elements available to the grazing animals. For example, non traditional pasture species such as chicory and plantain contain higher concentrations of Cu and Co than grasses (Mitchell, 1945; Younie and Umrani, 1997, cited in Condron et al., 2000).

3.6 ENVIRONMENTAL IMPLICATIONS OF ORGANIC FARMING

Since organic farming relies on ecosystem management, a main aim is to maintain the health of each component of the farming system. In keeping with this purpose, regulations ban the use of chemical fertilisers, pesticides and additives, leading inherently to the protection of natural resources. It is widely accepted that organic agriculture contributes to the long term conservation of soil, water, wildlife habitats and genetic diversity (Biao et al., 2003).

As reviewed in the previous section, one of the most well documented arguments of the positive effect of organic agriculture in the environment is the reduction in nutrient losses. Nitrogen leaching not only represents an economic loss, but also a potential for water contamination and disruption of freshwater ecosystems. Boer (2003) criticised nutrient balance as the most common approach to assess the environmental consequences of agricultural systems, because it excludes nutrient losses during production of farm inputs and environmental issues such as fossil fuel energy and greenhouse emissions. The author reviewed studies (from Sweden, Holland and Germany) that use the Life Cycle Assessment (LCA) technique to assess the impact of organic milk production on the environment. LCA is a method for integrated environmental impact assessment that, in the case of milk production, encompasses all processes in the life cycle of milk, from production of dairy feed to milk storage and consumption.

Boer (2003) found that the acidification potential of milk production is due mainly to volatilisation of ammonia, which is not reduced by the conversion to an organic system of production. Similarly, Berentsen et al (1998) found higher ammonia emissions after conversion to biological dairy farming due to a higher number of animals. Ammonia is a gas that in the atmosphere can be combined with other molecules being transformed into ammonium and deposited on the soil. In the soil, The nitrification process releases hydrogen from the ammonium, which eventually causes soil acidification and may result in high aluminium concentration in the ground water (Boer, 2003). Therefore, the acidification potential of dairy farming systems is related to livestock density per hectare of farmland and, thus should not be an important issue when organic dairy farms reduce stocking rates.

Since lower fertiliser application rates in organic milk production reduces NO_3^- and PO_4 leaching, eutrophication potential (per ton of milk and per hectare) is indeed lower (Boer, 2003). Methane emissions in organic milk production inherently increases because of the lower milk production per cow and increased use of roughage. Therefore the only contribution that organic milk production can do to decrease global warming is to reduce the emissions of CO_2 and N_2O emissions (Boer, 2003). Stockdale et al. (2000) suggested in his review that calculated CO_2 emissions from dairy systems are generally lower in organic farming systems mainly due to a reduction in energy use (e.g. reduce imported feeds). In addition, lower stocking rates are likely to result in lower gaseous nitrogen emissions and methane emission per hectare (Stockdale et al., 2000).

Preservation of biodiversity is not only a philosophical desire of organic agriculture but also a practical need to maintain productivity (Biao et al., 2003). Organic farming shows a greater diversity of landscapes, which are represented by different land-use types, crops, hedges, shrubs, tress, and flora (Stockdale et al., 2000). Un-cropped areas, intrinsic in organic regimes, are reservoirs of fauna and flora diversity (Stockdale et al., 2000). Field margins tend to have more abundance of grass species in organic farms and potentially more diversity of flora, providing a diversity of habitats for wildlife. (O'Riordan & Cobb, 2001). Also, the abundance and diversity of weed species in organic systems tend to be higher (Stockdale et al., 2000; Biao et al., 2003).

An increase in flora diversity in organic systems should contribute to an increase in fauna diversity. O'Riordan and Cobb (2001) found increasing numbers and diversity of spiders and non-mobile butterflies on organic farms relative to their conventional pairs. The same results have been reported in a number of studies, as described by Stockdale et al. (2000) and Biao et al. (2003). Increases in bird populations on organic farms have been attributed to changes in their habitat structure and availability of food resources. Lower trimming frequency and more sympathetic management of boundary features, provide good nesting places. In addition, crop and flora diversity, and arthropod populations provide food resources for birds (Stockdale et al., 2000).

3.7 ECONOMIC IMPLICATIONS OF ORGANIC FARMING

The general perception that organic farming is less profitable or more risky, discourages many farmers from conversion. As reviewed previously, milk yield does tend to decrease in organic farms. However changes in the cost structure may compensate for lower milk production and premium prices may even make organic dairying more profitable than conventional dairying.

Dabbert and Madden (1986) stated that farm's profit during transition is affected by 5 kinds of effects: rotational adjustment, biological transition, price, learning and perennial effects. The *rotational adjustment* effect is the reduction in income caused by the introduction of less profitable crops in the rotation. The *biological transition* effect refers to the impact on profits due to changes in natural process when chemicals (pesticides and herbicides) are taken out of the system. The *price effect* is the impact that changes in the price of saleable commodities have on farm's profitability, thus when organic produce is granted price premiums, the price effect is positive. The *learning effect* is the reduction in income related to the farmer's lack of experience or information on organic practices. Finally, the *perennial effect* is a long term effect on farm profits after considering the effects of rotation adjustment, biological transition, price and learning. Once the organic system is operating, the perennial effect is the change in profits caused by an established organic farm in comparison to the previous conventional farming system (Dabbert & Madden, 1986).

The severity of these effects on the profitability of organic farms during transition depends on the management of the farm before conversion, climatic and soil properties, cropping history and the transition strategy to follow (Dabbert & Madden, 1986). However, the most evident effect on the profitability of organic systems in conversion is perhaps a reduction on production costs.

After analysing four sources of data (from two Danish and two Canadian programs), Morisset and Gilber (2000) noted that there are areas in which organic dairy farms show notable savings (fertilizers, pesticides, purchased feed and livestock health and reproduction) and others in which expenses are higher (production of on-farm feed and labour). In Canada, the organic farms tend to have lower gross income, but also lower total costs, which results in higher net incomes than conventional farms. In Denmark, organic farmers also showed lower total costs and higher gross income than conventional farms, leading to even higher net incomes. This difference was explained because of the existence of market premiums and subsidies in the latter but not in the former case.

Similar results were reported by Stonehouse et al. (2001), who studied the technical and economic productivity of organic and conventional dairy farms in the province of Ontario, Canada. Conventional farms were more productive in terms of livestock (milk sales per cow), land (milk sales per hectare) and labour (milk sales per person-equivalent), and showed superior economic performance. However, this research did not include premium prices for organic milk and, as the authors explained, in an attempt for self-sufficiency organic farmers greatly reduce costs of production, particularly in relation to herd replacements and purchased feeds (Stonehouse et al., 2001).

Conversely, Butler (2002) showed that precisely these two units of costs (i.e. replacements and feeds) greatly contribute to higher production costs on organic dairy farms in California. Butler's study shows that total costs per cow are about 10% higher for organic producers than for conventional producers, and 20% higher than the average state-wide farm. Higher costs were associated with higher feed costs, higher labour costs, higher replacement costs and higher transition costs. However, on organic farms, net farm income per cow was more than double that of conventional farms, mainly because of the higher prices paid for organic milk

Many reasons can explain the different findings amongst these studies. The inclusion of price premiums in the calculations has major influence on the net farm income in organic farms. In addition, organic standards in different countries such as the level of organic feed required and inclusion of replacements into the herd affect the total cost of production. Finally, the time frame of the research and the time in conversion of the organic farms under study may produce variations in the results. The studies by Morriset and Gilber, and Stonehouse et al. cited previously include data collected for three up to six years whereas Butler's study was conducted for one year. Since the conversion period to obtain certification carries extra costs of inscription, sourcing organic inputs and a temporary decline in milk production, it is critical to consider the stage in transition when comparing research. None of the studies describe above specified the stage in transition of the organic farms under study.

One of the earliest studies that assessed the financial performance of biodynamic farms in New Zealand for a five year period found that organic farms are as financially viable on a per hectare basis as are conventional farms (Reganold et al., 1993). Even though one of the organic dairy farms showed greater variable costs compared with the representative conventional farm for the region (NZ$/ha 833 vs. NZ$426), total income was higher (NZ$2283 vs. NZ$1355) and so was the gross margin per hectare (NZ$1,450/ha vs. NZ$929/ha). Milk was processed on-farm, adding value and securing the market and economic stability of the farm.

Bauer-Eden (1999) evaluated the financial performance of 7 organic dairy farms in New Zealand using production and input data for the 1997/98 season and comparing it to available statistical data. The model showed that, although milk production per hectare tended to be lower, the gross margin income tended to be higher on organic dairy farms due to lower production costs (see table 3.4). Fertiliser and animal heath expenditures were the items that showed the largest decrease in cost in organic farming (Bauer-Eden, 1999). The study concludes that lower production costs seem to outweigh losses in milk production on organic dairy farms. If premiums for certified organic milk had been included, organic production would have been even more profitable.

Table 3.4. Range per hectare of milk production and gross margin.
(Source: Bauer-Eden 1999)

	Conventional	Organic
Milk and stock income ($/ha)	2,347 – 4,108	2,346 – 3,692
Variable Costs ($/ha)	934 – 1,211	433 - 728
Gross margin ($/ha)	1,414 – 2,954	1,913 – 2,964

An analysis that modelled the financial performance of organic and conventional dairy farms was used to assess the viability of different organic production units in New Zealand (MAF, 2002). The study used representative values of seasonal supply dairies in Waikato and Bay of Plenty regions. It was based on an 83 effective hectares farm, wintering 220 cows and producing 62,250 kg MS. The price used for conventional milk was assumed to be $4.58/kg MS on average for the next five seasons and the premium was set as a breakeven premium required to deliver an equal cash farm surplus. The breakeven premium used was 12 c/kg MS, less than 3% over the conventional price (MAF, 2002). The results of this analysis have been summarized by Christensen and Sounders (2003) and are presented in table 3.5.

Table 3.5. Milk solids, cash farm expenditure and gross farm revenue for conventional and organic dairy farms.
(Source: Christensen & Sounders, 2003)

	MAF (conventional model)	Organic model	% change
Milk Solids (kg MS/ha)	825	761	-7
Cash farm expenditure ($/ha)	2,335	2,125	-9
Gross Farm Revenue ($/ha)	4,113	3,903	-5

This study calculated a breakeven premium of 12c/KgMS (3%) to deliver an equal cash farm surplus in organic farms and concluded that the conversion of dairy farmers to organics does not depend on a premium to be profitable. However, several assumptions in MAF's model do not represent common practices in organic dairying. In the organic model, the stock was reduced by 10% (2,5 cows/ha), yearling heifers were grazed on, cows were grazed off-farm in winter, the replacement rate was lowered, calving dates were set earlier, and maize silage was incorporated as summer supplement (MAF, 2002). These four last assumptions are indeed opposite to what organic farmers should aim for.

Finally, despite all the studies described above being based on reliable financial data, none of them considered the social and environmental costs when comparing production systems. As showed previously, there is evidence that organic farming is an environmental friendly alternative system of production. In economic terms, this translates into a reduction of negative externalities which are derived from conventional farming, such as water pollution and chemical residues. As Morisset and Gilber (2000) explain, organic farming assumes part of the costs that otherwise are assumed by society such as water treatment plants and health problems linked to the use of phytosanitary products and pesticides. However, "the difficulty in calculating this benefit results in a bias against organic farming, which is difficult to quantify but which needs to keep in mind" (Morisset & Gilber, 2000, p.26).

3.8 CONCLUSIONS

The organic sector is today one of the fastest growing food sectors in the world. However, artificial incentives for organic production in European countries have caused supply/demand imbalances and, as a result, some markets are now shrinking. In contrast, in New Zealand's relatively unregulated economy, the organic sector is growing according to market signals at a slower, but probably more stable and sustainable pace.

Even when organic standards worldwide are subjected to frequent changes, challenging the ability of the farmers to adjust their production systems, trade of organic products is eased by equivalency agreements. This is a difficult but necessary process, particularly important in an export oriented sector such as the New Zealand dairy industry. The positive consequences are reflected in the acceptance of New Zealand certifying authorities as able to certify organic products exported to EU and USA. The unsatisfied demand of organic products suggests a further need to review the consequences of the conversion process in New Zealand.

The social dimension of the conversion process, as well as the conceptual frameworks for conversion, has been explored. In addition, the implications of conversion on the productivity of dairy farming systems and on different aspects of management have been reviewed. Finally, the financial and environmental effects of conversion have been described.

There is a general consensus in the literature that the productivity of a dairy farm is affected with conversion. The decline in per cow production is often attributed to changes in feeding regimes, prompted by organic standards. In the New Zealand seasonal pastoral-based dairy system, a decline in milk production will probably be driven by a decline in pasture production which would particularly affect milk production per hectare. In effect, the prohibition of using synthetic and soluble forms of nitrogen is perhaps the key factor that generates most changes in farm management practices in organic dairy systems in New Zealand. Overall pasture production is compromised and spring growth is delayed. Therefore, organic dairy farmers may need to increase the amount of supplementary feed in early spring or reduce stocking rates. In contrast, if pasture growth is extended during summer, delaying calving dates could be a feasible strategy to adjust feed supply and feed demand. On the other hand, animal health is maintained by good nutrition, prevention and breeding for resistance. This review suggests that health problems appear to be no worse on organic dairy farms than on conventional farms

In relation to the economic performance of the farm, research shows that, despite a decline in productivity, organic dairy farms can have the same or higher profitability levels than conventional farms. The environmental performance of the farm is improved, particularly in relation to soil and water quality, diversity of wildlife and energy conservation. Finally positive social impacts are reflected in the high level of satisfaction that organic farmers develop.

On the whole, the differences between New Zealand and northern hemisphere dairy production systems restrain the applicability of research from European countries and the USA, and, consequently, slow down the adoption of new technologies. However, as the New Zealand dairy farming system, based on clover pastures, is more similar to the organic farming concept than are the conventional farming practices in USA and EU (Condron et al., 2000), it is expected that farms in transition may escape many of the negative impacts of conversion reported overseas.

CHAPTER 4: RESEARCH DESIGN

4.1 INTRODUCTION

The aim of this research is to identify the impact that transition to organic dairying has in the agronomic, environmental, social and financial performance of the farm and to examine how organic dairy farmers manage the process of conversion. On addressing this subject, this research seeks to identify the issues that hinder the process conversion and to discover the strategies employed to successfully manage conversion in organic dairy farms. In addition, this research seeks to describe the implications of conversion on the environmental, social and financial performance of the farm. The review of previous research elucidates some answers to these issues but data for the New Zealand context remains limited. Therefore, the particular circumstances of the New Zealand dairy sector should be taken into account when developing a research design for addressing the objectives in this research. This chapter describes the data collection methods used in this research, and it presents the approach for the analysis the data collected. Finally the limitations of this research are discussed.

4.2 SELECTION OF RESEARCH STRATEGIES

The recent development of the organic dairy sector and lack of information on best management practices for organic systems in New Zealand suggest a need for a preliminary exploratory research. Exploratory research is necessary when very little is known about a topic being investigated or about the context in which the research is to be conducted (Blaikie, 2000). The aim of the exploratory research in this case is to provide a picture of the impacts of conversion at the farm level, to become more familiarized with the specific topic area and to sharpen the focus of the research. A survey was considered the most appropriate strategy to achieve the objectives of the exploratory research.

On the other hand, with the intention of fully understanding the management of the conversion period and to address the objectives of this research thoroughly, further descriptive research was considered necessary. Descriptive research, in the form of a multiple case study, aims to gather the experiences and practical knowledge of organic dairy farmers without losing the context of their particular circumstances.

In summary, the transition to an organic dairy system is explored using a multimethod approach: an exploratory survey which covered a set of issues through a more structured approach of mostly quantitative research, and descriptive interviews that allowed the investigation of farmers' perspectives of the conversion process through qualitative research.

Nevertheless the nature of this research, which considers conversion to organic farming as a process, places qualitative research at the foreground (Bryman, 2001). Quantitative research is mostly used to provide information on which to base the selection of cases and the design of further case studies. "One of the chief ways in which quantitative research can prepare the ground for qualitative research is through the selection of people to be interviewed" (Bryman, 2001, p. 450). Therefore, the use of mixed methods in the present research is conceived as a sequential process, in which the quantitative phase of the study is followed by a separate qualitative phase (Tashakkori & Teddlie, 1998),

Finally, the unit of analysis is the unit about which we obtain information (De Vaus, 2002). The definition of the unit of analysis is related to the way the initial research questions have been defined (Yin, 2003). In social research, the most popular unit of analysis has been the individual (Yin, 2003; De Vaus, 2002). In the present research, the units of analyses are the organic dairy farmers in New Zealand.

4.3 THE EXPLORATORY SURVEY

Based on the lack of information about the basic characteristics of organic dairy systems and the small number of organic dairy farmers in New Zealand, a survey was considered an appropriate research strategy to generate initial description of organic dairy systems and the transition process. Surveys are considered an example of *extensive* research techniques, capable of gathering comparable information from respondents across a wide range of circumstances (Aldringe & Levine, 2001). In this context, surveys can be used in the first phase of a project to establish the general outlines of the researchable problem and then to use the data collected to design a more intensive second phase using case studies or other intensive approaches (Aldringe & Levine, 2001).

4.3.1 SURVEY INSTRUMENT: SELF-ADMINISTERED QUESTIONNAIRE

The survey was applied in the form of a postal self-administered questionnaire in which individual respondents completed the questions themselves. Self administered questionnaires are exempt from the intrusive effect that other survey instruments have, and are recommended when addressing sensitive subjects (Aldringe & Levine, 2001). The nature of the topic being investigated validates the use of a self-administered questionnaire. Since organic farming emerged from a critical view of conventional agriculture, early converters were viewed as a threat to the rural identity, and consequently experienced social isolation (Padel, 2001). Even when organic farmers are gaining credibility and social acceptability (Padel & Lampkin, 1994), many are still sceptical of the viability of organic agriculture and the topic remains controversial. Self-administered anonymous questionnaires provided the respondents with the opportunity to express their honest opinion, without being intimidated.

Another advantage of mail questionnaires is the low cost involved in data collection (Aldringe & Levine, 2001; De Vaus, 2002). Mail questionnaires are less demanding in terms of staff requirements and costs of questionnaire distribution than other survey instruments. Budget limitations and time constraints made this consideration important for the present research.

In addition, mail questionnaires are able to cover a wide geographical area without incurring expensive and time consuming travelling for data collection. Even though the population of organic dairy farmers in New Zealand is small and clustered in the Waikato Region, the objective of the survey was to carry out a complete enumeration of the population, making it necessary to use a survey instrument that allowed data from the more disperse cases to be collected.

One of the main limitations of mail self-administered questionnaires is lower response rates. De Vaus (2002) suggested that the combined effect of the topic, nature of the sample, length of the questionnaire and care taken in its implementation influence response rates. Therefore, an appealing questionnaire layout and design that attracts the interest of respondents should be used. Floyd and Fowler (2002) stressed that in self-administered questionnaires, the main goal is to make the questionnaire easy to use, and thus the formatting is crucial. Postal surveys must be easy to follow and provide self explanatory questions in order to maximise the response rate.

QUESTIONNAIRE DESIGN AND DATA COLLECTION

The first page in the questionnaire was a cover letter, which provided a short, easy-to-read introduction to the survey in order to attract the interest of respondents. The cover letter explained the purpose of the research and how the questionnaire should be returned. It also included an assurance of confidentiality with respect to the information gathered.

The questionnaire layout was intended to reflect a logical flow of questions (see Appendix Three for the full questionnaire). To provide a better flow, questions are grouped into sections (Aldringe & Levine, 2001; De Vaus, 2002). In this research, the questionnaire was divided into 5 sections: Organic history of the farm, farming enterprises, biophysical conditions, conversion management issues and strategies, and the farmer's points of view on the conversion process.

De Vaus (2002) recommends starting with questions that respondents will enjoy answering: factual, easy-to-answer, relevant questions. This was addressed by asking *attribute questions* in the first place. Attribute questions are designed to obtain information about the respondent's characteristics. In this questionnaire, attribute questions were mostly used to characterise the farm in terms of its conversion history, certification status, land area, herd size, milk production and type of production system, as well as to the physical conditions of the farm. *Attitude* questions were then used when asking people to score the problems faced in conversion as well as to assign a level of success to the strategies applied. In addition, attitude questions were used in the last section of the questionnaire to get an idea of the respondent's opinion on the conversion process.

A variety of question formats were used to maintain the respondent's interest throughout (De Vaus, 2002). A combination of closed and open questions were used. In closed or forced–choice questions, respondents are offered a set of answers and are asked to choose the one that most closely represents their view (Frankfort-Nachmias & Nachmias 1996). Closed questions are easy to ask and fast to answer and the analysis is straightforward. They are especially appropriate when the questionnaire is long and respondent's motivation to answer is not high (De Vaus, 2002). However, with closed questions, false opinions can be created about some issues either by giving an insufficient range of alternatives from which to choose or by prompting people with 'acceptable' answers (De Vaus, 2002).

On the other hand, open-ended questions allow respondents to answer in their own terms and frames of reference, and reveal what is most salient to them. The virtue of open-ended questions is that it does not force the respondent to adapt to preconceived answers. Once the respondents understand the intent of the question, they can express their thoughts freely, spontaneously and in their own language (Frankfort-Nachmias & Nachmias 1996). However, researchers agree that open ended questions are more difficult to answer and, in particular, to analyse, partly because of coding problems (Frankfort-Nachmias & Nachmias 1996; Aldringe & Levine, 2001). The small sample of people included in the present research was expected to diminish the relevance of this consideration.

In order to account for the benefits of open and closed questions, and to offset their weaknesses, the possibility to provide other alternatives or to expand with additional comments was always offered to respondents. Thus, the main part of the questionnaire was composed of precise but expandable questions. In the first 3 sections of the questionnaire, instead of only offering alternative answers for the respondents to choose from, a blank space to answer was provided. In the fourth section a numerical rating scale was used in which respondents had to indicate where their attitude lay, in between the low and high extremes (De Vaus, 2002). The degree of difficulty of management issues and the degree of success of management strategies during conversion were assessed in this way. Since the objective of the fifth section was to explore farmer's motivations, perceptions and opinions of the conversion process, the use of open-ended questions was considered appropriate.

Given that the questionnaire was used to generate follow-up interviews, at the end of the questionnaire, the intention to conduct further research was explained and participants were offered the opportunity to participate further, by providing their name and contact details. Although this compromised anonymity, confidentiality was maintained throughout the data recording, reporting and analysis process.

4.3.2 PILOT STUDY

Once the design of the questionnaire was completed, it was pilot-tested to ensure the questions were well understood and precise. As De Vaus (2002) explains, the purpose of testing is to establish how to phrase each question, to evaluate how respondents interpret the question's meaning, and to check whether the range of responses of alternatives is sufficient. Taking advantage of the opportunity to attend a discussion group of organic dairy farmers, the questionnaire was delivered to two organic dairy farmers and one consultant for pre-testing. The pre-test respondents were asked to comment on the clarity of individual questions as well as to provide feedback on the flow and comprehensibility of the whole questionnaire. Following their feedback, the survey was refined.

4.3.3 SURVEY SAMPLE

Frequently resources are limited and the population is too big to be entirely covered, restricting the application of surveys to a subset of cases from the target population. *Sampling* is the process of choosing a subset of cases or units from which data will be collected to represent the pool of all those potentially relevant to the research or *target population* (Aldringe & Levine, 2001). Samples can be randomly chosen to represent the entire population (*probability samples*) or intentionally chosen to obtain an idea of the range of responses (*non probability samples*). Complete coverage of small target populations may be practical in particular circumstances. The situation in which data are collected from every case in the target population is referred to as *complete enumeration* (Aldringe & Levine, 2001).

In New Zealand, the number of dairy herds managed under the organic principles is relatively low compared to the total number of dairy herds. Therefore, it was decided to include the entire population of organic dairy farmers in the sample, so in effect the survey was a complete enumeration of the population. At the time of the study, there was no official list all organic dairy farmers in New Zealand. Therefore, the contact details of the farmers were obtained from the main dairy industry company, Fonterra, and two certification agencies, BioGro and Agriquality. The survey included 65 certified and uncertified organic dairy farmers.

4.3.4 RESPONSE RATE

One of the most common criteria used to judge surveys as a data collection method is the response rate they achieve (De Vaus, 2003). Mail surveys have developed a reputation for low response rates. However, in surveys of *specific*, more *homogeneous* groups, when the topic under investigation is of particular relevance to the group, mail surveys seem to provide good response rates (De Vaus, 2003). The rate of non response is often overestimated in mail questionnaires because questionnaires may be sent to people that are no longer part of the population or have changed their address.

In order to increase the response rate in this research, 11 non-respondents were phoned and encouraged to respond the questionnaire. From these, two farmers declared having no intention in participating in this research. It was later decided that sending a follow-up letter would be a better strategy to improve response rates. Therefore, a letter accompanied by a further copy of the questionnaire was sent to all non-respondents about one month after the questionnaire had been sent for the first time. In reaction to this, two farmers sent a letter back or called to excuse themselves from the research arguing that, because they have started conversion long time ago, they did not have accurate records to fill-in the questionnaire. In addition, three farmers said that they had withdrawn from organic farming and two of them sent letters explaining their reasons for quitting. From these, one still filled in the questionnaire and, given the purpose of this research, it was considered as a valid response. The addresses of two farmers were wrong and, despite some efforts to track them down, it was not possible to reach them. Finally, from 57 possible replies, 32 questionnaires were returned, producing a response rate of 56%. From these 32 final responses, six were anonymous and two were unsuitable as a case study (i.e. Massey farm and not organic farmer anymore) leaving 24 candidates for the second phase of the research.

4.4 DESCRIPTIVE MULTIPLE CASE STUDY

The descriptive phase of this research required a research strategy that allows for an empirical assessment of the conversion process, – that is to investigate conversion within a real life context. One of the most appropriate research designs that provides detailed information is the case study: "the case study method allows investigators to retain the holistic and meaningful characteristics of real-life events" (Yin, 2003, p.2).

The need to cover contextual conditions to investigate issues, strategies and impacts of the conversion process supported the use of a multiple case study. According to Yin's classification of case study design types, the case study in this research falls into a multiple-case holistic design, where 'holistic' refers to a single unit of analysis. Studying more than one case is often considered more compelling and the overall study is regarded as more robust than a single case study (Yin, 2003). However, every case should serve a specific purpose within the overall scope of the research and the decision to include more cases should follow a "*replication*" logic (this issue will be developed further when explaining the sampling procedure for the descriptive research).

One of the biggest limitations of the case study design is that the findings of each case provides little general explanation or prediction (Philliber et al., 1980). While the addition of cases can give the research an added dimension, generalisability is still limited. Therefore, findings of the case study should be compared against theory and not against populations. A previously developed body of theory is used as a template with which to compare the empirical results of the case study. This is known as *analytic generalization* (Yin, 2003).

The development of a rich theoretical framework is essential for replication purposes because it establishes the conditions under which a particular phenomenon is likely to be found (Yin, 2003). This theoretical body becomes the vehicle for generalisation. If the empirical cases do not work as predicted, the researcher can suggest new elements to be added to the theory. In this research a theoretical framework was developed via a review of the literature.

4.4.1 CASE STUDY SAMPLE

In the case study, the sample size is one (Philliber et al., 1980). In fact, each case is selected not as a sample unit, but as a whole new element to be investigated. In a multiple-case study the question has to do with the *number* of cases considered sufficient for the study. The inclusion of new cases should follow a *replication logic*. If the intention is to predict similar results (*literal replication*), the number of replications depends on the certainty required by researcher about the results (Yin, 2003). If the intention is to produce contrasting results but for predictable reasons (*theoretical replication*), the number of replications depends on the complexity of external factors influencing the results. In circumstances in which variation is attributed to external conditions, larger numbers of theoretical replications are needed (Yin, 2003). In the present research, the purpose was to study the conversion process from the experience of a whole range of farmers. Therefore this research aims at theoretical replication and the number of cases for this research was determined based on a *selection criteria* that included information thought to represent a wide range of situations.

The selection of cases that represents a scheme or classification of interest to the researcher is called *purposive sampling*. Purposive sampling is a form of non-probability sampling because cases are not selected randomly and the information obtained does not have statistical representativeness (De Vaus, 2002). The characteristics of the population are the basis of selection (Ritchie et al, 2003). In this research the questionnaire responses provided the characteristics on which the cases were selected. As explained earlier "the survey is a rich source of data to support a refined purposive sampling for a qualitative follow up-research" (Ritchie et al., 2003, p. 90).

The rationale is that the questionnaire provides basic information about the sample, and interviewing allows the researcher to probe more deeply into the respondents' feelings, attitudes, orientations, hopes and fears (Aldringe and Levine, 2001). By following the principles of *purposive sampling* it is possible to determine *what* cases are suitable to study and by following the principles of *theoretical replication* it is possible to determine *how many* cases are relevant for this research. The selection process is summarized in the following section.

SELECTION CRITERIA

The selection criteria were elaborated according to the research questions and the information for choosing cases according to these criteria was obtained from the questionnaire. The first criterion for the selection of cases was to choose those farmers that rated high in the scale of helpfulness of common organic practices. It was assumed that these farmers would have a greater level of success in managing conversion and would be able to provide more useful information. The second criterion acknowledged that location determines biophysical conditions, which in turn influences management practices on a particular farm. This criterion required diversity in case selection. The third criterion was the period since conversion, which included 3 categories (1 to 3 years, 4 to 6 years and 7 to 25 years in conversion). Preference was given to farmers in mid stage of conversion (4 to 6 years). It was assumed that this group would have more experience in managing conversion than those farmers just starting conversion, and that they would be more capable of recalling changes through conversion than those farmers who had converted a long time ago. Different conversion management issues in the fields of soil management, pasture management, animal health and business management were considered a fourth criterion in order to include a range of possible problems and strategies. Finally, the fifth criterion accounted for diversity in the type of farming systems (i.e., spring calving, mostly grass, once a day milking, split calving, high input system, and milk processing), number of hectares used for milk production and herd size. The selection criteria are summarized in table 4.1.

Table 4.1. Selection criteria used in case study sampling

CRITERIA	DESIRABLE TYPE	ACCOUNTED FOR	RELATED QUESTIONS
1. Level of success	High	- Production level (kg MS/cow/year) - Degree "helpfulness" (low, med-low, med, med-high, high) of the practices used. - Achievement of Expectations - Additional comments in the questionnaire	Q8, Q15, Q18
2. Location	Diversity	- Select at least one case from the north, west, centre and south regions of the north island - Different soil types	Q10, Q13
3. Period in conversion	Mid stage	- Time since conversion started	Q1
4. Conversion Mgmt. issues	Diversity	- Different conversion management issues in the fields of soil management, pasture management, animal health and business management	Q14
5. Type of farming system	Diversity	- Different farming systems: spring calving, mostly grass, once a day milking, split calving, high input system and milk processing. - Farm size, herd size	Q5, Q6, Q9

According to the criteria described above, eight cases were considered adequate to represent all the points described above. Even though that is a relatively large number of cases for qualitative research, given the nature of this research, it was considered reasonable to trade-off depth for breadth and, thus, to increase the scope of this research. As it has been suggested, "more powerful theory describes a broader range of phenomena" (Grey, 2003, p. 10).

Table 4.2 shows the characteristics of the cases used in this research according to the selection criteria described above. The precise location of the case study farms was excluded in order to maintain confidentiality, yet this research included farmers located in Northland, Waikato, Taranaki and the lower North Island.

Table 4.2. Characteristics of the cases selected according the selection criteria[2]

CASE	LEVEL OF SUCCESS	PERIOD IN CONVERSION	CONVERSION MGMT. ISSUE	FARMING SYSTEM
1	Med-High	6 years	- Mastitis - Metabolic disorders	- Mostly grass - Winter calving - Self contained operation - High production
2	High	6 years	- Maintaining desirable pasture sp. - Calf diseases	- Mostly grass - Split calving - Milk processing - Self contained operation - Calve 4 times/year - Large operation
3	Med	5 years	- Weed control - Calf diseases	- Spring calving - Mostly grass
4	Med-High	10 years	- Metabolic disorders - Herd fertility - Low P levels	- Autumn calving - Planning OAD
5	Med	1 year	- Soil microbiological activity - Metabolic disorders - Mastitis	- Spring calving - Mostly grass - Self contained operation - High stocking rate
6	Med	20 years	- Weed control - Maintaining desirable pasture sp. - Metabolic disorders	- Spring calving
7	Mid-High	6 years	- Weed control - Mastitis - Lameness	- Spring calving - Mostly grass - Self contained operation - High production
8	Med-High	14 years	- Mastitis - Animal health	- Spring calving - Mostly grass - Just starting winter milk - Large operation

[2] The second criterion - location – was omitted in order to maintain confidentiality

4.4.2 CASE STUDY INSTRUMENT: SEMI-STRUCTURED INTERVIEW

One of the most important data sources of the case study is the interview (Yin, 2003). The purpose of interviewing is to allow the researcher to enter into another person's perspective (Patton, 2002). Surpassing the limited capacity of observation, interviewing allows the perspectives, feelings, thoughts and intentions of other people to be captured.

A *semi-structured interview* was used as an instrument for data collection in the case study research. In this interview technique, the topics to be covered are specified in advance in an outline form and the interviewer decides the sequence and wording of questions in the course of the interview (Patton, 2002). Using an interview guide makes data collection more systematic and comprehensive, as well as allowing the interviewer enough liberty to decide which information to peruse in greater depth (Patton, 2002). However, two main weaknesses of semi-structured interviews are that some topics may be inadvertently omitted and that the flexibility to word and sequence questions differently can reduce the comparability of responses (Patton, 2002).

In this research, the topics covered in the interviews were specified according to the objectives of the research, and an interview guide was elaborated in advance to aid data collection in the field (See Appendix Four). Each farmer was contacted for an interview at their own place. The interviews normally lasted 2 hours and they were taped with prior consent of the interviewee. The recordings were then textually transcribed for data analysis. A commitment was made to treat all the information collected with confidentiality.

After defining the approach and strategies used in this research, the *framework of analysis* for this thesis was developed to illustrate the process of data collection in a logical sequence. Figure 4.1 portrays the framework of analysis followed in this research.

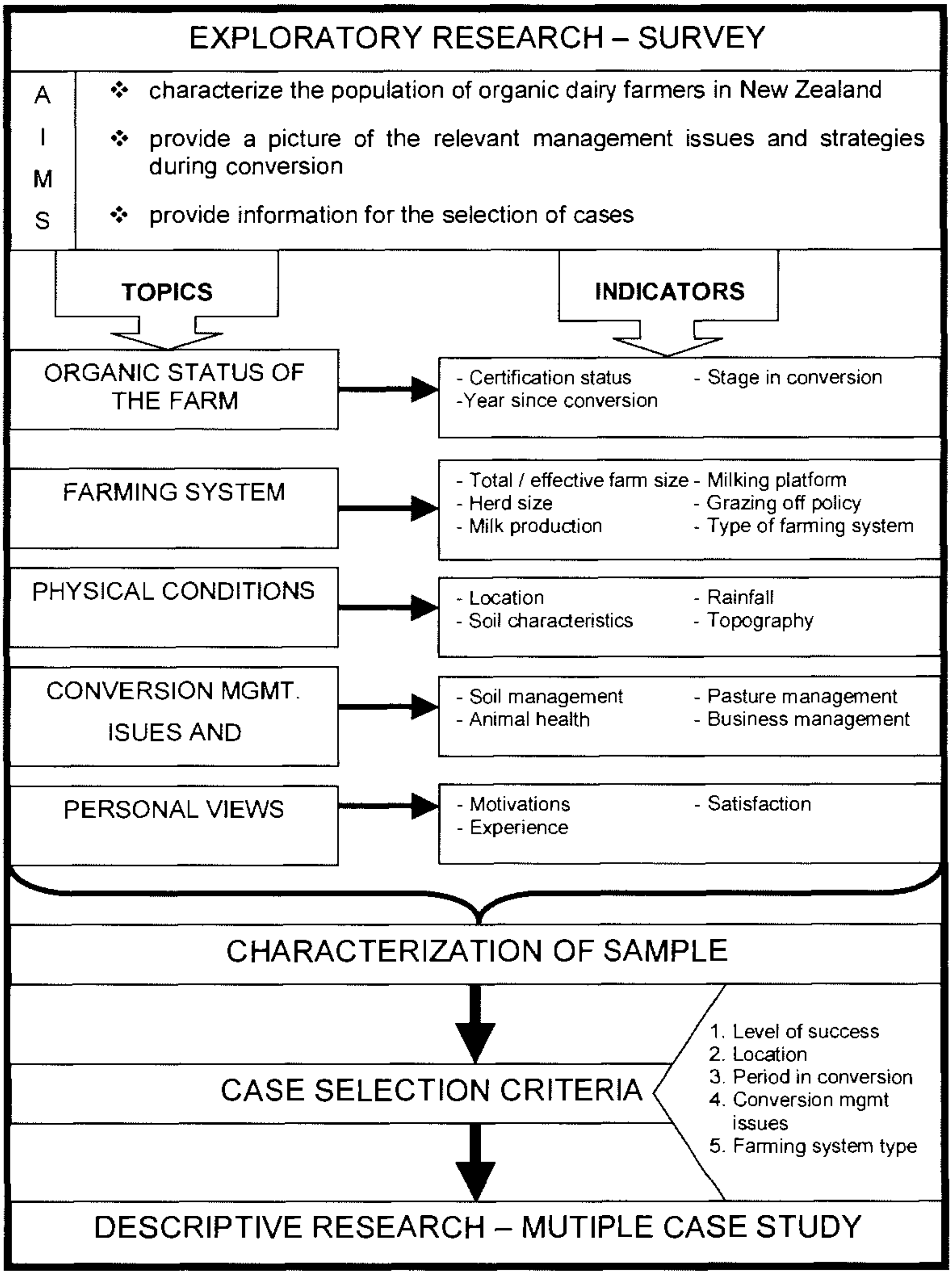


Figure 4.1. Framework of Analysis (continues next page)

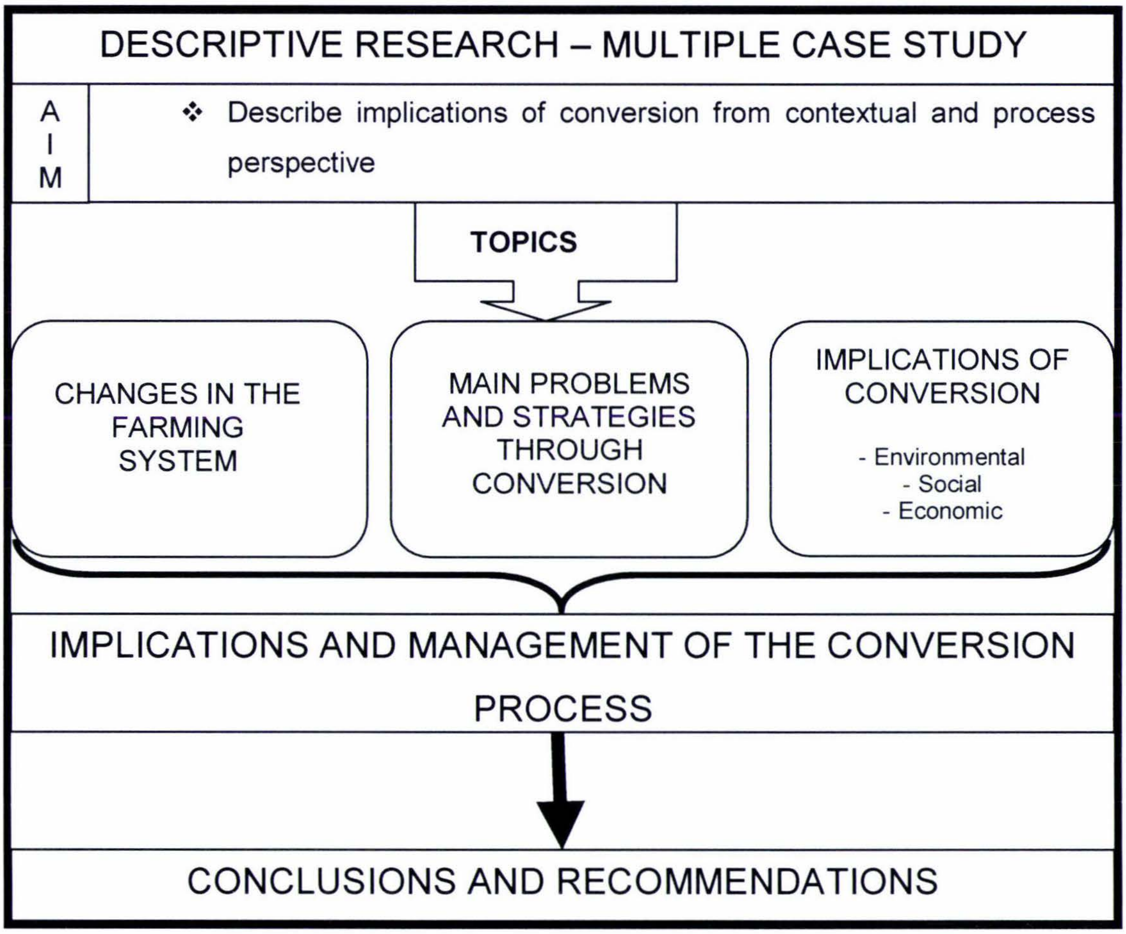


Figure 4.1. Framework of Analysis (cont'd)

4.5 DATA ANALYSIS

The analysis of two distinct data sets, one qualitative, and the other quantitative, with the subsequent combination of its results, is a challenging task. Given the particular nature of the topic under study – an emergent, small, controversial sector - the survey was not designed to test pre-defined hypotheses, nor were the interviews designed to gain complete depth in describing the complexity of particular cases. Rather, the aim of the research strategies employed was to provide sensible information about the conversion process on organic dairy farms in New Zealand, based on both survey and interview data. Therefore, in this research, the survey intended to prepare the ground for further interviews. Based on this consideration, and under the approach of a mixed methods research developed by Bryman (2001), the present research falls into the belief that "quantitative research facilitates qualitative research", in which qualitative methods are the principal data gathering tool.

Framed in a qualitative approach, the analysis in this research is based on the premise that 'objective reality' can never be captured completely (Denzin & Lincoln, 1994). By acknowledging that each individual may have a different conception of reality and a particular interpretative perspective, this research fits best within the so called post-positivist paradigm. "Postpostivism relies on multiple methods as a way of capturing as much of the reality as possible" (Denzin & Lincoln, 1994, p.5). In searching for close proximity with the reality, the use of both quantitative and qualitative strategies of enquiry added rigor, breadth and confidence to this research. As shown in figure 4.2, methodological triangulation in this research allowed examining the same issues from the perspective of the farmers as a group and as individuals.

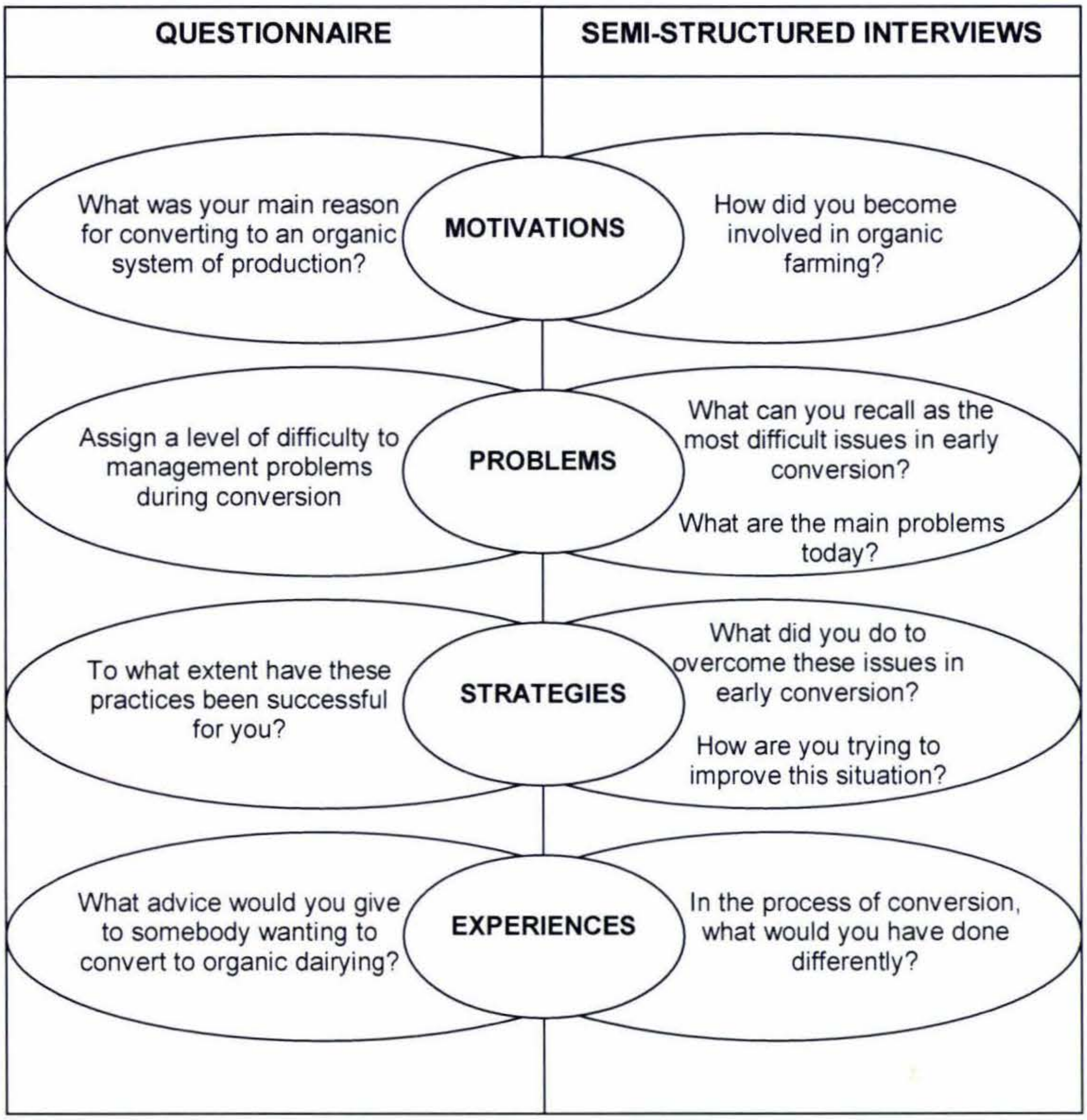


Figure 4.2. Double examination of topics in the different data sets

The qualitative approach to data analysis in this research extends over the quantitative methods. Even when the actual analysis of the survey was impartial, the presentation of the findings is enclosed within the personal characteristics of the researcher (Bryman, 2001). Further, the analysis of the interviews also represents the researcher's understandings and interpretation. As Denzin and Lincoln (1994) defined: "qualitative research is a multimethod in focus, involving an interpretative, naturalistic approach to its subject matter" (Denzin & Lincoln, 1994, p. 2). Hence, qualitative research is described as a naturalistic approach because the researchers study things in their natural settings, trying to understand the phenomena in terms that make sense to them.

Previous sections have explained how data have been collected so that other researchers can "replicate the outcomes of the analysis procedure" but "whether they also agree about what those outcomes mean is a different issue" (Hardy & Bryman, 2004, p. 7). In summary, the approach to the analysis of the data collected is mainly qualitative and aims to report findings in close proximity with reality within the particular perspective of the researcher. The methods of analysis for each data set collected are explained in the following sections.

4.5.1 SURVEY ANALYSIS

Analysis of surveys depends on the information to be obtained from the data collected. In quantitative analysis, one of the factors that affect how data are analysed is whether the data are to be used for descriptive or inferential purposes (De Vaus, 2003). In this research, the survey used a *non-probability sample* because the goal was to collect data from as many organic dairy farmers as possible. Therefore the results only represent the ideas and beliefs of those who were prepared to respond to the questionnaire.

UNIVARIATE ANALYSIS

A *univariate analysis* was conducted to describe the distribution of individual variables within the sample. The information contained in the questionnaires was entered in Excel where it was organized and prepared for the analysis. Later, the data were analysed using a computer statistical program (SAS, 2001). Using these programs, descriptive statistics that summarise patterns on the sample (De Vaus, 2003) were obtained. Additionally, important indicators of productivity, such as pasture production, stocking rate and pasture utilisation efficiency, were calculated from the given data and compared against district figures for New Zealand.

As explained earlier, the survey included farmers that are already certified and farmers that are in the process of conversion to achieve certification. Therefore farmers were asked to provide information on productivity at different stages of the conversion process: before conversion, during conversion, and after conversion. It was assumed that those farmers who considered that conversion on their farms has been completed were, at least, able to provide data for the stage "after conversion", whereas those farmers who are still in the process of transition were only able to provide data on the stages "before conversion" and "during conversion".

Based on this and with the intention of using as much of the information obtained to calculate current figures on organic dairy farms (e.g., current number of milking cows, current milk solids per cow, current milk solids per hectare), data on "during conversion" was used in those cases on which data on "after conversion" was not available.

On the other hand, open-ended questions in the survey (i.e., question 17, 18 and 19) were coded in order to facilitate their analysis. In doing this, a coding scheme was developed based on the responses provided by the respondents (De Vaus, 2002). The categories obtained in coding each of these open-ended questions are presented in the next chapters of results and discussion.

As mentioned previously, issues and practices during conversion were assessed using a numerical rating scale of five levels (low to high) in which respondents had to indicate where their attitude lay. This corresponds to question 14 and question 15, respectively. Given the low number of participants in this research, it was considered appropriate to merge level 1 and 2 in one category named as "low", and level 4 and 5 in another category named as "high". Responses obtained for level 3 were evenly distributed in these categories. When odd responses were obtained for level 3, the nearest lowest even number was considered, divided in two and allocated evenly to the low and high categories. The remaining unit was allocated randomly to either the lower or high categories.

BIVARIATE ANALYSIS

A *bivariate analysis* was used to test association between variables and elucidate explanatory accounts. Two variables are associated when the distribution of values of one variable change for different values of the other variable (De Vaus, 2002). The importance of the bivariate analysis is based on the ability to predict the behaviour of one variable knowing the actual value of another variable. As de Vaus (2002) explains, the main purpose in trying to detect a relationship between two variables is to help in the task of explanation.

Based on the objectives of this research, the bivariate analysis was focused on explaining management issues during conversion. Therefore conversion management issues (in question 14) were treated as dependent variables and data regarding the organic history of the farm, farm size, herd size, level of production, location, and physical conditions were used as independent variables. Cross-tabulations, using a chi-square analysis were performed for categorical data. In cross-tabulations, the information is displayed in the form of a table with rows and columns. Usually, the independent variable is placed across the top of the table, generating columns for each category of that variable, whereas the dependent variable is allocated on the side of the table, generating rows for each category of that variable. The intersection of a row and column is called a cell and it is used to represent cases which have the characteristics of both that column and that row (De Vaus, 2002). Any difference between the cells reflects some association.

Bivariate analysis not only provides an indication of a relation between two variables but also shows the character of this relationship. In this respect, cross-tabluations indicated the strength, direction and nature of the associations while correlation coefficients were also used to get a concise description of the extent of the relationships. Chi-square and Pearson correlations were calculated together with their respective tests of significance. However, the limited amount of data from the surveys led to frequent misinterpretations and difficulties in using these correlation coefficients. Therefore, the analysis of variance, a procedure used to determine the statistical significance of differences among means, was used together with its corresponding F-test.

Using tests of significance in conjunction with correlation coefficients allows testing the null hypothesis which, in bivariate analysis is that there is no relationship between two variables (De Vaus, 2002). If the test of significance produces a p-value higher than what is predetermined, the null hypothesis is accepted and the relationship detected is attributed to simply chance (sampling error). Generally, values of 0.05, 0.01 and 0.001 are used as critical cut off points to conclude that a finding is statistically significant. However, these levels are conventional and arbitrary (De Vaus, 2002) and, "other levels – 10% or 20% – may be used when considered appropriate" (Snedecor & Cochran, 1980, p. 65; Harris, 1998). For this research, it was considered appropriate to use a less stringent p-level of 0.1 in order to accept any relationship or difference between variables as significant.

4.5.2 CASE STUDY ANALYSIS

There is no formula for the transformation of qualitative data into findings (Patton, 2002; Ritchie & Lewis 2003; Yin, 2003). Analytical guidelines are just tools to aid the process of analysis and their application requires the judgement and creativity of the analyst. It is the analyst's skills that are needed to read, sift, order, synthesise, and interpret the data (Ritchie & Lewis 2003).

Different authors have proposed different processes for the analysis of qualitative data. However, two main tasks common to all analytic processes are managing the data and making sense of the data. Patton (2003) suggests that the real challenge of qualitative analysis is making sense of the data because it attempts to identify core consistencies and meanings.

The analytical process in this research followed the approach of *content analysis* as a data reduction technique focused on the content and context of the information being analyzed, in which the text is searched for recurring themes and patterns (Patton, 2003). Therefore, building findings from the raw data contained in the interviews involved capturing and interpreting common sense, substantive meanings from the dialogues without losing their individual context.

First, having in mind the objectives of the present research, each interview was reviewed to identify recurring ideas that were used to create a template or index. Meaning was attributed to the original data by moving up in the abstraction of language. Then, the interview transcripts were examined again and labelled according to the main themes in the index. Later the data were synthesised and classified, to be further compared in an attempt to find similarities and patterns. Finally, having examined the data thoroughly and generated an overall impression, it was confirmed against the framework of theory developed previously in the literature review.

4.6 LIMITATIONS OF THE STUDY

The limitations of choosing a qualitative approach to data analysis come mostly from ontological aspects of conceiving reality as multiple and socially constructed. Thus, the reflections on the findings are shaped by the researcher's personal history whereas others may have addressed them differently. In addition, the survey provided information on those who were prepared to answer, whereas the interviews are context specific, meaning that the overall information gathered in this research has limited representativeness.

Considering that the survey included questions for "before", "during" and "after" conversion in order to study changes in productivity through time, the reader has to keep in mind that the accuracy of the information obtained for these questions depends on the farmer's criteria and may not be based on actual measurements. Thus, the data obtained on productive parameters should be considered as estimation.

Finally, the lack of literature on organic pastoral dairy systems limits the discussion of the findings in this research. In fact, the majority of research on organic dairy farming has been conducted in countries where intensive production systems prevail. Moreover, previous studies have focused on comparing conventional and organic systems rather than following the implications of conversion in organic systems per se.

CHAPTER 5: CONTEXT AND PERCEPTIONS OF THE CONVERSION PROCESS

5.1 INTRODUCTION

The results of this study are reported in two chapters, 5 and 6. This first results chapter presents an overview of the outside factors influencing conversion, the farmers' own perceptions of the conversion process and it's implications on the financial and environmental performance of the farm. In acknowledging that individuals' opinions, experiences and visions are naturally reflected in people's actions, it was considered relevant to look at the process of conversion from a social perspective. Therefore, exploring the context of conversion as well as farmers' motivations, perspectives and views becomes a way to prepare the ground for better understanding the practical problems and strategies during conversion, which will be covered in chapter 6. In both chapters, data obtained from the survey and the interviews are presented together in order to provide a better understanding of the findings in this research, and are further discussed in relation to the literature.

5.2 FACTORS THAT MOTIVATED CONVERSION FOR ORGANIC DAIRY FARMERS

The information obtained from the survey and the interviews suggests that farmers usually do not have only one reason for conversion, but many. When asked about the main reasons for the conversion to an organic system of production, the respondents of the survey usually provided a variety of reasons as shown in Figure 5.1. Figure 5.1 shows that, from the variety of reasons that motivated conversion environmental concerns or land conservation were mentioned most frequently in the survey. Similarly, the data from the interviews showed that organic farmers have a caring attitude towards the environment and the land. Two interviewees were particularly concerned about the state of their land for the wellbeing of subsequent generations.

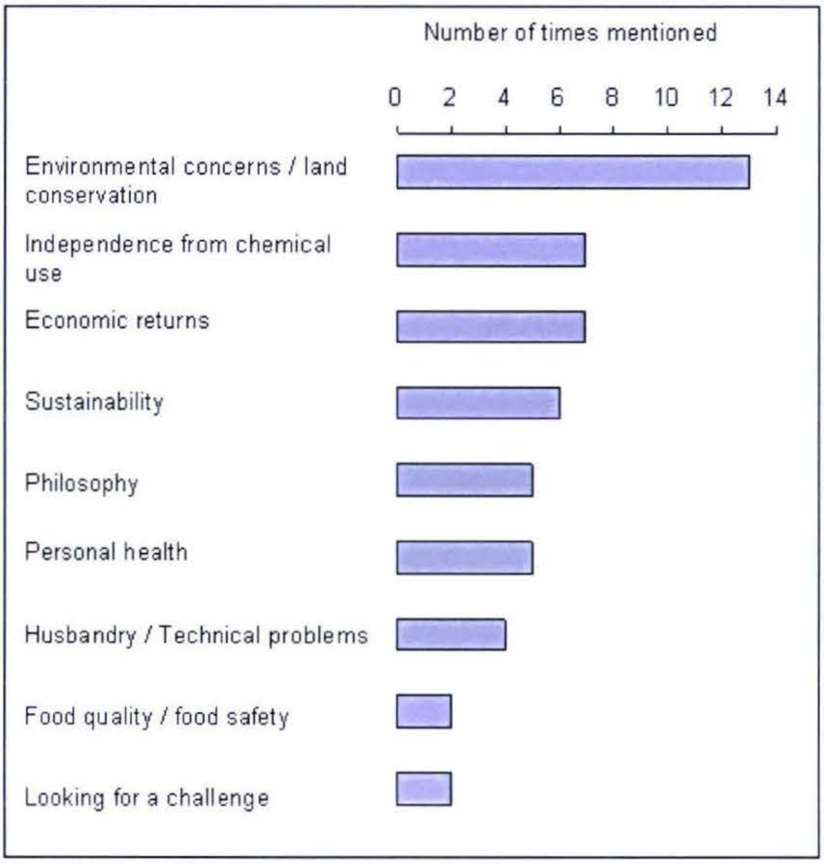


Figure 5.1. Reasons for conversion to an organic system of production for dairy farmers (n[3]=30).

These findings are consistent with others reported in New Zealand, in which a high proportion of farmers emphasized organic philosophy or general concerns for the environment as a motivation to grow organic products (Fairweather, 1999). These results may reflect an altruistic idealism on the part of the farmers, in which contributing to the overall current and future state of the global environment is as important as achieving immediate direct benefits from farming. In addition, the data from the survey and the interviews support the view that a common factor leading farmers to consider conversion is their dislike of the use of chemicals (Fairweather, 1999). Figure 5.1 shows that gaining independence from the use of chemicals was an important consideration for conversion in the survey. Furthermore, six farmers showed an aversive attitude towards the use of chemicals during the interviews. They argued that chemicals are damaging to health and harmful for the natural

[3] n = total valid number of responses

fertility of the soil. This inclination for a chemical-free lifestyle led three interviewees to an accidental encounter with organics. As one participant explained:

"We didn't know that we were going organics in the beginning; it was just something we were working on and it was other people who told us we were farming organically, not ourselves personally"

Further, past adverse experiences from the use of chemicals made three interviewees reconsider their use. For one farmer, this was related to synthetic fertilisers; *"once we applied the mixture, it made all our grass go purple"*. Likewise, two other farmers lost part of their herd from intoxication. One of them found cows accidentally grazing a field of potatoes treated with arsenic, while the other observed cows suffering nitrate poisoning from excess nitrogen in the pasture. Similarly, actual problems in the operation of conventional systems also made some farmers consider conversion. For example, one interviewee observed a decrease in the effectiveness of chemical fertilisers, whereas another believed that the soil was not able to release nutrients for the plants and it was growing poor quality pasture.

On the other hand, the survey showed that economic considerations are not least important when considering conversion. Increasing the economic returns by targeting a specialized market was an important consideration for three interviewees, whereas reducing costs of animal health was a main concern for one farmer: *"we did it to save ourselves money, ...save on animal health. So we say we were not doing it for the money but we were trying to do it to save our money"*. Finally, an interviewee that manages a big dairy operation went further in recognizing that conversion on his farm was *"purely a commercial decision"*. In this case, producing organically and processing the milk were both added-value strategies to increase the profitability of the farm. These findings are consistent with the literature, in which financial motives for conversion include attempts to cut costs of production and the desire of secure the long-term existence of the farm (Padel, 2001).

From the interviews, seeking differentiation in the business was often related to a search for a personal challenge and revitalizing the farming operation. Previous research suggests that organic farmers enjoy the challenge of organic farming because it requires individual initiative, acceptance of risk and innovation (Duram, 1999). All of the farmers interviewed in this research were approximately between 45 and 55 years old, a stage in life where people usually start questioning their old habits and reformulating a new lifestyle. The view that some farmers are psychologically predisposed to conversion or in the search for a new way of life (Fisher, 1981) is reflected in a fragment of one particular interview:

"We were also looking for a challenge.....that was about the stage that (my husband) was going through that 40 stage, a middle life crisis, he was 38, and then we discovered biodynamics..... 'cause we didn't want just to farm by default and do nothing"

It is often argued that motivations for conversion change through time. Early converters are usually motivated by husbandry problems or philosophical reasons, while recent converters are more concerned about the environment, have economic reasons and see organic farming as a professional challenge (Paddel, 2001). However, in this research it was not possible to detect any relation between stage in conversion and motivations for conversion.

In summary, the data from the survey and the interviews in this research suggest that the factors that motivated conversion in organic dairy farmers are diverse. They range from environmental concerns and land stewardship to technical problems with conventional farming methods to economic reasons. In addition to the personal reasons that motivated conversion, conversion is also affected by events happening in the immediate environment of the farm and at the institutional level.

5.3 SOCIAL AND INSTITUTIONAL FACTORS AFFECTING FARMERS IN CONVERSION

5.3.1 SOCIAL ACCEPTABILITY

In the same way that organic farmers challenge traditional agriculture, conventional farmers are sceptical about the practicability of the organic philosophy and feel threatened by this, rather alternative, approach. Under this scenario, social acceptability has been a major issue for early converters (Padel, 2001) and a barrier for conversion for many others (Padel & Lampkin, 1994). In this sense, the conversion to organic farming has been previously studied as a psychological process (Hill, 2000). Organic farmers in the process of conversion bear ridicule, rejection, abandonment and lack of respect (Hill, 2000). This situation was reflected in the present research since all of the farmers interviewed experienced some social stigma during early conversion. Conventional farmers, even friends and family, were critical about this change, disapproving new ideas and laughing at newcomers. Social rejection even led one interviewee to hide what she was doing: *"we didn't tell anyone what we were doing because they always had bad words"*

Nevertheless, interview data and the literature agree that, as organic farming gains recognition as a viable option and more credibility through the involvement of the industry (Padel & Lampkin, 1994), the attitude of conventional farmers towards their organic peers has changed. For some interviewees, the change from scepticism to curiosity in organic farming is putting pressure on them to demonstrate that organic farming is a viable option:

"I get looked at, I don't like that...........I rely on facts, figures and paper work to show them that it is OK, it will work and it will do better because not always they believe what you say"

"Nearly all our neighbours can look at us and say: OK, they are commercially producing organic milk"

"They are looking closely, 'cause if it works they're going to do the same"

In addition, the interviews showed that organic farmers are increasingly interacting with conventional farmers and may potentially influence their surrounding environment with new ideas. In this respect one farmer commented: *"One of the most radical people against organics was a farmer down the road, but 5 years down the track he is now selling organic eggs"*. Some interviewees mentioned participating regularly in conventional discussion groups while others exchanged experiences with conventional farmers on their daily routine. Although many farmers enjoy the interaction with their peers, some of them are not prepared to share their experience. For instance, one interviewee that produces most of the organic inputs applied on her farm was reluctant to share her recipes, partly because she considers that organic farming is not about replacing inputs but about preventing problems. On the other hand, another interviewee reported feeling overwhelmed by people interested in organics and believed that they were probing for information about her methods. She went further and explained: *"You get to a point sometimes where you just don't want to go out, because you know you are going to talk shop"*

5.3.2 INSTITUTIONAL SUPPORT

Farmers' views on regulations and their influence on management have been previously discussed in research related to treatment choices for mastitis on organic dairy farms. Vaarst et al. (2003) found that regulations were perceived as difficult to understand and self-contradictory, and observed that there is often a connection between herd problems and the perception that legislation resulted in problems, or was considered as 'illogical' or 'irrelevant to organic farming'.

As in the study by Vaarst et al. (2003) the results from the interviews suggest that there are opposing opinions regarding certification agencies. Three interviewees consider the inconsistencies in the rules and the slow reaction capacity of certification agencies as a threat. In the present research, many farmers initiated conversion at the same time as the Agriquality organic certification agency was being set up and the standards were developing. Under this scenario, the manager of a big dairy operation confessed to have hassled Agriquality to finish the standards: *"we told him to finish the Agriquality certification because we wanted an insurance policy against BioGro changing their mind about things we couldn't live with"*. In contrast, some interviewees consider certification agencies as allies in the process of conversion. They believe that certification agencies have the "know-how" that the farmers seek in order to develop their organic system. As one farmer in Northland commented: *"If you are not with them you are sort of playing blind"*.

The recent interest within the dairy industry in capturing organic dairy farmers with the intention of supplying overseas markets is challenging farmers' capacity to comply with stricter rules. In this respect, one interviewee appeared particularly uneasy about having to comply with Agriquality standards. Agriquality is a recognized third party agency under the NZFSA to certify organic milk suitable for the USA market. The farmer believes that with her previous certification agency, Demeter, the rules were aligned with the organic philosophy but still negotiable, whereas now Agriquality is just doing its duty in enforcing rules but does not work *with* the farmers: *"it's gone from a........philosophical to a beaurocratic one"*. In summary, the interviewees who initiated conversion more recently have a more positive view on the role of certification agencies, mainly based on their guiding function in conversion, yet those who have been farming organically since long ago are more critical of regulations.

Regarding the role of the industry in the development of the organic dairy sector, different opinions were obtained. Despite the fact that some farmers criticized the unsupportive position that Fonterra had taken in the past, most interviewees are positive about the recent involvement of Fonterra in the organic sector. In contrast, for other interviewees, it seemed difficult to reconcile the organic philosophy with the magnitude of the dairy industry in New Zealand. A personal commitment with environmental protection, specifically in terms of reducing pollution and decreasing food miles, is making one farmer to think of moving away from Fonterra: *"I really don't like being involved with Fonterra. It is such a huge organisation. I guess, ultimately part of what are you doing is to try and reduce pollution.......I'd like to process the milk separately".*

Most of the interviewees agreed that Fonterra should support the farmers from the beginning of conversion in economic and technical terms, particularly with extension services or discussion groups. Similarly, farmers frequently commented that the premiums should be higher and appear to be optimistic about the effects that accessing the USA market will have on premium prices. One interviewee referred to figures in the Massey trial to support his position for an increase in premium prices: *"Massey have sort of said that the cost increases are 22% so they have to put an increase on that so I think it has got to go to 30%.....Fonterra says: we work on costs plus incentives so......unless they do that they won't get a lot of conversion".*

In other words, organic dairy farmers showed divided opinions towards the role of certification agencies and the industry in helping to develop and maintain their organic farming systems. However, farmers were well informed about the current changes at the institutional level, and seem positive about the expansion of the organic dairy sector. Certainly, current events happening at the institutional level influence farmers' plans for improving their business. The fact that many interviewees are currently trying to comply with the USDA standards to export milk for higher premiums, implies big changes in the management and structure of some operations. For example, one interviewee was particularly concerned about having to provide 100% organic feed to his herd and is aiming for a self-contained operation, reducing the herd size and building up a reserve of feed.

On the other hand, some interviewees are actually in the process of gaining independence from the industry and are aware of the new business avenues that organic farming opens to them. Producing organic meat, planting an organic orchard, breeding for A2 organic milk and tourism projects are some of the plans mentioned. In addition, some farmers are quite passionate about the quality of the food that they are producing and would like to promote it and increase their production levels.

As mentioned before, most of the organic farmers interviewed are in a mature stage of life and would like to reduce their workload on the farm and have more time for leisure. A farmer who prioritised personal life over farm work has developed a stewardship philosophy for over his land, rather than a merely productive one: "*The soil is here and we help it with fertilisers, we do our best for the animals......but I am not going to spend all day out on the farm being a farmer. We help nature come back*". In the same way, three other interviewees are looking to share the responsibility of managing their farm with other employees, or reduce their work levels by going once-a-day milking. As one of them commented:

"I am getting old, I am 50, we are getting in that stage where we want to get out of the cow shed. Our big thing now is how are we going to manage this organic system and to be really fully hands on there the whole time"

However, it seemed difficult for these farmers to reconcile the pressure of developing a new faming system (i.e., conversion to organic farming) with their lifestyle longings. The next section moves on from examining the external issues affecting conversion, with its consequent influence on the farmers' future perspectives, to examining their personal experiences and views of the conversion process.

5.4 ARE FARMERS SATISFIED WITH THEIR ORGANIC OPERATION?

In the present research, both the survey and the interviews provided information on the satisfaction that farmers obtained from farming organically. In response to a question on the survey (i.e., has organic faming achieved your expectations? why?) 26 farmers affirmed that organic farming has, to some extent, achieved their expectations. From these, 18 respondents give different reasons for their satisfaction. Furthermore, all interviewees reported to be personally satisfied with their organic system and seemed enthusiastic about what they are doing. In fact, interviewees often expressed a strong commitment to the organic philosophy and reported that they *"wouldn't farm any other way"*. The satisfaction that farmers obtain from their organic system was justified at different levels. As shown in figure 5.2, the respondents of the survey mentioned a number of reasons to explain the satisfaction obtained from organic farming, however, improvements in animal health or animal welfare was the most common.

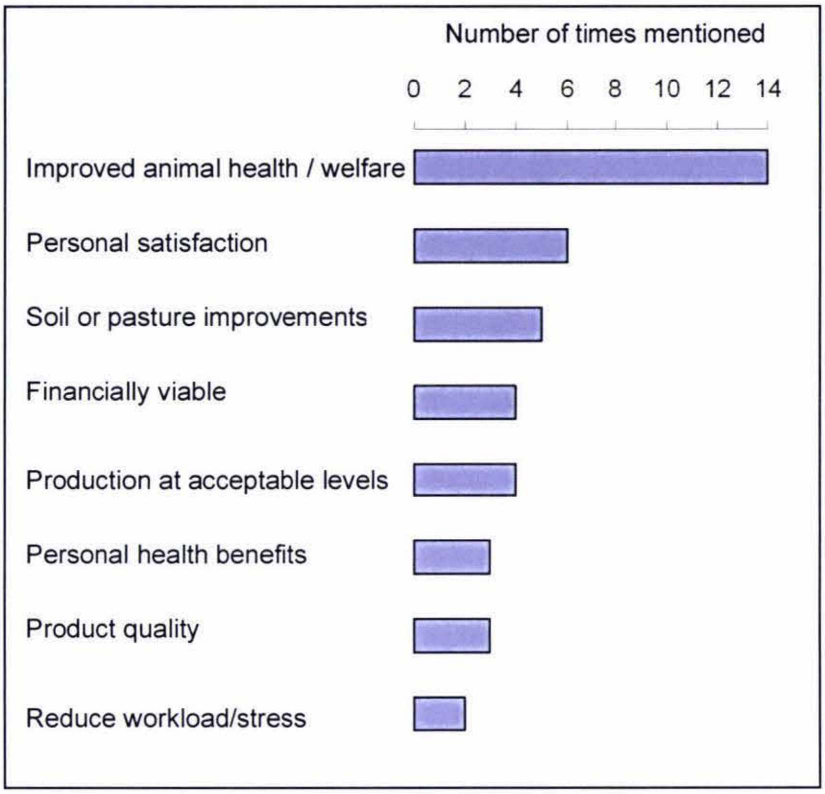


Figure 5.2. Reasons contributing to reported satisfaction as a result of conversion to organic dairy farming (n=18)

In the interviews, farmers seemed to be satisfied with organic farming in different ways. One farmer said: *"we are happy where we are, fully certified, low cost, high payout"*, whereas other farmers explained that the animal health and soil resilience were the main strengths on their farms. The relief that farmers experience of not working with chemicals appeared to be an important issue for some interviewees: *"you don't have to worry about your workers injecting the cows and then milking them and putting the milk in the vat"*. Other interviewees feel restricted with conventional farming and enjoy the challenge of experimentation that organic farming offers: *"it just revitalises (you),....it just gives you a whole new meaning of farming"*. In contrast, only 4 respondents of the survey reported to be discontented with organic farming citing problems like high costs, consumer demand, animal stress/health problems and feed supply or nutrient imbalances.

5.5 THE MEANING OF CONVERSION FOR ORGANIC DAIRY FARMERS

In response to the question "when did the conversion process of your farm begin?", the data obtained from the survey suggests that, in New Zealand, conversion to organic dairying started as early as 1981. However, during the late 1980s and early 1990s, this process showed a decline. It was not until late 1990s that conversion to organic dairy farming increased notably, with the greatest number of conversion cases reported in 1998. This is illustrated in figure 5.3.

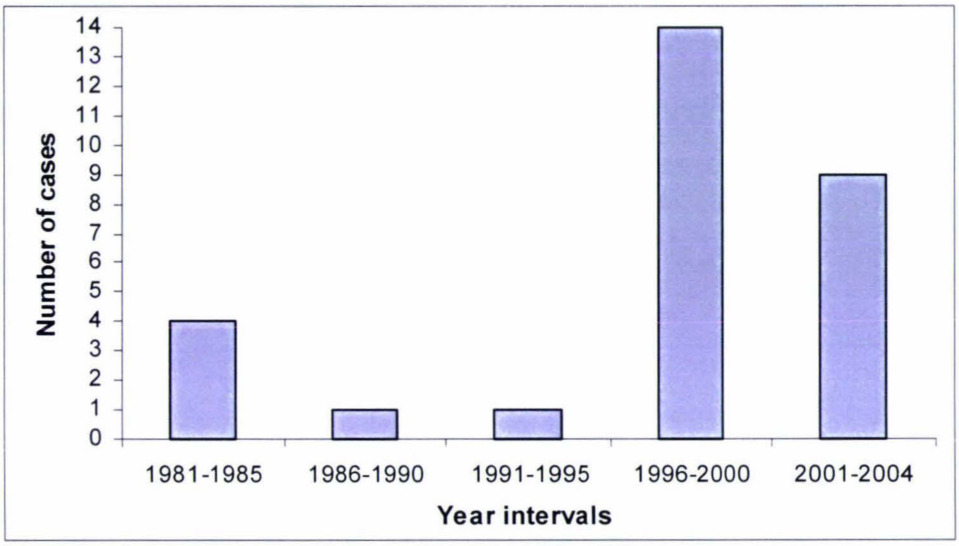


Figure 5.3. Conversion in organic dairy farms through time (n=29)

Data from the surveys indicated that organic farmers conceive the *conversion process* differently from the *certification period.* The survey showed that 75% of the respondents have fully certified operations, 19% are in the process of certification, and only 6% are not certified and do not intend to gain certification in the future. And yet, from all the fully certified operations, over half (54%) of the farmers reported that conversion has not been completed or has been only partially completed. This position suggests that for many organic farmers, conversion does not end with certification but improvements on the farm continue beyond the period required for certification. Respondents to the survey illustrated this issue saying: *"Conversion is a difficult term"*, *"Things are in place and we are organics but we still need to learn and improve"*; *"Still learning, developing ideas, experimenting"*, *"We have obtained certification. However, the soil improvements are ongoing"*. This vision agrees with previous research in which conversion is regarded as an "ongoing process that requires a high level of commitment" (Macrae et al., 1990).

In this respect, a combined analysis of the survey and the interviews in this research suggests that the notion of *conversion* for organic dairy farmers agrees with Hill's (2000) model, in which the transition to sustainable farming implies the progress through three consecutive stages: efficiency, substitution and to redesign. Efficiency and substitution are considered as only shallow approaches to sustainable agriculture, while redesign is a deep approach that implies a change in the structure and functioning of the systems (Hill, 2000). In effect, most of the interviewees in this research appeared to aim for this "redesign stage" on their conversion process. They strongly criticized those that practice organic farming only as a substituting exercise:

"Some farmers went crazy and are still going crazy. They spend thousand of dollars in exotic, seaweeds, cider vinegar or molasses. Some organic farmers are quite conventional in their thinking...............we have also removed that need"

"You can't just substitute and say: this is how we used to do it, this is how we do it now....it doesn't sort of work like that"

"Yes it does work (apple cider vinegar), but I think it is like a plaster...........it's like cheating because you are not fixing the problem"

In abandoning substitution and moving on to a redesign stage, farmers become more reliant on people, knowledge, planning and prevention (Hill, 1985), and conversion becomes a process of learning.

5.6 LEARNING AS A STRATEGY FOR PREVENTION IN ORGANIC DAIRY SYSTEMS

The responses obtained from the survey to the question: "what advice would you give to somebody wanting to convert to organic farming?" are illustrated in Figure 5.4. This figure shows that only one productive aspect (i.e., adjusting stocking rates or selecting animals) was emphasised, while the most frequent recommendations were related to learning, planning and changing attitudes. This suggests that the farmer's capabilities and attitudes are essential for conversion and, perhaps, the foundation for restructuring farming systems.

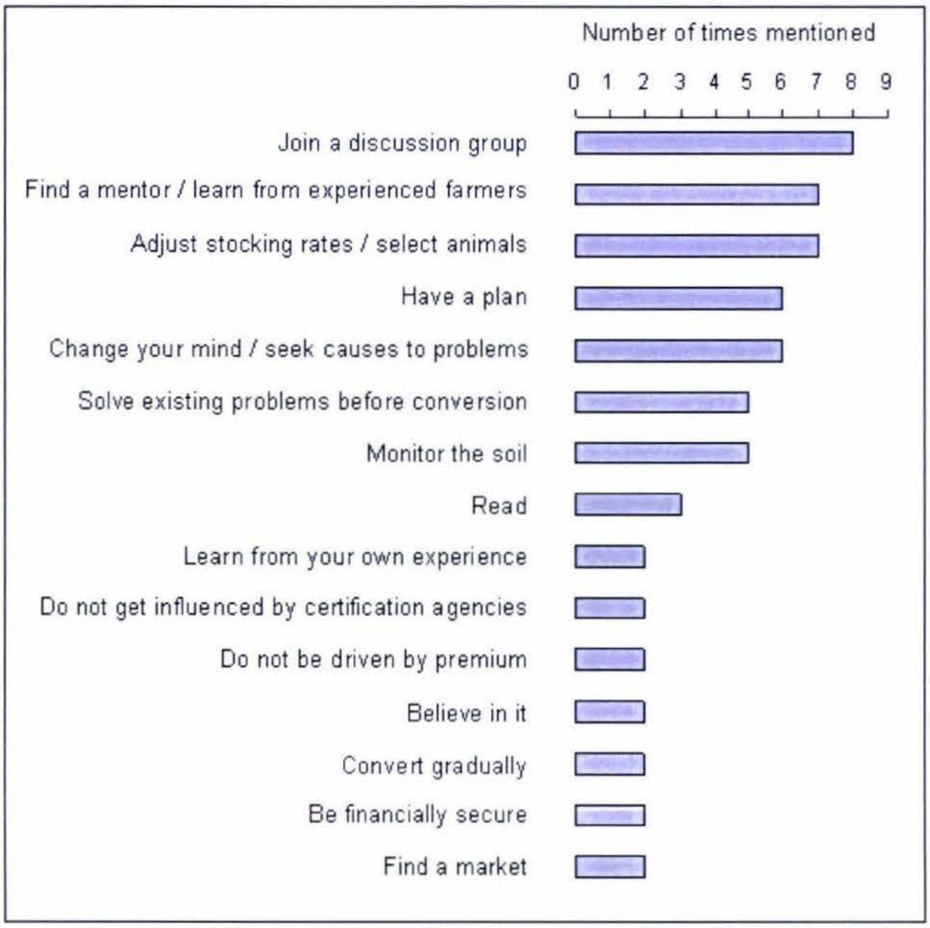


Figure 5.4. Recommendations given for other farmers interested in converting to organic farming (n=29)

Furthermore, data from the interviews support the importance that organic farmers place on intellectual or personal aspects of conversion. Perhaps the clearest example is from an interviewee who, when asked about the changes made on his farming system in order to farm organically, simply responded: *"certainly, you have to change your mind"*. In fact, a number of interviewees believed that the problem-solving approach of conventional farmers is too simplistic, while more complex management abilities are required in organic systems. This idea is well illustrated with some passages from the interviews:

"......all the conventional farming is easy, you know, you put on the fertilisers twice a year and put urea on.....it is a very simple way of farming"

"One thing I do believe as an organic farmer is that you spend more time looking for problems before they arrive. Conventional farming, I don't think people do that"

"Certainly you have to change your mind and that is probably the biggest reason why more people are not converting"

An exception to the rule is the manager of a large dairy operation, who still follows the same monitoring programme that they used before converting to organic farming: *"our original philosophy was that we were trying to be as conventional as possible inside the organic certification".* Perhaps the fact that this farmer has the opportunity to transfer sick animals to an adjacent conventional farm liberates him from the continuous need for prevention.

On the whole, this research suggests that organic farmers have to break their own psychological barriers to successfully put organic principles into practice. In this sense, it supports the view that "the process of conversion to organic farming starts with a change in attitudes" (Padel & Lampkin, 1994, p. 300) and "the conversion of the (own) farmer" (Blake, 1990, p.47). The matter of a *mind change,* from the surveys and interviews, was usually related to confronting problems at a causal level. As one respondent of the survey put it: *"Don't treat the problems but try to find where they come from".* Developing a preventative approach requires an integrated, rather than linear, way of thinking. Based on the data obtained from the survey and the interviews, the present research proposes that prevention is the main strategy employed to approach management problems in organic dairy systems. Furthermore, prevention emerges from learning, which in turn arises from the processes of capturing information and building experience during conversion.

CAPTURING INFORMATION

In general, data from the survey and the interviews suggest that organic farmers conceive conversion as a *learning process,* showing similar patterns to those described previously by Padel and Lampkin (1994). These authors, based on an analogy of the adoption/diffusion model, maintain that conversion occurs in four stages: initial knowledge, acceptance as a good idea, acceptance on a trial basis, and adoption. The first two stages involve interacting with other organic farmers, attendance at seminars and conferences, discussion with extension agents and reading available literature (Padel & Lampkin, 1994). As illustrated in figure 5.4, the respondents of the survey stressed the importance of gathering information on conversion. Likewise, data from the interviews provided many examples on how farmers source information from external sources. In the present research, this process has been defined as "*capturing information*".

Capturing information appeared to be especially important in early stages of conversion. In effect, when an interviewee was questioned about the most critical problems in early conversion, she replied: "*Knowing what to give to the animals, that was the major problem.........like if you get a sick animal, finding the information of what can I use.....I used to go to the library every time that something went wrong*". To the same question another farmer answered: "*one of the biggest things I noticed was the stress of not knowing what the outcome would be*"

The data from the survey and the interviews support the view that organic farmers seek information from a wide range of sources (Lampkin, 1999). Seeking advice from consultants with expertise in the organic field was essential for at least three interviewees, particularly when dealing with animal health and in learning the use of homeopathies. On the other hand, joining discussion groups was the most frequent recommendation from the survey (See figure 5.4) and a common way of capturing information for the interviewees:

"Join a discussion group, and walk around their farms when they have a group and just go to those meetings and sit there and suck up as much information as you can, ask a lot of questions and just try to learn as much as you can"

Perhaps, the fact that discussion groups allow farmers to establish a more horizontal relationship with their peers makes them an important way to capture information. As Lampkin (1999) explained, "direct personal contact is often far more convincing than the quantity of written material" (p. 526). In this respect, discussion groups allow farmers to exchange experiences rather than purely absorb information. In particular, exchanging experience through direct contact with other organic farmers seemed important for the interviewees, possibly because they share common problems and solutions. The interviewees remarked on this point: "*The big thing as with any problems we have had, the big thing is to talk to someone else. That's the key*"; "*Find yourself a mentor, someone who you can ring, someone to talk to*"; "*ask for help*".

In contrast, reading publications and academic research was not often mentioned in the interviews, except in one case. In this case, the interviewee proved to be up-to-date with local and international research, and was successfully implementing some of these findings. Interview data suggests that keeping information and contacts available is for some farmers a matter of developing a quick reaction capacity when problems arise: *"and the other one that I think is important is to have that information before you need it"*

A range of interviewees at different stages in conversion agreed that conversion is getting easier for the newcomers. Farmers argued that more information is readily available, scientific research on organic systems is being conducted and extension networks are already working in different areas of the country. Furthermore, a recently converted farmer believes that economic incentives will make conversion easier for newcomers:

"Two years ago, Massey and Dexcel weren't even interested in doing anything organically, it's changing rapidly, it's going to get easier……I am sure, next season Fonterra will pay that 10% from the day you start your conversion, so that would bring in a lot of framers"

BUILDING EXPERIENCE

Interview data suggest that farmers do not only rely on capturing information from external sources but utilize this knowledge to find effective solutions in the context of their own farming systems. In this research, this process has been defined as *building experience*. *Building experience* is a long-term and perhaps endless process, but allows farmers to increase their knowledge and understanding of their own farm and gain confidence in the organic practices. As one interviewee commented: *"Instead of playing around with years of trial and error in our fertiliser program, we (now) know what we like, what grows good grass so we don't have to play around anymore"*.

In this research, the most evident way in which farmers build experience is through on-farm experimentation, which corresponds to stage 3 - acceptance on a trial basis - in Padel and Lampkin's model (Padel & Lampkin, 1994). Two particular cases emphasized the importance of on-farm experimentation. In the first case, a mastitis outbreak led a particular farmer to experiment with different treatments (homeopathy, stripping, and control group) in order to find the most effective solution. A second case is from a farmer who started conversion when she observed that her pasture had been contaminated with a fertiliser mix. Facing this, the farmer started experimenting with different fertilisers: *"we have a paddock called the "trial plot paddock" because that's where we make trials with different fertilisers and bits and pieces"*. In both cases, on-farm trials were carried out on the basis of previous knowledge or under the guidance of consultants. Therefore, *capturing information* from external sources appeared to be a vehicle for *building experience* on farm.

Nevertheless, *building experience* in this research is not limited to testing organic products. In effect, farmers "experimented" with management practices such as grazing levels, rotations, supplement availability, weed control methods, stocking rates and milking routines, as a way to determine the solutions best suited for their particular operations. In some cases, every aspect of farm management was evaluated before conversion, mitigating possible mistakes in the conversion process. As shown in figure 5.4, planning was an important consideration in the survey. Planning involves an assessment of the current situation on the farm, proposals for a target organic endpoint and a strategy for getting from "here" to "there" (Padel & Lampkin, 1994). Even when some interviewees started conversion impulsively, planning was also a frequent recommendation in the interviews: *"Plan it. Do lots of thinking and then plan how you are going to do it. Set yourself a path, not just wake up one day and decide: right, we are going to be organic"*.

Further, planning as a tool to reduce risk (Padel & Lampkin 1994; Macrae et al, 1990) was reflected in the interviews. In particular, for one farmer who aimed to find a niche market and gain entire control over his business, conversion was part of a bigger long-term plan that contemplates the construction of a milk processing plant and the development of a tourism project. A complete technical manual that included the possible problems and solutions in conversion was written by the farmer, together with a SWOT analysis of the entire project.

To summarise, the present research suggests that conversion may be considered as a learning process through which, by *capturing information* and later by *building experience*, farmers are able to develop personal skills and effective management practices that aim to prevent potential problems. Therefore, prevention is a multifactorial task that allows farmers to gain better control over their system and reduce risk. The vision of conversion proposed in this research is illustrated in figure 5.5.

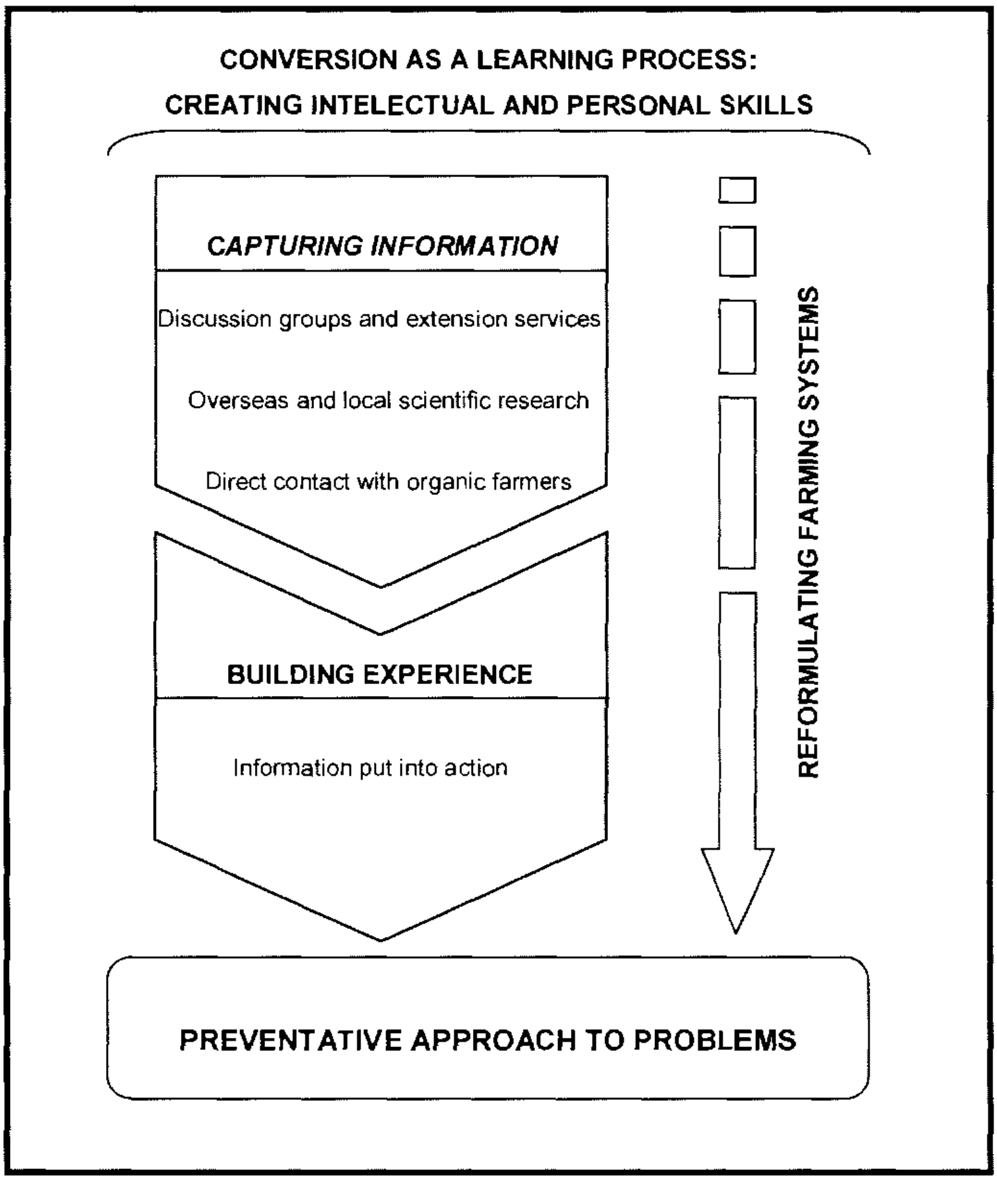


Figure 5.5. A conceptual model of conversion as a learning process.

The importance of developing a preventive approach to problems in organic systems was illustrated in different ways. In a particular case, the interviewee showed a strong ability to look at problems in the context of the overall farm: "*Organic farming is about the whole system. You can't fix mastitis by doing one thing; you have to do lots of things to prevent it before you fix it*". Prevention was materialized in several aspects of farm management. Above all, *knowing* each individual animal together with practicing *observation* enables the farmer to detect changes in animals' behaviour or appearance and adjust management routines to their particular requirements:

"If you know your animals and she (the cow) is walking along a spot (where she did not use to walk) and then you know that something is not right ....why do you walk in there? What are you coming up with?, what's wrong with you?...and to me that's watching so you pick it before it is too bad". "If the cow is eating barberry they are lacking in boron.....so they are actually telling you that something is lacking in their diet. So its just watching how you find out. They (the cows) are the ones that are teaching me. If you watch your animals, they will tell you, they will show you what they need."

This statement also reflects the strong connection that some organic farmers have for their land and animals, which seems to influence directly on daily farming decisions:

"I'd never take the cows off the pasture....I reckon it's cruel. A lot of people do hold them in yards and have a lot of feet problems and what not, and bruising and what not in their feet and a lot of mastitis problems 'cause there are sitting in their shit all the time."

"Some cows are good friends...........it is really a silly reason for an animal to die just because they are not in-calf. We give them another chance. What I have to do is feed them for a year without return because I can't milk them."

Practical implications derived from these statements are different. For the first farmer, his beliefs suggest that he places special importance on monitoring the availability of pasture to avoid feed shortfalls. For the second farmer, the attachment to his animals may prevent him from selecting against those with reproductive problems. The influence of farmers' emotions and ideals on management practices has been reported in previous research. Cabaret (2003) reported that Arcadian ideals may influence health and related welfare treatments of the farm animals, while Vaarst et al. (2003) observed that some cows had a special status in the mind of the farmer, which influenced treatment choices related to mastitis.

As reflected in these passages, the affective connection between the farmer and the animals deviates from the idealistic vision of organic farming to attain a practical dimension. In other words, affection turns into attention, which turns into observation, and observation turns into prevention. In order to keep an effective observation of the herd, one interviewee commented on the importance of keeping the farm small and spending time on the farm: *"I think it will be too much stress on the animals in one big farm, too much walking, too much stress on the person working because you ...don't know your animals". "If I am in the house all time...I can't learn in here".*

In summary, one way in which farmers prevent problems is by using their observation abilities to detect any differences in the cow's condition or behaviour. In addition, great importance is placed on providing a favourable environment for the animals. A clean environment and comfortable conditions help to prevent disease from spreading and reduce stress.

5.7 FARMERS' PERCEPTION OF THE PERFORMANCE OF THEIR ORGANIC OPERATION

The final section of this chapter explores farmers' perceptions of the financial and environmental performance of organic systems. In general, the public opinion accepts organics as an "environmentally friendly" alternative to conventional farming but is dubious about the financial viability of this option. There is still no consensus on the profitability of organic systems in the scientific circles. Therefore, it was considered important to examine the interviewees' perceptions of the impact of organic farming on the profitability of their business and thus, capture farmers' own practical experience in this matter. In addition, given the importance that organic farmers place on the environmental issues, it was also considered relevant to examine their perception of the environmental implications of organic farming.

5.7.1 PROFITABILITY OF ORGANIC DAIRY FARMS

It has been argued that a farm's profits during conversion to organic farming are determined by a combination of five kinds of effects: rotation adjustment, biological transition, price, learning and a perennial effect (Dabbert & Madden, 1986). Although not all of these effects were represented in the present research, some interviewees experienced the price effect and the learning effect. In the context of organic dairy farming, the price effect is related to the changes in the price of milk, due to premium prices. At least three interviewees acknowledge that a premium is necessary to maintain the profitability of their businesses. As one interviewee expressed: *"My budget is all set now on getting the premium. We are certainly not high producers and we need the premium to keep going".* In contrast, two farmers mentioned that a premium price is not necessary to maintain the profitability of the farm but is desirable: *"we want one (premium) but we don't need one"*.

On the other hand, the concept of "*the learning effect*", as a reduction in income related to the farmer's lack of experience or information regarding organic methods (Dabbert & Madden, 1986), was implicitly manifested in two interviews. When talking about a reduction in costs due to conversion, one interviewee explained: *"It has now, but it wouldn't in the first four or five years. But now, it is definitely coming down, it wouldn't reduce in the beginning where we did not know enough, I think. We are still learning as we go along"*. Similarly a newly converted farmer noted: *"If I knew now what I knew a year ago, probably I would have chosen a few products that I didn't"*. In addition, two other interviewees recognized that finances were severely affected in early conversion but did not offer further explanations.

Some previous research suggests that costs of production are greatly reduced in organic dairy farms (Stonehouse et al., 2001). This was the opinion of the majority of the farmers interviewed in the present research. Fertilisers and animal health expenditures have been reported as areas of cost that show the largest decrease in organic dairy farming in New Zealand (Bauer-Eden, 1999). These findings were also reflected in some interviews. A one year in-conversion farmer reported that his fertiliser bill was lower than before, whereas another interviewee said: *"our vet bill dropped quite dramatically"*. On the other hand, buying organic feed was the most frequently mentioned critical area of cost in the interviews.

With a considerable reduction in costs and the benefit of premium prices, it should not be surprising that organic dairy farms show acceptable levels of profitability. Local and overseas studies have shown that profitability on organic dairy farms is comparable to the profitability obtained in conventional dairy farms (Reganold et al, 1993; Stonehouse et al., 2001; Bauer-Eden, 1999; Christensen and Saunders, 2003). In the present research, three farmers reported that their profitability following conversion has either not been affected or improved. One of them believes that he has succeeded in "*commercially producing organic milk*", while another farmer gave detailed information on his farm finances:

"Our costs are lower now, they are half of what they were. Our farm working expenses (FWE) are 20% - 23% of the total farm income (TFI). So our costs are low, in fact, I think the national average is 44 – 45% (FWE), something like that. In a good

year we maybe graze $300,000…., plus at the other end of the scale is the premium, you know 16% we get now, 16% it is big bucks!. Our premium based on 5000 kgMS is nearly $50,000 cash. That changes life quite a bit!"

5.7.2 PERCEPTIONS OF THE ENVIRONMENTAL BENEFIT OF ORGANIC FARMING

When asked about the perception of the environmental benefits of organic farming in the interviews, the answers did not always come immediately. At least three interviewees considered it hard to visualize the environmental benefits of organic farming. However, they briefly start recalling changes and finally all the interviewees reported on environmental benefits following conversion.

Several studies have reported on the increased biodiversity in organic farms (Biao, et al, 2003; Stockdale, 2000; O'Riordan & Cobb, 2001). This view was supported by most of the farmers interviewed in the present research. In particular, four farmers commented on an increased number of birds following conversion: *"more birds, more ducks, ducks nest now on our pond"; "we have a flock of 400 – 500 sparrows lifting off in one area. Before you never saw anything like that"*. Similarly, interviewees commented on the abundance of insects, such as grasshoppers and lady bugs, and frogs: *"we get grasshoppers now and frogs, we had never seen them before"*. Further, four interviewees have planted trees on their properties in order to provide shade and shelter for the animals, attract wildlife and increase the aesthetic value of their properties.

Two interviewees provided anecdotical evidence of the natural balance working on their organic farms. In the first case, one interviewee noticed a decrease in the damage from field crickets on his pasture. The field cricket (*Teleogryllus commodus*) is an insect widespread in the grasslands of Northland that feeds on the leaves and germinating seed's of pasture species, particularly ryegrasses (Smith, 2004). In this way the insect not only competes with stock for available food and affects pasture regeneration, but also attacks the growing crown of grasses killing the plants and leaving the soil open for weed invasion (Smith, 2004). The interviewee explained that crickets used to live in the soil cracks and believed that improvements in the soil structure and pasture cover has helped to reduce their damage:

"Field crickets have been a problem in (this region) in the last couple of years, but I don't seem to have much of a problem with them now…yeah! you ended up with lots

of dead patches really. Like that paddock in front of the river, they really got it harmed really bad.......I think because the summers have been a little bit wetter anyway, could have helped, but even the cracks, I don't seem to get them cracking so much, the pasture doesn't seem to dry up as much, possible because there is more grass cover so the sun is not getting down on the dirt to start with"

In the second case, the interviewee observed how biological control occurred naturally on his farm. Unlike his neighbour, the interviewee reported his farm to be free from armyworms (*Spodoptera litura*) and has observed the dead insects in a sorghum crop on his farm. Moreover, the farmer believed that armyworms have consumed the weeds on his sorghum crop without damaging the crop, and at the same time, armyworms have been killed by paper wasps. The literature suggests that armyworm can be a serious pest of pasture by feeding on clover and broad-leaved weeds, causing severe defoliation in those species but showing no damage to grasses (Cox, 2004). In addition, the paper wasp has proven to be an effective parasitic insect in attacking armyworm in Northland (Dymock, 2000). These two latter cases suggest that some organic farmers consider their farm as an ecosystem and are aware of the interaction that exists between the different components of their farm (COG, 1992).

It has been suggested that improvements in the soil chemical, biological and physical properties of the soil in organic dairy farms may be slow to show and not evident in the early stages of conversion (Kelly et al., 2004). Surprisingly, some interviewees reported environmental improvements as early as after the first year of conversion. Regarding soil improvement, one farmer added: *"...and that's what we noticed after, not even the first 12 months you sort of notice a little bit of difference"*. Similarly a one year in-conversion farmer said: *"Already this year I can see an improvement from last year by doing what I am doing, so that's promising."*

Soil improvements were a recurring way to justify environmental benefits in the interviews. In relation to soil tests, two interviewees observed an increase in organic matter and pH levels: *"Organic matter is slowly increasing, pH is improving"; "Yes it has improved (organic matter), even the pH level and stuff have come up, and it is more even not so imbalanced as it was"*. Likewise, two other farmers reported improvements in the structure of their soils. To illustrate this effect, both farmers provided examples of plant-soil interactions:

"when we first changed over, grubbing the thistles ....you dig away a thistle and it will be hard all the time, you know, you'd be jarring yourself as you dig into the soil, but now it just seems so much more lighter, it is like a compost heap really, it seems to be a lot more friable"

"Grass roots are a lot deeper with soils you (normally) get your top soil and then it will be almost a line and it will go down to the clay or the under-soil. With organics, the two lots of soil...there's no direct line ".

The latter farmer further commented on the greater porosity and better drainage of his soil, while two other farmers have observed an increase in worm life on their land. Interestingly, two farmers in different stages of conversion noticed a change in the smell of their soils: *"The soil has got a sweeter smell"*; *"It has got a slightly better smell I find".*

Several studies have found nitrogen losses reduced in organic dairying mainly as a consequence of a decrease in stocking rates and nitrogen inputs (Dalagaard et al., 1998; Biao, 2003; Boer, 2003). In New Zealand, Condron et al. (2000) concluded that organic dairying is likely to result in lower nitrogen leaching losses than conventional dairy farms. In this respect, only one interviewee was able to comment on nitrogen losses from his farm. Since he manages a large operation, the District Council requires regular monitoring on the quality of drainage water from his farm. The farmer commented that the quality of the drainage water, in terms of biological oxygen demand and nitrate levels, has improved since conversion: *"we don't use nitrogen anymore, the runoff from the place is probably less offensive than it was originally"*

Finally, animal behaviour was also used to express the benefits of organics in the overall environment of the farms. A number of interviewees reported that cows are literally *happier* than before, yet two farmers illustrated this effect with opposite arguments:

"They (cows) are pleasant and quiet. It's just so different from when we started from...Their nature has changed, they are so calm and quiet and it makes your job easy"

"Like I will go and pick the cows out of the paddock and probably 8 out of 10 times they will start dancing and jumping and springing around, heading out of the paddock, whereas before you might get that once or twice a year".

However, the latter interviewee recognized that, when working with the animals keeping the young stock calmed is a problem. Further, two farmers reported changes on the grazing behaviour of their animals and believed that cows are grazing the paddock more evenly: *"on the grass, the cows seems to eat the paddock nicer, more even, not picky, not patchy…they are lawn movers now!"*

CHAPTER 6: CHARACTERISING ORGANIC DAIRY SYSTEMS: PROBLEMS AND STRATEGIES DURING CONVERSION

6.1 INTRODUCTION

This chapter, as the second chapter of results and discussion, focuses on describing the issues and problems faced during conversion to organic dairying and the strategies employed to successfully manage conversion. First, information from the survey and the interviews was used to briefly characterize organic dairy systems. Second, the problems faced during conversion and the strategies employed to overcome them are discussed. Finally, using survey data, an estimation of the productivity (i.e., pasture and milk production) of organic dairy farms is presented and discussed.

6.2 MAIN CHARACTERISTICS OF ORGANIC DAIRY SYSTEMS

The data collected from the interviews support the notion that the extent of changes in a farming system required for the adoption of organic principles is directly proportional to the degree of intensification of the conventional system prior conversion (Lampkin, 1999). Experience shows that the relative low cost of production of extensive farms encourages dairy farmers to consider organic systems (Rosati & Aumaitre, 2004). In the present research, most of the interviewees were already farming under a low-chemical policy prior to conversion; thus, they did not observe great changes in their farming systems following conversion. Two of them commented on this, but one explained: *"Low input farmers are more likely to change (to an organic system) because it is not such a big change for their system".*

These results are similar to those found by Vaarst et al. (2003), who observed that only few routines and management choices changed following conversion in organic dairy systems in Denmark. In the present research, the interviewees' responses suggest that changes due to conversion are more related to accomplishing certification requirements. Interviewees refer to the total abandonment of chemicals and the time spent on administrative tasks as the biggest changes in early conversion: *"Having to work to a plan was different. Normal farming you sort of make up the decision as you are going….. Having to ask other people permission to use any products we wanted to use, that was different".*

Further, data from the survey show that organic dairy farmers most frequently identified their current farming system as a mostly grass, spring calving and self-contained operation. None of the farmers identified their farming system as a high feed input system. Only 5 farmers responded to the category "other", specifying features such as beef and sheep, autumn calving, planning to go once a day milking, growing crops for green feed and silage, winter caving, calve four times a year, and closed system. The characteristics of organic farms, based on the survey, are summarized in figure 6.1.

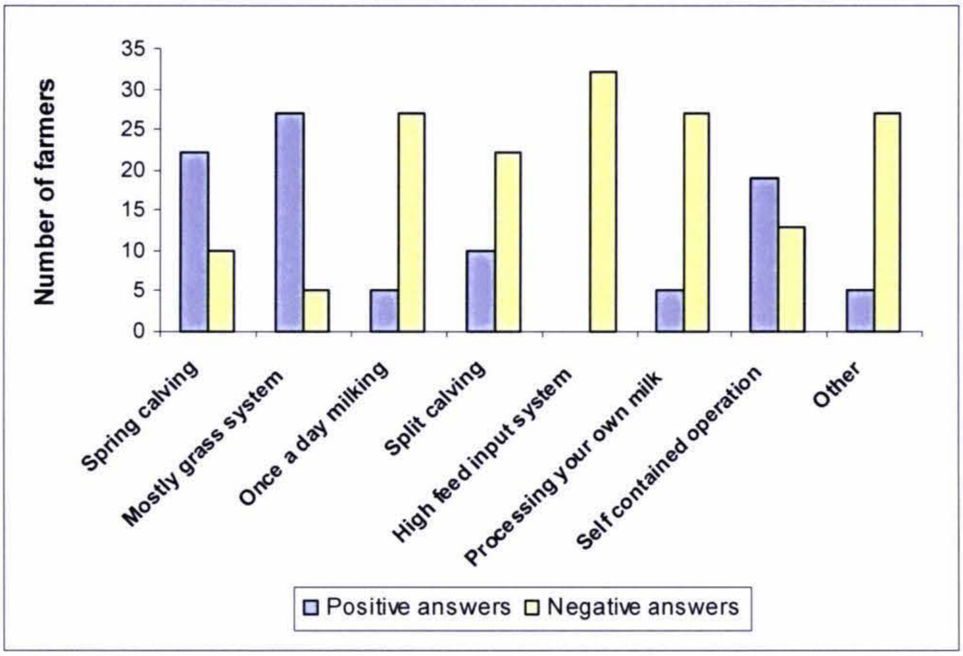


Figure 6.1. Main characteristics of organic dairy systems in New Zealand (n=32)

When analysing the different sections of the survey as a whole, it appeared that a self-contained operation is more of an aspiration than a peculiarity in organic dairy systems. As shown in table 6.1, there is no significant difference between the proportion of farmers that graze-off a part or all of their herd, and the proportion of farmers that do not have a grazing off policy.

Table 6.1. Number of organic dairy farms with a grazing-off policy in New Zealand

	Frequency	Percent
Farmers showing a grazing-off policy	17[a]	61
Farmers not showing a grazing-off policy	11[a]	39

a: same letter indicates no significant differences under the Chi-square test (P>0.1)

Considering grazing-off as an alternative to imported feed, the results shown in table 6.1 indicate that, in terms of feed supply, self-sufficient is not a characteristic of organic dairy systems. In addition, from the eight farmers interviewed, six of them grazed-off part of their stock for different periods of the year, despite most of them supporting the idea that an organic farm should be a closed operation: *"for an organic system it's got to be a closed system"*. Only one interviewee appeared to have achieved a self-contained operation or, as the farmer named it, "*a closed shop*". In this farm all the feed is produced on-farm, there is no grazing-off policy and organic drenches and sprays are also prepared on the farm.

As explained earlier, changes at the institutional level are urging some farmers to achieve a self-contained operation. The recent opportunity of access to the USA market requires farmers to comply with the USDA standards, under which cows should be fed on 100% organic feed. Under this scenario, achieving a self-contained operation was for some interviewees a matter of ensuring the economic viability of their farms. In contrast, other farmers have a more philosophical approach towards self-sufficiency and believe that all nutrients should be recycled on-farm. Regarding the possibility of selling feed surpluses, one farmer commented: *"I don't think it is a good thing to do because your fertility is something that you want to preserve"*.

A particular interviewee sustained a contrasting view of self-sufficiency. He believes that a closed system can hinder social contact, which is necessary to keep updated with the industry and stimulated in business:

> *Many people want to be self sufficient............ if my organic calves have to graze-off on someone else's organic farm for them to grow into heifers, fine I don't have a problem with that. Or if actually I do happen to run out of feed and need to buy some hay or silage from an organic farm, I will go and do it, I don't have a problem with that. But a little bit beyond that, you have to keep looking*

outside. You need that outside stuff..........but a really good way to keep interested in the industry is to get out there, go and talk to farmers or go and spend the day at the grazers with your heifers...........It must sound a bit silly, but you have to keep yourself stimulated by going out.

Self-sufficiency can also be considered a strategy for prevention of potential problems during conversion. Some interviewees reported on their preference to keep any surplus feed as a reserve on the farm in anticipation of future feed shortfalls. In an attempt for self-sufficiency, many of the farmers interviewed are aiming to reduce off-farm inputs and are producing their own organic inputs like biodynamic preparations, compost teas, tonics and drenches.

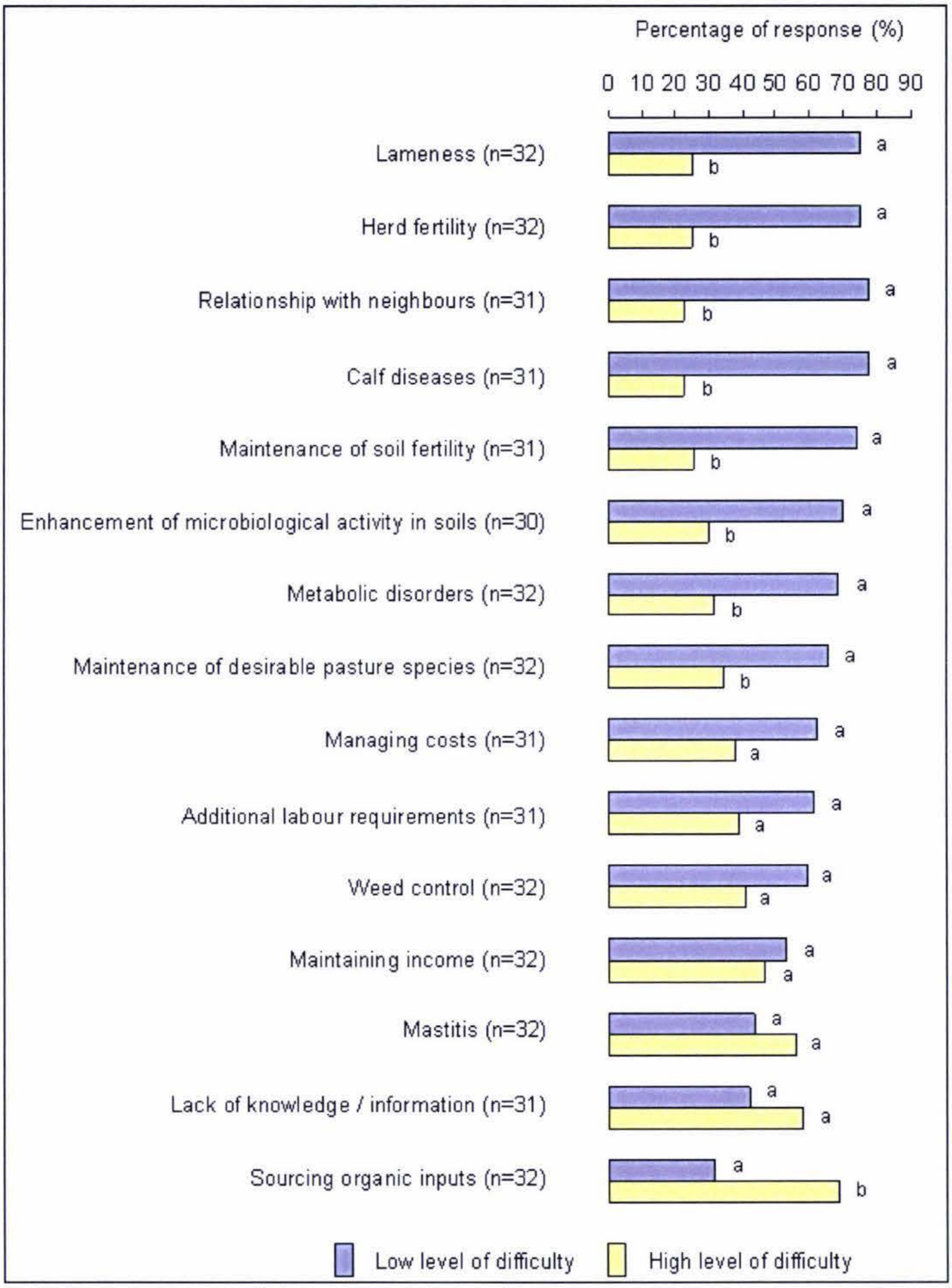
In accordance with the organic principles, diversification was also expected to be a characteristic of the farms surveyed. In effect, the principles of organic farming encourage organic farmers to seek diversity in their operations (IFOAM, 2002; BioGro, 2001). In the same vein, it has been argued that organic farms become less specialized and less intensive than conventional farms (Langer, 2002). Nevertheless, diversification was not a characteristic of the participants of this research. In the survey, when considering diversification as any enterprise other than milk production, no significant difference was found between the proportions of farms that showed a degree of diversification (41%) to those purely dedicated to milk production (59%). Organic production of fruit, arable, beef and sheep, dairy goats, forestry and poultry were mentioned as additional enterprises. However, other products that may not represent a business for the farmer, such as fish, pine trees, wildlife and riparian, were also mentioned in the survey. These results suggest that, although milk production is the main enterprise for these organic dairy farms, farmers are aware of the importance of biodiversity in their organic systems.

In summary, the data obtained in the present research suggest that dairy farms do not experience large changes during conversion to organics, probably because the cases studied in this research were already low-input pastoral systems prior conversion, as are most of the dairy systems in New Zealand. Survey data showed that organic dairy farms are mostly grass, spring calving systems. Despite self-sufficiency and diversification being desirable characteristics under the principles of organic farming, this shows that they are not particular characteristics of the organic dairy systems studied. Other characteristics of organic dairy systems in New Zealand, such as herd size and farm size, are discussed later on this chapter.

6.3 PROBLEMS AND STRATEGIES DURING CONVERSION of ORGANIC DAIRY FARMS

6.3.1 SURVEY FINDINGS: PROBLEMS AND STRATEGIES DURING CONVERSION

In order to explore the main problems faced during conversion, question 14 of the survey asked: "*from your own experience, assign a 'level of difficulty' to the problems indicated below that you may have faced during conversion to organic dairying*". To answer this question, farmers were presented with 15 potential issues during conversion and a scale of five levels that ranged from "not difficult" to "very difficult" (see Appendix Five for the complete responses to this question). However, the responses presented here were grouped in "high level of difficulty" and "low level of difficulty" and the differences between these proportions were tested statistically, as explained in the methodology chapter. These results are presented in Figure 6.2.



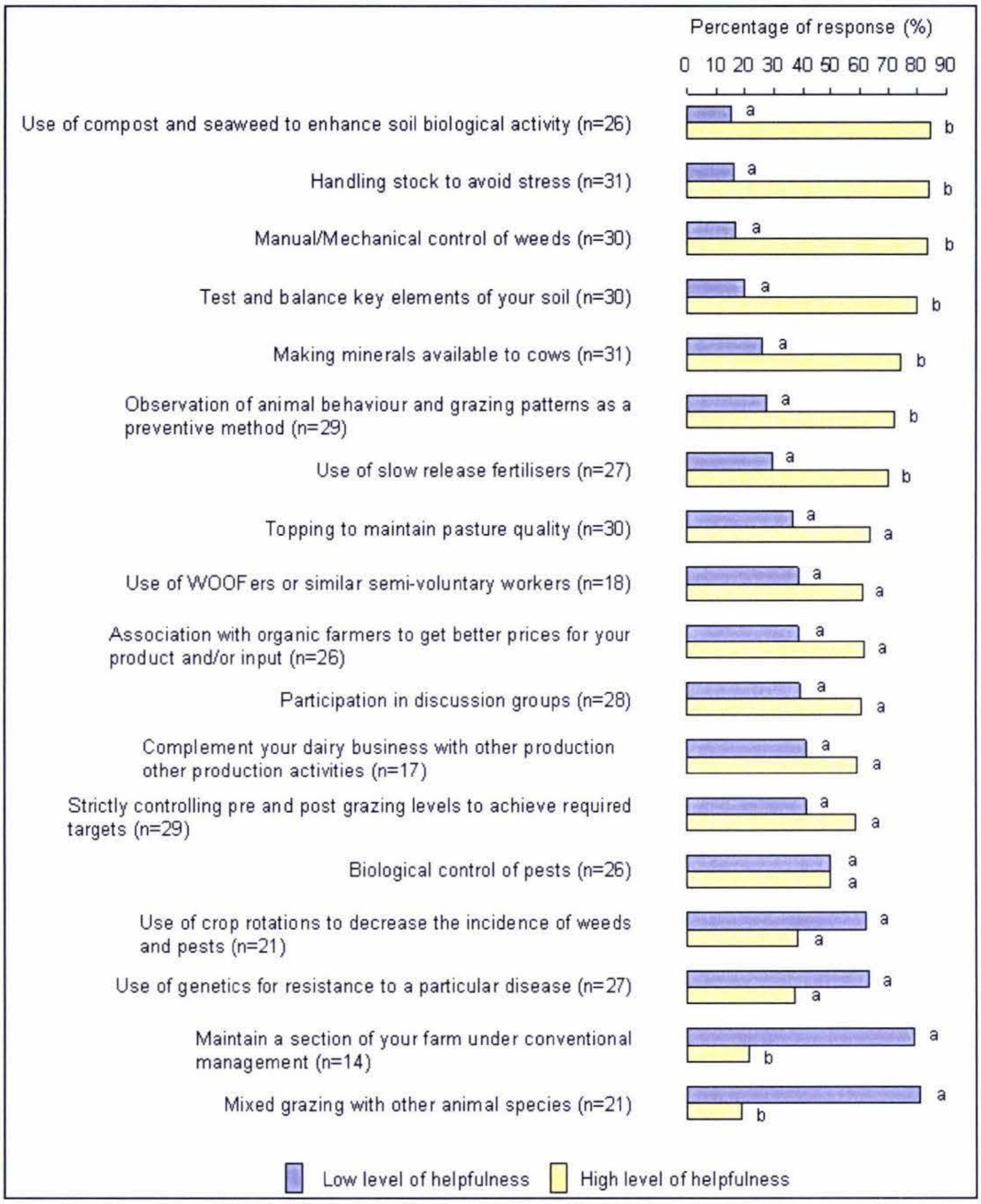
a, b: proportions with different letters within the same category of difficulty were significantly different (P<0.1)

Figure 6.2. Rating of problems faced during conversion to organic dairying

Figure 6.2 shows that significantly more farmers scored eight potential problems as "low level of difficulty" than those who scored them "high level of difficulty" ($P<0.1$). These were: lameness, herd fertility, relationship with neighbours, calf diseases, maintenance of soil fertility, enhancement of microbiological activity in soils, metabolic disorders, and maintenance of desirable pasture species. In contrast, for only one potential problem – sourcing organic inputs – the proportion of farmers whose opinions fall in "high level of difficulty" was significantly greater than the proportion of respondents who considered it as a "low level of difficulty" issue ($P<0.1$). For the remaining six potential problems, there was no significant difference between the proportions of farmers that considered them low or high in level of difficulty ($P<01$). These were: managing costs, additional labour requirements, weed control, maintaining income, mastitis, and lack of knowledge/information.

A report produced in New Zealand by MAF provides the closest opportunity to compare these results with local literature. The report identified and prioritised the main constraints to conversion in different agricultural sectors based on facilitated workshops. For the dairy group, animal health, particularly mastitis control, was the major threat identified. In addition, maintaining soil fertility, weed control and access to new information were also main issues reported (MAF, 2002). As mentioned above, the present research shows divided opinions as to the level of difficulty of these issues during conversion, with 'maintaining soil fertility' rated with "low level of difficulty" by the majority of respondents.

Respondents were also questioned as to how successful for them were certain management practices used during conversion. Specifically they were asked: "*A number of common practices used by organic dairy farmers to manage conversion are listed below. To what extent have these practices been successful for you in managing the conversion of your dairy farm?*". To answer this question, farmers were presented with 18 practices and a scale of five levels that ranged from "not helpful at all" to "very helpful". As explained in the methodology chapter, the answers obtained were grouped in two: "high level of helpfulness" and "low level of helpfulness", and the difference between these proportions was tested statistically. These results are summarized in Figure 6.3. The full results are presented in Appendix Six.



a,b: proportions with different letters within the same category of success were significantly different (P<0.1)

Figure 6.3. Rating of practices employed during conversion to organic dairying

From the 18 practices provided in the survey, seven were considered as "high level of helpfulness" by a significantly greater proportion of respondents ($P<0.1$). These practices included: use of composts and seaweeds to enhance soil biological activity, handling stock to avoid stress, manual/mechanical control of weeds, test and balance key elements of your soil, making minerals available to cows, observation of animal behaviour and grazing patterns as a preventive method, and use of slow release fertilisers. For only two strategies – maintaining a section of the farm under conventional management and mixed grazing with other animal species – the proportion of farmers that considered them "low level of helpfulness" was significantly higher than the proportion of farmers that considered them highly helpful.

Finally, for the remaining nine practices, there was no significant difference between the proportions of farmers that considered them helpful to those who did not considered them helpful. These practices were: topping to maintain pasture quality, use of WOOFers or similar semi voluntary workers, association with organic farmers to get better prices for your product/input, participation in discussion groups, complement your dairy business with other production activities, strictly controlling pre and post grazing levels to achieve required targets, biological control of pests, use of crop rotations to decrease the incidence of weeds and pests, and use of genetics for resistance to a particular disease.

In an attempt to explain these findings, the association between some variables in the survey was tested. However, given the small amount of data, it was difficult to find any relationship between the variables. When observing the relation between levels of milk production per cow and animal health problems, the farms with higher per cow production (relative to the district average during conversion) showed lower levels of difficulty in managing metabolic disorders and herd fertility problems during conversion ($P<0.1$). Despite previous studies showing an inverse relation between milk production and reproductive parameters (Lucy, 2001; Macmillan et al., 1996), it has been suggested that this relationship is weaker under pastoral conditions (Garcia & Holmes, 1999). For instance, McDougall *et al.* (1995; cited in Garcia & Holmes, 1999) reported a positive relationship between daily milk yields and conception rates to the first service for cows fed pasture alone or pasture supplemented with grass silage. High milk yields indicate high intake levels, low negative energy balance, and, consequently, high fertility (Garcia & Holmes, 1999).

6.3.2 INTERVIEW DATA: PROBLEMS AND STRATEGIES DURING CONVERSION

Data from the interviews provided more context to understand the main difficulties and practices used in conversion. Before describing the results obtained from the interviews, it is important to clarify how organic farmers face problems and approach solutions. In this respect, most of the interviewees would not commit themselves to attribute the issues faced during conversion solely to organic farming, and neither did they believe that solutions resulted from single practices. Evidence of this approach to problems and solutions in organic systems is reported in the literature, particularly in relation to animal health issues.

In studying animal health and welfare of dairy herds in transition to organic production, Vaarst et al. (2001), found that organic dairy farmers and agricultural advisors would not regard animal health problems as being directly related to organic farming or to the conversion to organic farming. Furthermore, it has been suggested that diseases are related to a complex set of mostly management related factors (Sundrum, 2001). Diseases are often due to mistakes of the farmer, inadequate handling or inappropriate housing conditions (Enevoldsen & Gröhn, 1996, cited in Sundrum, 2001). This particular view was shared by one interviewee who, talking about empty rate on her farm, commented: *"I blame it on me, it is my problem 'cause I didn't get it right, so.....I will make sure we've got better conception rate because I wanted them even lower this year...because I think most of it is management".*

Taking in consideration this approach to problems and solutions, after analysing the interview data, two main problematic aspects in managing conversion were identified: animal health and pasture production.

ANIMAL HEALTH ISSUES ON ORGANIC DAIRY FARMS

Health and reproduction of the milking cow

It has been previously reported that, "in organic dairy herds, mastitis is definitely the dominant disease problem" (Vaarst et al., 2003, p.110). In the survey, mastitis was the only animal health issue for which there was not significant difference between the proportions of farmers that considered it a difficult issue during conversion and from those who did not considered it difficult. All other issues related to animal health were considered to be not difficult by a significantly greater proportion of respondents. Furthermore, mastitis was certainly a concern for four of the farmers interviewed. A farmer who faced a mastitis outbreak in the first winter of conversion commented: *"the real problem was animal health; everything else fits in pretty easily".*

In Europe, several studies have reported the use of homeopathic remedies as a common treatment for mastitis amongst organic dairy farmers (Andersson & Leon, 2000; Hovi & Roderick, 2000). In New Zealand, the preliminary results of a survey showed that the most popular method to treat clinical mastitis was the use of homeopathies and apple cider vinegar (Thatcher, 2004). Similarly, in the present research, all of the interviewees are currently using or have used homeopathic products in the past. Most of the interviewees have experimented with homeopathies, and developed an expertise in detecting symptoms and prescribing the right remedies.

On the other hand, multiple stripping has also been reported as a common treatment for clinical mastitis for New Zealand organic dairy farmers (Thatcher, 2004). One interviewee supported this view and considered the physical stripping of milk from the udder as the most important technique to treat mastitis. Finally, as reported by Thatcher (2004), culling was mentioned as a minor strategy for controlling mastitis but, in the present research, it was still preferable to the use of antibiotics:

"But we've culled very heavily in the last 3 to 4 years for mastitis cows, and older cows and high cell counts"

"I could have use penicilins, but that cow would have been out for a year for organic milk……. I am going to cull them out and try to breed more natural cows"

Even when the interviewees agreed that homeopathies and apple cider vinegar are effective in reducing mastitis, many of them combine these treatments with preventive measures. In relation to apple cider vinegar, one farmer had a categorical opinion: *"Yes it does work, but I think it is like a plaster…….it is like cheating because you are not really fixing the problem. I have gone back to make sure that they are handled properly and every udder is treated nicely. A lot of people swear by apple cider vinegar in the troughs and so did I in the beginning. It does help your cell counts, controls it very quickly……but I still think that most of it (mastitis) has to do with the way they are milked".*

The latter interviewee emphasised the importance of providing gentle treatment for the animals, especially during the milking routine. On this farm of 90 cows, each cow is treated and milked as an individual animal, considering their productivity, health history, appearance and behaviour. However, this caring approach for the animals may only be practical for small herds; it likely would be difficult and time consuming with larger herds, suggesting that the owners of big farms may need to rely on other strategies to cope with mastitis. The owner of a large herd (665 milking cows) has developed a drying-off method that contributed to decreasing the incidence of mastitis on his farm. As the farmers explained: *"it is a process of slowly taking the cows out of the herd and moving them through this system where they end up dry".* Cows are consecutively transferred from the milking mob into drying-off groups where they receive hay, apple cider vinegar and homeopathic remedies. In this process, any cow with mastitis is stripped by hand and grazed on a herbal ley. The herbal ley is a small paddock that contains herbs with medicinal properties.

In relation to metabolic diseases, at least two interviewees reported a decrease in metabolic problems in their organic herd: *"Acidosis, ketosis and milk fever...........better than they were.........nowadays we would maybe have 6 or 7 cows with milk fever. When we converted we would have had 20"*; and *"production dropped but metabolic problems weren't there"*. This last statement agreed with the literature in which a decrease in metabolic problems in organic dairy systems has been explained as a result of a reduction in production levels (Vaarst et al., 2003; Boehncke, 1997, cited in Sundrum, 2001)

On the other hand, for one interviewee located in a zone of high risk facial eczema risk, grazing management has been crucial in preventing the disease. The interviewee reported that feeding the cows on hay before entering the paddock and having a fast rotation has helped in preventing diseases: *"We don't have the problem around here that a lot of other people get because we don't graze it so low, specially in high risk times... Just topping is what our cows do"*

Finally, reproductive problems were not a recurring issue in the cases reported on here. Although two interviewees appeared concerned about having high empty rates (14% and 25% empty rates), both of them believe that it is a seasonality effect. In particular, the farmer that reported 25% empty rate experienced similar levels 4 years ago, before initiating conversion in his dairy herd. He further believes that young cows have too much pressure put on them in competing for feed with the rest of the herd. Therefore, the farmers is planning reducing the main herd and splitting the calving dates as a way of reducing pressure in his young stock and, consequently improve their reproductive performance. The findings in relation to reproductive problems are consistent with the literature. In fact, when comparing conventional and organic dairying, several studies and reviews agreed that there is no difference in the reproductive performance of both systems (Reksen et al., 1999; Rosati & Aumaitre, 2004).

Parasites in calves

Although the results of the survey showed that calf diseases were not an important issue on organic dairy farms, four interviewees were concerned about parasite infestation in their young stock. Calf diseases and welfare have been previously identified as the most significant problematic area in organic dairy herds in (Vaarst et al., 2001). In particular, group housing, cow-calf relationships (i.e., ensuring calf consumption of colostrum) and grazing management were identified as critical aspects of calf rearing on organic dairy farms in Denmark. These two latter aspects appeared to be important for the interviewees in this research. Data from the interviews suggest that organic dairy farmers have not found organic products to control internal parasites in calves successfully, but are focused on developing effective rearing systems for their young stock.

Regarding cow-calf relationships, the interviewees are aware that calves should receive enough colostrum and milk to build up their immune system. One early converted farmer was particularly convinced: *"a lot of problems are surprisingly commonsensfull. Like calves and parasites problems. I mean the solution is quite simple, just feed them more milk. I mean, it is expensive but instead of weaning them at 8 weeks as the conventional practice, keep on feeding them milk until they are 150 kilos"*. The hypothesis is that feeding the calves on milk for a longer time reduces their intake of pasture, and consequently the ingestion of parasites. In general, the interviewees reported that they feed calves on milk for 10 to 15 weeks, or until they are 120 to 150 kilos in weight, which is about 30 to 50 kilos heavier than conventional targets (C. Holmes, 11 March, 2005, personal communication).

In relation to grazing management for parasite control, the interviewees appear to develop strategies which are different to those reported in the literature. In Sweden, Svensson et al. (2000) found that the main strategy for parasite control in organic dairy herds was to graze calves on pasture which has been not grazed by any cattle in the current or previous grazing seasons, as well as alternating grazing with other livestock species. As mention before, organic dairy farms in the present research rarely had other species of animals grazing on their pastures, suggesting that these practices are not commonly used for reducing parasites in calves in New Zealand.

Conversely, the farmers interviewed aim to control grazing levels and rotations for parasite control. For example, one interviewee developed a rotational rearing system, in which calves are raised in a different paddock each year and, at the same time, are offered different sections of the same paddock during the season.

Similarly, another interviewee, following local research findings, is creating a weaning system based on paddocks with high chicory content. In fact, when studying the effect of different pasture species on the growth and health of farmed deer in New Zealand, Barry et al. (2002) found that chicory contains substantial concentrations of condensed tannins which help to reduce problems caused by internal parasites. Finally, some interviewees stressed the importance of observation and supervision of the young animals to prevent parasites: *"Usually, just after they are weaned, I take them to the runoff, but this year I kept them at home longer so I can keep and eye on them better....to help stop those worms"*

To summarise, regarding animal health issues on organic dairy farms, the information obtained from the interviews suggests that mastitis and parasites in calves are the main concerns amongst organic dairy farmers. In addition, farmers appeared to be knowledgeable about the use of alternative medicines such as homeopathic remedies and apple cider vinegar, but they haven't yet found organic products to control internal parasites in calves successfully. However, organic farmers are focused on preventing diseases by providing a clean environment, diversity of feed and enough milk when rearing the young stock. Metabolic problems and reproductive problems were not recurring issues for the interviewees in this research.

Strategies related to animal health

As can be deduced from the previous sections, the results of the survey and of the interviews on problems and practices related to animal health are not always consistent. However, in comparing common practices in both data sets, preventative practices identified from the survey (i.e., handling stock to avoid stress, making minerals available to cows, and observation of animal behaviour and grazing patterns) and in the interviews appear to be important in managing animal health. The alternative of maintaining a section of the farm under conventional management was not mentioned commonly in the interviews, except in one particular case. On a large operation that farms 1200 organic cows, a separate farm was deliberately maintained under conventional management. This has been a successful strategy to deal with animal health problems. In effect, after six years in conversion, only 4% to 5% of the herd is transferred from the organic to the conventional site each year, mostly because of feet problems. As a result, the manager of this farm is continuously selecting the most healthy animals: *"We have actually bred out all the problems....So looking ahead, in five more years we will get the ideal dairy herd for any (organic) farm in NZ, it just doesn't have problems, we rid them out".*

The impracticality of this strategy in smaller operations leads other farmers to consider other measures to prevent animal health problems. Organic animal health strategies have previously been divided into housing, nutritional and breeding strategies (Boehncke, 1998, cited in Stockdale et al, 2000). Since in New Zealand most of the dairy farms are pastoral systems, housing strategies appear irrelevant to animal health. Consequently, only the two latter approaches to animal health proposed by Boehncke – nutritional and breeding strategies – were reflected in the present interviews. In the particular context of New Zealand dairy systems, nutritional strategies are mostly related to grazing management, while breeding strategies are linked to animal selection. In effect, the idea that some breeds and strains are better suited to organic systems of production (Stockdale, et al., 2000) was sustained by 2 interviewees in this research:

"Not so much the land has got to change, often it's the animals that have to make the biggest adjustments, and some of them don't adjust at all, can't handle it, so you basically have to get rid of them"

"That cow..........has got to learn to be able to come out right without being on penicillin or artificial things. They got to learn to survive by themselves. If they were not going to come up right with the homeopathic remedies or the apple ciders, well I don't want them in the herd"

FEED SHORTFALLS

It has been stated that one of the main problems during the conversion process is shortage of forage, particularly due to a reduction in yields and increased reliance on home-grown forage (Lampkin, 1999). The interview data support both of these arguments. First, pasture deficit was a recurring problem. The interviewees agreed that not being able to use nitrogen affected pasture growth, especially during winter. As one farmer commented: *"The biggest problem we ran into was not being able to use nitrogen in our all-grass system".* In most of the cases, pasture shortfalls were associated with early conversion, suggesting that farmers have developed different strategies to deal with feed shortfalls. In effect, when asked about the most difficult problem experienced at the beginning of conversion, a one-year converted farmer said: *"it was mainly pasture growth, I had to manage the grass a lot more carefully, keep the cows tight through those winter months......as far as animal health goes, I didn't experience many more problems than other years"*. Based on this experience, the farmer recommended: *"if you are thinking of going organic farming in a seasonal system, it is really good if you can do it 6 months, or even a year in advance (to the calving date),.. so you put your calving date back a little bit,... get your stocking rate right,... have enough supplements on hand,... just go into winter with a little bit more grass and also cut your fertilisers a lot earlier."*

Second, the increasing reliance on home-grown forage appeared to be a particular issue for some interviewees and is further aggravated by the recent introduction of the USDA standards in New Zealand. As explained earlier, under the USDA standards cows must be fed only on organic feed. The difficulty in sourcing organic inputs as the only challenging aspect of conversion, as was reported in the survey, was reflected in the interviewees' responses regarding feed supply. Sourcing organic feed is a particular problem for farmers who run large operations or are located in relatively isolated conditions. As one interviewee commented:

"Therefore, to say that the animals have totally organic feed, we have to have all our animals on this property and there are times when you can't feed them properly and you have to have the ability to bring in food."

However, another farmer interviewed argued that sourcing organic feed is not difficult but it is expensive: *"I mean, bought in feed is a bit more expensive because it is organic.....there is quite a lot out there actually"*.

From the interviews, another problem affecting pasture productivity is weed control, which also has been identified as a key problem during conversion in previous studies (Lampkin, 1999; Stockdale, 2000). In this research, three interviewees mentioned weeds as a main concern on the farm. In the specific case of a Northland farmer, a certification agency is restricted his use of organic weed sprays in order to reduce the infestations of thistles and kikuyu. The farmer, who has been trying to keep kikuyu grass out of the farm for a long time, is now moving to another certification agency which is more flexible on the use of organic sprays.

Most of the farmers use mechanical control of weeds, either by using a grubber or pulling the weeds out by hand. Additionally, one interviewee reported applying salt around ragwort plants to kill them, while another farmer manually harvests the weeds before they seed and applies lime to the remaining spot. In this sense, farmers believe that weed control is not such of an infestation problem, but it is a time consuming task. On the other hand, one particular interviewee successfully controlled ragwort on his farm using natural predators: *"We used biological control with ragwort beetle. It worked well. Ragwort is not even a factor now really......the beetles (ragwort beetles) have dropped in numbers simply because they don't have more food".*

On the whole, despite the result that weed control was not a significantly difficult problem for survey respondents, it was a concern from some of the interviewees. In addition, feed supply was a concern for the organic farmers interviewed mainly because of a decrease in pasture productivity and the difficulty in sourcing organic feed. Pasture shortfalls appeared to be a particular issue for organic dairy farmers in early conversion, suggesting that productivity levels recover as conversion progresses and/or farmers are able to adjust feed supply and feed demand through a variety of strategies such as grazing management, reduced stocking rates and delayed calving dates. This issue is further discussed in the following section.

6.4 PRODUCTIVITY OF ORGANIC DAIRY FARMING SYSTEMS

In a recent review of organic dairy farming in Europe, Rosati and Aumaitre (2004) argued that, when applying organic standards, extensive dairy systems should not experience as much of a reduction in productivity as intensive systems. This view was represented in the data obtained in this research and was particularly emphasised by a couple of interviewees:

"I am getting more convinced that you can put an organic level on a conventional farm and have very low effect, so it is probably no logical reason that the average dairy farm in New Zealand couldn't go organics and still have the same production"

"You are not going to get a high drop (in milk production) just because you are changing to organic farming, but again it also depends on how much nitrogen and inputs were you using earlier"

This section examines the productivity of organic dairy systems. First, pasture productivity is estimated according to the data obtained for the survey on milk production, number of animals and grazing-off policy. Second, the seasonality of pasture growth in organic dairy systems is examined and the levels of stocking rates, farm size and herd size are discussed. Finally, milk production and its evolution through the conversion process are considered.

6.4.1 PASTURE PRODUCTION

No data set was available for pasture production on the farms surveyed. Therefore the amount of feed which must have been provided on the farm was calculated from information about the number of animals and their performance on the farm. Although the grazing-off days were subtracted from this calculation, there was no way to know the amount of imported feed on the farm. Feed requirements of each animal category, including requirements for maintenance, production, growth and pregnancy, were calculated and then added together to account for the total amount of feed eaten on-farm (See Appendix Seven). Finally, the estimated figures for pasture eaten on-farm (tDM/ha) were compared to the corresponding district average data for pasture growth from Dexcel (2004), as shown in Table 6.2.

Table 6.2. Estimated data for pasture eaten on-farm relative to average local pasture growth data from Dexcel (2004)[4]

Estimated pasture eaten on-farm using survey data (Appendix Seven) tonne DM/ha/year	Average Pasture growth data (Dexcel, 2004) tonne DM/ha/year
8.4	18.6
7.9	16.9
8.3	16.4
13.7	16.4
11.1	12.3
6.5	12
12.0	12.4
9.3	16.4
9.6	15.9
13.2	13.2
9.6	12.6
10.9	16.1
13.7	16.4
9.3	14.3
14.8	13.2
8.7	11.8
11.1	15.2
9.5	12.7
11.2	16.4
7.9	13.3
9.1	14.3
11.3	11.8
16.1	16.1
10.6	12

[4] In Table 6.2 locations are not given to preserve confidentiality, but each farm was paired with local growth data from Dexcel (2004).

The data shown in table 6.2 are illustrated graphically in figure 6.4. As a reference point, estimated figures of pasture grown (tDM/ha) and pasture harvested (tDM/ha) for conventional farms in the Waikato and Bay of Plenty were also plotted on the graph (Holmes, 2000).

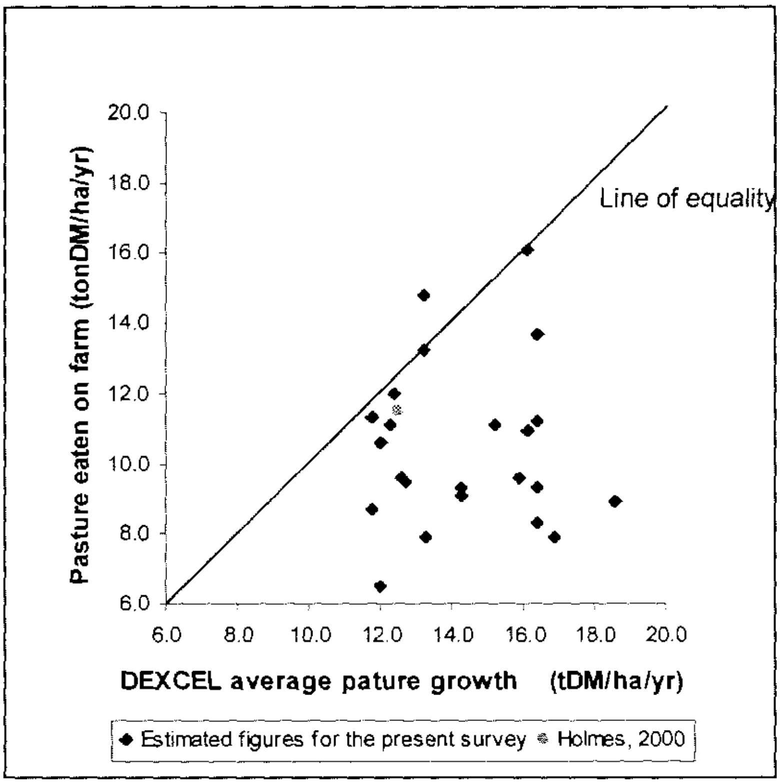


Figure 6.4. Pasture eaten on farm calculated from animal performance (Appendix Seven) relative to district average pasture growth (Dexcel, 2004)

For all but three of the farms, the estimated mount of pasture eaten was lower than the district average pasture growth and the average value for pasture utilisation efficiency, calculated as (pasture eaten/pasture grown)*100, was 74.5%. Macdonald et al. (2001) offers good data to benchmark this value. In this research, Holstein Friesian cows were stocked at different rates on farmlets growing 17-20t DM/ha, with no heifers grazed-on and no imported supplements, and pasture utilisation levels ranged from 63% to 81% (Macdonald et al., 2001). This latter value indicates that pasture utilisation in organic dairy systems is within in an acceptable range. However, the common trend to decrease stocking rates in organic dairy systems indicates that a decline in pasture consumption per hectare and consequently, a decrease in the efficiency of pasture utilisation would be expected.

In New Zealand, it has been argued that the productivity of pastures in organic dairy systems during conversion suffers a decline (Kelly et al., 2004b; Macgregor et al., 2002). The interviewees on the present research have divided opinions on this subject. Three farmers mentioned a decrease in pasture growth experienced in early conversion: one of them was unsure whether it was due to effects of conversion or weather, while another mentioned that pasture growth was slightly affected during the winter. Conversely, some interviewees believed that their organic pasture produces as much grass as before conversion and one of them even reported an increased in pasture growth of 15 to 20%.

SEASONALITY OF PASTURE GROWTH

Some interviewees reported that seasonality of pasture growth patterns under organic management is different from those in conventional farming. From their experience, pasture is *"slower to get away"* in early spring: *"We grew grass slowly, if that makes sense, it doesn't grow as fast and it never gets as long"*. This is consistent with findings in the New Zealand literature, in which unlike conventional systems, the greatest pasture growth rates on organic farms have been recorded in mid spring (September-October) (Macgregor et al., 2002) or late spring (November-December) (Kelly et al., 2004b). The farmers interviewed are aware of the practical implications of a change in pasture growth patterns: *"grass changes, so your growth pattern changes, so you've got to farm to those*". In that sense, one farmer reported to have increased the rotation length on his farm, particularly in winter to 120 days, in order to have a reserve of grass for the calving period.

Overall, the interviewees believed that the strength of their pasture is on its quality. Although none of them providing quantitative evidence to support this belief, pasture quality in this context is related to a diversity of pasture species. In effect, all of the farmers interviewed are trying to maintain a diversity of species in their pastures. Two farmers reported a higher amount of clover content on their farms, which is consistent with the results obtained in previous investigations (Halberg & Kristensen, 1997; Patterson, 1998 cited in Faiweather & Campbell, 2001). Some other farmers have introduced species like chicory, plantain, red clover and cocksfoot to their pastures, while others have planted herbs with varying results. For example, and consistent with other New Zealand farmers (Gillat & Coats, 2003), some interviewees found that herbs like parsley and dill are not persistent under intensive grazing.

In summary, comparisons of pasture consumption from the survey with district averages for pasture growth suggest that pasture utilization efficiency, and therefore pasture growth in organic dairy farms are in an acceptable range. In addition, data from the interviews suggests that pasture growth is delayed in early spring and pasture composition in organic dairy systems is diverse.

STOCKING RATES

From the interviews, the most common practice used to prevent feed shortfalls was to decrease the stocking rate. Perhaps the fact that many farmers reduced the stocking rate prior to conversion is the reason why many of them did not perceive a decline in pasture production in early conversion. One interviewee recommended reducing the herd size by 10% to 12%, while another mentioned to have reduced the number of cows in 20 to 25 cows in early conversion. Nevertheless, some interviewees that did initially reduced their herd size, are now starting to increase their stock numbers again. In the words of a farm manager interviewed: *"We actually decreased our stocking rates because we expected that we were going to be short of feed. In actual fact, we weren't...........so we went up to where we were (before)"*. Likewise, two other farmers, who started conversion approximately 6 years ago, observed that their pastures regain productivity: *"But now with the lesser numbers (of cows) the grass does get away a little bit..............I am slowly trying to (build the number of cows back up)"*; and *"the grass is starting to grow again and we are increasing our numbers again"*.

The survey did not provided data on farm size at different periods of the conversion to allow estimating changes in stocking rates and support the statements from the interviews. However, Table 6.3 shows that the decline in the number of milking cows in the first period of conversion (7.2%) is greater than the decline in the number of milking cows in the second period of conversion (0.7%). In addition, the number of milking cows in the whole process of conversion decreases on average in 10.5%.

Table 6.3. Number of organic dairy farms in which milking cows have decreased, increased or remained constant in conversion and percentage change in the number of milking cows (n=18)[5]

	Number of farms in which milking cows:			Change in the number of milking cows
	decreased	increased	remained constant	
Before – during conversion*	14	1	3	-7.2%
During – after conversion	11	5	2	-0.7%
Before – after conversion*	12	3	3	-10.5%

In addition, Table 6.4 shows the average number of milking cows at different stages of conversion, and gives an indication of an overall reduction in the number of milking cows during conversion.

Table 6.4. Average number of milking cows on organic dairy farms at different stages of the conversion process (n=18)

	Sample size	Mean (± SD)	Median	Range (Min to max)
Before conversion	18	273 (± 271)	178	100 to 1200
During conversion	18	260 (± 274)	159	100 to 1200
After conversion	18	255 (± 272)	160	90 to 1200

The average stocking rate figure calculated for the survey was 2.12 cows/hectare, which is lower than the national average of 2.75 cows/hectare (LIC, 2004). In addition, the proportion of farms that showed lower stocking rates was significantly higher ($p<0.001$) than those showing higher or equal stocking rates compared to the national average (see table 6.5).

[5] The Massey trial was not included in the calculations

Table 6.5. Number of cases from the survey in which stocking rates were higher or equal to and lower than the national average

Stocking rate[6]	Frequency	Percent
Higher or equal to the national average (≥ 2.75 cows/ha)	4[a]	13
Lower than the national average (< 2.75 cows/ha)	26[b]	87

a,b: different letters indicate significant differences under the Chi-square test ($P<0.01$)

In relation to the size of the organic operations, previous research conducted in the USA suggests that organic farms are larger than the state-wide average (Duram, 1999). However, no evidence of this trend was found in the survey reported on here. Despite the average area for milk production on organic farms being similar to the national average (110 has vs. 111 has, respectively), the median area for milk production on the surveyed organic farms was 67 hectares, showing that there are many small organic dairy farms. In addition, the surveyed farms showed high variability (Std dev. 145) in size, ranging from 20 to 810 hectares. Table 6.6 shows that a significantly greater ($p<0.01$) proportion of the farmers surveyed are smaller than the national average.

Table 6.6. Number and percentage of farms from the survey in which area for milk production was higher or equal to and lower than the national average

Area for milk production	Frequency	Percent
Higher or equal to the national average (≥111 hectares)	8[a]	25
Lower than the national average (< 111 hectares)	24[b]	75

a,b: different letter indicate significant differences under the Chi-square test ($P<0.01$)

Regarding herd size, the survey also showed contrasting results to the literature. A previous study concluded that organic herds in Denmark are approximately 20% larger than conventional herds (Enemark & Kjeldsen, 1999 cited in Bennedsgaard et al., 2003). In contrast, when comparing the current average number of milking cows

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6 Stocking rate in organic dairy farms was calculated using survey data as current number of milking cows / hectares for milk production

in the present survey (213) to the average number of lactating cows reported by LIC for the 2003/04 season (302), the organic dairy herds were 30% smaller than the national average. Probably, the fact that dairy production systems in Denmark are more intensive than in New Zealand makes it necessary to expand organic herds in order to compensate for a reduction in concentrate intake (C. Holmes, 11 March, 2005, personal communication).

The results for milking area and herd size obtained in the survey suggest that the fact that many farmers decrease their stocking rates in early conversion prevents them from having to expand their farmland in order to farm organically. If this is the case, instead of showing an increase in land use as reported by Boer (2003), organic dairy farms in New Zealand will probably suffer from a decrease in milk production per hectare. Milk production in organic dairy farms is examined in the next section.

6.4.2 MILK PRODUCTION

It is often argued that milk production levels on organic systems are lower than in conventional farms. In Europe, the literature shows that milk production per cow in organic dairy systems is nearly 20% lower than on conventional systems, a difference that is generally explained by a change from a diet based on concentrates to a diet based on forage (Hardeng & Edge, 2001; Stockdale et al., 2000, Bennesdgaard et al., 2003). Once again, the difference in traditional dairy production systems between New Zealand and Europe makes it important to discuss the findings of the present research in the context of pastoral dairy systems.

In New Zealand, preliminary results from the comparative (conventional vs. organic) trial at Massey showed similar figures for milk production per cow on the organic farm and on the conventional farm (Kelly et al., 2004b). On the other hand, modelling studies in New Zealand have reported a decrease in per cow production of 7% (MAF, 2002) and in per hectare production of 10% (Bauer-Eden, 2001) on organic dairy farms relative to conventional systems. The data obtained from the present survey support the results previously reported in the New Zealand literature. Current average milk production per cow on organic farms is similar to New Zealand's national average (327 kgMS/cow and 322 kgMS/cow, for organic and national average, respectively). However, the difference in average milk production per hectare is larger (799 kgMS/ha in the organic dairy farms surveyed vs. 889 kgMS/ha for New Zealand).

A more complete assessment was conducted in order to compare current on-farm production levels to average district figures. Using the regional dairy statistics for the 2003/04 season (LIC, 2004), milk production data from the survey was compared to average data for milk production in the closest location, as shown in tables 6.7 and 6.8.

Table 6.7. Milksolids per cow on organic farms relative to the average production on its corresponding location[7]

Survey data KgMS/cow/year	LIC 2003/04 data kgMS/cow/year
280	250
318	248
358	326
360	326
360	333
320	341
310	325
320	319
320	326
378	326
275	241
317	307
380	319
240	277
300	326
320	326
360	319
360	326
360	341
220	339
375	314
310	319
290	307
270	311
350	307
405	350
400	374

[7] In table 6.7 locations are not given to preserve confidentiality, but each farm was paired with average district data from LIC (2004).

Table 6.8. Milksolids per hectare on organic farms relative the average production on its corresponding location[8]

Survey data KgMS/ha/year	LIC 2003/04 data kgMS/ha/year
564	550
508	536
1023	914
1000	914
650	871
600	911
753	914
955	1012
700	869
870	914
607	715
979	1012
990	1012
1000	914
923	1012
950	1011
300	637
950	1024
775	914
685	841
670	765
1050	869
965	977
700	1145

[8] In table 6.8 locations are not given to preserve confidentiality, but each farm was paired with average district data from LIC (2004).

Data from tables 6.7 and 6.8 are displayed graphically in figures 6.5 and 6.6, which provide a picture of the level of milk production on the organic farms relative to district averages. The points above the line represent those cases in which milk production on-farm is higher than the district average, whereas the points below the line represent those cases in which milk production on-farm is lower than the district average.

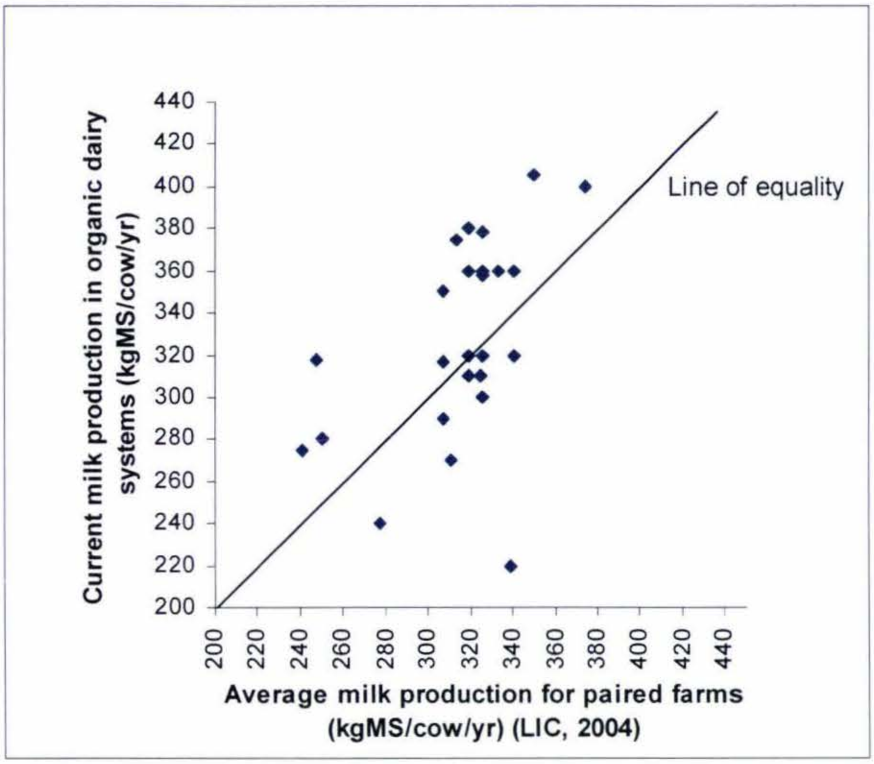

Figure 6.5. Milksolids production per cow on organic farms relative to district average figures

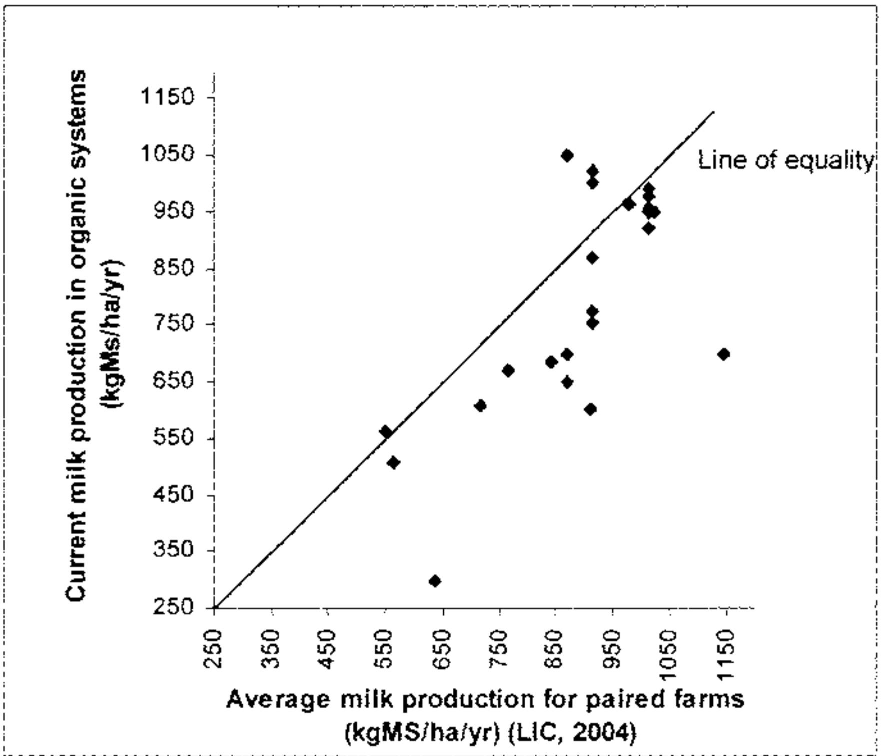

Figure 6.6. Milksolids production per hectare on organic farms relative to district average figures

Figure 6.5 shows that a similar proportion of organic dairy farms are above and below the line of equality, while figure 6.6 shows that most of the organic dairy farms are below the line of equality, meaning that most organic dairy farms have a lower per hectare production than the district average. In order to examine this trend further, data from table 6.6 and 6.7 were analysed using a t-test so to compare the means of these two data sets (i.e., survey data and LIC 2003/04 data). The analysis showed no significant difference between the average milk production per cow on organic farms and for average district farms. However, average milk production per hectare on the organic farms is significantly lower than milk production per hectare on average district farms ($P<0.1$). The difference observed was 88 kgMS/ha/year. In addition, the variability in both milk solids per cow and per hectare appeared to be higher on the organic farms. The results of this analysis are shown in tables 6.9 and 6.10.

Table 6.9. Average milksolids production per cow on all organic farms surveyed and on all paired district farms

	Cases under comparison	Average kgMS/cow	Average Difference	Standard Deviation
Paired farms (LIC 2003/04)	27	316[a]	--	30
Surveyed organic farms	27	328[a]	-12	47

a, b: different letters within the same column indicate significant differences (P<0.1)

Table 6.10. Average milksolids production per hectare on all organic farms surveyed and on all paired district farms

	Cases under comparison	Average kgMS/hectare	Average Difference	Standard Deviation
Paired farms (LIC 2003/04)	24	887[a]	--	148
Surveyed organic farms	24	799[b]	88	200

a, b: different letters within the same column indicate significant differences (P<0.1)

The results obtained for milksolids production on organic dairy farms in this research are as expected. Holmes (2003) argued that the components of all dairy systems everywhere are feeds, cows and milk. In New Zealand dairy systems, most of the feed offered to the dairy cow is pasture. Considering that all participants in this research initiated their organic operation from a conventional herd and that no big changes in the type of cow have been made, *pasture* is the only element that can explain the changes observed in milk production. It has been previously mentioned that facing a reduction in pasture productivity, organic farmers decrease their stocking rate. A decrease in stocking rate produces a decrease in pasture consumption per hectare but and increase in pasture consumption per cow (Macdonald, 2001). Consequently milk production per cow tends to increase at the cost of a reduction in milk production per hectare, provided that the cows remain healthy in the organic system. The next section moves from comparing milk productivity in organic farms to conventional farms, to examine the changes in milk production in organic dairy systems through the conversion process.

CHANGES IN MILK PRODUCTION DURING CONVERSION

It has been suggested that, as conversion progresses and the new system is established, the initial decline in milk yields is at least partially recovered in the subsequent years (Bani & Sandrucci, 2003). In Denmark, data on organic milk production before and after conversion showed that daily milk yields per cow decreased slightly in the first year of conversion but returned to the original levels in the second year (Vaarst et al., 2003). Even though it was not possible to examine the yearly trend in milk production in the present research, a similar trend was observed in the survey data when estimating changes in milk production for the periods before, during and after conversion (see table 6.11).

Table 6.11. Changes in milksolids production per cow during the process of conversion; for a group of 15 farms

	Mean (± SD)	Median	Range (Min to max)
Before conversion	296 (± 49)	300	230 to 400
During conversion	294 (± 52)	300	220 to 400
After conversion	316 (± 51)	318	220 to 405

When comparing milk production per cow in the stages before, during and after conversion, it was noticed that no farm showed a decline in milk production per cow in the period during – after conversion (See table 6.12). In effect, the change in milksolids production is slightly negative for the first period of conversion (-0.6%) and then recovers markedly in the second period of conversion (8%). On average, milksolids production per cow tends to increase by 7% during the overall conversion period. This suggests that organic dairy farmers in New Zealand may experience a decline in per cow production at the beginning of conversion but are then able to recover those productivity levels.

Table 6.12. Number of organic farms in which milksolids per cow decreased, increased or remained constant during the conversion process; for a group of 15 farms

	Number of farms in which milksolids per cow:			Average change in kgMS/cow
	decreased	increased	remained constant	
Before – during conversion	4	7	4	-0.6%
During – after conversion	0	13	2	7.9%
Before – after conversion	2	11	2	7.2%

When examining the changes in per hectare production during conversion, mean figures suggest that milksolids per hectare is slightly lower after conversion (See table 6.13). In fact, table 6.14 shows that, on average, milksolids per hectare tend to decrease 2.7% in the period before – after conversion.

Table 6.13. Changes in milksolids production per hectare during the process of conversion; for a group of 14 farms

	Mean (± SD)	Median	Range (Min to max)
Before conversion	764 (± 209)	778	400 to 1150
During conversion	720 (± 205)	748	377 to 1050
After conversion	742 (± 213)	719	300 to 1000

Table 6.14. Number of organic farms in which milksolids per hectare decreased, increased or remained constant during the conversion process; for a group of 14 farms

	Number of farms in which milk production per hectare:			Average change in kgMS/ha
	decreased	increased	remained constant	
Before – during conversion	9	3	2	-5.7%
During – after conversion	5	7	2	3.6%
Before – after conversion	7	5	2	-2.7%

In summary, these survey data shows that, on organic dairy farms, milksolids per cow tend to increase by 7%, while milksolids per hectare tend to decrease by 3% for the period before-after conversion. It is often argued that a decline in milk production in organic dairy systems is caused by a decline in the levels of concentrates offered in the diet (Rosati & Aumaitre, 2004). In contrast, in pastoral dairy systems which do not feed concentrates, a decline in pasture production and consequently a decline in stocking rates may be to a great extent responsible for a decline on milk production per hectare. At least some interviewees supported this point. Regarding early conversion, one of them commented: *"yes we did struggle and the cows never had a hell of a lot to eat..........production dropped"*. As discussed earlier, organic dairy farmers facing a decrease in pasture production will probably decrease their stocking rate and consequently achieve greater production per cow at the expense of lower productivity per hectare.

CHAPTER 7: SUMMARY AND CONCLUSIONS

7.1 INTRODUCTION

The organic dairy sector in New Zealand is in a developing stage. At the farm level, one of the biggest limitations for the expansion of organic dairying is the lack of knowledge on organic practices applicable to pastoral dairy systems. Therefore, a need was identified to gather and expand on the experiences of dairy farmers in New Zealand regarding converting to an organic production system. In particular, the present research aimed to identify the main problems experienced and the strategies employed to successfully manage the conversion in organic dairy systems. Further, this study explored farmers' perceptions of the implications of conversion on the social, environmental and financial performance of the farm.

7.2 FARMERS' PERCEPTION OF THE CONVERSION PROCESS AND IMPLICATIONS FOR ORGANIC FARMING

Farmers' perceptions of the conversion process can be examined from two angles: external and personal. In terms of external issues affecting conversion, social acceptability and institutional support were important for the farmers in this research. Organic farmers experienced disapproval and criticism from peers. Similarly, the inconsistencies in organic standards and lack of support from the industry hindered the process of conversion. However, these external issues were less important in the later stages of conversion, and most of the farmers acknowledged that organic farming is gaining recognition as a viable option and were positive about the recent involvement of Fonterra in the organic sector. Regarding personal aspects of conversion, dairy farmers appeared to be satisfied with their organic production system and showed a strong commitment to the organic approach. Farmers' attachment to their land and animals seemed to influence farm management choices.

Conversion was considered a process that extends beyond the certification period. Conversion was regarded as an ongoing process of learning in which two phases were identified: *capturing information* and *building experience*. Capturing information is related to seeking advice from consultants with expertise in the organic field, joining discussion groups and reading available literature. Discussion groups were especially relevant for organic dairy farmers as they allow the exchange of experiences about shared issues. In terms of sourcing information, farmers agreed that conversion is getting easier for newcomers; they believed that information is becoming more readily available, scientific research on organic systems is being conducted, and organic extension networks are already working in different areas of the country.

Building experience, the second phase in the learning process of conversion, is related to putting into practice the information obtained in order to develop solutions for the particular context of the farming enterprise. The most evident way in which organic dairy farmers build experience is through on-farm trials, which allow them to increase their knowledge and understanding of their own farm and gain confidence in the organic practices.

By *capturing information* and then by *building experience*, farmers are able to develop personal skills and effective management practices that aim at preventing potential problems, gain better control over their system and reduce risk. Prevention seems to be the most important strategy employed to approach management problems in organic dairy systems. Organic dairy farmers believe that the problem-solving approach of conventional farmers is too simplistic, while more complex management abilities are required for managing organic systems. In this respect, observation of cow appearance and behaviour, together with providing a favourable environment for the animals appears fundamental.

Organic dairy farmers generally felt that cost of production decreases following conversion to an organic production system. Some farmers believe that premiums are important to maintain the profitability of their organic operations while others do not think they are necessary. Similarly, farmers felt that there were environmental benefits following conversion. Environmental benefits were related to increased abundance of wildlife, improvements in soil structure (i.e. greater porosity, better drainage), and increases in organic matter, pH levels and worm life.

7.3 MAIN PROBLEMS AND PRACTICES DURING CONVERSION

The results from the survey and from the interviews on problems and practices during conversion were not consistent. From the survey, the only potential problem that appeared to be significantly difficult for organic dairy farmers during conversion is *sourcing organic inputs.* In general, soil management was not such a serious issue for organic dairy farmers, and neither were aspects related to animal health (i.e., lameness, herd fertility, calf diseases, metabolic disorders). On the other hand, results from the interviews suggest that animal health, particularly mastitis and calf diseases, and feed shortfalls are primary concerns for organic dairy farmers. Possibly, the survey did not include some important issues that were later revealed in the interviews.

On the interviews, farmers found it difficult to attribute particular problems only to the conversion to organic farming. Similarly, solutions were attained by many different management practices. Regarding mastitis, organic dairy farmers seemed to have developed an expertise in using alternative medicines and generally agreed on the effectiveness of homeopathic remedies and apple cider vinegar. However, routine management practices, such as milking methods, animal handling and feeding, appeared to be fundamental in preventing mastitis. On the other hand, feed shortfalls were mostly associated with a reduction in pasture growth, particularly in early conversion, and the increasing reliance on home-grown forage. This latter issue is of major relevance for farmers wishing to fulfil recent industry requirements (i.e. USDA standards) and who are located in isolated conditions or run large operations. In those cases, difficulties in sourcing organic inputs were mostly related to feed supply. Finally, weeds appeared to be a challenging and time consuming task, since organic farmers most commonly controlled weeds manually. Woody weeds, such as blackberry and gorse, thistles and ragwort were frequently mentioned.

Some common practices on organic dairy farms, such as balancing key elements in the soil, using slow release fertilisers and using composts and seaweeds to enhance soil biological activity, appeared to be highly helpful in managing soil fertility. In relation to pasture management, manual/mechanical control of weeds is also important practice for organic dairy farmers during conversion. Equally important were practices related to animal health such as handling stock to avoid stress, observing animal behaviour and grazing patterns, and making minerals available to cows. In contrast two particular strategies – mixed grazing with other animal species and maintaining a section of the farm under conventional management – were not considered to be helpful for organic dairy farmers in managing conversion.

Regarding the need to adjust feed supply and feed demand in organic dairy systems, farmers recommended applying organic fertilisers in advance, having extra supplements on hand, increasing the rotation length, delaying calving dates and, above all, reducing stocking rates. Apart from being the main strategy to anticipate feed shortfalls in organic dairy systems, reducing stocking rates also appeared to be an opportunity for selecting animals with low SCC (by culling those with high SCC) and with a healthy profile. Farmers reported on stock number reductions in the order of 10% to 12%. Similarly, the average stocking rate calculated for organic dairy farms was lower than the national average (i.e., 2.12 cows/hectare versus 2.75 cows/hectare national average). A significantly greater proportion of the farms surveyed had lower stocking rates than the national average ($P<0.01$). However, most of the farmers that experienced a decline in pasture production in early conversion and, consequently, reduced their herd size, have observed a recovery in pasture productivity as conversion progresses, and are now starting to increase their stock numbers again.

7.4 CHARACTERISTICS AND PRODUCTIVITY OF ORGANIC DAIRY FARMS

Given that most conventional dairy farms in New Zealand are low-input, pastoral, seasonal systems, participants in this research did not observe great changes in their farming systems following conversion to organics. Further, organic systems were identified as mostly grass, spring calving and self-contained operations. However, when considering grazing-off as a form of reliance on external supplies, a self-contained operation became more of an aspiration than a real feature of organic dairy systems. In addition, although organic dairy farmers reported on a diversity of pasture species, wildlife and elements of aesthetic value (e.g., trees, fish, etc), organic farms did not appear to be diversified in terms of commercial enterprises other than milk production. This is opposite to what is recommended in general organic principles.

The results obtained in this research suggest that organic dairy farms in New Zealand tend to be smaller in area and herd size than the national average. The median effective area for organic farms are 67 hectares and a significantly greater proportion of organic dairy farms is smaller than the national average of 111 effective hectares ($P<0.01$). In addition, organic dairy herds on average were 30% smaller than the national average.

Regarding productivity of organic dairy systems, when pasture eaten on-farm was estimated and compared to average pasture growth figures, utilization efficiency on organic dairy farms appears to be within an acceptable range (i.e., an average of 75%). In addition, farmers reported that the seasonality of pasture growth under organic management is different from that in conventional farming. The common opinion is that pasture growth is delayed in early spring. Organic farmers believed that, by maintaining a diversity of pasture species, they are offering good quality pasture to their cows. Desirable pasture species in organic systems are chicory, plantain, red clover and cocksfoot, and herbs with different medicinal properties.

Milk production per cow in organic systems appeared to be similar to the respective district average. However, milk production per hectare on the organic farms was significantly lower than average values for the respective district ($P<0.1$), by 88 kgMS/ha/year. On the other hand, farmers observed that milk yields tended to recover as conversion progresses. In the whole conversion period (before – after conversion) milk production per cow tend to increase on average by 7%, whereas milk production per hectare tend to decrease slightly, by 3%.

Finally, the present research supports the view of previous studies that the impacts of conversion, in terms of changes in productivity and problems expected, are related to the type of farming system **before** conversion. For New Zealand organic systems, the prohibition of synthetic/soluble forms of nitrogen is perhaps the key factor that affects pasture productivity. As a consequence, farmers are forced to reduce stocking rates, compromising milk solids production per hectare but maintaining or even improving per cow production.

7.5 ASSESSMENT OF THE METHODOLOGY

The present research first used a survey to elucidate the general characteristics of organic dairy farms in New Zealand, and to assess the difficulty of management issues during conversion, the success of the strategies applied, and farmers' appreciation of the conversion process. Having obtained this information, the results from the survey were used to select candidates for further interviews. The aim of the interviews was to gather farmers' experiences and perceptions of the conversion process at a practical level. Accordingly, eight semi-structured interviews were conducted on organic dairy farms in New Zealand.

Given the particular nature of the topic under study – an emergent, small, controversial sector – the selected methodology seemed to be effective in achieving the objectives of this study. The survey provided a convenient means to overview relevant topics in this research and prepared the ground for further interviews, from which more detailed information was obtained. Therefore, the information gathered here can only be generalized to those who were prepared to answer the survey and to the interviewees that participated in this research. Nevertheless, while the organic dairy sector in New Zealand remains small, studies can represent with some confidence what is happening in the general sector, compensating for the need for inferential studies.

7.6 CONCLUSIONS AND RECOMMENDATIONS

In New Zealand, organic dairy farmers have followed a relatively isolated process of conversion and, consequently, organic dairy systems are the result of farmers' individual experiences in adopting organic principles. From the farmer's perspective, conversion to organic farming is a learning process. Achieving personal skills and developing an integrated and critical attitude towards problem solving are the foundations on which to solve specific technical issues and successfully manage an organic operation. In particular, organic farmers are continuously seeking to prevent potential problems by managing all aspects of the farm in an integrative way. Therefore, it is important that organic farmers initiating conversion interact and share experiences with other organic farmers.

The fact that most New Zealand dairy farms are pastoral spring calving systems facilitates conversion to organic farming, relative to the high input systems that predominate in Europe and North America. This experience may also apply to developing countries, where dairy systems rely on lower levels of technology, the labour force is cheaper and more available, and simplified production systems translate to low production costs that allow producers to remain competitive. Therefore, the competitive advantages of dairy systems in developing countries could be further exploited under organic management, adding value to dairy products.

In general, New Zealand's dairy farmers should not expect a large reduction in per cow production following conversion to an organic production system. However, they should be aware that milk production per hectare on organic farms is compromised, mainly because a decline in pasture productivity requires a reduction in stocking rates. Further, when planning conversion, farmers may consider having additional supplementary feed and/or delaying calving dates to compensate for feed shortfalls in early spring. On the other hand, alternative methods to deal with mastitis on organic farms could be relevant to conventional farmers, given the general desire to reduce the use of antibiotics in agriculture.

If the organic dairy sector in New Zealand is to be enhanced, the industry should support organic farmers with conversion. Providing technical assistance and information is just as important as providing economic incentives for farmers in conversion. In fact, Fonterra has recently announced that, in addition to price premiums, farmers in conversion will receive information and advice through discussion groups, reference sources and farm visits (Fonterra Shareholder Services, 2005). In addition, there is an urgent need for research institutions to generate and expand scientific knowledge about organic dairying that accounts for specific local circumstances. To date, no studies have evaluated the environmental implications of organic dairy farming in New Zealand. There is a need for specific research regarding the financial impacts of the conversion process so dairy farmers are provided with reliable and accurate information on which to base their decision regarding conversion. Finally, research should continue in different areas of farm management of organic dairy farms, specifically regarding pasture management and practices aimed at prevention and control of mastitis.

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APPENDICES

APPENDIX ONE: High Level Definition of the FONTERRA Chosen Standard for the Supply of Organic MILK

(Reproduced with permission from Massey University, 2004)

Friday 7th May 2004

The Standard

Fonterra has only one standard – "The New Zealand Food Safety Authority's Rules of Organic Production AND appendices". This means for milk to be complaint to Fonterra's chosen standard the milk must comply with **both** "The New Zealand Food Safety Authority's Rules of Organic production" and "The New Zealand Food Safety Authority's Rules of Organic Production including appendices".

Fonterra has set a target that all organic milk processed will be meeting "The New Zealand Food Safety Authority's Rules of Organic Production AND appendices" by 1 June 2006.

Conversion Conditions

All new contracts (not renewals) must agree to farm according to "The New Zealand Food Safety Authority's Rules of Organic Production AND appendices" from commencement of conversion.

Milk Premium Payments

All Suppliers under the current organic contract will receive:

(i) The standard premium (currently 16%) for milk certified compliant with "The New Zealand Food Safety Authority's Rules of Organic Production AND appendices" by a New Zealand Food Safety Authority recognised auditor.

- (The increase to 16% is an interim measure (to 31st May 2005) to allow market development activity. Any extension beyond this date is subject to Fonterra Board approval and requires determination of the cost proportion of the organic milk premiums.)
- Once farmers commit to supplying milk compliant with "The New Zealand Food Safety Authority's Rules of Organic Production AND appendices" then this standard must be maintained.

(ii) The base premium (currently 10%) upon meeting the NZFSA Technical Rules of Organic production as certified by a New Zealand Food Safety Authority recognised auditor.

(iii) No organic premium payments for years one and two of conversion.

- (There is a proposal, subject to Fonterra Board Approval, to fund the costs during conversion. this requires determination of the cost proportion of the organic milk premiums.)

Recognised third Party Agencies (TPAs)

TPAs must be recognised by NZFSA. Currently only Agriquality and BioGro are recognised.

Key points of Fonterra's chosen standard:

Definition: **Organic** = meeting the requirements of the NZFSA Technical Rules of Organic Production AND appendices and certified as such by a NZFSA recognised TPA.

LAND / PASTURE

- Must be managed organically for at least 3 years.

  The pasture may be managed according to the NZFSA Technical rules of Organic Production for the first 2 years but for the least 12 months the pasture must be managed in accordance with the NZFSA Technical Rules for Organic Production AND appendices.

FEED

- **For the 12 months prior to conversion of the whole herd:**

  The animals must be fed a minimum 80% organic feed for the first 9 months and 100% organic feed for the last 3 months.

  Supplements and feed additives may be no organic (e.g. molasses) provided they are fed in accordance to the definitions (see below**).

  Note: Where non-organic molasses is administered via drenching, this may only occur to provide an energy boost to sick cows. Routine daily drenching is not allowed.

- **Once the whole herd is converted:**

  100% organic feed (including silage and hay). Exemption: If the farm experiences severe environmental conditions, e.g. flooding / drought, the farm can apply to the NZFSA through their TPA for a temporary exemption. Approval must be granted before non organic feed can be fed.

  Supplements and feed additives may be non organic (e.g. molasses) provided they are fed in accordance with the definitions (see below**).

  Note: Where non-organic molasses is administered via drenching, this may only occur to provide an energy boost to sick cows. Routine daily drenching is not allowed.

LIVESTOCK

- Animal for milk production

  Prior conversion to "The NZFSA Technical Rules of Organic Production AND appendices", all animals must be under continuous organic management for at least 12 months.

  Once the farm is converted:

- All the animals must be under continuous organic management from the last THIRD of their gestation (i.e. 3 months prior birth).

- The animals con never be managed on a non organic operation.
- Any new cow brought into the herd must be under continuous organic management for at least 12 months prior

• Breeder stock

Maybe brought from a non organic operation onto an organic operation at any time: Provided that if the livestock is gestating and the off spring are to be raised as organic livestock, the breeder stock must be brought onto the farm no later than the last third of gestation.

• Other animals

Must be managed organically from the last THIRD of their gestation (i.e. 3 months prior to their birth) if they are to be sold as organic at the time of slaughter.

• Vaccinations

Vaccinations are allowed. Fonterra requires this to be in accordance with the NZFSA Technical Rules of Organic Production excluding appendices to allow continued access to the EU markets.

ANTIBIOTICS

• Prior to conversion to the NZFSA Technical Rules of Organic Production AND appendices, the animals must NOT have received antibiotic treatment for a period of at least 12 months.

• If the animal does require an antibiotic treatment the animal will loose its organic status. This can be regained provided the animal undergoes continuous organic management for 1 year.

<u>Definitions</u>**

<u>Feed Supplements</u> - A combination of feed nutrients added to livestock feed to improve the nutritional balance or performance of the total ratio intended to be :

(1) Diluted with other feeds when fed to livestock;

(2) Offered free choice with other parts of the ratio is separately available; or

(3) Further diluted and mixed to produce a complete feed

Note: hay and silage are considered as "feed" by definition and not supplements

<u>Feed additive</u> – A substance added to feed in micro quantities to fulfil a specific nutritional need, i.e. essential nutrients in the form of amino acids, vitamins and minerals.

END

APPENDIX TWO: The Principal Aims of Organic Production and Processing (IFOAM, 2002)

Organic Production and Processing is based on a number of principles and ideas. All are important and this list does not seek to establish any priority of importance. The principles include:

- To produce sufficient quantities of high quality food, fibre and other products.
- To work compatibly with natural cycles and living systems through the soil, plants and animals in the entire production system.
- To recognize the wider social and ecological impact of and within the organic production and processing system.
- To maintain and increase long-term fertility and biological activity of soils using locally adapted cultural, biological and mechanical methods as opposed to reliance on inputs.
- To maintain and encourage agricultural and natural biodiversity on the farm and surrounds through the use of sustainable production systems and the protection of plant and wildlife habitats.
- To maintain and conserve genetic diversity through attention to on-farm management of genetic resources.
- To promote the responsible use and conservation of water and all life therein.
- To use, as far as possible, renewable resources in production and processing systems and avoid pollution and waste.
- To foster local and regional production and distribution.
- To create a harmonious balance between crop production and animal husbandry.
- To provide living conditions that allows animals to express the basic aspects of their innate behaviour.
- To utilize biodegradable, recyclable and recycled packaging materials.
- To provide everyone involved in organic farming and processing with a quality of life that satisfies their basic needs, within a safe, secure and healthy working environment.
- To support the establishment of an entire production, processing and distribution chain which is both socially just and ecologically responsible.
- To recognize the importance of, and protect and learn from, indigenous knowledge and traditional farming systems.

APPENDIX THREE: Questionnaire

Massey University

INFORMATION SHEET

STRATEGIC MANAGEMENT OF THE TRANSITION
TO AN ORGANIC DAIRY FARM: A SYSTEMS PERSPECTIVE

Thank you for taking the time to answer this questionnaire and help in research regarding organic agriculture.

What is the study about?
This research is about how dairy farmers manage the conversion from conventional to an organic system. This study will identify management issues and concerns during conversion and strategies that are employed to overcome them. A key reason for this research is to gain a better understanding of management in organic dairy systems, as well as to help reduce the costs, risks and uncertainties during conversion.

Your reply to the study
Enclosed is a **free post** envelope. No stamp is required; simply drop the envelope into the mailbox. The number on the return envelope is for identifying returns only and it is not linked to the questionnaire in anyway.

Confidentiality
The information you provide is anonymous. You have the right to decline to participate or answer any particular question in this survey. By replying to this survey, you give your consent to be part of this study.
This questionnaire will be followed up by more in-depth case studies. If you are willing to participate as a case study for this research or if you want a summary of the research findings please provide your contact details at the end of the questionnaire. Your response will remain confidential.

Who are the researchers?
This study is part of a thesis for a master degree at Massey University. Participants are invited to contact any member of this research team for any further information.

Student: Carolina Schweikart, Massey University phone (06) 356-9099 ext. 7208
E-mail: carolinaschweikart@entelchile.net

Supervisors:

Dr. Terry Kelly, Massey University	phone (06) 350-5517
Professor Colin Holmes, Massey University	phone (06) 365-9099 ext.7580
Gareth Evans, Agricultural Services	phone (06) 350-5176

Who are the participants of this study?
This survey has been sent to the entire population of organic dairy farmers in New Zealand.

Sincerely

Carolina Schweikart
Institute of Natural Resources
Massey University

NOTE :
This project has been reviewed, judged to be low risk, and approved under delegated authority from Massey University Human Ethics Committee. If you have any concerns about this research, please contact Professor Sylvia Rumball, Chair, Assistant to the Vice-Chancellor (Ethics & Equity), telephone 06 350 5249, email humanethics@massey.ac.nz

SECTION A: Organic History

1. When did the conversion process of your farm begin? ____________________________

2. Do you think that the conversion process of your farm has been completed? Please tick the appropriate box.

   a. ☐ Yes, When? ____

   b. ☐ No, How many more years do you expect it will take? _______________

3. What is the certification status of your farm? Please tick the appropriate box.

   a. ☐ Fully certified, With whom?____________________________________

   Since when?____________________________________

   b. ☐ In the process of certification, Year in conversion__________________

   c. ☐ Not certified,
   if not, do you intend to certify your farm in the future? ☐ Yes, ☐ No

SECTION B: Farming Enterprise

4. What is the size of your farm? Total ___________(ha) Effective ___________(ha)

5. For the following enterprises on your farm, please indicate how many hectares are farmed conventionally and how many are farmed organically.

	CONVENTIONAL (ha)	ORGANIC (ha)
a. Milk production	________________	________________
b. Orchards	________________	________________
c. Vegetable crops	________________	________________
d. Arable	________________	________________
e. Beef	________________	________________
f. Sheep	________________	________________
g. Other____________	________________	________________
h. Other____________	________________	________________

6. Indicate below the number of animals that were/are part of your organic dairy enterprise. If you have not yet completed conversion, please indicate your target stock numbers in section 'Stock target'.

	Before conversion	**During conversion**	**After conversion**	**Stock target**
a. Milking cows	________	________	________	________
b. Heifers: (i)Rising 1st year	________	________	________	________
(ii) Rising 2nd year	________	________	________	________
c. Bulls	________	________	________	________

7. If you have a grazing-off policy, please indicate the type and number of animals and the period they are grazed off during a one-year period.

a. **Type of stock**	b. **Number of animals**	c. **Grazing off period (weeks)**
________	________	________
________	________	________

8. What is/was the average milk production of your dairy herd during the following periods? If you have not yet completed conversion, please indicate your target production level in section 'd'.

a. **Before conversion** ________ kg MS/cow/yr ________ kg MS/ha/yr

b. **During conversion** ________ kg MS/cow/yr ________ kg MS/ha/yr

c. **After conversion** ________ kg MS/cow/yr ________ kg MS/ha/yr

d. **Production Target** ________ kg MS/cow/yr ________ kg MS/ha/yr

9. Which characteristic(s) best describe your dairy farming system? Please tick the boxes below.

a. Spring calving ☐

b. Mostly grass system ☐

c. Once a day milking ☐

d. Split calving ☐

e. High feed input system ☐

f. Processing your own milk ☐

g. Self contained operation ☐
(Low reliance on off farm resources)

h. Others – please specify: ☐

SECTION C: Biophysical Conditions of Your Farm

10. What is the nearest town/city to your farm?___________________________________

11. In your farm/district, what was the average annual rainfall during the past 5 years?

___________mm

12. In your farm/district, what is the average rainfall during the following quarters?

January to March ___________mm April to June __________mm

July to September ___________mm October to December ___________mm

13. In relation to the land that is used for dairy farming,:

a. What is the main soil type (e.g., Manawatu Silt Loam, Tirau Ash)

____

b. What percentage of the land is flat/hilly? __________% flat

__________% hilly

c. What is the current fertility level of the organic dairying soils

(i) Organic Matter __________(%)

(ii) pH __________

(iii) Olsen P_________(μgP/g)

(iv) Potassium __________ (me/100g)

SECTION D: Conversion Management Issues

14. The conversion to an organic system of production is a critical phase and it involves many adjustments in the production system. From your own experience, assign a 'level of difficulty' to the problems indicated below that you may have faced during the conversion to organic dairying. Please circle number.

	Not difficult				**Very difficult**	**Not applic.**
	1	2	3	4	5	(√)
Soil Management						
a. Maintenance of soil fertility	1	2	3	4	5	
b. Enhancement of microbiological activity	1	2	3	4	5	
c. Other - please specify	1	2	3	4	5	
d. Comments:						
Pasture Management						
e. Weed control	1	2	3	4	5	
f. Maintenance of desirable pasture species	1	2	3	4	5	
g. Other - please specify	1	2	3	4	5	
h. Comments:						
Animal Health						
i. Metabolic disorders	1	2	3	4	5	
j. Mastitis	1	2	3	4	5	
k. Lameness	1	2	3	4	5	
l. Herd fertility	1	2	3	4	5	
m. Calf diseases	1	2	3	4	5	
n. Other - please specify	1	2	3	4	5	
o. Comments:						
Business Management						
p. Lack of knowledge / information	1	2	3	4	5	
q. Relationship with neighbours	1	2	3	4	5	
r. Maintaining Income	1	2	3	4	5	
s. Managing Costs	1	2	3	4	5	
t. Sourcing organic inputs	1	2	3	4	5	
u. Additional labour requirements	1	2	3	4	5	
v. Other - please specify	1	2	3	4	5	
w. Comments:						

15. A number of common practices used by organic dairy farmers to manage conversion are listed below. To what extent have these practices been successful for you in managing the conversion of your dairy farm? Please circle number.

	Not helpful at all				Very helpful	Not applic.
	1	2	3	4	5	(√)
Soil Management						
a. Test and balance key elements of your soil	1	2	3	4	5	
b. Use of slow release fertilizers	1	2	3	4	5	
c. Use of compost or seaweed to enhance soil biological activity	1	2	3	4	5	
d. Others – please specify	1	2	3	4	5	
e. Comments:						
Pasture Management						
f. Use of crop rotations to decrease the incidence of weeds and pests	1	2	3	4	5	
g. Manual / Mechanical control of weeds	1	2	3	4	5	
h. Biological control of pests	1	2	3	4	5	
i. Topping to maintain pasture quality	1	2	3	4	5	
j. Strictly controlling pre and post grazing levels to achieve required targets	1	2	3	4	5	
k. Other – please specify	1	2	3	4	5	
l. Comments:						
Animal Health						
m. Mix grazing with other animal species	1	2	3	4	5	
n. Observation of animal behaviour and grazing patterns as a preventive method	1	2	3	4	5	
o. Handling stock to avoid stress	1	2	3	4	5	
p. Use of genetics for resistance to a particular disease	1	2	3	4	5	
q. Making minerals available to cows	1	2	3	4	5	
r. Other – please specify	1	2	3	4	5	
s. Comments:						
Business Management						
t. Participation in discussion groups	1	2	3	4	5	
u. Association with organic farmers to get better prices for your product and/or inputs	1	2	3	4	5	
v. Maintain a section of your farm under conventional management	1	2	3	4	5	
w. Complement your dairy business with other production activities	1	2	3	4	5	
x. Use of WWOOFers or similar semi-voluntary workers	1	2	3	4	5	
y. Other – please specify	1	2	3	4	5	
z. Comments:						

16. If you faced any other problems during conversion not covered in question 14, please list them below along with the strategies you employed to deal with them.

____

____

____

SECTION E: Your views

17. What was your main reason for converting to an organic system of production?

____

____

____

18. Has organic farming achieved your expectations? Why?

____

____

____

____

19. What advice would you give to somebody wanting to convert organic dairying?

____

____

____

____

If you would be willing for me to contact you regarding a farm visit to help in my studies, please fill in the following details

Name: ______________________________

Phone No: ___________________________

E-mail: ______________________________

THANK YOU VERY MUCH
Carolina Schweikart

APPENDIX FOUR: Interview Guide

Before start:

- Briefly explain the purpose of the visit and stress the importance of the visit for my research
- Briefly explain the procedure of the interview
- Ask for permission to record the interview

☐ **Background of the farmer - How did he become involved in organic farming**

❖ Was there any critical issue in your conventional farm that made you think in organics as an alternative

❖ ?

❖ What kind of decision process did you go through in thinking about whether or not to convert your farm to organics? What did you see as the opportunities, what were the threats?

☐ **Changes in farm management**

❖ How did you start conversion on your farm?

❖ Overall, if I have visited and walked through your farm when you started conversion and now, what major differences I would have seen?
-Stock policy: (numbers, grazing off)
-Pasture mgmt. (grazing system, pasture composition,)
-Feeding strategies (supplementary feed, silage)
-Nutrient balance (fertilizers, rotations, manure applic.)
-Facilities
-Labour
-Herd health and reproductive program
-Breeding, genetics and selection program]
-Productivity: pasture, milk

☐ **Main problems and strategies in the early stages of conversion**

❖ What can you recall as the most difficult issue that you faced in the first years of the conversion?
- Pasture management
- Soil management
- Animal Health (SCC, parasites in heifers, reproductive parameters)

- Business management

❖ What kind of things helped you to deal with it?

☐ **Personal view of conversion process**

❖ In general, how has been the conversion experience for you?
❖ Were there any surprises?
❖ What would you have done differently?

☐ **Main problems and strategies today**

❖ As XXX was the main difficulty you faced when beginning conversion, What is the main difficulty that you are facing today?
❖ How are you trying to improve this situation?

☐ **Perception of the effect of organic farming on the environment**

❖ How can you see the environmental benefits of organic farming in your farm?

☐ **Effect of organic farming in the social aspect of the farm**

❖ How being an organic farmer has affected you and your family?
❖ How does organic farming affect your relations with neighbours or community groups?

☐ **Effect of organic farming on the economic performance of the farm**

❖ How inputs or work costs have changed in your organic dairy farm?
❖ Which are the critical areas that impact on your production costs?
❖ How has organic farming affected the economic performance of your farm?

☐ **Current state of the farm and plans for the future**

❖ Today what are the top five strengths of your organic dairy farm?
❖ What are the plans for the future?

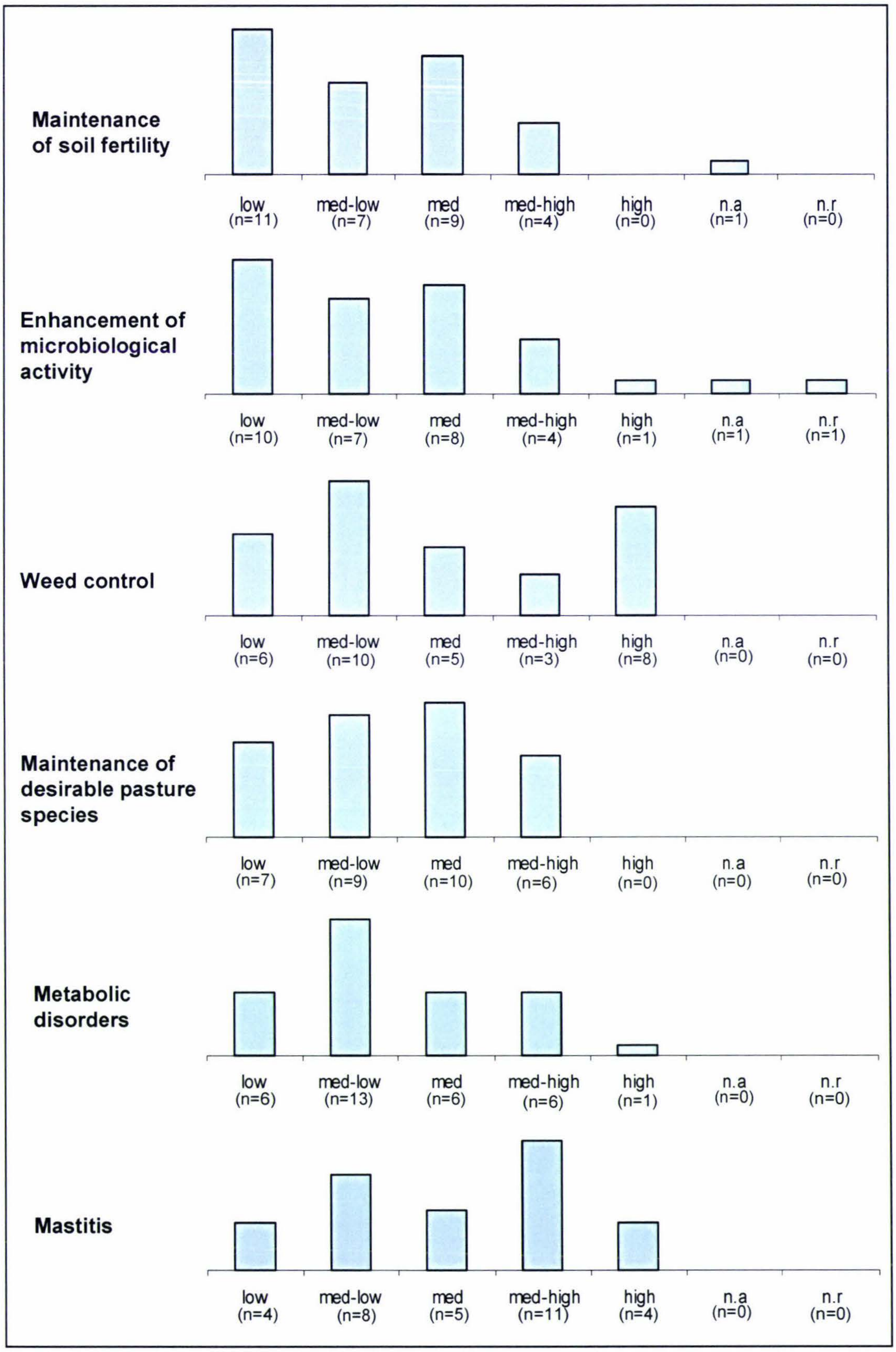
☐ **Space for further comments**

❖ Do you want to add something else to the conversation we have had today?

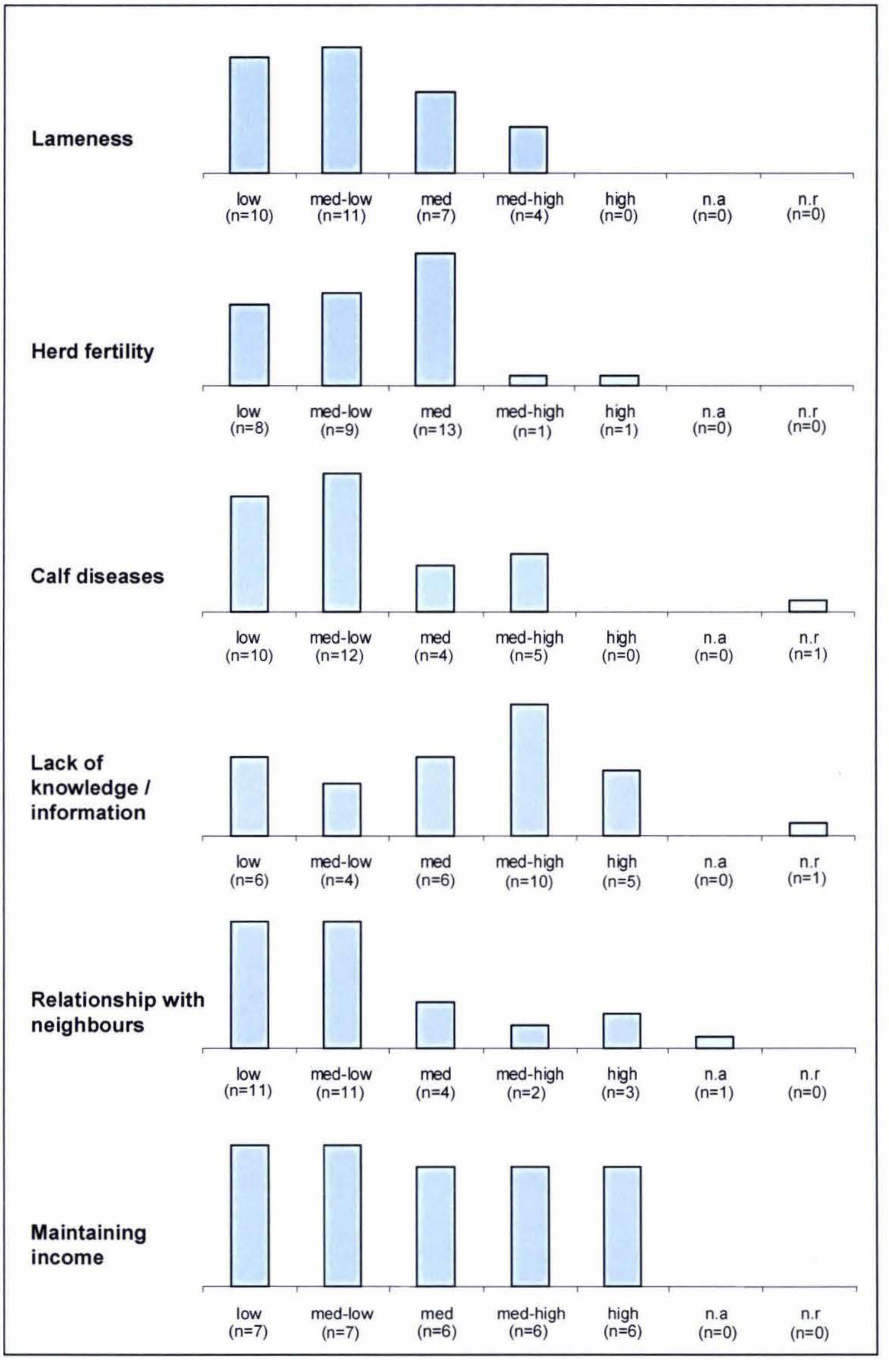
When finishing:

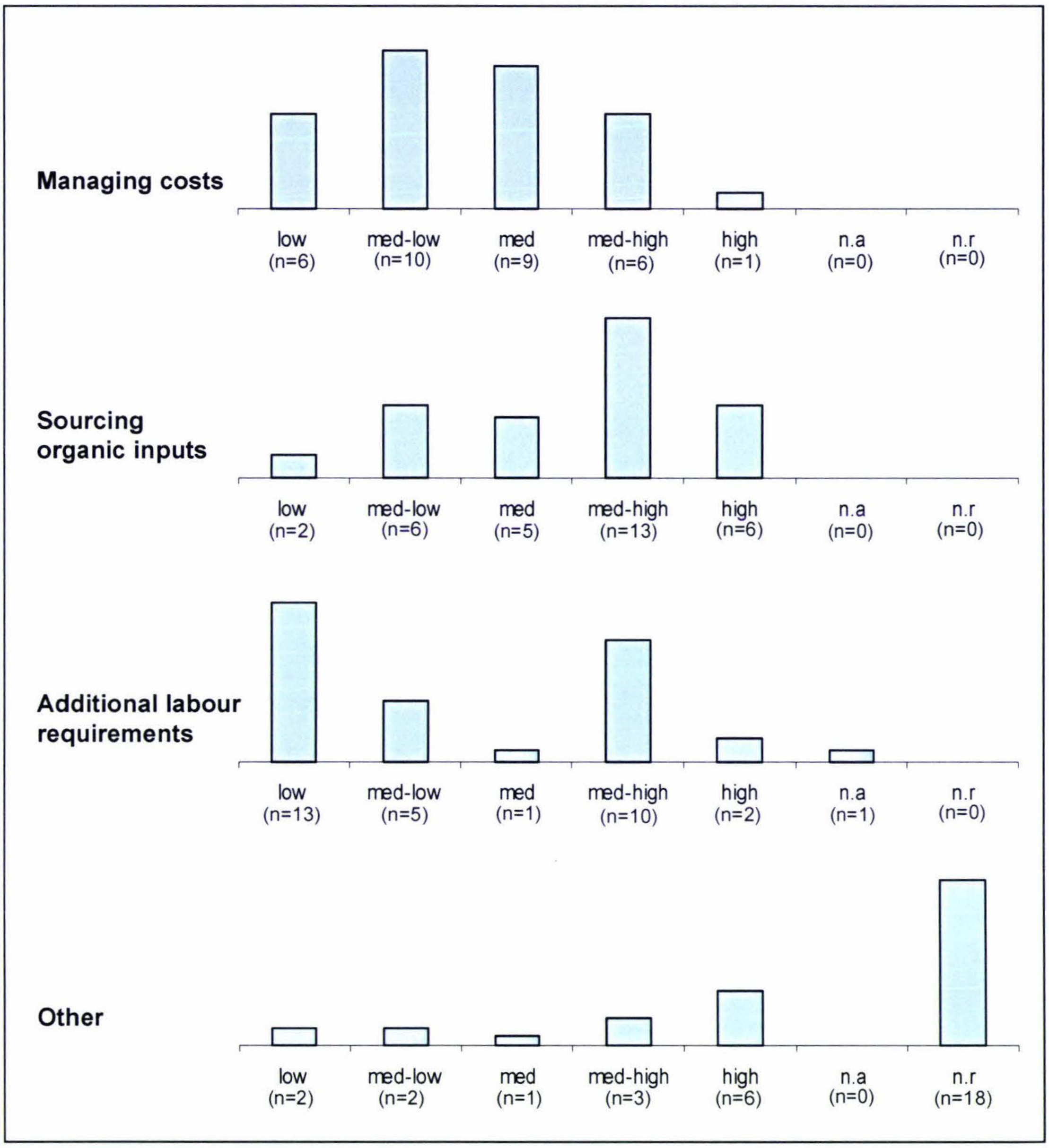
- Ask for the possibility of phoning them again in case I need clarify comments
- Offer the chance to get a summary of the findings of the research if they are interested

APPENDIX FIVE: Level of difficulty of potential problems during conversion to organic dairying

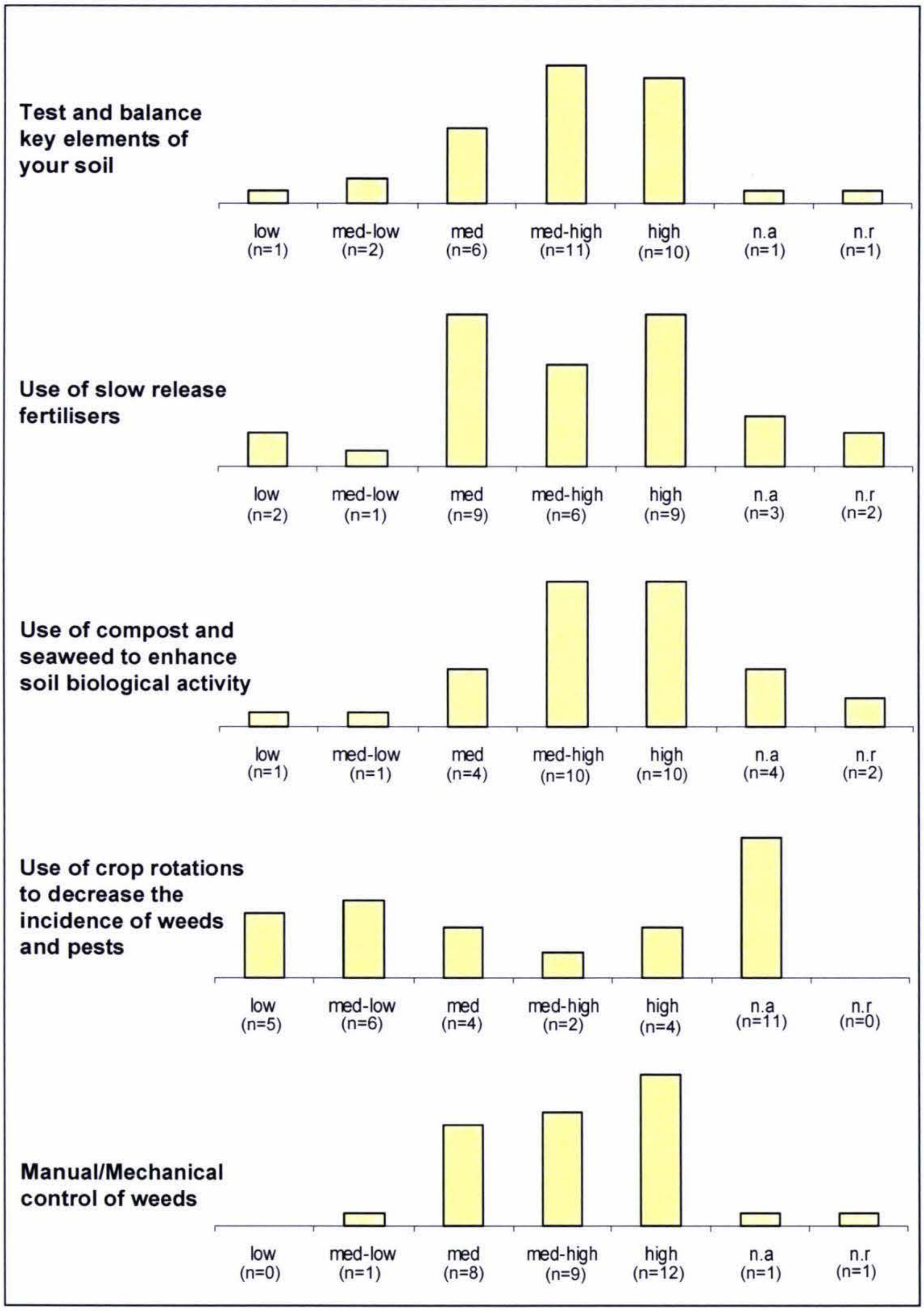


*n= valid responses in each category / n.a : not applicable / n.r : none response

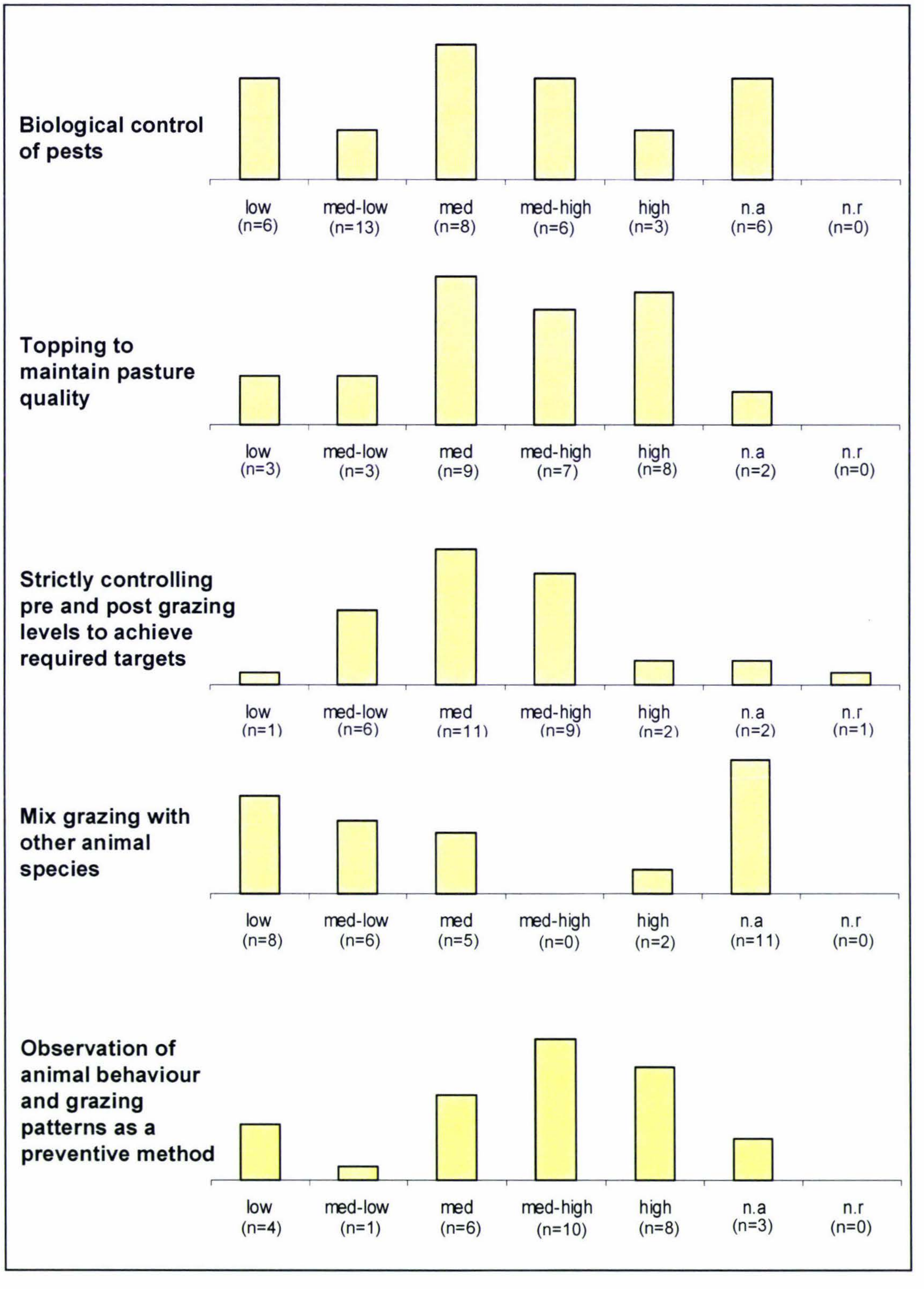

Lameness
low (n=10)
med-low (n=11)
med (n=7)
med-high (n=4)
high (n=0)
n.a (n=0)
n.r (n=0)
Herd fertility
low (n=8)
med-low (n=9)
med (n=13)
med-high (n=1)
high (n=1)
n.a (n=0)
n.r (n=0)
Calf diseases
low (n=10)
med-low (n=12)
med (n=4)
med-high (n=5)
high (n=0)
n.a (n=0)
n.r (n=1)
Lack of knowledge / information
low (n=6)
med-low (n=4)
med (n=6)
med-high (n=10)
high (n=5)
n.a (n=0)
n.r (n=1)
Relationship with neighbours
low (n=11)
med-low (n=11)
med (n=4)
med-high (n=2)
high (n=3)
n.a (n=1)
n.r (n=0)
Maintaining income
low (n=7)
med-low (n=7)
med (n=6)
med-high (n=6)
high (n=6)
n.a (n=0)
n.r (n=0)

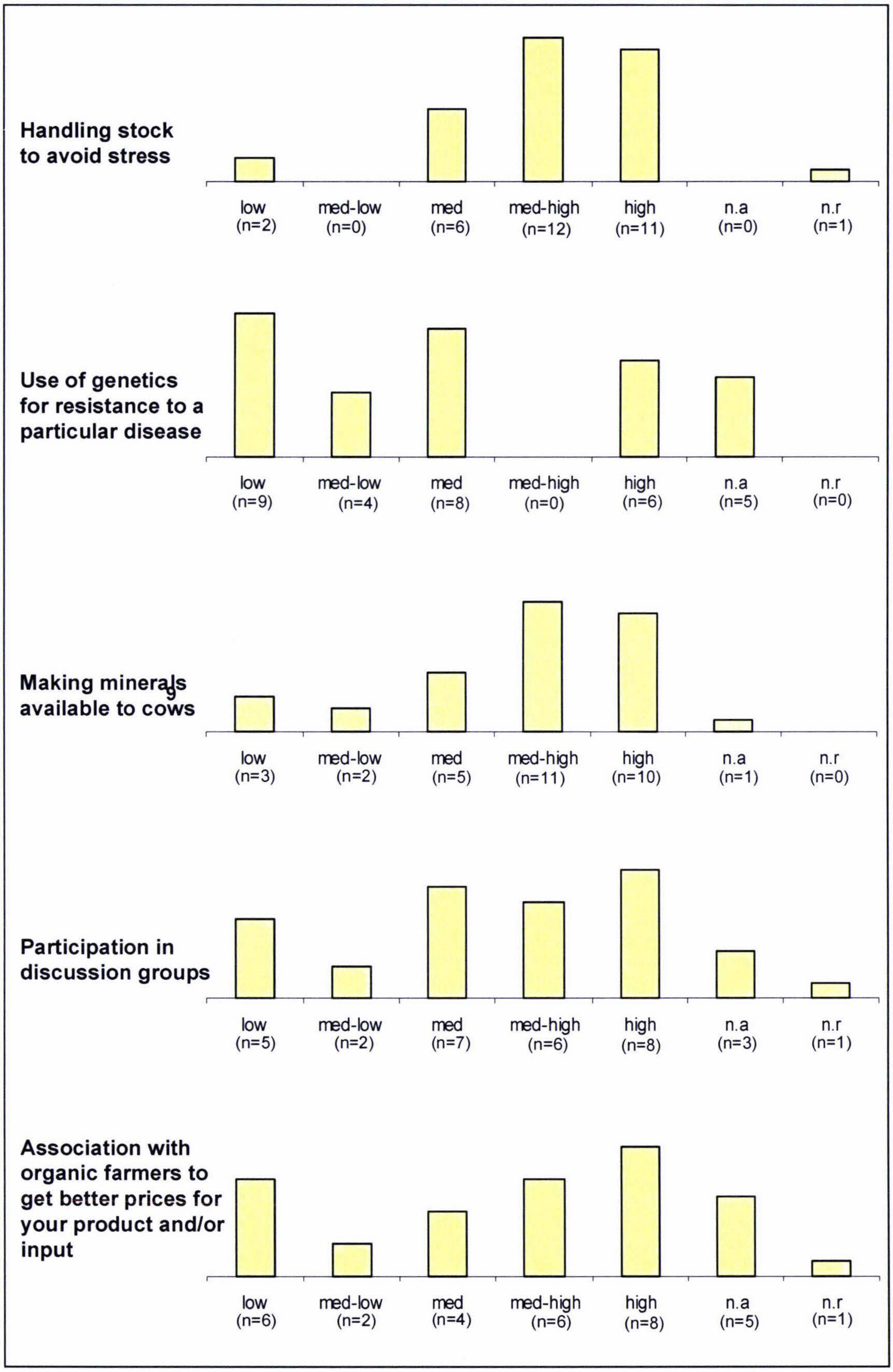

Managing costs
low (n=6)
med-low (n=10)
med (n=9)
med-high (n=6)
high (n=1)
n.a (n=0)
n.r (n=0)
Sourcing organic inputs
low (n=2)
med-low (n=6)
med (n=5)
med-high (n=13)
high (n=6)
n.a (n=0)
n.r (n=0)
Additional labour requirements
low (n=13)
med-low (n=5)
med (n=1)
med-high (n=10)
high (n=2)
n.a (n=1)
n.r (n=0)
Other
low (n=2)
med-low (n=2)
med (n=1)
med-high (n=3)
high (n=6)
n.a (n=0)
n.r (n=18)

APPENDIX SIX: Level of "helpfulness" of different practices applied during conversion to organic dairying



*n = valid responses in each category / n.a : not applicable / n.r : none response


Biological control of pests
low (n=6)
med-low (n=13)
med (n=8)
med-high (n=6)
high (n=3)
n.a (n=6)
n.r (n=0)
Topping to maintain pasture quality
low (n=3)
med-low (n=3)
med (n=9)
med-high (n=7)
high (n=8)
n.a (n=2)
n.r (n=0)
Strictly controlling pre and post grazing levels to achieve required targets
low (n=1)
med-low (n=6)
med (n=11)
med-high (n=9)
high (n=2)
n.a (n=2)
n.r (n=1)
Mix grazing with other animal species
low (n=8)
med-low (n=6)
med (n=5)
med-high (n=0)
high (n=2)
n.a (n=11)
n.r (n=0)
Observation of animal behaviour and grazing patterns as a preventive method
low (n=4)
med-low (n=1)
med (n=6)
med-high (n=10)
high (n=8)
n.a (n=3)
n.r (n=0)


Handling stock to avoid stress
low (n=2)
med-low (n=0)
med (n=6)
med-high (n=12)
high (n=11)
n.a (n=0)
n.r (n=1)
Use of genetics for resistance to a particular disease
low (n=9)
med-low (n=4)
med (n=8)
med-high (n=0)
high (n=6)
n.a (n=5)
n.r (n=0)
Making minerals available to cows
low (n=3)
med-low (n=2)
med (n=5)
med-high (n=11)
high (n=10)
n.a (n=1)
n.r (n=0)
Participation in discussion groups
low (n=5)
med-low (n=2)
med (n=7)
med-high (n=6)
high (n=8)
n.a (n=3)
n.r (n=1)
Association with organic farmers to get better prices for your product and/or input
low (n=6)
med-low (n=2)
med (n=4)
med-high (n=6)
high (n=8)
n.a (n=5)
n.r (n=1)


Maintain a section of your farm under conventional management
low (n=8)
med-low (n=3)
med (n=0)
med-high (n=0)
high (n=3)
n.a (n=16)
n.r (n=2)
Complement your dairy business with other production activities
low (n=2)
med-low (n=3)
med (n=3)
med-high (n=3)
high (n=6)
n.a (n=13)
n.r (n=2)
Use of WOOFers or similar semi-voluntary workers
low (n=4)
med-low (n=1)
med (n=5)
med-high (n=5)
high (n=3)
n.a (n=14)
n.r (n=0)

APPENDIX SEVEN: Estimation of pasture eaten on-farm

Using survey data, pasture eaten on-farm was calculated according the requirements for production, maintenance, pregnancy and growth for each animal category on the herd. According to DEXCEL data, these requirements were assumed as:

ANIMAL CATEGORY	REQUIREMENTS
MILKING COW	
- Milk production (cross bred cows)	67 MJME/kgMS
- Maintenance for the milking cow (500 kg LWT cow)	64 MJME/day
DRY COW	
- Maintenance + pregnancy (500 kg LWT cow)	8 kg DM/day
BULLS	
- Maintenance + growth	9 kgDM/day
1st YEAR HEIFER	
- Maintenance + growth	3.5 kgDM/day
2nd YEAR HEIFER	
- Maintenance + growth	8 kgDM/day

In addition, pasture energy content was assumed 11 MJME/kgDM. The detailed calculations for each survey case are presented as follows:

Id	Area for milk production	Milking cows	Milking cows: days on-farm	Current Production (MS/cow/yr)	Requirements for milk production (MJME/milking cows/yr)	Requirements for maintenance (MJME/milking cows/yr)	TOTAL REQUIREMENTS FOR THE MILKING HERD (tonDM/yr)
2	62	140	305	280	2,626,400	2,732,800	487
3	98	170	305	318	3,622,020	3,318,400	631
4	130	240	305	358	5,756,640	4,684,800	949
5	69	190	305	360	4,582,800	3,708,800	754
10	46	90	305	360	2,170,800	1,756,800	357
12	125	160	305	320	3,430,400	3,123,200	596
14	270	665	305	310	13,812,050	12,980,800	2,436
19	65	150	305	320	3,216,000	2,928,000	559
24	49	90	305	320	1,929,600	1,756,800	335
26	59	160	306	378	4,052,160	3,133,440	653
28	80	160	305	275	2,948,000	3,123,200	552
33	139	300	305	317	6,371,700	5,856,000	1,112
40	45	100	305	380	2,546,000	1,952,000	409
43	42	110	305	240	1,768,800	2,147,200	356
49	80	240	305	320	5,145,600	4,684,800	894
53	810	1200	305	360	28,944,000	23,424,000	4,761
61	65	135	305	360	3,256,200	2,635,200	536
63	30	55	305	220	810,700	1,073,600	171
70	110	200	305	400	5,360,000	3,904,000	842
71	75.5	180	305	375	4,522,500	3,513,600	731
72	75	135	305	310	2,803,950	2,635,200	494
73	115	225	305	290	4,371,750	4,392,000	797
74	60	150	305	270	2,713,500	2,928,000	513
76	50	150	305	350	3,517,500	2,928,000	586
77	20.38	45	305	405	1,221,075	878,400	191

Id	1st Year Heifers	1st year Heifers: days on-farm	FEED DEMAND 1YR HEIFERS (tonDM/1yr heifers/yr)	2nd Year Heifers	2nd Year heifers: days on-farm	FEED DEMAND 2YR HEIFERS (tonDM/2yr heifers/yr)
2	35	85	10.4	35	85	23.8
3	35	365	44.7	35	0	0.0
4	70	0	0.0	70	0	0.0
5	40	302	42.3	40	302	96.6
10	25	365	31.9	25	365	73.0
12	40	281	39.3	40	309	98.9
14	120	365	153.3	120	365	350.4
19	33	295	34.1	33	0	0.0
24	20	365	25.6	20	365	58.4
26	35	253	31.0	35	0	0.0
28	30	225	23.6	35	365	102.2
33	62	365	79.2	62	365	181.0
40	40	365	51.1	35	365	102.2
43	25	0	0.0	30	0	0.0
49	60	365	76.7	65	365	189.8
53	400	365	511.0	400	365	1,168.0
61	35	185	22.7	34	365	99.3
63	23	365	29.4	15	365	43.8
70	60	302	63.4	60	302	145.0
71	50	155	27.1	50	0	0.0
72	23	365	29.4	23	0	0.0
73	35	365	44.7	35	365	102.2
74	20	365	25.6	20	365	58.4
76	35	365	44.7	35	365	102.2
77	12	113	4.7	12	43	4.1

Id	Dry cows	Dry cows: days on-farm	FEED DEMAND DRY COWS (tonDM/herd of dry cows/yr)	Bulls	Bulls: days on-farm	FEED DEMAND BULLS (tonDM/total bulls/yr)
2	0	0	0	10	365	
3	170	60	81.6	4	365	13.14
4	240	60	115.2	5	365	16.425
5	70	60	33.6	5	365	16.425
10	90	60	43.2	2	365	6.57
12	160	60	76.8	0	0	0
14	465	60	223.2	20	365	65.7
19	0	0	0	4	365	13.14
24	90	60	43.2	2	365	6.57
26	160	60	76.8	6	365	19.71
28	160	60	76.8	4	365	13.14
33	300	60	144	0	0	0
40	100	60	48	2	365	6.57
43	70	60	33.6	0	0	0
49	0	0	0	8	365	26.28
53	1200	60	576	10	365	32.85
61	135	60	64.8	0	0	0
63	55	60	26.4	4	365	13.14
70	50	60	24	2	365	6.57
71	180	60	86.4	0	0	0
72	135	60	64.8	2	365	6.57
73	225	60	108	0	0	0
74	150	60	72	2	365	6.57
76	150	60	72	0	0	0
77	20	60	9.6	2	365	6.57

Id	TOTAL FEED EATEN ON-FARM (tDM/farm/yr)	TOTAL FEED EATEN PER HECTARE (tonDM/ha/yr)	Location	Average pasture growth DEXCEL (tonDM/ha/yr)	Pair location
2	521.4	8.4	Ruawai	18.6	Dargaville Ryegrass-kikuyu 130kgN/ha/yr
3	770.4	7.9	Dargaville / Whangarei	16.9	Dargaville Ryegrass-clover 130kgN/ha/yr
4	1,080.8	8.3	Edgecumbe	16.4	Edgecumbe
5	942.7	13.7	Edgecumbe	16.4	Edgecumbe
10	511.8	11.1	Stratford	12.3	Stratford
12	810.8	6.5	Fielding	12	Massey-100kgN/ha/yr
14	3,228.3	12.0	Featherston / Wellington	12.4	Carterton
19	605.8	9.3	Raglan	16.4	Ruakura
24	468.8	9.6	Te Aroha	15.9	Te Aroha
26	780.7	13.2	Matamata	13.2	Matamata
28	767.7	9.6	Kerikeri (Waipapa)	12.6	Kerikeri
33	1,515.9	10.9	Opotiki	16.1	Opotiki
40	616.8	13.7	Morrinsville	16.4	Ruakura
43	389.6	9.3	Thames	14.3	Ngatea
49	1,186.4	14.8	Matamata	13.2	Matamata
53	7,048.6	8.7	Auckland	11.8	South Auckland
61	722.3	11.1	Opunake	15.2	Hawera
63	284.0	9.5	Upper Hut	12.7	Foxton
70	1,081.1	9.8	Geraldine	.	Not available
71	844.1	11.2	Hamilton	16.4	Ruakura
72	595.2	7.9	Huntly	13.3	Taupiri
73	1,051.6	9.1	Ngatea	14.3	Ngatea
74	675.4	11.3	Auckland	11.8	South Auckland
76	804.9	16.1	Opotiki B.O.P	16.1	Opotiki
77	215.9	10.6	Palmerston North	12.0	Massey University