Susanne Padel

Conversion to Organic Milk Production: the change process and farmers' information needs

PhD-Thesis

December 2001

Institute of Rural Studies,
University of Wales, Aberystwyth

DECLARATION

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed…………………………………….. (candidate)

Date

STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated.

Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

Signed…………………………………….. (candidate)

Date

STATEMENT 2
I hereby give consent for my thesis, if accepted, to be available for photocopying and for inter-library loan, and for the title and summary to be made available to outside organisations.

Signed…………………………………….. (candidate)

Date

Acknowledgements

I gratefully acknowledge financial support to the following projects under which this study was carried out:

MAFF (now DEFRA) Conversion to organic dairy farming and post conversion phase (OF0113) and strategies of organic milk production (OF0146)

European Union (Project AIR - 3C 92-0776 Organic Livestock Farming, Nutritional, Environmental and Economic Implications of Conversion)

I would like to thank all those who have supported me:

The organic farmers who supplied the information about their accounts and spent their precious time being interviewed by me;

Frank Emmot; Sue Fowler, Bruce Kenworthy, Heather McCalman, Dan Powell and Ken Stebbings for data collection;

My supervisors Prof. Michael Haines and Dr. Tim Jenkins for their guidance and support;

Mark Measures, Dr. Nic Lampkin and Prof. P. Midmore for their critical comments;

Peter Bowling, Evan Jones and Richard Weller from IGER for additional data;

Dr. Harvey Perkins for inspirational teaching in qualitative research methods;

Annette Musker and Jane Powell for copy editing and proof reading, and

My family, Nic, Katrin and Steffan for their patience and support.

Summary

The thesis presents a study of the process of conversion to organic milk production and the resulting information needs of farmers, and the impact of conversion on production and incomes of eight case study farms.

There is a growing interest in organic farming as one of a number of alternatives to intensive agriculture. Information is considered to be important in replacing external inputs with the management of internal resources and biological/ecological processes, but there is a lack of strategic thinking about extension support.

A theoretical framework for the conversion process is developed using concepts of changing practices and farmer decision-making that are compared with the experiences of the case study farms. Three key stages of *Information gathering, Evaluation and adaptation* and *Implementation* are distinguished, as well as personal, farm-specific and external factors.

The empirical work used comparative case studies, in the traditions of farming systems and qualitative social science research, because no single conceptual model had been identified and the farmers' experiences and personal goals were considered important to understand information needs.

The impact of conversion on farm structure, forage and milk production was analysed and converting farmers' information needs identified as related to growing legume-based forage crops, forage yield development, budgeting of forage and preventive health management.

The analysis of the financial impact showed that through higher organic prices and reduced costs dairy farmers can compensate for output reductions in the long-term. Many dairy farmers could convert without income penalties with currently available financial support, despite increasing labour and general farming costs. Factors that influence income development during conversion were identified as farm type, structural changes, pre-conversion intensity and conversion strategy.

Recommendations for dairy farmers, providers of information and advice, and future research requirements are presented.

Table of Content

Table of Figures

Table of tables

Introduction

The aim of the research presented in this thesis is to investigate the process of conversion to organic milk production and its impact on production and incomes of farms, in order to identify converting farmers' information needs and to develop recommendations as to how these information requirements can best be met.

Background

At the turn of the millennium, agriculture and agricultural research in the developed world is characterised by a debate about the wider impact on the environment and society. This challenge of greater sustainability arises, in the first instance, at the farm level, as it is the individual farmer or farm manager who decides about land use and farming practices (Pretty, 1998; Webster, 1999). In order to promote different and more environmentally friendly ways of farming, it is therefore necessary to understand how farmers manage this process of change and what impacts it has on them and their farms (Gafsi, 1999).

Organic farming, considered to be the oldest precursor of sustainable agriculture (Lockeretz, 1990), is increasingly recognised as an important alternative, because of its environmental and other benefits (Stolze *et al.*, 2000) as well as meeting a growing consumer demand for organic food (Datamonitor, 1999; MINTEL, 2000).

Policy makers have considered organic farming both in the legislative context (e.g. EU regulation 2092/91, which legally defines organic crop production) and because of its benefits for the environment (e.g. direct financial support under EU regulation 2078/92, the agri-environment programme). Political strategies supporting more widespread conversion to organic farming have mainly concentrated on financial aid (see Lampkin *et al.*, 1999; Padel *et al.*, 2002, for a review of government policies in support of organic farming). In the UK, financial aid for conversion was first introduced in 1994, at a much lower level than in other EU countries, alongside support for marketing initiatives and research. In contrast, extension support for farmers received relatively little attention, both from researchers and policy makers, apart from some information programmes aimed at supporting farmers in making the decision to convert to organic, such as the Organic Conversion Information Service in England and Wales, which started in 1996 (ADAS, 1997; ECOTEC, 2001). However, farmers no longer qualify for publicly-funded conversion-related advice once they begin with the actual conversion of the farm, although a lump-sum payment is included within the post-1999 organic farming scheme, which is envisaged for training and advice, but rarely used for this purpose.

The lack of strategic thinking about extension and information support for converting producers is surprising, given that organic farming, like other forms of sustainable and low-input agriculture, is considered to be knowledge intensive. Organic farming aims to maximise production from farm-derived and renewable resources through the management of ecological and biological processes and interactions, whilst reducing, as far as possible, the reliance on external inputs, whether chemical or organic (adapted after Lampkin, 1994, p. 4). The external inputs are supposed to be replaced in part by information and management, yet little is known about what sort of information is needed, when farmers might require it and where it could come from (Lockeretz, 1991). Surveys of conventional producers identify lack of information as one of the main barriers to organic conversion (Blobaum, 1983; Chadwick and McGregor, 1991; Fairweather, 1999; Midmore et al., 2001) and this need for information continues throughout the conversion period itself. Farmers are reported to experience various technical problems, for example with weed control and nutrient supply, some of which result from a lack of knowledge and forward planning, and mistakes and learning costs have been identified as one reason for declining incomes during conversion (Diers and Noell, 1993; Padel and Lampkin, 1994b). Converting farmers' main source of information appears to be other organic farmers, even where alternatives such as specialist organic advisory services exist (Luley, 1996).

In 1993, when this research began, the lack of knowledge was particularly widespread among livestock producers, as organic farming research and advice had mainly concentrated upon aspects of crop production, despite the emphasis on the role of livestock in the principles and standards for organic production (e.g. IFOAM, 1998). There was considered to be a growing consumer demand for organic milk, and MAFF commissioned research in support of the development of organic milk production in Britain, of which this research was a part (Haggar and Padel, 1996).

Organic production standards (e.g. UKROFS, 2001) require that converting livestock producers replace synthetic nitrogen (N) fertilizer with legume-based forage crops, for example ryegrass/white clover leys. The process of establishing these may lead to a yield decline early in conversion (Padel and Lampkin, 1994b; Halberg *et al*,1997). The Standards also restrict the feeding of concentrates, and on Germans dairy farms reductions of up to 40% of concentrates in the diet were found (Schulze Pals, 1994). German converting dairy farmers also experienced problems with feed shortages (Freyer, 1994; Schulze-Pals, 1994), which could have a negative impact on milk production and animal health. The variation in milk yields on organic farms relative to conventional systems was found to be considerable, so that the evidence regarding the direct impact of conversion was inconclusive, but production intensity pre-conversion appeared to be one factor (Schulze-Pals, 1994). Two German studies reported actual yield trends of dairy farms during the first two to three years of conversion (Schulze-Pals, 1994, Freyer *et al*.,1994), whereas in the UK only two individual cases had been studied (Lampkin, 1993; Lampkin 1994). There was therefore a need for further research in the UK.

No single theoretical framework for studying farmers' information need during conversion to organic production could be identified. Some conceptual issues were identified by Dabbert (1994) and by Padel and Lampkin (1994b), such as the importance of the timing of access to premiums, yield trends, investment needs, changes labour, as well as motives and barriers, as well as a discussion of research approaches. Organic production standards (e.g. EC, 1991; UKROFS, 2001) define conversion as the period during which specified external inputs can no longer be used and before the product can be sold as organic, and specify a minimum length of time for land (24 months for land under annual crops) and each species of livestock. Farmers converting to organic farming may choose different strategies (staged or "all at once" conversion; Padel and Lampkin, 1994b; Vartdal, 1993) and have a range of motives for conversion (related to husbandry, farm income and personal goals (Vine and Bateman, 1981; Wernick and Lockeretz, 1977), but the reasons for this and the impact on the conversion process and its outcome are not well understood.

A number of agricultural disciplines are concerned with change processes and farmer decision-making. One theoretical framework for this was developed during the "green revolution": the adoption/diffusion model had its background and main application in technical agricultural innovations and led to development of the Technology Transfer Approach to agricultural extension (Rogers, 1983; FAO, 1998). The model also provides a descriptive structure of the adoption process on individual farms (Roger and Shoemaker, 1971; Albrecht, 1980), although the relevance to environmental innovations and systems changes is debatable (e.g. Altieri, 1987; Russel et al., 1989; Vanclay and Lawrence, 1994). Agricultural economists also developed linear and non-linear models to support decision-making based on optimisation with respect to specific objectives such as profit maximisation or risk or cost minimisation). These have been found to be of limited explanatory value regarding farmers' environmental behaviour (e.g. Nowak, 1982; Sutherland *et al*.,1995; Willock *et al*., 1999), which has prompted a return to more descriptive approaches in researching farmer decision-making (Jacobsen, 1994). Sociologists are concerned with the variety and complexity of farmers' objectives in relation to decision-making and with its social context of (Fairweather and Keating, 1990; Gasson and Errington, 1993; van der Ploeg, 1994b). If these various perspectives are combined, a considerable number of variables needs to be considered, and the complexity of the models limits their explanatory value, so that alternative approaches such as longitudinal studies of the evolution of farm businesses need to be explored (Austin et al., 1998b).

The Farming Systems Research and Extension (FSR) approach also presents an alternative framework, which developed in response to the low success in the developing world of the dominant Technology Transfer model of agricultural extension. Its practitioners, coming mainly from agronomic and farm management backgrounds, considered the social, economic, and ecological context of farming as important, and argued that new technologies should be developed and assessed on farms with a multi-disciplinary approach, rather than on research stations (Patton, 1990; Gilbert *et al*., 1980; Bawden, 1995). FSR, an umbrella term rather than a specific method (Bawden, 1995), provides a framework for qualitative study of the organic conversion process. The tools for studying the impact on farms can be taken from comparative farm management analysis, which allow various dimensions of a problem to be considered (Malcolm, 1990). However, given its mainly pragmatic roots, FSR does not provide a strong theoretical foundation for qualitative research on farms, although Patton (1990) considers it to be one example of qualitative inquiry. For the theory of the approach, and guidelines for collection and analysis of qualitative data, it was therefore necessary to turn to the broader literature on qualitative social inquiry (see below).

Detailed objectives

The work presented in this thesis was conducted as part of a MAFF/EC funded project on conversion to organic milk and livestock production with the aim of producing physical, financial and environmental data. Part of the project was the conversion of an experimental farm, and an assessment of the impact of conversion on commercial dairy farms, with the aim of investigating the conversion process as such and the specific information requirements of dairy farmers. To achieve this aim a number of specific objectives were identified:

1. Develop a theoretical framework for understanding conversion to organic production at the farm level, on the basis of farmer decision-making theory, studies of organic farmers and empirical observations on converting farms.
2. Develop and apply an integrated approach to analysing the personal, social, production-related and financial implications of the change process on converting dairy farms by combining the tools of qualitative social inquiry and farming systems research with those of farm management analysis.
3. Understand farmers' perspectives of the organic conversion process and explore the linkages to farm-specific variables, by using methods developed under objective 2 to investigate social issues, technical and financial problems, and the role of support and information.
4. Analyse the impact of the conversion process on forage and milk production and draw conclusions about the likely information needed to reduce mistakes and adverse effects.
5. Analyse the impact of conversion on dairy enterprise gross margins and farm incomes on mixed and specialist farms, and identify risk and profitability factors that highlight information needs.
6. Develop recommendations regarding information needs of converting farmers, information providers and for further research on conversion and organic dairy farming.

Approach

The main approach used in this study combines two alternative methods to study farmers' information requirements described by Davis and Olson (1985): (1) to direct questioning of farmers and (2) derivation of information needs from existing systems. Supplemented by literature reviews of the impact of conversion on dairy farms, these were combined in an in-depth case study approach. Using this approach, as Patton (1990) argues, a great deal can be learnt from a small number of cases, if in-depth information rich in context is collected.

Case study research is considered particularly useful to study processes (Patton, 1990), and has been widely used in research on organic farming (Vogtmann, 1983; NRC, 1989) and conversion (Lampkin, 1993; Freyer, 1994). Because of its ability to uncover farmers' perspectives and to help with conceptualisation of problems, qualitative social inquiry, to which case study research belongs, has been advocated for research on participatory agricultural extension and sustainable rural development (Albrecht, 1986; Skerrat and Midmore 2000). The recognition of the subjective nature of human behaviour (e.g. Patton, 1990) is central to various traditions, including the "soft" systems thinking of Checkland (1999), and corresponds with concepts of sustainability by referring to human actions towards natural resources and incorporating the standpoint of the observer (Norgaard, 1991; Webster, 1999; Woodhill and Röling, 1998).

This epistemology of contextual relativism relates to the methodological preference for inductive empirical research. Social phenomena should be studied within the context of their naturalistic setting and theories about human behaviour, it is argued, should be grounded in empirical findings (Glaser and Strauss, 1965; Lincoln and Guba, 1985; Patton, 1990). Central to the research are qualitative, unstructured data, providing descriptions of the cases in their context, but where possible different perspectives and types of data should be considered (Yin, 1994) so that the findings can be verified by triangulation (Patton, 1990).

This in-depth inquiry into conversion was carried out through the study of eight commercial dairy farms, selected to represent different situations in terms of size, structure and strategy. The farms were selected in 1993, when only approximately 50 dairy farms were converted to organic production in the UK, and the initial recruitment of 10 farms which Maxwell, (Maxwell, 1986) considered to be the maximum sample size for farm case study programmes. It covered a large proportion of converting dairy farms at the time. During the study period the number of organic dairy farms in the UK rose substantially, to ca. 180 holdings in 2000 and more than 300 in 2001. This increased interest was also reflected in research, as the references in the literature review illustrate, including the first results of this research that were published in 1996 (Haggar and Padel, 1996; Padel, 1996).

For each farm, personal and farm-specific variables were studied, using a combination of qualitative (conversational interviews) and quantitative (survey of farm accounts over a period of eight to ten years) approaches. The data analysis included cross-case comparisons, longitudinal comparisons with the pre-conversion situation and, for some quantitative indicators, comparisons with trends in the UK dairy industry in order to isolate the impact of conversion from other factors, as well as analysis of the cases in the context of the theoretical framework developed.

Structure of the thesis

The thesis is structured in three broad parts: a literature review and methodology section (Chapters 2 to 4), a results section (Chapters 5 to 8) and a final section integrating the results and developing recommendations on the basis of further analysis in the context of the conceptual framework and discussion (Chapters 9 to 11).

In the literature review section, Chapter 2 sets out the key elements of a theoretical understanding of the conversion process by reviewing literature on change and decision-making processes on farms and studies of the social characteristics of organic and converting farmers, and raises some further questions for the empirical research. Chapter 3 reviews the standards for organic livestock production, the likely impact of conversion on the physical and financial performance of dairy farms, and considers the potential contribution of production economics to optimising organic farming systems and understanding the change process, leading to further questions for the empirical research. Chapter 4 is concerned with methodological aspects, including the theory of qualitative social inquiry, Farming Systems Research and methodological guidelines for case study research, as well as presenting the specific approach used. All these review chapters include references available at the time when the research began in 1993 and also more recent publications.

The results section presents the results structured by the themes in order to facilitate cross-case comparisons. In Chapter 5, the situation of the eight case study farms before conversion is introduced, including a short description of each farm. Chapter 6 presents the personal context of the conversion, including the farmers' motivations and objectives, their experiences with the conversion process and their use of information sources, providing the reader with evidence for some conclusions in this and later chapters. Chapters 7 and 8 focus on the production-related and financial indicators, contrasted with the farmers' experiences where appropriate, with the aim of identifying the key factors influencing the development of and trends in important variables. Additional data for each farm are included in the appendices.

In the final section, Chapter 9 brings together the qualitative and quantitative data, which are contrasted with the key theoretical elements leading to a stage model of the conversion process. This is followed in Chapter 10 by a discussion of the results before, finally, Chapter 11 draws key conclusions and presents recommendations for information provision during conversion and further research in organic milk production.

Farmer decision-making and the organic conversion process

The main aim of the research is to investigate the process of conversion to organic milk production, its impact on production and income of farms, in order to identify converting farmers' information needs and to develop recommendations as to how these can best be met. Central to the question of information requirements is how the farmer handles the process of changes in farm practices at the farm level, as it is the individual farmer or manager who makes decisions regarding land use, stock numbers, and the use of inputs and technologies (Pretty, 1994; Webster, 1999). This requires the study of the conversion process within a broad framework that includes the human actors, their decision-making and the actions taken to implement the decisions, as well as the farm-specific and external factors that may influence these various processes. It is necessary to gain an understanding of the basic objectives of the decision-maker, and the behaviour of and interrelation between different parts of the farming systems, in an agro-ecological context (Herrero et al., 1999).

The objectives of this chapter are to:

1. Set out the key elements of such a broad theoretical framework,
2. Identify variables that are important with particular emphasis on human variables,
3. Conceptualise the organic conversion process itself, and
4. Identify gaps in the knowledge and raise specific questions for the empirical research.

This is achieved by considering a range of theoretical concepts dealing with change processes and decision-making on farms, and by reviewing studies of organic and converting farmers. The focus in this chapter is on farmers as decision-makers and implementers of change, the social context of conversion, as well as the change process itself. Some reference is also made to production, financial and economic factors influencing particularly decision-making, but the impact of the conversion period on various production-related and financial factors on grazing livestock enterprises and dairy farms is mainly reviewed in Chapter 3.

The literature review considers some key studies from the 1980s, because the number of studies specifically focusing on organic conversion remains limited. This also allows some observations to be made about changes in organic farmers' motivations over time. Studies published during the research period are also considered; these did not influence the data collection but are reflected in the subsequent analysis.

The chapter begins with a short introduction to key aspects of the organic conversion process and the areas that have been addressed by previous research. Various concepts of change processes on farms, farmer decision-making and the role of knowledge and information are reviewed. Studies of barriers and motives to organic conversion are considered, with the aim of identifying key variables that influence the organic conversion process and the role of information. The personal variables of organic and converting producers are compared with those of conventional producers. The conversion process is conceptualised, with a concluding section addressing the implications for the empirical research by summarising a list of potential variables and suggesting a simple descriptive framework of key stages of the conversion process.

What is the organic conversion process?

The conversion process covers the period during which a farm changes from existing (conventional) practice to organic management. During this period external inputs have, to a large extent, to be replaced by biological processes such as biological nitrogen fixation and the management of internal resources. Most, but not all, farmers have also engaged in conversion with the aim to achieve certification according to organic production standards and to sell their products as organic for a higher price.

It is assumed that the conversion process is in many ways different from established organic systems. For example, yield levels may be lower during conversion as soil fertility has not yet developed in response to rotational changes such as the inclusion of legumes, and there may be a need for other adjustments to farm enterprise structure including the introduction of new enterprises. Farmers need to learn new husbandry skills (e.g. mechanical weed control) and find outlets for their organic products that cannot be achieved through traditional marketing channels. The extent of the changes required depends in part upon the degree of specialisation and the intensity of input use of the conventional system before conversion (Dabbert, 1994; Padel and Lampkin, 1994b; Rantzau *et al.*, 1990).

There is some confusion over how long the conversion process actually takes and what is part of it. Organic production standards (e.g.EC, 1991; UKROFS, 2001) specify a minimum conversion period for each parcel of land (currently 24 months for land under annual crops) and each species of livestock (for further details of UK organic production Standards see Chapter 3). During this period non-permitted inputs have to be withdrawn, but the products cannot be marketed as organic. The main aims in specifying such minimum conversion periods are to protect the consumer from potential residues from previous conventional management, to discourage rapid alternation between organic and conventional management, and to encourage farmers to introduce organic management through the fertility-building phase of the rotation. Apart from new rules on simultaneous conversion of land and stock, most Standards documents give little guidance as to how a whole farm should be converted.

The change process on the farm starts before the conversion of land and stock, with the farmer making the decision to convert parts, or all, of the farm. In looking at information support, it is valuable to consider the time leading up to the conversion decision. It is also questionable whether the certification of full organic status really reflects the endpoint of the conversion. Dabbert argues that, from an economic point of view, the process does not finish until full organic certification and new stability as an organic farm has been achieved.

If these modified start and end points are considered, then the length of the conversion period is likely to be longer than the minimum period specified in the standards, but how long is not clear. What becomes clear is that the process affects both the farmer and the farm and that several different processes (decision-making, changes of farming practices, certification) take place during it. This is why Dabbert (1994) described the process as not only a challenge to the farmer, but also the researcher who tries to understand it.

Over the years, a number of studies have focused on a range of topics important to the organic conversion process (several covering more than one issue), which can be broadly grouped as follows:

- Technical and agronomic aspects of the impact of the conversion period on physical parameters at the farm level (Dabbert and Braun, 1993a; Løes, 1992; Peters, 1994; Rantzau *et al.*, 1990). Most of these focused on aspects of crop production, such as the development of rotations, soil fertility and nutrient supply, based mainly on plot experiments, case study research and comparative surveys of organic and conventional farms.
- Financial and economic studies on the outcome of conversion at the farm level, including attempts to improve the conversion process through the development of planning tools, using surveys (including time series data as well as cross-sectional analysis of comparative surveys of conventional and organic farms), case studies and farm-level modelling (Dabbert and Braun, 1993b; Dabbert, 1994; Lampkin, 1993; Schulze Pals *et al.*, 1994).
- *Ex-ante* modelling studies of the impact of widespread conversion on agriculture (Braun, 1994; Lampkin, 1994b; Midmore, 1994). These are not relevant to the conversion process at the farm level and have therefore not been further considered.
- Sociological aspects of farmers' attitudes to organic production and conversion, such as adoption behaviour, barriers to more widespread conversion, organic farmers' motivations, and farm and personal characteristics of the converting farmers, mainly based on structured surveys and interviews (de Buck et al., 2001; Fairweather, 1999; Midmore et al., 2001; Vogtmann et al., 1993; Wernick and Lockeretz, 1977).

Concepts of change processes and decision-making on farms

Change processes on farms and farmer decision-making have been studied by a number of different disciplines in agricultural research.

The adoption/diffusion model was developed in the United States by rural sociologists aiming to predict and support the adoption behaviour of individuals by looking at their personal characteristics, the time factor and the characteristics of the innovation itself. The main aim at the time was to encourage farmers to increase production by using inputs and technology. It was, for a long time, considered to be the main theoretical model for agricultural extension (Albrecht, 1980; Vanclay and Lawrence, 1994) and was also recognised in other disciplines as a model of change, such as marketing and consumer behaviour. Apart from the concerns about the diffusion of an innovation into the agricultural community, the adoption/diffusion model also conceptualises in a descriptive way the decision-making process at the farm level, which is relevant for this study.

Agricultural economists have used production economic theory to develop models aiming to predict as well as influence farmers' decision-making in particular areas (see Chapter 3), based on optimising resource use with respect to utility or profit maximisation objectives, but these do not specifically address change processes as such. Other researchers have been concerned with the variety and complexity of farmers' objectives and the social context of decision-making (Gasson and Errington, 1993), and with the impact of this on farming activities and management styles (Fairweather and Keating, 1990; van der Ploeg, 1994a). A further contribution to the understanding of decision-making and change processes on farms can be made by psychological theories (e.g. Weber, 1994).

The lack of success in predicting farmer behaviour in general terms with mathematical modelling and the failure to address adequately questions of the sustainability of agriculture have led to a move away from quantitative approaches in recent years, returning to more descriptive approaches to study farmer decision-making (Jacobsen, 1994). A number of these concepts of change processes on farms and farmer decision-making on farms are reviewed in this section.

The farm-level change process in the adoption/diffusion model

The adoption/diffusion model of (Rogers, 1983) is an important model describing the process of change on farms and the diffusion of innovations into the rural community. The model has been used in the context of organic conversion by a small number of researchers (Burton et al., 1999; Gerber and Hoffman, 1998; Padel, 2001; Vartdal, 1993). Based on a literature review of studies of organic producers, Padel (2001) discusses the conversion process as a typical example of the diffusion of an innovation, concluding that organic producers share many characteristics with innovators and early adopters of other innovations in agriculture. Like typical innovators, organic farmers are generally better educated and have a wider network of social relationships. The smaller average farm size in most countries reflects the higher number of lifestyle and self-sufficiency oriented farmers in the organic group, similar to early adopters of other environmental innovations (Padel, 2001). She concludes that the common occurrence of differences in personal characteristics between the organic and conventional farmers cannot be interpreted as hampering more widespread conversion, but is a typical feature of any diffusion process. Thus the adoption/diffusion model may have relevance to understanding the process of conversion to organic farming.

At the farm level, the adoption model structures the process of change in four phases (Lionberger, 1960; Rogers and Shoemaker, 1971):

1) Initial knowledge or awareness;
2) Acceptance as a good idea;
3) Acceptance on a trial basis or evaluation;
4) Adoption of action.

Awareness is considered a pre-condition of any adoption decision, followed by a stage of consideration whether or not the innovation seems like a good idea in general terms, i.e. without specific reference to individual circumstances. This is followed by a phase of evaluating the potential benefits of the innovation under the specific circumstances of the farm itself. Adoption research established that this usually involves some limited experiments with the innovation on the farm, e.g. introducing a new variety at first on one field only (Ryan and Gross, 1943). Highly divisible innovations, i.e. those that can be tried on a small scale, were considered to be more easily adopted than more complex ones (Buttel et al., 1990).

Most adoption research focused on the introduction of inputs or technical implements, like the use of hybrid seed corn in Iowa (Ryan and Gross, 1943) rather than strategic change. However, the adoption model has also been used as a framework to study the adoption of environmental innovations (e.g. Taylor and Miller, 1978), although others have rejected the model completely in this context (Pampel and van Es, 1977) and others have questioned the applicability in this area (Heffernan, 1982; Nowak, 1982; Vanclay and Lawrence, 1994).

Analysis of the determinants of adoption behaviour uses mathematical modelling to classify farmers according to their status at the time of being surveyed to explain the distribution across the two groups in terms of characteristics of farmer and farms. The focus on determinant variables (whether or not a farmer is likely to adopt) implies that the change process itself is ignored. Such techniques were used by Burton (1999) in a study of the determinants of adoption of organic horticulture in the UK, based on a survey of 237 producers, 86 of which adopted organic techniques, reference to the results is made in the following sections. Anim (1999) used similar techniques and found that awareness of soil erosion problems is a more important variable in predicting the likely adoption of soil conservation techniques in South Africa than personal variables such as size of the holding or age of the manager. He also identified increases in the long-term profit as a determinant variable, which confirms the importance of the time dimension for decision-making and change processes on farms. Although clearly recognised in the original adoption model, this is ignored in the search for determinant variables of adoption behaviour.

Quantitative models of farmer decision-making and behaviour

Research illustrates the complexity of farmers' decision-making and behaviour, particularly in relation to the environment (Skerrat and Dent, 1996; Sutherland et al., 1995). Mathematical modelling has been used, but compared with models of production-oriented behaviour, the success in predicting adequately the behaviour of individuals in adopting environmental practices is relatively poor, or merely yields highly constrained models of specific behaviour (Willock et al., 1999). The potential contribution of production economic theory in studying production related and financial aspects of conversion to organic milk production is discussed in more detail in Chapter 3.

There is a growing body of knowledge about the broad range of non-financial goals and objectives that appear to influence farmer behaviour, for example related to the stewardship of the land and personal lifestyle (Bahner, 1995; Fairweather and Keating, 1990; Gasson, 1973; Gasson and Errington, 1993). Hence, farmers' responses to policies and economic forces are likely to depend on their personal, financial and motivational circumstances (Vogel, 1994). Social scientists use the concept of attitude, defined as a negative or positive response towards an attitude object (person, idea, concept or physical object). The attitude is formed by what a person perceives to be true, which may or may not be based on knowledge and information, but is also based on emotions, beliefs and values. Studies of farmers increasingly consider attitudes of farmers as explanatory variables (Willock, 1999).

The multi-disciplinary Edinburgh project of farmers' decision-making aimed to understand and model the general process of farmer decision-making. The basis for a number of publications was a broad survey of approximately 250 farmers in the East of Scotland with three questionnaires related to attitudes, objectives and information about how the business was run (implementation), resulting in a multi-variant database used for modelling (Austin et al., 1998a; Austin et al., 1998b; Sutherland et al., 1995; Willock, 1994; Willock et al., 1999).

A key conclusion of the work was that multiple attitudes, including psychological factors, influence both business and environmentally oriented behaviour. Some attitudes were found to influence behaviour directly, while others were mediated by objectives, and farmers' behaviour was further influenced by some farm structure-related variables such as enterprise mix, capital resources and site. While it became clear that social and psychological factors clearly influence farmers' behaviour, it was not possible to offer clear models, causal direction of variables or farmer typologies (Willock et al., 1999). Some valuable insights could be gained from models of small sets of variables, but there was little evidence that greater model sophistication, through using multi-variant and non-linear models, improved their explanatory power (Austin et al., 1998a; Austin et al., 1998b).

They further point out that there may be mutual influences between attitudes and objectives and behaviour (Willock et al., 1999). This would mean that the experience of the consequences of a change in farming practices might also lead to changes of attitudes and objectives, in addition to the behaviour being influenced by the motivation and attitudes.

It can be concluded that farmer decision-making and behaviour is a complex process and is influenced by a considerable number of personal, farm specific and external variables. Researchers in the Edinburgh project concluded that future research should aim to obtain more key variables affecting farming behaviour, such as environmental and geographical factors and social interactions with the family, and that researchers should consider also different methodological approaches of farmer-decision making, such as obtaining longitudinal data so that farm business strategies could be studied over time and related to external events as well as attitudes, psychological and farm structural variables (Austin et al., 1998b).

Other concepts of farmer decision-making

A number of researchers refer to other aspects of farmer decision-making or conceptualise it in alternative ways using more qualitative and descriptive approaches. Psychological theory contributes the understanding that behaviour is determined by the perception of outside stimuli and events, rather than the events themselves. These perceptions are subjective, which explains the possibility of differences in behaviour between individuals in the same external situation. Ways of decision-making depend on the content and context of the decision. Utility maximisation is the most common rule for financial decisions, whereby the utility can be defined in different ways, such as high income, low debt, etc. Justifiability can be important if a farmer expects to have to defend a decision, for example to his children. In strategic decisions, the question of reversibility might also be quite important. For long-term decisions, where the future utility is difficult to assess, decisions might be taken on the basis of a '*narrative*', which represents the most consistent and conclusive mental reasoning process (Weber, 1994).

This idea of a narrative is also reflected in a finding that farmers construct a personal vision of their farm. This ideal farm existing in the imagination relates to the integrity of the whole farming system rather than individual enterprises. Farmers assess possible alternatives for enterprise management on how they would affect this vision (Bahner, 1995).

The recognition of the complexity of decision-making on farms and the limitation of developing models that explain adequately the long-term strategic decisions of farmers, as well as the lack of success with a largely normative and prescriptive approach in influencing farmer behaviour has leads to a return to more descriptive conceptualisation and qualitative tools which help to generate better understanding for the insights of decision-making. (Jacobsen, 1994), for example, proposed to distinguish two key phases of farmer decision-making: a phase of information and action in farmer decision-making.

In-depth interviews with Scottish farmers identified a considerable diversity between farmers regarding the processes underlying decision-making, from a lack of any formalised process to farmers preferring to have set out patterns of work well in advance (Sutherland et al., 1995). Two more recent studies (Gafsi, 1999; Öhlmer et al., 1998) of change in farming practice with respect to environmental management also describe different phases in the decision-making process. On the basis of 18 farm case studies, Öhlmer (1998) proposed four main phases: problem detection; problem definition (information search, identify options); analysis of alternatives and choice; and implementation. Gafsi (1999) studied changing farming practices in the catchment area of a water company. The change process on the farms lasted about 7 years and was divided into three phases of problem recognition; the gradual adaptation of proposed off-theshelf solutions to the specific farm situations, which included on farm experimentation; and the final phase of implementation. In Gafsi's study, the initiative for change originated from the water company, not the farmer, and a phase of initial awareness was not considered. Although no reference to the adoption/diffusion model was made, the phases are very similar to those in the adoption model, but use problem-oriented rather than innovation-oriented perspectives.

A different approach to study farmer decision-making is represented by the Dutch concept of '*farming styles*'. This conceptualises the relationship between diversity in attitudes and the interaction with farm management (van der Ploeg, 1994a,b). A range of physical and financial parameters from farm accounts were used to cluster farms styles that represent a 'cultural repertoire' of farmers. A style is a composite of normative and strategic ideas held by the farmer about farming, which influence farm management decisions, e.g. organisation of labour, the inter-linkages with markets, market agencies and government policy (van der Ploeg, 1994a; van der Ploeg, 1994b; Vanclay and Howden, 1997).

Among Dutch livestock farmers the following styles were identified (van der Ploeg, 1994b):

- Cowmen (good husbandry, lives with the cows);
- Greedy farmer (very profit orientated);
- Intensive farmer (uses all the newest inputs and quite a lot of them);
- Huge farmers (size is most important) ;
- Cow breeder (the farm is centred around breeding activities).

Diversity in farmers' management and decision-making was also studied in New Zealand using a similar approach, based on farmers' opinions (level of agreement to attitudinal statements). Among arable producers three distinct farm management styles were identified: the *dedicated producer*; the *flexible strategist* and the *lifestyler* (Fairweather and Keating, 1990). The authors emphasised that financially successful managers were found in all three categories.

Van der Ploeg (2000) highlights that farming styles also have relevance in terms of adaptation behaviour of farmers in relation to changing external circumstances and argues that a style of '*economic*' farming (low cost, low external input farming) may have particular potential for development, as it characterised by a high level of financial surplus (see below) per unit of end product, local innovativeness and higher input of labour.

Vanclay (1997) discusses the relevance of style to environmental decision-making in the case of the Australian Landcare movement. He argues that the failure to adopt environmental practices is not based on farmers' lack of consideration for the environment, but that from within a particular style, the choice of production practices is usually considered to be rational and is explained by attitudes of what is considered to be the right way of farming.

The role of information in decision-making and change process

The adoption/diffusion model considered the availability of information concerning an innovation as an important pre-condition for wider diffusion, but also for later stages of the decision-making process. Adoption researchers therefore studied the information sources of farmers in some detail (Buttel et al. 1990; Lionberger 1960).

Rogers (1983) differentiated between what he called 'hardware' and 'software' aspects of an innovation. With the term 'hardware' he referred to the necessary technology of an innovation, whereas under 'software' he understood information on how to use the technology, and evaluative information about its performance.

Using this classification organic farming would be a mainly 'software' based innovation and, similar to other low-input systems of agriculture, it has been described as information intensive (Lockeretz, 1991). Farming organically requires information so that biological and ecological processes on the farm can be managed effectively, for example by planning a diverse rotation with legumes for nitrogen fixation and elements to support preventive or indirect regulation of weeds, pests and diseases. The requirements for new inputs and new machinery ('hardware') are limited, although there may be some need for investment during the process of conversion, such as new weeding equipment or manure spreaders (Padel and Lampkin, 1994b).

The adoption/diffusion model suggests that the importance of the various sources of information differs according to the four stages of the adoption process (see Table 2-1). The mass media play an important role in raising peoples' awareness about an innovation, whereas information given to the individual by a close friend or an opinion leader was found to be more important for the actual decision to adopt (Lionberger, 1961).

Table 2-1 Rank order of information sources by stages in the adoption process

Awareness	*Evaluation*	*Trial*	*Adoption*
Mass media	Friends and neighbours	Friends and neighbours	Friends and neighbours
Friends and neighbours	Agricultural agencies	Agricultural agencies	Agricultural agencies
Agricultural agencies	Dealers and salesmen	Dealers and salesmen	Mass media
Dealers and salesmen	Mass media	Mass media	Dealers and salesmen

Source: Lionberger (1961)

The value of this is the reference to the four key stages of adoption, whereas farmers' preference and use of information sources in the decision-making phase also been subject of more recent research. For example, in the Edinburgh study Sutherland *et al.* (1995), information from the farming press was regarded as too general and hence not useful for actual decision-making, whereas farmers found any information from other farmers of greater interest because of their involvement in the same business. For important and financial decisions, farmers would usually consult with other members of the family, and for strategic business decisions frequently advisors or business consultants would also be used.

For environmental decision-making farmers also rely on a number of information sources and on other actors for support. However, the interactions with institutions and social networks has only recently become of greater interest to researchers in, for example, agricultural extension (1995 onwards), and a better understanding is considered important to develop effective support structures (Bager and Proost, 1997; Haug, 1999).

Vanclay (1997) related the concept of farming styles to the question of knowledge, by pointing out that each style or sub-style of farming refers to its own body of knowledge. It is therefore possible, but not further discussed by him, that different farming styles could also have preferences regarding the use of information sources.

There is also growing recognition that farmers do not use information uncritically, but evaluate it against their own knowledge and experience. Similar to what is described in the phase of trial and evaluation in the adoption model farmers also generate their own knowledge by hypothesising and experimentation (Vanclay, 1997). The farming systems Research and Extension Approach in particular has highlighted the important contribution that farmers make to the generation of knowledge (Chambers et al., 1989; Scoones and Thompson, 1994) and that indeed a two-way flow of knowledge and information needs to be considered.

Concluding remarks

This section has reviewed the contribution of a number of different agricultural disciplines to conceptualising the processes of farmers' decision-making and change. The adoption/diffusion model presented a largely descriptive model of four key stages of decision-making and demonstrated its relevance also to farmers' preferences for specific information sources. However, the main impact of the adoption/diffusion framework on research has been to stimulate the search for the determinants of adoption, i.e. for variables and mathematical models that allow the prediction of whether or not farmers are likely to adopt particular innovations. This approach largely ignores the dimension of the time in the processes of decision-making and change.

Because of the considerable number of variables that have been identified as influencing behaviour in principle (including farm structural, geographical, external and particularly attitudinal variables) particularly regarding long-term strategic choices, it can be concluded that farmer decision-making processes are fairly complex. There appears to be a need to use qualitative approaches and explore alternative concepts in studying processes of decision-making and change and their relationship to the use of knowledge and information, including case study research and longitudinal studies. Qualitative research approaches allow the study of a considerable number of subjective, personal and other variables (see Chapter 4).

Barriers to and motives for conversion to organic farming

Like many environmental management change processes on farms, conversion to organic farming represents a strategic or system change that affects the whole farm, as opposed to step or tactical changes in using practices or technologies affecting single enterprises. A number of studies of conversion have presented factors that appear to explain or influence the decision-making in favour of organic conversion. These are reviewed in this section, paying particular attention to issues that are related to the availability and use of information. The following section will look in greater detail at personal factors and attitudes of organic compared with conventional producers.

Conventional producers awareness of organic production

In a number of surveys of conventional producers, approximately one third expressed an interest in organic production in the future on all or parts of the farm (if they were not doing so already). In 1992, 38% of a total of 25,799 farmers said yes to the question "*Would you consider organic production?*" in a National Westminster Bank survey (Nat West, 1992). The highest interest was noted in Wales (45%), followed by Southern England (40%), Northern England (37%), Scotland (36%) and the Midlands (33%). Higher than average interest was shown by producers on smaller farms (below 50 ha), among dairy, beef and sheep producers and among farmers under 45 years old (NatWest, 1992). Similar percentages of 30 to 35% of conventional producers were found in surveys of horticultural producers in the UK (Burton et al., 1999), arable producers in New Zealand (Fairweather, 1999), and in a random sample of 247 farmers with different farm types in England (Midmore et al., 2001).

This is a higher percentage than the approximately 12% of farmers in England and Wales who have contacted the Organic Conversion Information Service (OCIS) since its launch in 1996 (SA, 2001a) and considerably higher than the number of producers who have actually taken up organic farming, currently about 2.0% of all agricultural producers in the UK (3.0% of land area) (Lampkin, 2001). This indicates that it is not just lack of awareness of organic farming that is the key barrier to conversion, but that there must be other important reasons why farmers are not converting.

By investigating conventional farmers' attitudes towards organic farming and conversion, such surveys have also contributed to a better understanding of potential barriers to organic conversion (Padel and Lampkin, 1994b). In order to understand the factors that may influence the conversion decision and change process, the following barriers are reviewed in more detail in the following sections:

- Lack of knowledge and information, including fear of weed, pest and disease problems, due to a lack of expertise in alternative control strategies;
- Financial risk and uncertainty associated with conversion, including yield variability and uncertainties about future demand, access to market outlets and the development of organic prices;
- Farm size and enterprise structure.

Earlier studies also identified social barriers to organic conversion, such as the negative image (hippie farmers) and the fear of becoming an outsider in the rural community (Blobaum, 1983; Fischer, 1982; Freyer et al., 1994; Wernick and Lockeretz, 1977). Later surveys make specific reference to an improvement in this respect (Maurer, 1997), although there is still anecdotal evidence of hostile peer pressure, particularly among farmers facing severe problems with their own systems.

Earlier studies, particularly from Canada and the USA, also make reference to institutional barriers, including difficulties with landlords, refusals of loans by banks, problems with insurance cover and difficulties with public agencies (Blobaum, 1983; Fisher, 1989; MacRae et al., 1989a; MacRae, 1990), but again these are less frequently mentioned in later European studies. These issues are considered further in the section on the process of conversion itself and information sources of organic producers.

Technical and information related barriers

Lack of information has been identified frequently as a barrier to organic conversion. Studies of conventional farmers' opinions about organic farming revealed, among other issues, their limited knowledge and their interest in more information (Agra-Europe, 1990; Chadwick and McGregor, 1991; Clarke, 1991; Fairweather, 1999; Midmore et al., 2001; Rantzau et al., 1990; Wynen, 1990).

In the Scottish survey of Chadwick (1991), farmers were confused with regards to the standards and missed independent information (from sources other than organic organisations) on the implications of conversion at the farm level. Arable producers questioned the sustainability of organic farming and dairy farmers were concerned about reductions in stocking rates and the seasonality of milk production (Chadwick and McGregor, 1991). Horticultural producers in the UK associated organic methods with higher production costs and a lack of marketing outlets (Burton et al., 1997b; Burton et al., 1999). Conventional and organic producers of various farm types mentioned uncertainties about strategies to control weeds, pests and diseases as a major obstacle to organic conversion, as well as the perception of lower profitability of organic systems (Midmore et al., 2001).

Technical uncertainties also feature in a number of international studies. The fear of weeds and other technical problems was one of the main reasons that deterred interested farmers in New Zealand from going ahead with organic conversion, as well as a lack of financial data on organic production (Fairweather, 1999). The author concluded that addressing these issues would help to overcome a major stumbling block for conventional producers and might result in higher rates of conversion in New Zealand. A sample of organic arable producers in the Netherlands also mentioned weed problems, soil fertility issues and the higher risk associated with yield variability as reasons for others not to convert (de Buck et al., 2001), some of which can also be related to lack of access to information. In Austria, the low uptake of organic farming methods was also attributed to a lack of technical know-how and information (Eder, 1998; Kirner and Schneeberger, 1999a; Kirner and Schneeberger, 1999b). No study focusing specifically on knowledge and information-related barriers among livestock producers was identified, but research with relevance to technical aspects of such farming systems is reviewed in the following chapter.

Financial barriers to conversion

Financial risk associated with organic conversion was identified as a barrier in two earlier surveys of conventional farmers in the UK (Beharrell and Crockett, 1992; Chadwick and McGregor, 1991). Reviewing a number of international studies, Padel and Lampkin (1994) concluded that conventional producers are afraid of yield reductions and crop failure and that converting producers found the conversion period costly and would not necessarily improve profitability in the long term (Padel and Lampkin, 1994b). MacRae *et al.* (1989a), in contrast, emphasised that the diversification associated with organic conversion should help to reduce the financial risks of farming. There are no known studies that have quantified whether the risk-reducing benefits of diversification in organic farming are outweighed by the possible risk-increasing effects of foregoing yield stabilising inputs such as crop protection chemicals.

Based on the limited available data, it appears that over the last decade the relative profitability of organic farming systems in Europe has improved. Offermann and Nieberg (2000) carried out an extensive review of comparative economic studies in Europe and concluded that, on average, organic farm incomes were higher than those achieved on similar conventional farms making for most producers the decision to convert financially attractive in the long term. Higher relative profits on organic arable and dairy farms, compared to horticultural and beef/sheep holdings, showed a clear impact of farm type. Organic farm income data for England and Wales show similar trends (Fowler et al., 2000). Such comparative data provides a potential guide to the financial outcome of the conversion process; studies relevant to livestock and dairy conversion are reviewed in Chapter 3. However, small sample sizes and substantial unexplained variation in all studies imply caution (Offermann and Nieberg, 2000) and the studies do not investigate the income development during the conversion process itself.

If perceptions of lower profitability are an important barrier to conversion, then better relative profits should lead to wider uptake of organic farming, which has indeed been observed in general terms (Padel et al., 1999). Although Offermann and Nieberg (2000) found higher profits on organic arable farms, compared with similar conventional farms, uptake of organic methods among arable producers has remained low in many European countries (Michelsen et al., 2001).

There are two possible explanations:

- The farmers concerned did not know about, or did not believe, the relatively better performance of the organic arable systems, or
- Other factors are important for their decision-making.

Fairweather's (1999) survey of organic and conventional producers in New Zealand supports both explanations. Most of those he interviewed had never seen any economic data for organic production, but several also quoted a range of other factors that prevented them from converting, including several financial (mortgage payments and time constraints), technical and other factors. The lack of financial information was also identified in several other surveys (see above).

An Austrian survey of barriers to a more widespread conversion also identified other economic-related concerns apart from profitability, such as the perceived higher labour demands of organic production, the lack of and uncertainty about organic marketing outlets and the constraints on future farm development arising from organic standards. Specifically, livestock farmers were concerned about the necessary investment in animal housing (Kirner and Schneeberger, 1999a; Kirner and Schneeberger, 1999b). Higher demand for manual labour and the implied financial risk was also considered to be a barrier to organic production for arable farmers in the Netherlands (de Buck et al., 2001) and in Switzerland (Maurer, 1997).

Financial support programmes for organic conversion and continued organic production have been introduced in individual countries since 1987 and under EC Regulation 2078/92 since 1993. The positive impact of these on growth rates of the organic sector across the EU confirms the importance of financial considerations for the conversion decision. The EC Reg. 2078/92 programmes were designed to meet some or all of the farmers' costs of conversion and in most countries (not in the UK) they also provided financial support for ongoing organic management. However, it is not possible to establish a clear relationship between financial support schemes and the growth of the organic sector in all EU countries. In some countries (e.g. Austria and Denmark), stagnation in sector development occurred despite ongoing support programmes occurred (Michelsen et al., 1999; Padel et al., 1999).

In an evaluation of EC Reg. 2078/92 agri-environment programmes, Loibl (1999) questioned 1000 farm households in approximately 20 sample regions across Europe in 1997 about their attitudes to organic farming and appropriate measures to encourage it, and found considerable differences between regions. In countries where organic farming had received publicity and conversion support as part of agricultural policy prior to or outside the EU agri-environment programme (Austria, Switzerland, Germany and Sweden), farmers were well able to express their attitudes to organic farming. In Spain and Portugal, producers were not aware about organic production, its principles and key differences to extensive production. In the UK and France, farmers saw organic farming largely as a niche activity. The author concluded that financial support should not just focus on production, but also on marketing initiatives (Loibl, 1999). From their results, it appears as if one important contribution of organic aid programmes may be raising the profile of organic farming in the farming community and reducing the perception of risk, as well as directly contributing to improved profitability.

Farm specific barriers

The NatWest (1992) survey found higher interest for organic farming on smaller farms. This corresponds with a historically lower than average size of organic compared with conventional holdings across the EU, and in several countries (Padel, 2001). It is argued elsewhere that the prevalence of smaller than average holdings in organic production may be a consequence of the high proportion of small horticultural units in the organic sector, farmed by producers with urban backgrounds and less likely to have the same inherited land and capital resources as established farming families (Padel and Lampkin, 1994b). However, it appears as if this situation may have reversed in the 1990s, when average sizes of organic farms became larger than for the conventional sector (Offermann and Nieberg, 2000; Padel, 2001), also in the UK. Despite this, the survey by Midmore *et al.* (2001) identified size to be a potentially limiting factor for the uptake of organic production in England.

Uptake of organic farming in Europe and in the UK has been notably higher on livestock farms and in grassland-based regions (SA, 2001a; Schneeberger *et al.*, 1997 1748; Schulze Pals, 1993). A number of surveys have identified organic conversion to be more likely on extensive and mixed farms, where it does not imply major restructuring of enterprises. This favours organic conversion more strongly in the less-intensive, mountainous regions, whereas the acceptance of organic methods in regions with more intensive arable, fruit and wine growing regions remains low (Kirner and Schneeberger, 1999a; Kirner and Schneeberger, 1999b; Loibl, 1999). Apart from the greater intensity and specialisation of production, however, this may also arise from concerns about the financial risk (the perceived risks of conversion are greater and the support payments are relatively less generous) (Lampkin et al., 1999), the technical feasibility of organic production and the lack of knowledge about alternative strategies for pest and diseases control.

Motivation for organic conversion

Farmers who have converted to organic production, despite the barriers identified, are the focus of this section. Motivations for organic conversion identified in research relate to farming and to personal concerns and fall into four broad categories: husbandry and financial motives, and general and personal concerns (see Table 2-2), which allows a tentative comparison of different studies, despite differences in the survey methods utilised.

Table 2-2 Motivations to convert to organic production

Farming-related motives	**Personal concerns**
Husbandry and technical animal health problems soil fertility and erosion problems	**Personal health** own and family health problems ergonomic reasons
Financial solve existing financial problems secure future of the farm cost saving premium marketing	**General** stewardship food quality conservation environmental rural development

Source: Padel (2001)

In the first economic survey of 70 organic farmers in England and Wales (Vine and Bateman, 1981), the farmers surveyed mentioned husbandry improvement (ca. 75% of respondents), concerns about food quality for humans and stock (38%), debt reduction (28%) and the risks associated with agro-chemicals (24%) as reasons for their decision to convert to organic production. Ten years later, in intensive interviews with 40 organic farmers and growers, Ashmole (1993) identified similar motivations, but environmental concerns were more dominant. Several farmers and growers mentioned the desire to go "*back to the land*". Also Burton *et al.* (1997b) found non-economic aspects dominant in the decision to go organic in a sample of 151 conventional and 86 organic horticultural producers. In the only UK study of factors influencing organic producers reverting to conventional, Rigby *et al.* (2000) identified that those who mentioned cost cutting as the main motive for conversion were more likely to revert than the control group, whereas those that mentioned consumer health or the image of agriculture as the main reason were more likely to remain organic.

The international literature shows a change in the motivations to convert over time. In earlier studies, the husbandry and technical concerns were mentioned more frequently, whereas in later studies financial reasons appear more dominant. Between one third and more than half of farmers mentioned problems with their conventional farming system, for example in the area of animal health or soil erosion (e.g.Wernick and Lockeretz, 1977) or general concerns about food quality and environmental issues (Svensson, 1991). Financial issues are also mentioned in earlier studies, such as attempts to solve existing problems, cost savings on inputs and the desire to secure the long-term existence of the farm, but these are generally mentioned by smaller proportion of the sample and/or in connection with other motives (Brighton et al., 1988; Conacher and Conacher, 1982; Fisher, 1989; Lockeretz and Madden, 1987; MacRae et al., 1990; Svensson, 1991; Vogtmann et al., 1993; Wynen, 1990).

In later studies the incentive to sell for a premium and seeing organic farming as a way to cut costs are more frequently mentioned (e.g.Duram, 1999; Maurer, 1997). In the less intensive regions of Switzerland, direct aid payments and environmental reasons were important for conversion and the improved social acceptance of organic farming was noted (Maurer, 1997). A Finnish survey of 1300 organic farmers (approx. 30% of all organic farmers in the country) in 1998 identified environmental considerations as the main reason for conversion, but economic reasons were second most important for converting and conversion support was crucial for making the decision (Kallio, 1997). A larger survey of 577 Danish organic producers found the prospect of higher incomes to be main reason for organic conversion for more than 50% of the respondents (Noe, 1999, personal communication; Michelsen, 1999, personal communication). Farmers in later surveys also mentioned husbandry-related motives, but the emphasis shifted from problem-solving in conventional systems to seeing organic conversion as a professional challenge (de Buck et al., 2001; Duram, 1999; Maurer, 1997).

Early studies of organic producers reported a lack of social acceptance as a consequence of conversion, particularly among farmers with close links to their rural community (Fischer, 1982; Kramer, 1984; Wernick and Lockeretz, 1977), but later studies regarded this point as less important (e.g. Lockeretz and Madden, 1987; Maurer, 1997). This may be a reflection of increased emphasis on the husbandry aspects of organic production in the literature, compared with a more ideological focus previously. Direct experience of organic production in the neighbourhood or directly on the farm was important for the farmers' likelihood seriously to consider organic farming, which could also be an indication of improved access to knowledge from those organic farms in the neighbourhood.

In the international studies, farm-business related motives become more important in later studies, whereas technical problems with conventional farming systems and personal or religious concerns are less frequently mentioned. 'New' organic farmers appear interested in it for economic and environmental reasons, and increasingly see organic farming as a professional challenge, whereas the change of personal lifestyle is less important to them.

More recent studies in the UK show the presence of technical as well as financial motives for organic conversion, but also a strong dominance of lifestyle-related goals, particularly among horticultural producers (Burton et al., 1999). With the help of factor analysis of a survey of 122 organic producers in Scotland, McEachern and Willock (2000) identified *naturalness, market demand* and *policy* factors as important for the conversion decision, because producers were more strongly inclined to agree with statements regarding these areas than with other statements. The broad trend towards more financial motives for organic conversion was confirmed by a survey of organic and non-organic producers in the UK (Midmore *et al.*, 2001).

Although the direct comparison of survey results with results obtained by different methods is problematic, there appears to be a trend in the international literature towards greater importance of financial motives for organic conversion in more recent studies, although non-financial aspects also feature strongly. This may be related to the improved relative performance of organic farming systems, including the wider availability of organic aid and better-developed markets.

However, this trend is not confirmed by all recent surveys in the UK. For example Burton *et al.*'s (1999) survey found strong emphasis on lifestyle, but covered only horticultural producers. This raises the question whether farm type and attitudes are somehow related, or more specifically whether new entrants from non-farming backgrounds are more likely to choose particular farm types, and whether some of the changes in motivations identified arise from an increased preponderance of established farmers converting. However, as non-financial goals remain important for the conversion decision, at least for some producers, it is necessary to study the system with a broad perspective (Burton et al., 1997b) and in the context of the objectives for which it was set up. No studies specifically address the issue whether farmers' motives change as they progress through the conversion period (see also 2.4.3).

Conclusions

This review of conventional farmers' attitudes and organic producers' motives to organic conversion reveals a number of factors that are likely to influence the conversion decision.

The reviews show that lack of information was and remains an important barrier to organic conversion, which was referred to by Clarke (1991) as the 'fear of the unknown'. Uncertainty and lack of information were found in the following areas:

- Technical aspects of organic production, such as weed and pest control strategies and yield development;
- Organic standards' requirements;
- Relative profitability of organic farming compared with conventional;
- Costs of conversion.

A lack of information is also likely to contribute to false perceptions of technical and financial risk associated with organic conversion. The need to consider the availability of financial information was also confirmed by the review of financial and economic barriers.

The review of barriers and motives also highlights other financial and non-financial factors that appear to influence the conversion decision and change process:

- Organic support payments (although not available in the UK when this study began)
- Yield variability
- Resource use constraints (mortgage payments and labour demand)
- Perceptions of relative profitability and future market development
- Farm size (smaller farms more likely to take up conversion)
- Farm type and enterprise structure (with conversion more likely on mixed and low intensity farms).
- Social and institutional contexts (although less important in later surveys)

The impact of conversion on production related and financial factor is reviewed in the Chapter 3. The review also highlights considerably variety in motivation for organic conversion. There therefore appears to be a need to consider individual systems in their own contexts, i.e. the specific reasons for the conversion on a farm and the personal and farming-related goals of the farmer and review of the literature of these areas is the focus of the next section, whereas the farming-related factors specific to livestock producers are covered in the next chapter.

Personal variables influencing the conversion process

The review of models of farmers' decision-making illustrated the importance of personal factors for decision-making and change. For example, research based on the adoption model was concerned with the 'innovativeness' of producers in relation to personal characteristics, such as age and education. More recently the importance of attitudes, particularly for decisions related to the environment, was established. In the following section, the personal characteristics of organic producers that have been studied and found to influence the conversion process are examined.

Personal characteristics of organic producers

Among organic producers, a high proportion of people with urban backgrounds was found in a number of studies, as well as high levels of general academic education, below average age and low levels of farming experience (Burton et al., 1997b; Duram, 1999; Harris et al., 1980; Henning et al., 1991; Lockeretz, 1997; Murphy, 1992; Tovey, 1997; Vartdal, 1993; Vogtmann et al., 1993). (Richter, 1990) concluded that urban people might in some ways be better prepared for the challenges of conversion, because they are less dependent on acceptance in the rural community and have a different social support structure. However, farmers with urban backgrounds are less likely to have the same natural and capital resources or farming experience as more traditional farmers.

There is some evidence that gender is a factor in farmers' attitudes towards organic production. On several of the 100 organic farms where the motives to go organic were studied in a qualitative social study in Switzerland (Fischer, 1982), the initial 'organic' idea came from the female partner. Organic methods were tried at first in the vegetable garden, which is traditionally the woman's domain, before they were introduced on the whole farm (Dettmer, 1986; Fischer, 1982; Fisher, 1989). Women's influence is also likely to be important where reasons of family health are cited, as traditionally it is the woman's role to look after nutrition and health of the family.

Burton *et al.* (1997), in their survey of British organic and conventional horticultural producers, also found a higher proportion of female growers in the organic compared to the conventional group. Logit analysis of the survey data confirmed a higher probability for conversion if the farmer was female, alongside other factors including concern about the environment, membership of an environmental organisation, obtaining information mainly from other farmers, aiming for higher self-sufficiency and a belief that organic farming could satisfy society's need for food and fibre (Burton et al., 1997a; Burton et al., 1999). Furthermore, level of education, the proportion of income from agriculture and beliefs about the effect of farm size on the environment were considered as explanatory variables, but were not confirmed in the statistical analysis. In a later study, the same team identified age, education and gender as factors that may influence reversion to conventional methods (Rigby and Young, 2000).

Lockeretz (1997) could not confirm any relationship between different production practices and a number of variables, including education, background, gender, age, years in farming and reasons for farming organically, within a sample of 43 certified organic growers in the north-eastern US in which he found considerable variation. He concluded that other variables might be more important in explaining different choices in production practices, such as personal attitudes to nature conservation.

Attitudes of organic and conventional producers

A comparative survey of 42 organic and 43 conventional producers in England showed similar levels of agreement to statements about economic aspects of organic production, but unlike conventional producers the organic farmers believed that organic food tastes better, is healthier and better for the environment and that the security of food supplies is not negatively affected through organic farming (Beharrell and Crockett, 1992).

Similarly, interviews with 15 conventional and organic producers in Michigan in 1991 found both groups sharing concerns for the economic situation of farming, but the organic farmers reported a significantly greater concern for long-term sustainability and a greater willingness to incur risk at present in favour of future benefits (McCann et al., 1997). In a Swiss survey, all farmers saw the economic future of farming as relatively bleak, regardless of whether or not they seriously considered organic farming in the near future (Maurer, 1997).

A study in Colorado found eight mainly attitudinal characteristics important for organic producers' decision-making. These were related to diversity, challenge, change, overcoming obstacles, stewardship of the land, the farming business, and towards a regional movement of radical environmentalists as well as the personal characteristic of the absence of formal agricultural training (Duram, 1999).

Fairweather (1999) studied the reasoning behind conversion-related decision-making of organic and conventional producers in two regions of New Zealand, using ethnographic decision-tree modelling. Those that had adopted organic farming were attracted by similar motives as mentioned above, such as the underlying philosophy, consumer preference for organic produce, personal illness, higher organic prices and problems experienced with the conventional system. However, a number of conventional producers also agreed with the same attitude statements. Furthermore, there was some variation among the organic group and Fairweather and Cambell (1996) proposed a distinction between 'committed' and 'pragmatic' organic producers.

The conventional producers had other reasons for not taking up organic methods, such as uncertainty about the technical and economic feasibility on their particular holding. Fairweather concluded that a diversity in attitudes exist in both groups. He suggested to differentiate between constraints related to farmers' attitudes and those related to farm resources. Those related to personal attitudes could be addressed through well-targeted information campaigns, as many conventional producers had not actively rejected organic production, but rather had never really considered it. Constraints related to resources would change with any variation in internal or external circumstances.

The results confirm that attitudinal differences between organic and conventional producers have been found which may influence the conversion-decision, although the explanatory value of them for the propensity to convert may have been overstated. Both groups share many of the views that they hold, for example, about the financial aspects of farming, but differ in other areas, such as belief in the potential of organic farming. There is considerable attitudinal variation in both groups, and the differences between them appear to be of gradual rather than of principal in nature. It also appears to be possible to differentiate between attitudes in relation to external (objective) factors and those that are of a more subjective, personal nature. Change in the latter category could lead to a farmer converting his holding whereas change in the former are more likely to be triggered by changes of farm specific or external circumstances.

Farming styles among organic and converting producers

Farming styles research uses a combination of quantitative (account derived) and qualitative data (van der Ploeg, 1994b; van der Ploeg, 2000) to identify groups of farmers that share values and attitudes and show similar behaviour (see also 2.2.3). The concept of styles refers to the heterogeneity among farmers in terms of personal and business-related goals and values, which influence their use of inputs and technology, as well as their relationship with marketing and agricultural agencies. Of relevance to the organic conversion process is the question of whether farmers of a particular style are more likely to convert than others and whether there is variation in styles also among the organic producers.

This was partly attempted by Noe (1999) who studied value orientation among organic and conventional dairy producers in Denmark. He found two pairs of opposing values: a) *craft* and *business*; and b) *turnover* and *economy*. From this he identified three distinct styles: *craftsmen*; *businessmen* and *entrepreneurs*, and found organic farmers to be represented in all three categories. This contradicts the idea that farmers of a particular style are more likely to convert and confirms that the differences between organic and conventional producers are gradual rather than distinct. However, no other studies using the concept of styles in determining the likelihood of organic conversion have been identified.

The diversity in attitudes and behaviour among organic producers has also been established in other studies. Vartdahl (1993) for example made reference to the categorisation of farmers in adoption research, but used different variables. She proposed three different categories of organic farmers: *Anthroposophists*, *Ecosophists* and *Reformists*. The *Anthroposophists* were influenced by bio-dynamic agriculture and Rudolf Steiner, with a very strong commitment to their ideas and were seen as Innovators. Farmers in the second group of *Ecosophists* were motivated by green ideas, they saw themselves as part of the environmental and back-to-the-land movement and Vartdal (1993) argued that they showed some similarities to Early Adopters. In both theses categories a non farming background was widespread. The *Reformists* were described as 'normal' farmers with a pragmatic approach to organic agriculture and were seen as corresponding to the Early Majority in the adoption model (Vartdal, 1993). This confirms the variety of values, and also potentially attitudes, among organic producers in relation to the timing of their conversion. The results also confirm the relevance of the adoption model to questions of organic conversion. However, some of Vartdal's results seem to suggest that the *Reformists* also correspond to the Early Adopters category of the model, whereas the two other groups would fall into the category of Innovators, and the category Early Majority would not be represented.

Ramsden and Rodgers (1999), in a postal survey of 59 organic producers in the UK, found a differentiation in attitudes of organic producers to marketing. For the majority, direct marketing was the main outlet, but a large proportion of the sample (81%) used more than one marketing channel; five producers supplied supermarkets. The authors detected a difference in attitude between the supermarket users and other producers, with the former group characterised as more *business-oriented*, whereas the non-supermarket users were concerned about their loss of independence and the lack of compatibility of the supermarket outlet with the organic farming ethos.

A similar categorisation of *low-input* and *market-orientation* was also found by (Peters, 1997) among German organic producers that converted under the 1989 conversion aid programme. In a comparison of organic producers in France and Scotland by (Marshall, 1999), differences were also found: economic considerations were the main motive for the five Scottish producers, whereas the interviewees in France were attracted by the values of organic farming.

It can be concluded that there is limited research on whether a particular farming style is more likely to convert to organic production. A diversity of styles has been confirmed among organic producers, which is likely further to increase with the growing number of organic producers and established farmers converting. The research on styles of organic producers is based only on attitudinal surveys and has not been related to the outcome of the decision-making process in any other way. The relationship between different styles of organic production and the use of information has not been explored.

Conclusions

On the basis of this review of research on personal characteristics of organic compared to conventional producers, a number of variables that may potentially influence the conversion process can be identified:

- **Background** and **age**: Urban people, people with limited farming experience and young farmers are more likely to farm organically.
- **Social network:** Organic farmers are more likely to have different social support structures than the village or local rural community.
- **Gender:** Female farmers are more likely to convert and may try organic methods in the vegetable garden.

However, several studies highlighted that personal variables alone could not satisfactorily explain differences in farming practice between organic and conventional producers, or within groups of organic producers. Differences in attitudes between organic and conventional producers, and therefore of possible significance for the conversion decision, were found in the following areas:

- Concerns about the environment;
- Attitude to self-sufficiency and business;
- Belief in organic farming;
- Flexible attitude to challenge, change and overcoming obstacles.

It appears as if personal attitudes alone do not satisfactorily explain the conversion-decision and that attitudinal differences between organic and conventional producers may have been overstated. The review shows that both groups of farmers have similar attitudes in some areas related to external factors of farming, such as the economic future of farming. Organic and conventional producers appear to represent different points on an attitudinal scale (between extremely 'organic' and 'conventional') rather than fundamentally different groups.

Attitudinal differences were also found between various organic producers, who cannot therefore be regarded as one homogeneous group. These are likely to influence management and the choice of farming practices, but this link in relation to the conversion process itself has not been investigated. Such a link is likely also to have implications for the information requirements of converting farmers.

The process of organic conversion

The previous two sections were concerned with factors that appear to have some influence on the organic conversion process. However, as the review of concepts of change and farmer decision-making highlighted, it is also necessary to conceptualise the change process itself including the role of information. This section discusses some of the findings of surveys of organic and conventional producers reviewed above, in the context of the stages of the farm level adoption process (see 2.2.1), and reviews the very few attempts that have been made to conceptualise the organic conversion process or particular aspects of it, including conversion strategies and the role of information and conversion planning in the change process.

Applying the stages of adoption to the organic conversion process

The adoption/diffusion model structures the farm-level adoption decision into the four stages of awareness, information gathering, and adoption on a trial basis and final adoption and considers information, albeit from different sources, to be important for all these stages. The following section discusses the organic conversion decision in the context of these stages.

The information-related barriers identified in various studies (e.g. Chadwick and McGregor, 1991; Burton *et al.*, 1999; Midmore *et al.*, 2001) show that many conventional producers are not very well informed about organic farming and would like more information about technical and economic feasibility. For example, Fairweather (1999) summarised the main reasons why farmers do not convert as a lack of awareness of the potential and concerns about technical and economic feasibility of the system. This would confirm that a stage of awareness and information resulting in general acceptance of organic farming is very important in the conversion process.

As far as 'adoption on a trial basis' is concerned, the situation is less clear. Farmers have been reported to experiment with organic farming by trying it in the vegetable garden (Fischer, 1982; Fisher, 1989), or by converting a small section of the holding to gain some experiences (Lampkin, 1993). Conventional farmers have also indicated their willingness to try organic farming on parts of their farm (Clarke, 1991; NatWest, 1992), which would suggest that this phase is also important for conversion-related decision-making. However, it is not clear how livestock farmers in particular can 'experiment' with organic production. Because conversion to organic farming represents a complex systems change with various interactions between different enterprises, it is not so easy to try organic farming on small parts of the farm. For example, growing a crop organically on just one field, without the context of a fertility-building rotation, is likely to lead to crop failure. Most organic Standards therefore do not allow certification of individual fields (also because it is difficult and time-consuming to carry out inspection of such small units), although designated larger parts of a farm can be certified in the UK (UKROFS, 2001). Small-scale experiments with organic methods are therefore not likely to show the potential of organic management for a farm, as crucial elements of the system (such as a full rotation, marketing of organic products) are missing. It therefore appears important to study whether and how such trials take place and how important this phase is for the organic conversion process.

The three broad stages of the adoption model of awareness and information-gathering, adoption on a trial basis and full adoption, appear helpful in distinguishing key stages of the conversion process. From a problem-oriented perspective, Öhlmer *et al.* (1998) proposed very similar phases of problem detection and definition, analysis of alternatives and choice, and implementation. The distinction between information gathering and action that was proposed by Jacobsen (1994) appears to illustrate different functions in the decision-making process, rather than key stages, and the interplay between these two functions of decision-making and action is particularly interesting in the second phase of trial and evaluation. The outcome of the action may provide further insights to the farmer, alongside information obtained from external sources.

Conversion strategies

Conversion strategy refers to the sequence of the process of changing enterprises on a farm, particularly the land. From the literature, two broad strategies can be identified: a 'staged' approach whereby the conversion of fields and livestock enterprises is spread over a longer period of time; and 'single-step' or 'crash' conversions, whereby the whole farm is converted at the same time.

The desire to spread capital investments, risk and to restrict learning costs during conversion, especially the costs of mistakes made with new enterprises or new production practices, is a major reason why many farmers traditionally adopted the 'staged' approach to conversion (Lampkin, 1990). In addition, fields can be transferred into organic management with a fertility-building legume crop. In the first couple of years, only a small area of land is converted. During this time, experience can be gained with the costs and risks carried by the remainder of the farm still under conventional management. Once the implications of organic management are better understood, and confidence has been gained, the remainder of the farm may be converted more rapidly.

Converting the whole farm in one step can have the advantage that the farm can get access to premium prices sooner, which may be particularly attractive for livestock producers. However, it also means that the learning costs, capital investments and risks are concentrated into a short period of time and rotational disadvantages might arise. The farm business needs to have sufficient financial flexibility to absorb the costs, but this approach may be appropriate where a new business is being established and there is no established system to provide a 'cushion' anyway (Padel and Lampkin, 1994b), or where the reward from early access to premiums outweighs the other considerations. In Germany, 'single-step' conversion is obligatory under certification and organic aid programme rules (for more details, see Lampkin *et al.*, 1999).

Both strategies are represented among converting farmers in the UK, the predominant choice historically appearing to be staged conversion (Lampkin, 1993), although more recently, with the availability of financial support for conversion and strong market demand, single-step conversions have become more common. In contrast, Vartdal's (1993) survey of converting producers in Norway found that later adopters were more likely to choose gradual conversion whereas the early organic farmer usually converted the whole farm at once. However, more research is needed to determine what factors influence the farmer's choice of a specific conversion strategy and to explore the potential relationship to stages of the adoption process.

The interplay between attitudes and experiences

The framework of the adoption model highlights the potentially interesting interplay between decision-making and action in the second phase of trial and evaluation. Reference to this was also found in the decision-making literature indicating that the relationship between attitudes and behaviour may be bi-directional, whereby the later can influence the former and *vice versa* (Willock *et al.*, 1999). The following section explores whether experiences encountered during the conversion process may have contributed to changes in farmers' attitudes.

"Conversion begins in the head" said a farmer on an introductory organic farming course. He experienced the process not so much as a technical or economic problem, but rather as a process that began with a change of his own attitudes. Similar statements of organic farmers are also found in other studies. Ashmole (1993) refers to 'really organic' people, those who work according to the principles laid down in the Standards, rather than applying them just as a rulebook. She quoted one farmer saying: *'… it has to be a way of life'*. De Buck *et al.* (2001) argued that strong belief remains a necessary pre-condition for arable farmers in the Netherlands to convert to organic farming.

It is easy to conclude from such statements that personal attitudes determine the likelihood of conversion. However, the farmers interviewed would have answered on the basis of where they stood at the time of interview. They may not fully remember whether they had the same views when they started the process.

Canadian researchers captured the potential for the conversion process to influence farmers' attitudes using a simple, three-stage model (MacRae et al., 1989a; MacRae et al., 1990):

1) Increased efficiency of the conventional system
2) Substitution, where certain inputs are replaced by biological ones
3) Redesign, where a new system is established.

Changes at a particular level are seen as the result of experiences in the previous stage. Farmers converting to more sustainable practices begin with the aim of improving the efficiency of their current (usually conventional) management system. If this does not lead to the desired effects they substitute certain inputs with less harmful or biological inputs, but without major change to the farming system. At this stage the experience will frequently be negative, because the withdrawal of inputs without alternatives will lead to crop failure, unless unnecessary amounts of inputs were used before. This negative experience then leads the farmer towards a fundamental re-think or re-design of their whole farming system.

Based on this model, it appears likely that the organic conversion process is not only influenced by the farmer's attitudes, but that the relationship may also go the other way, i.e. that the experience of implementing the system influences the farmer's attitude. As well as having a different attitude converting farmers could develop a more 'organic' attitude as a result of the conversion process, which limits the explanatory power of post-conversion attitudinal variables as determinants of adoption.

Information sources of organic farmers

Organic and converting farmers in early studies in other countries were found to be using specialist publications, books and magazines, friends and neighbours, and other organic farmers as information sources (Fisher, 1989; Madden *et al.*, 1984; Wernick and Lockeretz, 1977), relying less on traditional extension agents (Blobaum, 1983), but no study addressing this issue in the UK could be identified. These information sources are similar to those reported in the context of adoption research, apart from the reduced reliance on agricultural extension agencies and general farming publications. This is not surprising, as at the time of these surveys no specialist advisory support for organic producers existed in most countries. Farmers were also sceptical as to whether they could receive reliable information adapted to organic systems from more traditional sources (Fersterer and Gruber, 1998; Gengenbach, 1996).

A Norwegian study illustrates the potential role that '*narratives'* may have for the conversion decision in referring to one arable farmer who talked about the importance of his vision of an 'ideal organic farm' in steering him through the conversion process (Østergaard, 1996).

Very few studies have evaluated professional organic advisory services. In one early study the advisors were seen as lacking knowledge and experience (Berg, 1989), but later studies found more consistent client satisfaction when farmers used specialist organic advisory and information services (ADAS, 1997; Hamm et al., 1996). Burton even concluded from this that the likelihood of organic conversion in the UK increased with the establishment of the Organic Advisory Service at Elm Farm Research Centre (Burton et al., 1997b).

However, in most surveys other organic farmers were found to be the most important source of information for converting and organic producers, even where alternatives existed (Luley, 1996). Burton *et al.* (1999) used the preference for farmers as an information source as an explanatory variable for the likelihood of conversion, but it can be argued that this variable is more likely to represent an effect rather than a cause of conversion. For example Wynen (1990) found that the importance of organic farmers as an information source for Australian farmers increased as the conversion progressed, but she does not go into detail as to what sources of information and support farmers were using at the beginning of their conversion process.

This gives an indication that during the conversion process, like in the phases of the adoption decision, the importance of information sources changes. However, not enough research exists in the UK to establish a clear rank order of the different sources of information and advice in relation to key phases of the decision-making and change process. The increasing importance of organic farmers as information sources during the conversion process raises the interesting question of what sources of information farmers use before they embark on conversion, but this would need to be subject of a different study.

Conversion planning

Planning the conversion should help to assess the feasibility of a proposed conversion and guide the farmer through the difficulties of it by helping to identify potential problems in advance, for example in relation to resource constraints, financial returns and cash flow. Conversion planning could also make an important contribution to assessing the feasibility of the conversion during the trial and evaluation phase of decision-making.

Techniques for conversion planning were first developed in Germany and Switzerland as student projects during the early 1980s (reviewed in Lampkin, 1993) and were subsequently adopted by organic farming advisors, including organic advisors in the United Kingdom. Conversion planning also formed part of case study research of the conversion process by Freyer (1991) and Lampkin (1993).

Like other whole farm planning methods, the technique involves (Measures, 1990; Padel, 1988; Padel and Lampkin, 1994b; Schmid, 1987):

- An assessment of the current situation of the farm,
- The development of a 'target' organic endpoint, and
- A strategy for moving from the current situation to the target.

The assessment of the current farming system and management provides an opportunity for identifying the personal and resource limitations that might be faced during the conversion (Schmid, 1987).

The next step, the planning of the organic target or endpoint, requires in the first instance, the setting individual of goals for the conversion process of the specific farm, in line with personal and farming objectives, farm resources and marketing opportunities and preferences. This is very important for a successful conversion and should ideally involve everybody on the farm (Rantzau et al., 1990). Planning the target further requires the development of appropriate cropping and stocking plans, and the testing of the technical and financial feasibility of the proposed production activities. A Norwegian study illustrates the potential role that the organic target may have in referring to one arable farmer who talked about the importance of his vision of an 'ideal organic farm' in steering him through the conversion process (Østergaard, 1996). This appears to be similar to psychological rule of making decisions on the basis of '*narrative'* (see 2.2.3).

The planning of the transition from the current to the target system has to take into consideration the conversion strategy, i.e. staged or single-step conversion, extent of crop and livestock enterprises, the timing of changes, major soil improvements, changes in land and labour resources and capital investments.

A full conversion plan therefore would imply a multi-period analysis of financial and physical aspects of the whole farm. The plan should also include guidance on how to enhance the animal welfare, environmental and nature conservation characteristics of the farm. Financial aspects, in particular cash flow during the transition phase, also need to be considered. Effective planning of the transition phase requires linkages between years and, ideally, re-planning during the conversion period to accommodate deviations from the original plan.

Conversion planning has frequently been suggested as a strategy to reduce the risk of conversion (Freyer, 1991; MacRae et al., 1989b; Padel, 1988; Rantzau et al., 1990; Wynen, 1992). Wynen (1992) quotes an anonymous farmer as saying: *"If you fail to plan, you plan to fail"*. Yet in surveys of converting farms in Germany and Norway there was very little planning of the process (Løes, 1992; Vogtmann et al., 1993). More than 30% of the Norwegian organic farmers surveyed by Løes (1992) considered lack of planning as one reason for later problems with weeds and labour requirements during conversion, but reasons why farmers did not plan the conversion were not explored.

At the time when the current research began, the Organic Advisory Service at Elm Farm Research Centre offered conversion planning following the guidelines to interested producers. It was one aim of this research to investigate whether and when the converting farmers were using this service and how they perceived its benefits, or whether other forms of planning had been carried out.

Conclusions

It can be concluded that the key stages of the farm-level adoption decision appear to describe the conversion process reasonably well, in contrast to the more simple distinction between decision-making and action that was proposed as an alternative. In the following section a similar model of key stages that guided the empirical research will be outlined, as well as a listing of variables that appear to influence conversion.

It can also be concluded that a process of attitudinal change may go hand in hand with the process of changing farming practices, raising questions as to whether post-conversion attitudes can be used as determinant variables for the decision to convert.

Implications for the research

The main aim of the review of mainly the social science literature on organic conversion in this chapter was to explore existing concepts of researching change processes on farms and to develop a framework of influencing variables and of the process itself, and to raise specific questions for the empirical research.

Variables

Conversion is influenced by, and in turn influences, a range of personal, farm specific and external variables. The complexity of variables and processes represents a challenge, not only to the farmer facing a difficult period of change and adjustment, but also to researcher who wants to understand it.

Research on farmer decision-making and organic conversion has looked at both the determinants and the outcome of the process. From this a number of possible variables that are likely to be important for conversion to organic farming can be derived. These are summarised in Table 2-3, using three categories of Personal, Farm and External variables, effectively sub-dividing the two categories of external and internal variables that were used by Willock (1994).

Table 2-3 Factors influencing the decision to convert to organic farming

Personal	*Farm*	*External*
Personal characteristic	**Farm resources**	**Relative profitability**
Background	Farm size	Conversion aid programmes
Age	Farm type	Organic market outlets
Social network	Enterprise structure	Organic premiums
Gender	Capital resources	Input & output prices
Goals, objectives, values	Labour resources	Subsidies
Lifestyle and health		**Institutional factors**
Organic farming knowledge		Availability of information
Technical		Farming press
Profitability		Research
Market development		Advisory support
Personal attitudes		Loans
To the environment		
To inputs & technology		
To business		
To challenge and change		

Source: Own summary of the basis of various studies

At the time this research began in 1993, a large number of the personal variables were poorly understood. Recent research has improved the awareness of attitudinal variables in decision-making, but the exact mechanism and cause and effect relationships remain not fully understood. Psychological and sociological theories of behaviour highlights that external factors do not influence the decision-making directly, but through the farmer's perception of them, which may be mediated by personal values. Research has further indicated interdependence between behaviour and attitudes, where attitudes may also be influenced by behaviour and not only *vice versa* (e.g. Willock et al., 1999). This makes it problematic to clearly distinguish between determining and dependent variables in the decision-making process and interactions between the personal and farm specific variables during the process may occur.

Whether or not a farmer decides to convert to organic production could be seen as a result of a specific combination or personal, farm related and external circumstances. Changes in any one of the three categories could therefore potentially trigger a farm conversion, i.e. determinant variables are found in all three categories. This implies that the change process could potentially be reversed, which indeed has been observed in Austria (see Kirner et al, 1999a,b). However, the focus of the empirical research were variable that are influenced by and in turn influence the conversion process itself, with the aim to establish information requirements of converting farmers was mainly the process of conversion and the determining were only of minor interest.

The next chapter will focus more strongly on farm-specific variables through a review of the literature on physical and financial aspects of organic livestock systems, in order to develop an idea of how these are likely to be influenced by the conversion process itself.

Stages of the conversion process

The literature review highlighted that existing concepts of the process of change over time are largely descriptive, using key stages and highlighting the important functions in decision-making and implementation.

An amended version of the phases of decision-making at the farm level in the adoption model is proposed as the basis for the empirical research. As awareness about organic farming appears to be present among the majority of farmers, the first important phase to consider is that of information gathering, which is followed by a phase of trial and evaluation, resulting in making the decision to convert and full adoption. Following the suggestions of Dabbert (1994), the endpoint (stable organic system), rather than the adoption decision itself, has been added, as the process that follows after the decision to convert has been made, is considered to be different from the eventually resulting organic farming system.

The importance of the first phase of *Information gathering* for the conversion has been confirmed by a number of larger surveys of attitudes of conventional producers, which come to the conclusion that a lack of technical and economic information remains an important barrier. This was still the case in the most recent survey in the UK that was carried out by Midmore, Padel et al. (2001).

Less research has focused on the second phase of *Trial and evaluation*, which was a particular interest in this study, concerned as it is with the role of information requirements and support during the conversion process. The systemic character of organic farming and the reliance on biological and ecological processes implies that small-scale experimentation may not show the system's full potential. This leads to specific questions such as whether and how a livestock producer could experiment with organic farming for the purpose of evaluation.

These phases highlight different functions of the decision-making process: consideration or problem recognition, evaluation (either experimentally, on single fields or theoretically through planning), and decision-making and implementation. The process also involves specific actions that have to take place, e.g. the minimum conversion time for land leading to enterprise certification. It may also involve other actions, such as planning, adjustment of the whole farm structure and leads (hopefully) to the establishment of a stable organic system for the whole farm, the products of which can be marketed at a premium. The order of the functions and actions within the phases is, however, less clear.

Not very well understood, in the context of this phase, is why specific farmers choose particular conversion strategies. Staged conversion is assumed to allow gradual learning and hence spread the risk of conversion, once the decision has been made. However, the cited benefit of this strategy of time for learning indicates a relationship between evaluation and the trial phase. The strategy does allow the farmer to gradually gain personal experience whilst avoiding some of the problems of small-scale experimentation.

The literature also suggests that conversion planning could play a role in evaluating the feasibility of a conversion as well as reducing its risk. However, it is believed that a large proportion of producers are in fact not planning the conversion. The question therefore arises whether and how the dairy producers studied were planning conversion, and whether this played any role in evaluating the options.

The final phase *Adoption* appears necessary as during conversion a farm have to reduce the reliance on external inputs and increase the management of biological and ecological processes and the process of conversion is, in several ways, considered to be different from the management of established organic systems.

Adoption research suggests the importance of information for all phases of decision-making. Following Roger's (1983) terminology, organic farming can be considered to be a 'software' innovation consisting mainly of information rather than of new technology. In this context, similar if not greater importance of information then for the wider diffusion of other input or technical innovations could be expected. This has been confirmed by a number of surveys for the initial awareness phase. The literature gives some indication of the changing importance of different information sources during the phases of the decision-making process (existing organic farmers becoming more important during later stages of a farmer's conversion). However, the literature does not allow information sources to be ranked accurately according to their importance, and does not fully consider the role of specialist organic sources of information and advice.

Implications for the empirical research

Different disciplinary approaches to studying change processes and decision-making on farms were identified, all of which highlight important areas, but fail to account adequately for the complexity of particularly long-term, strategic decisions and their implementation on farms. There appears to be a need to consider personal and attitudinal variables as well as farm structural, geographical and external ones, and to use alternative and more qualitative approaches that allow the decision-making to be studied within context and over time. Such approaches can explore diversity and commonalities among farmers, both in terms of the change process itself and in terms of personal goals and objectives, attitudes and farming practices.

The review of personal variables in studies of conventional and organic producers also confirmed the absence of the clear concept of the importance of personal variables, insufficient understanding of the relationships involved, and the important time dimension of the process itself (see below), which gives further support to the choice of a qualitative in-depth inquiry of a small number of case study farms.

Such alternative approaches are well developed in qualitative social sciences and allow the researcher to consider many variables, but at the expense of the number of cases (Ragin, 1987). These approaches were not commonly used in agricultural research when this study began. An alternative research tradition in agriculture was identified in the Farming Systems Research and Extension approach (FSR). The theory of qualitative social inquiry, FSR and the specific case study approach that was used in this study is discussed further in Chapter 4.

The aim of the empirical work in this thesis is to focus on the phase of trial and evaluation of decision-making and to identify whether and how livestock producers experiment with organic farming for the purpose of evaluation, and how important this is for their decision-making. Furthermore in order to study the conversion process in the context of its conceptual boundaries it was the aim to identify personal factors that influence conversion, such as the farmers' motives for conversion and their attitudes to farming, their reasons for choosing a particular strategy for conversion and in organic production; and their personal experience of the conversion process (support and barriers, specific problems and information needs), and preference for a range of information sources.

The following chapter discusses the likely impact of the organic conversion on dairy farms, based on a review of the principles set out in organic production standards, as well as research literature on organic and converting livestock and dairy farms, before the case study approach that was used for the empirical research is discussed in Chapter 4.

Husbandry and financial changes during conversion to organic milk production

Introduction

The conversion process, the period during which the farming system changes from existing farming practice to organic management, affects both the farmer and the farm. The previous chapter reviewed literature dealing with the personal and social issues relating to it, leaving out any specific reference to the likely changes related to production and income. These are covered in this chapter, including the requirements of organic livestock production standards and the likely implications for converting dairy producers and for researching the conversion process. As in the previous chapter, literature from the UK and elsewhere, published prior to and during this research, is considered.

The chapter begins with a section on production standards and regulations, certification procedures and the key principles of organic livestock farming, followed by a number of sections reviewing studies that either compare established organic livestock systems with conventional ones or specifically investigate the conversion process. The second section covers a range of biophysical parameters, such as forage production and utilisation, milk production, feeding regime and animal health. The next section addresses dairy enterprise financial data and farm fixed costs, overheads and incomes. The potential contribution of production economics theory to understanding the financial performance of organic farms is discussed. The chapter concludes with a summary of the key changes that are likely to affect converting dairy farms and discusses the implications of this literature review for the empirical research.

Organic livestock standards and key principles

1.1.1 Organic production standards and certification procedures

The permitted and non-permitted practices in organic farming are defined by a set of organic production standards (in the following referred to as the Standards) that have evolved over a number of years. In the UK the Soil Association (SA) developed the first set of Standards and established certification procedures. SA-Cert. Ltd is now the largest certification body, licensing approximately 60% of all operators in the UK (farmers, growers, processors and importers (Lampkin, 2001). The Soil Association was founded by Lady Eve Balfour in 1946, initially to research the role of a healthy, fertile soil in the production of healthy crops and livestock and the linkages to human health (the Haughley Experiment) (Balfour, 1976).

UKROFS (the United Kingdom Register of Organic Food Standards) was established by MAFF in 1987 with the aim of setting common standards for organic production in the UK. It oversees the certification activities of the registered certification bodies, such as the SA Cert. Ltd., Organic Farmers and Growers Ltd and the Bio-Dynamic Agricultural Association.

Since 1993 the term 'organic farming' (and equivalent terms in other languages) has gained legal recognition in the European Union through the EC regulation 2092/91 'defining organic crop production'. The regulation was introduced to avoid confusion, protect the consumer and genuine producer, and hence assist in the development of a market for organic food (EC, 1991). It has been implemented in all EU countries. UKROFS became the designated authority for the implementation of the EU regulation in the UK.

The development of the EU regulation, which focused initially on crop production -not considering livestock in greater detail -is typical of the development of the organic sector as a whole, including research. One reason for this unbalanced development may be that specialist market outlets for crops and horticulture developed well ahead of markets for organic milk or meat, making the need for common rules more apparent.

The regulation 2092/91 set out what conditions in terms of production, inspection and certification must be fulfilled if any crop product is to be marketed as 'organic' (or biological, ecological in other countries). Since then 19 further regulations and additional legislation amending the original have been passed. The most important amendment for this research is the EC Reg. 1804/1999, which, after a long period of negotiation, defines common rules for organic livestock production and prohibits the use of genetically modified organisms in organic systems. However, the EC Reg. 1804/1999 allows countries to maintain higher national standards in the area of livestock production (EC, 1999). The most recent edition of the

UKROFS standards largely adopts the wording of the EU regulation thus incorporating all the most recent amendments to the regulation (UKROFS, 2001).

Summary of key principles

According to the EU regulation and UKROFS standards, organic livestock farms have to manage both their land and their livestock according to the requirements of the organic production standards (UKROFS, 2001).

Rules governing organic crop production (including forages) and the conversion of the land were set out in EC Regulation 2091/91. For forage and grassland production, the most important principles are:

- Reliance on legumes for nitrogen fixation and prohibition of synthetically produced nitrogen fertilisers;
- Development of a crop rotation with legume crops where appropriate;
- Restrictions on the use of farmyard manures (coming from extensive husbandry) and organic and non-organic fertilisers (recognition of an approved body, applied only where a need can be proven).
- The general prohibition of the use of pesticides (applies in forage crops mainly to the use of herbicides).
- The principles of organic stock farming according to EU Reg. 1804/1999 on organic livestock production can be summarised as follows:
- Organic stock farming is a land-related activity. In order to avoid environmental pollution, in particular of natural resources such as the soil and water, organic production of livestock must, in principle, provide for a close relationship between such production and the land.
- Livestock should have access to free range exercise area and/or grazing (apart from some specified exemptions)
- Biological diversity should be encouraged and preference should be given to breeds adaptable to local conditions. Genetically modified organisms (GMOs) and products derived thereof are not compatible with organic production.
- Organic livestock should be fed on organically produced grass, fodder and other feedstuffs, (apart from some specified derogations: for ruminants 10% of DM[1] of specified components may originate from non-organic sources).
- Animal health management should be mainly based on prevention (appropriate breeds, a balanced high-quality diet and a favourable environment in terms of stocking density and husbandry practices). The preventive use of chemically synthesised medication is not permitted, but sick and injured animals must be treated immediately (although this may affect their status with regard to organic certification if more then three courses of treatment have to be administered in one year).
- Housing should satisfy the needs of the animals concerned regarding ventilation, light, space and comfort and sufficient area should be provided to permit ample freedom of movement to develop the animals' natural social behaviour.

The rules governing organic production of livestock evolved during the period of this research, but the UK national standards at the time when the research began (UKROFS, 1993) stated similar principles to

[1] 15 to 20% in 1992, see below

those of the EU regulation. Organic livestock production should aim to sustain animals in good health by the adoption of effective management practices, including high standards for animal welfare, appropriate diets and good stockmanship, rather than relying on routine use of veterinary treatment. Key differences to the current rules were the higher allowances for supplementation from conventional sources (15-20% as compared with 10% now) and lower levels of detail in some areas, e.g. the GMO rule did not exist and the Standards contained limited detail regarding housing conditions. Regarding the origin of stock, the UK developed stricter guidelines ahead of other countries, in part due to BSE.
The Soil Association's standards in 1992 (SA, 1992) were comparable, although in some areas more detailed than the UKROFS rules. For example the SA standards recommended the use of loose housing systems, allowing cubicles if the slatted floor area did not exceed a maximum of 25%. Minimum space requirements for livestock housing were included, e.g. for the winter housing of dairy cows a minimum lying area of 1.2 m^2 per 100 kg of animal and an additional loafing area had to be provided.
In summary, the Standards place restrictions on the use of certain inputs to the farming system, such as N-fertiliser, pesticides, drugs, concentrates and purchased forage. They aim to encourage the farmer to develop a system that makes use of farm-derived rather than external resources, prohibiting very intensive systems that depend heavily on bought-in fertilisers and feeds and thus would be able to utilise the manures produced without leading to waste disposal or pollution problems. Stocking rates should reflect the inherent carrying capacity of the land and not be inflated by reliance on 'borrowed' hectares, and health management has to be based on the principle of prevention rather than cure.

Farm type and land use

A key principle of organic farming -the reliance on farm-derived rather than external inputs -implies increased reliance on the transfer of benefits between enterprises, such as nitrogen fixation, soil fertility and weed suppression benefits transferred from a leguminous forage to a non-legume crop, or the reduction of parasite burdens on grazing fields through integrating different livestock species. These internal transfers are more easily realised in mixed rather than highly specialised systems. Indeed, some authors believe that organic farming can only be realised on mixed farms, because only they allow sufficient diversity and organisational intensity to achieve stable production, whereas it is argued that this is not possible on highly specialised livestock and horticultural holdings (e.g. Köpke, 1998). Conversion is considered to be easier for mixed farms with grazing livestock, whereas intensive arable farms or those with substantial pig or poultry enterprises find it more difficult (Neuerburg and Padel, 1992). However, the general development of agriculture has led to ever greater specialisation, so the question arises whether and how more specialist farms can convert to organic production.
Detailed statistical data on organic farms were virtually absent at the time the study began. Recently published data show that the land use on organic farms differs from conventional farming. In the UK the total land use on organic farms in 1999 included approximately 75% grassland (rotational leys and permanent pasture) and 25% arable and horticultural cropping, whereas, on average, conventional farms had only 55% grassland (OCIS, 1997; SA, 1999). A review of studies on the economic performance of organic farming across Europe found that the area of cereals, oilseeds and forage-maize was reduced compared with conventional systems, whereas the area for leys, vegetables, pulses and other fodder crops was increased (Offermann and Nieberg, 2000). However, these data are averages for the total organic land area, and are not differentiated between particular farm-types.
Data for dairy systems are available from a Danish survey of land use on organic and conventional dairy farms, which found more temporary grassland on organic farms (45% compared with 22% on conventional farms), less cash crops (38% compared with 54%), but also less fodder beet and whole crop silage (Kristensen and Kristensen, 1998). Another publication from the same Institute shows the variation within each group of organic and conventional dairy producers as well as average values (Table 3-1). Organic farms were found to be larger, have more cows and more leys, but less fodder beet, other fodder crops and cereals, but the range for some variables was significant within each group (Halberg and Kristensen, 1997). These Danish results seem to indicate less diverse land use on the organic dairy farms and hence contradict the conclusion of Offerman and Nieberg (2000) for the organic sector in general. A comparison of a sample of five UK dairy farms in 1997/98 with 124 similar conventional farms selected with the help of multi-variant cluster analysis showed a lower proportion of cereals (6 cf. 10%; a lower proportion of root and fodder crops (2 cf. 9 %) and a higher proportion of fallow, let land and set aside

(9.1 cf. 1.3%) (Fowler et al., 2000). However, some of the farms reported are identical to the case study farms in this study.

Table 3-1 Land use on organic and conventional dairy farms in the Denmark

	Organic		*Conventional*		*Relative*
	Average	*Range*	*Average*	*Range*	*Conv=100*
Area (ha)	76	25–81	63	30–150	120
Permanent pasture (%)	11	1–40	8	3–33	137
Leys (%)	38	25–67	26	10–70	145
Fodder beet (%)	3	0–11	10	5–29	30
Other fodder (%)	14	1–38	16	3–63	88
Cereals (%)	28	15–50	32	0–68	88
Cows	67	21–170	60	36–94	112
LU/forage ha	1.06	0.5–1.5	1.44	0.6–2.3	74

Source: Halberg *et al.* (1997)

Biophysical aspects of production

Stocking rates

The stocking rate, the number of grazing livestock units (GLU) kept per forage hectare on a farm, is a function of both grassland output and of purchased feed inputs. It is influenced by the grassland productivity of a farm and is therefore often taken as a simple indicator of it, but differences in stocking rates may in fact reflect differences in reliance on purchased feed inputs rather than grassland output.

Reviewing data from a range of European studies, Lampkin (1993) reported stocking rates to be 20% lower in organic compared with conventional systems, and in the range of 1.6 to 2.0 LU/forage ha. More recent data for organic dairy farms in the UK over a 3-year period showed 1.3–1.45 LU/ha compared with approximately 2.0 LU/ha on conventional farms (Fowler et al., 2000), but purchased feed inputs were significantly reduced relative to the previous studies reviewed by Lampkin (1993) and compared with conventional farms (see below). Other surveys have reported much lower levels: 0.8 to 1.1 LU/forage ha in Denmark (Kristensen and Kristensen, 1998) and 1.2 LU/forage ha in Germany (Schuhmacher, 2000)[2]. A German survey of 54 dairy producers found that the reduction in stocking rate during conversion appears to be larger on poorer than on better soils (Schulze Pals, 1994; see also Table 3–3), confirming the strong influence of forage production on the potential stocking rate of farms.

Offermann and Nieberg (2000) found stocking rates (total livestock units per hectare UAA) to be consistently lower on organic farms (between 70 and 88% of conventional systems). Absolute values ranged from 0.8 to 2.4 LU/farm hectare; the highest values were reported for arable systems in Denmark and cattle systems in Finland, which included the non-grazing livestock on the farms. The authors attributed the generally lower values in organic systems to a range of factors, including restrictions imposed by organic production standards, the aim to feed stock mainly from farm produced feeds and higher prices for organic cereals, but did not consider the potentially lower productivity of forage crops as one explanation (see below).

For experimental clover–based milk production in Scotland (not organic farms), Leach (1999) reported a stocking of 1.9 LU/ha with concentrate levels of 1,100 kg per cow, which is higher than for most of the organic systems reported above. Trials with clover production on commercial farms across the UK resulted in increased stocking rate on some farms, contrary to expectations, (Bax and Browne, 1995) (no information on concentrate levels). Stocking rate development during the conversion period was reported from two case study farms. Initial reductions were in the range f 20%, but levels subsequently increased to almost pre-conversion levels (Lampkin, 1993).

[2] Some data report in forage ha per cow or cows per forage hectare and the calculation may not be fully identical.

It can be concluded that observed stocking rates on organic dairy farms appear to vary considerably from 0.5 to 2.0 LU/forage ha (if the higher values including non-grazing livestock are discarded). In the majority of studies and reviews, values are reported to be lower than for comparable conventional systems. It is therefore likely that dairy farms would experience some reduction in stocking rates during conversion, particularly early during conversion.

However, stocking rate is a function of grassland output and of purchased feed input likely to be also influenced by restriction in the Standards and by potential changes in diet (see 3.4.4), making the use as an indicator of the natural carrying capacity of the land somewhat questionable.

Grassland and forage production

In two studies looking specifically at the conversion process on dairy farms, problems with feed shortages were reported. The converting farmers had to buy more forage than before, or increased their forage area to compensate, but neither study included any direct measurements of changes in the forage supply situation on the farms (Rantzau et al., 1990; Schulze Pals, 1994). Apart from the studies reviewed above, showing lower stocking rates in organic systems, some studies have looked in detail at forage yields under organic management, but very few in particular on the situation during the conversion period.

Newton (1995) conducted measurements on organic farms and reported forage yields of 10 to 14.1 t DM per hectare. Jones *et al.* (1996) found herbage production levels of 5–10 t DM per hectare on farms in the later years of their conversion (in the first phase of this research project) and attributed the differences between their and Newton's results to differences in sampling method, in particular cutting height, although the conversion status of the farms may have been a factor. In both studies the variation in yield levels between farms was considerable. Some of the variation could be explained by site class differences. The authors of both studies concluded that organic forage yields were higher than for pure grass swards receiving no nitrogen, which is consistent with other trials of grass/clover mixtures in conventional systems, but neither trial contained any direct comparison with conventional farms.

Organic forage production relies on nitrogen fixed by legumes (available directly to the sward and indirectly through animal manure), as the use of other sources of nitrogen is either prohibited (synthetic N) or severely restricted (organic N). An important factor determining yield levels is therefore likely to be the clover content of the sward. Newton (1995) established a relationship between clover content and forage yield and found more clover in leys than in permanent pasture. Similarly, Kristensen *et al.* (1995) found N fixation to be related to clover content and age of the sward**.** The variation in harvested fixed N was considerable (38–208 kg N/ha and year). Twice as much nitrogen was fixed in the first two years after establishment than in the following years. Younie and Baars (1997) also highlighted the difference in fixation utilisation depending on sward age and concluded that short-term leys are a more efficient way of utilising atmospheric nitrogen, but they may have other drawbacks for dairy producers (e.g. grazing management) and their environmental value may be considerably lower than that of permanent swards (Baars, 1999). An important difference between clover-based and pure ryegrass swards is also the later turnout date, due to slower spring growth of clover-based sward without supplementary N (Bax and Browne, 1995).

Several authors found short-term red–clover leys to be about 10–15% more productive than white clover-based swards (Baars and Dongen, 1997; Jones et al., 1996), whereas permanent pasture and medium term white–clover grass leys do not appear to differ significantly in their productivity in the long–term. -

The yields in organic forage production also seem to be determined by soil and climatic conditions. In addition to the site classification of fields, rainfall was found to be a good indicator for explaining yield differences between organic farms (Newton, 1995). He also considered the available nutrients in the soil (P, K) as important and found a positive correlation between clover content and available P.

However, the studies of forage yields on organic farms do not appear to explain satisfactorily why feed shortages due to greater yield reductions during conversion should occur, as has been reported from commercial farms (Schulze Pals, 1994; Rantzau, *et al.*, 1990). Direct measurements of forage yield development during conversion have mainly taken place from experimental sites. The yields of the permanent grassland swards at the IGER experimental farm Ty Gwyn suffered initially substantial yield reductions, but reached near pre-conversion levels several years after conversion (Weller, 1999), which could be one explanation for feed shortages early in conversion. Halberg *et al.* (1997) used modelling to predict the yield development during conversion on the basis of measured yield levels on some organic and conventional dairy farms in Denmark, reported in gross energy values (Table 3-2). Through modelling the authors attempted to isolate the organic management effect from other factors (e.g. water supply). The predicted yield reductions of clover grass leys during conversion were found to be in the range of 12% on clay, 13% on sand and 17% on irrigated sand, but initially greater yield declines are not mentioned. However, the authors stressed that results should not be generalised beyond the climatic and site conditions of Denmark and that the yield variation between the farms not accounted for by the model remained substantial.

Table 3-2 Average input and forage yield of organic clover grass leys by soil type in Denmark

		No of samples	Manure t/ha	Fertiliser kg N/ha	Yields* GJ ME/ha	Rel.(conv.= 100)
Clay	Conv.	6	4	281	81.6	88
	Org.	32	8	0	72.0	
Not irrigated sand	Conv.	21	13	215	74.4	74
	Org.	12	17	0	64.8	
Irrigated sand	Conv.	31	10	215	90.0	72
	Org.	20	27	0	64.8	
Whole farm average	Conv.	19	31	148	79.2	77
	Org.	17	22	0	61.2	

* Data in Scandinavian Feed Units (1SFU=12 ME) have been converted to GJ ME per ha.

Source: Halberg *et al.* (1997)

It can be concluded that limited data on forage production potential on organic farms (even more so when the research began in 1993) exists and the evidence is inconclusive. On the one hand feed shortages during conversion have been reported, on the other hands forage yields on organic farms were found to be comparable to conventional ones. Model calculations predicted yield reductions during conversion under the soil and climatic conditions of Denmark to be in range of 12–17%, (Halberg and Kristensen, 1997).

It appears possible that forage supply during conversion could be a problem on some farms, particularly with less favourable soil and climatic conditions. Converting farmers may have take special action to establish clover (and the nitrogen fixing *Rhizobia* populations) in existing swards by taking land out of production for reseeding when nitrogen fertiliser was withdrawn, but choice of crops (more short term leys) may allow the farmer to influence the forage supply favourably. Farmers may also need to adjust to the later slower spring growth of clover-based swards. Monitoring the forage yield development on the commercial farms throughout the whole conversion was therefore an objective of the project.

Milk yield

Most studies reporting on milk yields compare data from organic and conventional herds, from which likely changes can to some extent be predicted, but studies of actual yield development during conversion are rare. In older studies, annual milk yields for organic dairy cows varied from 4500 to 7000 kg per cow (Kristensen et al., 1994; Krutzinna and Boehncke, 1996; Lampkin, 1993; Redelberger, 1995; Snijders and Baars 1995; Winter, 1991) (see also Table 3–3). In a recent review of comparative economic studies from various European countries, milk yields per cow were found to be in the range of 80% (France, Norway) to 105% of conventional levels (Belgium, Czech Republic, Italy) (Offermann and Nieberg, 2000). At the lower end of absolute yields were studies from Germany, Italy, Norway and Switzerland with 3990 to 5500 kg per cow, whereas studies from the Netherlands, Denmark and Finland reported 6000 to 7200 kg per cow (Offermann and Nieberg, 2000). The latter are higher than levels recently reported from the UK (5100 to 5800 kg per cow, average value of 5500 kg per cow) (Fowler et al., 2000; Fowler et al., 1999).

These studies do not identify whether the reduced yields are related to the management system or different objectives of organic producers, who might no longer be aiming for high milk production levels per cow.

The few studies that monitored milk yield trends directly during conversion found more marked reductions on intensively managed dairy farms with high yielding breeds (such as Holstein/Friesian) and high levels of concentrate use. Maintained or even increasing yields during conversion were observed on farms with relatively low milk yields and less intensive breeds (Freyer, 1994; Huus, 1992; Lampkin, 1993; Schulze Pals, 1994).

It can be concluded that milk yield development during conversion may vary, from up to 20% decline to 5% increase, influenced by the intensity of the system pre-conversion. In addition changing yield levels during conversion may be a reflection of the change process itself (e.g. feed shortages) or changing objectives of the producers.

In combination with reduced stocking rates, lower yield levels would lead to lower milk production per forage hectare with likely implications for financial output and profitability.

Feeding regimen and diet

The aim of organic farming to reduce external inputs, applied to dairy farms, would translate into the broad objective of minimising the use of non-organic and purchased feeds (concentrates and grains) whilst maximising milk production from farm grown forage and feed. A shift in this direction is also likely to have beneficial effects for herd health, as high concentrate feeding in the diet may impair the functioning of the rumen. High levels of concentrates lead to reduced pH levels in the rumen which in turn may lead to metabolic stress and can have negative effects on the cows' feet, liver, saliva production and immune system (Boehncke, 1996). Apart from such health and welfare concerns, there are also ethical and political reasons for the emphasis on reducing concentrates in organic diets (Phillips and Sorensen, 1993).

On the other hand, an unbalanced energy and protein supply, particularly during the peak period of early lactation, would also represent a threat to animal health and welfare. Standards therefore allow a proportion of the diet to be supplied by concentrates (up to 40% for cattle) and, before 1999, up to 20% (now 10%) of the dry matter of the diet from specific conventional sources. (Baars and Buitink, 1995) came to the conclusion that poor nutrition (forage as well as energy and protein supply) often underlies health problems on organic dairy farms and therefore recommended that farmers carry out routine forage analysis. Also trials in Norway (Reksen et al., 1999) and Austria (Gruber et al., 2000) that were cited by Steinwidder (2000) attributed fertility problems of organic cows to the lower supply of energy in early lactation.

On the basis of a long-term trial comparing different levels of concentrates for dual purpose and pure dairy breeds, Haiger and Sölkner (1995) came to the conclusion that even in times of energy deficiencies (i.e. no concentrate feeding), the dairy breeds remain the more efficient milk producers and no negative impact on fertility was observed under this trial, where forage of sufficient quantity and quality was feed in abundance (Haiger and Sölkner, 1995). This gives an indication that the change to a diet with lower concentrates may have managerial implications.

Differences between organic and conventional farms have been found with regard to concentrate feeding. A survey of 268 organic herds in Germany found an average use of concentrates of 600 kg per cow (Krutzinna and Boehncke, 1996), which the authors considered to be low compared with common practice in the German dairy industry. Similarly, the Kristensen's Danish study reported higher amounts of energy in the organic cows' diet supplied from forage (43% of the energy intake) compared with conventional farms (31% ,Kristensen and Kristensen, 1998). Studies generally do not report the proportion of concentrate that is grown on the farm. During conversion Lampkin (1993) and Schulze Pals (1994) reported concentrate reductions in the range of 15% to 40%. This indicates a strategic change in the feeding regimen, rather than a gradual reduction, but neither study investigated this issue in greater detail. On the other hand farmers may, during conversion, make full use of the concentrate feeding allowances in the Standards aiming to maintain milk production and fulfil quota to avoid income losses.

There was no evidence in the literature that the forage quality differs between organic and conventional farms and hence would be affected by the conversion, apart from potentially higher proportion of legumes in the sward. An analysis of 450 forage samples from commercial organic farms in Germany found a wide range of crude protein contents (Veauthier and Krutzinna, 1992). The authors recommended that organic farmers carry out forage analysis and, depending on results, provide additional supplementation with energy or protein. Silage qualities similar to conventional samples were found in Denmark. Digestibility of organic matter (DOM) and crude protein content were almost identical, despite substantially higher legume content in the organic forages (Kristensen *et al.*, 1994; Kristensen and

Kristensen, 1998). This higher legume content of the forages is likely to have a beneficial effect on forage intake and animal production, due to a more rapid microbial digestion in the rumen (Davies, 1996; Sheldrick et al., 1995), but the possible risks of bloat and some difficulties with ensiling should not be ignored (Bax and Browne, 1995; Newman, 1995).

There is further evidence that diets for organic cows are more diverse, with a higher proportion of hay and root crops (swedes and fodder beet) and a reduction in silage use (Ebbesvik and Loes, 1994; Krutzinna and Boehncke, 1996), although the reported land use on the Danish organic dairy farms seems to contradict this. It can be concluded that converting dairy producers may face conflicting aims:

- Reducing the amount of non-organic and purchased feeds and increasing milk production from farm resources, leading to strategic reductions in concentrate feeding, and
- Making use of the feed allowances in the Standards to avoid energy shortages and to maintain milk yield and income.

The literature suggests that forage quality is not adversely affected by the conversion, but that diet may become more diverse as a result of the system change and the feeding regime may change.

The legume contents in the diet is likely to be higher, which may improve digestibility and intake, but may bring new challenges in terms of silage making and grazing management to reduce bloat risk.

Animal health

Organic production standards for health require a move to preventive management rather than prophylactic treatment, which is potentially the most difficult compliance area for many livestock farmers. On the other hand, problems with animal health were one important motivation for farmers converting to organic methods (see Chapter 2).

Detailed studies of the health situation of animals under organic management are rare. Several studies identified mastitis as one of the key problems, alongside hoof and fertility disorders, whereas metabolic disorders were less frequent (Baars and Buitink, 1995; Ebbesvik and Loes, 1994; Roderick et al., 1996), but there is an indication that fertility problems related to unbalanced diets (energy and protein supply) occur (Baars et. al, 1995). Overall, the key health problems of organic cows appear to be similar to conventional ones (Krutzinna and Boehncke, 1996). A survey of 240 livestock farmers (including 34 dairy farms) in the UK found farmers using a combination of preventive management (e.g. lower stocking density, clean grazing systems), alternative treatments (especially homeopathy), and in severe cases chemotherapy to maintain animal health (Roderick et al., 1996).

Hovi (1999) investigated patterns and levels of mastitis on 17 organic and 7 conventional farms with the aim of describing treatments and control strategies and identifying risk factors. For organic cows as a group, the risk of clinical mastitis was found to be significantly lower than for conventionally managed cows, but incidences of mastitis were higher in the dry period and in the first lactation week, and somatic cell counts for individual cows and in the bulk tank milk were significantly higher on the organic farms. The majority of cases on organic farms were treated with homeopathy, followed by antibiotics, other treatments being of lesser importance (Hovi, 1999). Weller (1998) also reported a relatively low incidence of clinical mastitis on one organic experimental farm, but higher somatic cell counts than for conventionally managed herds.

It can be concluded that gaining knowledge and experience of alternative control strategies and therapies is a key issue for the dairy farmer during the conversion period, so that the use of routine medication, for example dry cow therapy to prevent mastitis, can be stopped.

Financial performance

Development of the market for organic milk in the UK

At the time when this study started in 1993, the organic milk market in the UK was relatively small with few organic dairy producers (see Table 2–3). However, an increasing demand for organic products had been forecast (e.g. MINTEL, 1991) and the situation changed considerably during the study period. The dissolution of the Milk Marketing Board in 1994 allowed the formation of an Organic Milk Suppliers Co-operative (OMSCo) in Southwest England that sold milk to a number of processors in the same region.

Increasing demand (at times outstripping supply) led also to growth in the processing capacity (Campbell, 1995), but the number of producers did not significantly increase until 1998.

Table 3-3 Development of the organic milk production in the UK

	1993	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*
No. of dairy cows	3,750	3,750	3,750	3,750	4,500	5,250	5,900	14,900
No. of dairy farms	50	50	50	50	60	70	80	180
Annual organic sales (t)	2,700	7,000	8,700	17,800	23,700	26,550	32,500	82,000
Average milk price (ppl)	21	21	24.5	27.5	29	29	29.5	29.5

Source: Own estimates based on consultation with several processors; SA (2001a)

Organic premiums also became available in west Wales through Milk Marque, the company that was formed following the dissolution of the Milk Marketing Board. In other regions of the UK, producers still had difficulties in achieving an organic premium, but the situation has changed quite fast as new processors enter the organic market. Organic milk prices in 1996 were on average about 3 ppl above the conventional milk price of 24.5, varying between 2 and 6 ppl over conventional prices. In 1997 the conventional prices had fallen to 22 ppl, whereas the organic prices were in the range of 29 ppl. In 1998/99, conventional prices decreased even further, while organic prices increased marginally, resulting in a higher organic premium over conventional prices.

Between 1998 and 2000, organic milk production and marketing have developed even further. At first, increased consumer demand led to increased imports, with around 40% of the total volume imported mainly from Austria and Denmark. Domestic production more than doubled between 1999/2000 and 2000/01, which has led to some problems in marketing organic milk in 2001. OMSCo, now operating throughout the UK, remains the biggest trader of organic milk, but several new companies now offer producers more outlets for their organic milk, bringing with it the danger of market fragmentation (Lampkin and Measures, 2001). The increases in supply and competitive pressures have led to reductions in the farm gate prices of organic milk in some cases, but also to newly converting producers failing to find any organic outlet for their milk and thus having to sell at conventional prices. Whether this is a temporary problem reflecting the large number of producers entering conversion in 1999 and achieving organic status in 2001, or a longer-term structural surplus, remains to be seen.

Dairy enterprise performance

A range of studies have reported financial results of organic dairy enterprises compared with conventional ones, some of which have been summarised in Table 3-4. Without access to specialist markets and premiums for the organic milk, the gross margins per cow on organic farms were mostly lower than conventional (Huus, 1992; Redman, 1991; Vittersø, 1995; Weber, 1993).

However, some cases of similar or higher gross margins per cow were reported, where management was good and the savings in variable costs for forage production and concentrates were high enough to balance losses in production (Houghton and Poole, 1990; Lampkin, 1993; Muehlebach and Naef, 1990; Winter, 1991). With organic premium prices, the organic farms could achieve higher gross margins per cow (Schulze Pals, 1994). Reductions in variable costs are in the range of 13–25%, mainly due to a reduction in fertiliser costs in the forage production. However, due to lower stocking rates similar gross margins compared with conventional management have not been achieved per hectare under current premium levels in the UK.

Reduced concentrate feeding did not always lead to cost reductions, because of higher prices (or opportunity costs) for organic cereals and higher costs for other components or '*organic*' mixtures. Reductions in variable costs have also been associated with lower veterinary and heifer rearing costs, but the empirical evidence is missing and the overall effect on the total variable costs of livestock production appears to be insignificant.

.

Table 3-4 Gross margins of organic dairy farms in national currency relative to conventional data

Source	*Houghton & Poole (1990)*		*Redman (1991)*		*Winter (1991)*		*Muehlebach (1990)*		*Weber (1993)*		*Schulze Pals (1994)*	
Years, Country	*1989/90, UK*		*1990/91, UK*		*1989/90, DE*		*1986–88, CH*		*1987–92 DE*		*1989–92 (DE)*	
Method	*Organic farms; conventional averages*		*Organic farm; conventional averages*		*Organic farms; conventional averages*		*Paired farms*		*Split experimental farm*		*Conversion study, second year*	
System	organic	rel.*	organic	rel.*	organic	rel.*	Organic	rel*	organic	rel.*	organic	rel.*
No. of farms	11		13		18		87				63	
Herd size	57	56	73	67			21.9	92			26.1	96
Stocking rate (LU/ha)	1.56	66	1.78	80	1.43	79	2	88	1.3	74	1.3	81
Output												
Yield (l/cow)	4589	91	5332	91	5415	91	5060	88	5180	85	5068	97
Price (p/litre)	0.2	97	0.21	112	0.78	103	1.03	103	0.692	99	0.72	94
Total (£/cow)	1010	91	1123	103							4298	87
Variable costs												
Conc. use (kg/cow)	930	64	1153	79	1100	71			550	27	870	86
Conc. cost (per cow)	170	75	178	92			440	86			365	83
Forage (per cow)	34	40	8	15	522	86	255	65	262	39		0
Total (per cow)	310	73	186	75			878	77			1431	87
Margins (excluding premium)												
per cow	700	102	764	90	3095	97	3291	99	2465	88	2867	87
per litre	0.153	113	0.143	99	0.57	104	0.65	112	47.6	103	0.57	90
per hectare	1092	67	1360	72	4677	81	6619	85	3034	67	3675	70

* conventional = 100

Reductions in stocking rate or increases in the forage area per cow led to almost uniformly lower gross margins per hectare on organic as compared with conventional farms, indicating the lower intensity of the organic system. In a situation in which milk quotas limit production, the gross margin per litre or kg milk is also an important performance indicator, in which the organic herds tended to outperform conventional comparisons (Padel and Lampkin, 1994a).

Gross margin trends per cow and per ha on two converting dairy farms showed initial decline followed by subsequent increases, particularly after premiums became available Lampkin (1993).

According to the 1993 organic production standards, converting dairy farms would not qualify for access to organic premiums for at least 27 months, at which time their herd may, depending on their conversion strategy, fulfil all requirements for full certification. Initial reductions in gross margin per cow during the period of conversion are therefore likely, unless cost savings or other income can compensate for potential losses in productivity

Labour requirements and fixed costs

Labour requirements on organic farms are frequently reported to be higher on organic than on conventional farms, but data are limited and the evidence is not conclusive (Jansen, 2000). In their review of comparative farm monitoring of organic and conventional farm data from nine European countries, Offermann and Nieberg (2000) concluded that labour use per ha UAA on organic farms is, across all farm types, on average 10–20% higher than for comparable conventional farms. Because of the more general focus of most surveys, labour requirements were typically only assessed using broad measures such as annual labour units (ALU) or costs. Indirect use of labour, e.g. through contractors and casual labour were not included.

It is well known that vegetable growing is more labour intensive (due to mechanical and hand weeding), but the changes in other enterprise are less well understood. Higher labour on farms might also be related to differences in land use patterns and there appears to be an influence of the farm type. Higher total labour use was found on organic arable and mixed farms and much higher labour use on horticultural units, whereas for dairy farms labour requirements were found to be comparable to conventional data (Offermann and Nieberg, 1999; Jansen, 2000). On the other hand, Lampkin (1993) and Freyer *et al.* (1994) reported increasing labour costs on converting dairy farms. Across Europe the comparative labour costs on dairy farms ranged from 70% of conventional values to 450% (Offermann and Nieberg, 2000). Higher labour costs were found to be the main reason for higher fixed costs on organic dairy farms in Norway (Vittersø, 1995).

In Switzerland and Germany, where samples of organic farms have now been monitored for a considerable length of time as part of government farm incomes monitoring, the labour use on organic farms (in annual labour units per ha) has declined significantly since the beginning of the 1990s, in line with trends on conventional farms. On this basis, Offermann and Nieberg (2000) concluded that levels of higher labour requirements on organic compared with conventional farms might be exaggerated.

Fixed costs are often higher on organic than on conventional farms but the extent of the difference varies between farm types, studies and also countries (Offermann and Nieberg, 2000). One general explanation is that organic farms replace external inputs through higher input of management and labour, resulting in higher labour and machinery costs on organic farms (Zerger, 1995). Additional fixed costs may also arise as a result of investments (Padel and Lampkin, 1994b), certification charges, and costs for advice and information (Diers and Noell, 1993), but few studies have investigated in any detail the issue of fixed costs on organic farms during conversion.

Overall, the evidence regarding labour on converting dairy farms is not conclusive. Reported increases in labour demand appear to be related to cropping rather than livestock enterprises, but increased labour costs were found on some converting dairy farms. Increased labour use per animal is likely, as labour requirements may not decline in proportion to reduction in stock numbers. The impact of conversion on other categories of fixed costs is poorly understood, but some increases appear likely.

Net farm incomes

Apart from publications generated by this research (e.g. Hagger and Padel, 1996), only one older British study (apart from Lampkin's two case studies of converting farms, see below) presented whole farm income data for organic dairy producers in the UK. Murphy (1992) found considerably lower incomes on organic dairy farms compared with conventional farms. Lampkin (1994a) criticised the study for the method of selection of the conventional comparison data. In particular, the organic sample contained a large proportion of small farms (less than 4 British Size Units), which are excluded from the UK Farm Business Survey (FBS) sample with which the data were compared. He re-analysed the data for Wales excluding these units and found higher net farm incomes (NFI) on the organic dairy farms, both per hectare and per farm.

A Canadian survey of eight organic milk producers in Ontario (representing 40% of all organic dairy producers in the province at the time) was compared with a random, stratified sample of conventional farms. Contrary to the authors' expectations, the organic farms achieved similar milk yields, had considerably lower costs (25% reduced) and achieved a 60% higher net farm income per farm (using a similar definition as FBS) or 30% higher income on a per hectare basis (Ogini et al., 1999; Sholubi et al., 1997).

Across Europe, Offermann and Nieberg (2000) found that the relative profitability of organic dairy farming per hectare ranged from 50% of comparable conventional values to 140%. Values per labour unit were consistently found to be higher in all but one study.

Important profitability factors for organic livestock producers in Germany were found by Zerger (1995) to be milk yield and forage area per grazing livestock unit (GLU), whereas the sales price (incl. organic premiums) was not found to be an important factor in determining performance. Differences between the organic farms in variable costs and hence the likely influence on farm performance was marginal, but financially more successful farms showed higher overhead costs than less successful ones (Zerger, 1995).

As for other indicators, studies investigating farm income changes during conversion are limited. Lampkin (1993) surveyed accounts of two dairy farms during the whole conversion period (including the last year of conventional management) and compared the data for each farm with conventional averages. A specialist dairy farm achieved similar incomes to the conventional comparison group during most of the conversion period. A mixed farm had lower NFI for most of the time, only achieving similar values to the conventional comparison group towards the end of the study period, once an organic premium could be obtained. The income trend on both farms was also influenced by factors that affected the whole industry, in particular the introduction of milk quotas. What can be generalised from Lampkin's results for two farms is clearly limited, but his findings demonstrate the need to include conventional comparisons in studies of converting farms, so that conversion–related effects can be isolated from others affecting the economic climate for the whole industry. How this can best be achieved is discussed Chapter 4. This was not considered by Freyer (1994), who reported increasing profits during conversion for seven case study dairy farms in Germany, but failed to provide any conventional reference data.

Schulze Pals (1994) surveyed 107 farms, 54 with dairy production, during their first two years of conversion to organic agriculture under the German organic aid programme introduced in 1989. In contrast to Lampkin's results, farms with grazing livestock gained less through the organic conversion compared with the arable and mixed farms in his sample. Schulze Pals (1994) attributed this to the lack of marketing opportunities in the meat and milk sector in Germany at the time.

In summary, the studies comparing farm incomes of organic and conventional dairy farms illustrate that various factors may influence financial success, such as levels of biophysical productivity including forage crops, levels of premium price, variable and overhead costs and organic farms are also affected by some trends of the dairy industry in general.

The few results available comparing the income trends during conversion on mixed and specialist dairy farms contradict each other, so that it is not possible to predict how the income on dairy farms might change during conversion.

Potential contribution of production economic theory to optimising organic systems and understanding changes in physical and financial performance during conversion

The aim of this research is to investigate the human, production–related and financial aspects of the process of conversion to organic farming, and in particular the role of knowledge and information in decision-making during the change process. Therefore the question arises whether (a) production economic theory can also contribute to a better understanding of the change process during conversion

and whether (b) it can provide an appropriate theoretical focus in relation to organic production in general.
Production economic theory is concerned with the relationship between the use of resources (inputs or production factors) and the outputs achieved, with the aim of determining allocative efficiency, i.e. economically optimal levels and combinations of inputs and outputs (Upton, 1976). In its simplest form, the theory assumes profit (or utility) maximisation as an objective, as well as perfect competition and perfect knowledge.
Production factors may be classified in the four broad categories of land and natural resources, labour, capital and management. With respect to these factors or production, a key distinction is made between variable resources, the level of which can be adjusted in the short term, and fixed resources, the levels of which are fixed in the short term and therefore may act as a constraint on expansion. Applied to agriculture, a major focus is on the level of use of variable inputs that can be controlled by the farmer. Most of these are external to the farming system (e.g. fertilisers, purchased feeds) and have to be purchased at a given price (the perfectly competitive firm is a price taker, where the amount purchased is too small to influence the input cost).
Central to the theory of production economics is the law of diminishing marginal returns. The implications of this law for the optimisation of organic production systems and the conversion process are discussed in more detail below, but the law gives rise to an important distinction between marginal and average physical and financial values for inputs and outputs, whereby it is change at the margin, for example the increase in production resulting from an additional unit of input, that is fundamental for optimisation. In principle, production economics and the law of diminishing marginal returns can be applied to support farmer decision-making with respect to:

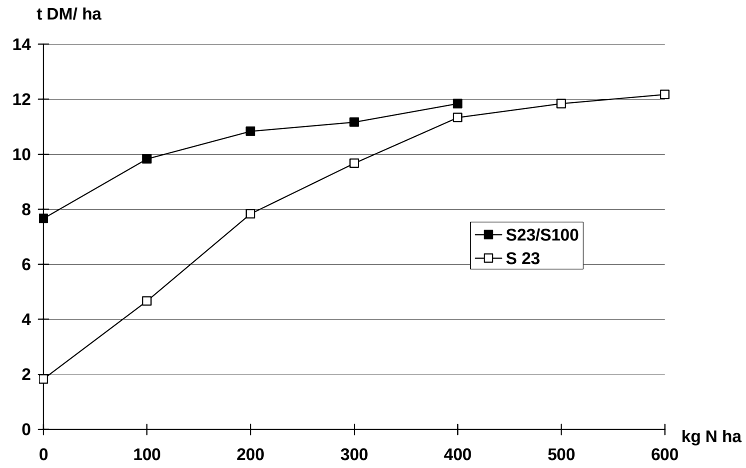
- How to produce (the optimal level of variable input use and combinations of variable inputs for a specific production activity, governed by factor–product and factor–factor relationships);
- What to produce (the optimal combination of production activities, governed by product–product relationships);
- How much to produce (the optimal scale of production, governed by the cost function and the potential economies of scale).

In the context of diminishing marginal returns, average performance data, to which farmers and consultants are more likely to have access, are much less relevant, unless linear approximations to non–linear relationships are made: in practice this is what usually happens in farm planning, because of the lack of marginal performance data. Linear programming provides a means of optimising linear relationships that can be seen to be analogous to production economics (Upton, 1976). Dabbert (1994) argued that linear production functions have the advantage that the cyclical transfer of farm–internal resources could be considered, making it theoretically a more appropriate approach to study conversion. However, the practical application of the LP approach to converting farms by Dabbert (1994) was hampered by the lack of data to consider the reality of organic farms in sufficient detail, and a larger number of crude estimates had to be used in the modelling.
In both non–linear and linear situations, the underlying assumption of perfect information, and the lack of information in practice, presents a particular challenge, and further consideration needs to be given to dealing with risk and uncertainty in the real world. This issue will be revisited after a more detailed consideration of the application of production economics to specific aspects of optimising production systems.

Factor–product relationships

The principle of diminishing marginal returns states that, *ceteris paribus*, the output generated from successive units of a variable input will eventually decline, in particular because fixed resources (i.e. all other inputs that are held at a constant level) limit production potential as they are used up. This may be illustrated by crop response to nitrogen fertiliser inputs, which typically shows diminishing marginal returns as a result of other key nutrients (P, K, etc.) being used up, and negative marginal returns (declining total yield), possibly as a consequence of lodging and/or increased pest and disease incidence. Figure shows a typical curve for S23 ryegrass response to nitrogen fertiliser input .

Figure 3-1Nitrogen fertiliser production response curves for perennial ryegrass only (S23) and perennial ryegrass/white clover r



Source: Thomas *et al.* (1991)

Conversion to organic production involves restriction of nitrogen fertiliser input, although some nitrogen would be obtained from organic manures and slurries applied (say 100 kg N/ha). Depending on the relationship between the cost of nitrogen fertiliser and the value of the grass produced (in terms of milk or meat sales), the yield obtained (ca. 4.5 t/ha) might be seen as sub-optimal, in technical (maximum output per unit of fixed resource) as well as economic (marginal/unit factor cost equals value of the marginal product) efficiency terms. A higher organic product price would compensate financially for the sub-optimal situation, although the higher marginal value product would suggest more nitrogen fertiliser use would be justified, if it were not constrained by organic regulations.

As indicated above, diminishing marginal returns may not solely be attributable to the consumption of limited fixed resources. Agriculture is a dynamic biological system and inputs into a biological system will modify that system (for example nitrogen fertiliser inputs may adversely affect earthworm numbers and the nitrogen fixing potential of *Rhizobia*, encourage increased breakdown and mineralisation of organic matter, and increase the risk of plant pest and disease incidence). The fixed resources represented by the soil and crop ecosystems cannot be assumed to be unchanged, and any changes may become increasingly significant in subsequent production periods. From this perspective, the comparative static *ceteris paribus* assumption of production economics is questionable. From an organic farming standpoint, this is a significant issue.

More importantly, however, the assumption that conversion to organic production involves remaining on the same production function is fundamentally incorrect, as the conversion involves modifications to the mix of resources and practices used, so that the *ceteris paribus* condition is violated. In the example illustrated, clover (S100) would be introduced to provide biologically–fixed nitrogen, resulting in a new production response curve (albeit one where the principle of diminishing marginal returns still holds). There is also a need to consider residual fertility from preceding crops, and the impact on following crops in the rotation, with different production functions generated in each case.

These issues, together with the Standards restrictions on certain inputs, significantly complicate the application of production economic theory to understanding the complex physical and financial performance changes that take place as a result of conversion to organic production. Evaluating the optimal combinations of inputs and outputs given the number of critical variables would in practice require a substantial body of additional data from experiments and/or farm surveys, which is only starting to be addressed.

Factor–factor relationships

The principle of diminishing marginal returns and the resulting factor–product relationships discussed above provide a basis for analysing the optimal mix of variable inputs to produce a given product (where the marginal product per unit of expenditure is the same for each resource). Within an established organic system, this approach may have some relevance, for example the constrained optimisation of livestock diets involving the production of specified levels of output at least cost. Once again, however, the analysis of conversion to organic production is complicated by the prohibition or restricted use of certain inputs, resulting in potential discontinuities in the factor–factor relationships, in particular because the combination of certain 'conventional' and 'organic' inputs may not be an option. It may of course be that in such a scenario the optimal use of an input lies on the corner of the discontinuity, implying that profit–maximising producers should utilise permitted inputs, for example conventional feed allowances, up to the specified limits, but this is not necessarily the case.

A further issue in the organic farming context is the emphasis on minimising external inputs and increased reliance on internal resources, including the farming system's human and natural capital and the associated agro-ecosystem services. In the two–factor model, a shift to a new production response surface could result in higher levels of production from given levels of variable (external) inputs through more effective utilisation of the fixed (internal) resources, effectively breaching the *ceteris paribus* condition.

Product–product relationships

The principle of diminishing marginal returns also provides a basis for analysing the optimal mix of enterprises in a system given limited availability of variable inputs. In this context, the relationship between enterprises may be competitive, supplementary or complementary. A *competitive* situation arises where a transfer of the available variable resources from one production activity to another would result in increased production of the second at the expense of the first. Normally, the optimum combination of products (where the value of the marginal product per unit of variable factor is equal for each enterprise – the principle of equi-marginal returns) occurs within the competitive segment of the production possibility frontier. Because of diminishing marginal returns, a combination of enterprises rather than a single enterprise would normally be involved, favouring diversification over specialisation.

A *supplementary* situation exists where a change in the level of one activity has no impact on the level of another activity, either because the limiting factor of production is not needed for both activities, or more generally the marginal product of the resource is zero for one factor (for example where total product is at the maximum point of the production response curve).

Complementarity is said to exist where a transfer of variable resources from one activity to another results in an increased output of both activities. In the context of the theoretical model, this arises because the marginal product of one activity is negative, i.e. so much variable input is being used that total product is actually declining rather than increasing with each additional unit of input.

The concept of complementarity is very important in organic farming, as many practices (including rotations, intercropping and mixed grazing) are utilised to capitalise on the benefits to be obtained from integrating enterprises. The fundamental concept of emergent properties in systems theory (the whole is greater than the sum of its parts) also reflects this.

Internal transfers of often non-market and therefore unvalued benefits between individual production activities and between the ecological infrastructure of the farm and its production activities are a key part of this complementarity. For example, in organic farming forage legumes form the basis of the fertility–building phase of a crop rotation because of their capacity to support high levels of biological nitrogen and carbon fixation. Whether utilised by livestock or supported by set–aside payments, the returns per hectare for these forage crops are often lower than would be obtained by cash crops such as cereals and vegetables. In this context, the lower returns on the forage crops can be seen as part of the 'costs' of achieving higher returns on the cash crops.

Such relationships can be integrated into the basic theory: if a two–product model, 'forage' and 'cereals', is considered, with land plus related nitrogen, organic matter and pest/disease suppression capacity as the limiting resources that are being shared between the two, then as the area of land (the variable input) allocated to cereals is increased, declining nitrogen, organic matter and pest/disease suppression capacity will eventually lead to declining total output (negative marginal returns) and a complementary relationship with forage legumes will be established. If forage crops are increased beyond the point needed to maintain satisfactory levels of nitrogen, organic matter and pest/disease suppression capacity for the cereals activity, then the relationship becomes competitive.

A similar situation can be seen to exist where the parasite control benefits of integrating cattle with sheep might justify keeping cattle even though the returns are lower than for sheep. In this case, cattle+forage would be one activity, sheep+forage the other, and land with related sward quality and parasite infestation levels the resources that are limiting. As more land is allocated to the sheep enterprise, negative marginal returns may arise due to increasing parasite incidence and declining sward quality (i.e. the necessary parasite freedom and sward quality resources become limiting) and in this context a complementary relationship between cattle and sheep will exist, but the relationship becomes competitive once there is sufficient land allocated to cattle production to maintain the necessary parasite and sward quality levels.

Because of the limitations on external inputs and the need to make more effective use of internal resources, the challenge for the organic farmer is to determine the optimal combination of enterprises that allows for the most efficient management of the internal transfers of fertility and other benefits. While the theoretical model is relevant in this context, it is extremely difficult to apply because of the lack of information on the benefits arising from these internal transfers, including both physical quantities and financial values. Clearly some transfers, such as straw and grain from crop to livestock production activities, are easier to quantify and value than others, such as the fertility and crop protection benefits arising from different rotations.

The concept of opportunity cost (reflecting the financial impact of transferring a unit of limiting resource from one activity to the next most profitable activity) is highly relevant in this context. The value of a hectare of forage crops in a complementarity context can then be seen in terms of the reduced overall financial performance that would result if the land were transferred to cereals production, and not just the direct income derived from the utilisation of the forage crop. It might also be possible to evaluate the fertility benefits by calculating the fertiliser saving that would be made possible while maintaining cereal yields, but as fertiliser inputs are restricted under organic standards, this is less relevant.

Economies of scale

Despite the frequent assumption that organic farming is small-scale by definition, the average size of organic holding in the UK and in the EU is greater than for the industry as a whole (Lampkin, 2001), and the potential for economies of scale is arguably as important to the organic producer as the conventional producer (Offermann and Nieberg, 2000). Production economic theory may contribute some understanding to this issue. So far, input/output relationships have been considered in terms of the production function, where only the variable inputs can be altered, reflecting a short-term perspective, typically limited to the current production period. Increasing enterprise size and returns to scale can also be considered in terms of the cost function, which represents the least cost method of production for each level of output.

True economies of scale are said to exist where *all* factors of production can be increased in proportion, and output increases at a greater rate than the increase in these factors. However, factor indivisibility and limited availability of resources (as well as the dynamic nature of the biological system) make this assumption unrealistic: in practice the theory focuses on increases in size of the enterprise where the proportion of different factors utilised is likely to change as output increases. In the context of a production system that relies more heavily on internal resources, ecosystem interactions and management rather than external inputs, the biological constraints, for example the migration abilities of different organisms (whether animals, beneficial insects or pathogens), will be relevant to consider in this context. This may mean that the optimal size of enterprise (where marginal cost = marginal revenue) will be lower than might be the case in other contexts.

Underlying assumptions of neo-classical production economic theory

From the above discussion, some questions faced by organic farmers clearly come within the scope of production economic theory, but others remain outside the key areas for which the theory is most widely used, in particular because of lack of information on key relationships and variables and the dynamic nature of agricultural production systems. Apart from the specific issues identified, there are also some more general issues relating to the applicability of production economic theory in the context of this study. These are discussed based on the key assumptions (in italics) of production economic theory as specified by (Steinhäuser et al., 1978 translation from German by the author).

1. *'The producer is fully informed about the implications of his decisions'*. It is already clear from the preceding discussion, as well as that on the information–related barriers to organic conversion (Chapter 2), that this assumption is questionable with respect to organic and converting producers. (1990) argues further that in focusing on allocative efficiency problems, the theory ignores a very important problem of farm management decisions: that of identification and adoption of technically efficient combinations of inputs and outputs in general.
2. *'The producer aims to maximise the profit derived from his production'*. Arguably the aim to maximise profit, although often assumed to be central, is not essential to the theory. It could be interpreted as the broader aim of utility maximisation, which is likely to be of interest to all agricultural producers, whether conventional or organic. It is known that farmers have a wide range of goals related to lifestyle, stewardship and the environment, which are also reflected in the motives for farmers converting to organic production (see Chapter 2). The process of production and decision-making on farms, particularly a move towards greater sustainability of agriculture, is influenced by farmers' personal values and objectives, and by the social and institutional environment in which decisions are taken, even if the exact mechanisms and the extent of influence are yet unknown. It is likely, particularly in the context of this study, that the broader concept of utility maximisation is preferable to that of profit maximisation.
3. *'The theory largely ignores the dimension of time in the agricultural production process'*. Jarret (1957 cited after Malcom, 1990) points out that farmers generally make decisions on the basis of long-term objectives, whereas the focus of production economics is typically on optimisation in the short-term. Given the dynamic nature of agriculture as a biological system, and the impact that practices adopted in the past can have on the present (and current practices on the future) performance of agricultural systems, it is clear that ignoring the dimension of time can be problematic. In the context of the subject of this study, i.e. the process of conversion to organic farming involving a change from one established production system to another, the dimension of time is crucially important and cannot be ignored.
4. *'All production inputs and products can be divided into smaller units'*. Steinhäuser *et. al.* (1972) and Upton (1976) point out that this is only partly true that some inputs (e.g. regular labour and machinery and products (e.g. livestock) only exist as distinct units. The issue of factor indivisibility is one of the issues that gives rise to potential economies of size as discussed above.
5. *'The producer adjusts the intensity and level of production as he has no influence over the output price'*. This reflects the assumption of perfect competition and is true to the extent that producers are supplying commodity markets, so that they are 'small' relative to the total size of the industry. However, if a producer targets a specialist or niche market, the producer may become 'large' relative to that specific market, and may therefore no longer be a price taker. Arguably, this situation applies in the context of conversion to organic production, as an important aim is to produce output of a different quality, for which consumers are prepared to pay a higher price. As the organic sector expands, however, it might be that price is once again outside the control of the producer: problems in 2001 with oversupply in the UK organic milk market could be seen as reflecting this. The development of co-operative marketing, and initiatives to market produce directly to the consumer, may also be seen as attempts by producers to become price-makers rather than takers. Both have the clear aim to increase the value of the product and the price to the producer. Such efforts are not unique to organic producers, but are quite widespread among them. The financial reporting of organic farms using standard procedures frequently fails to differentiate prices according to sales channels, the proportion of which can vary considerably between commodities and between countries (Offermann and Nieberg, 2000).

The discussion illustrates that some of the underlying assumptions make using production economic theory for the purpose of this study questionable, in particular the broad range of objectives that influence farmer decision-making in the area of sustainability, the dimension of time and the dynamics of change, and the information barriers that are the focus of this study. Imperfect information and difficulties predicting future outcomes give rise to theoretical questions concerning risk and uncertainty in organic farming, and the relative impacts of specialisation and diversity.

Risk and uncertainty

In practice, risk and uncertainty are issues faced by all producers, particularly in the context of biological production systems such as agriculture, which may be significantly influenced by site, climate and management. Risk and uncertainty may therefore arise both from biological factors, influencing yields, and economic factors, influencing costs and prices (and which may be a consequence of biological factors, for example a good harvest leading to price reductions due to oversupply). The increased use of agro-chemical and other inputs in agriculture are considered to have given producers greater control and predictability of the production process, and thus contributed to reductions in the levels of risk and uncertainty. This is particularly the case where production takes place in controlled environments, such as greenhouses or livestock housing. From this perspective, it has been argued that the rejection of many of these inputs in organic farming lead to increased levels of risk and uncertainty. However, the so-called 'boomerang' effect, whereby the use of a pesticide to control a pests undermines the self-regulatory processes in an agro-ecosystem. Fragstein (1985) raises the question as to whether an automatic assumption of increased risk through not using such inputs is warranted. By also killing beneficial insects, or at least removing the pest as a food source, the use of a pesticide may mean that the pest can recover to more serious levels than had no pesticide been used at all.

In considering the theoretical context and the implications for organic farming, it is important to distinguish between risk and uncertainty. *Risk* can be defined as a situation where different, known outcomes are possible and that a probability can be attached to the outcome. The range of possible outcomes and probabilities may be defined on the basis of historical data relating to the industry as a whole, or may be more specific to the individual business. Given the availability of information on possible outcomes and probabilities, it is possible for the decision-maker to determine expected values for the (long-term) average outcome and to incorporate these into optimisation procedures. Diversification may be used as a strategy to reduce risk, to the extent that poor outcomes for one activity may be good for another (for example dry and wet seasons), but where activities are similarly affected by specific outcomes, which is arguably more likely in practice at least for different crop production enterprises, then diversification may reinforce rather than alleviate the problem. The combination of crop and livestock enterprises in mixed farming systems, where livestock may benefit from cheaper cereals for example, is more likely to result in potential for risk reduction. From this perspective, it is argued that organic farming based on a mixed farming approach will result in reduced levels of risk and uncertainty. No studies have been identified that have attempted to assess the overall impact on risk and uncertainty in organic farming considering both the position of reduced input use increasing risks and the risk reduction benefits of diversification.

However, the process of conversion entails the adoption of practices and activities that may be new to the farm, and therefore there is little or no information available to the producer to determine expected values of outcomes. This increases the level of *uncertainty*, where the outcomes are not known, or at least the probability of an outcome such as crop failure cannot be identified. In such situations, subjective (personal or judgemental) probabilities may be applied by the decision-maker, based on his/her own beliefs and perceptions. While various formalised approaches such as game theory can be applied in this context, these are rarely applied in practice (or at least not consciously). As discussed in Chapter 2, the complexities of decision-making with respect to the decision to convert and the change process in the context of uncertainty are significant and justify the focus of this research on these specific issues.

Specialisation and diversification

Production economic theory suggests that the optimal allocation of resources between competing activities will usually result in a mix of activities being selected due to the differing resource demands of individual activities and the impact of the assumption of diminishing marginal returns. However, economic pressures to specialise may arise due to the principle of comparative advantage and the need to expand individual activities to spread fixed costs, particularly those that have no alternative use for other activities, for example the milking parlour, cubicle housing and specialist labour in milk production. The same pressures to specialise can be seen to exist within organic production systems, including milk production, even though the arguments in favour of diversity and mixed farming systems are strongly emphasised as part of the organic approach.

In economic terms, the arguments in favour of diversification arise not just from efficient resource utilisation, but also as a strategy to deal with risk and uncertainty as discussed above. However, the biological basis for diversity is also important. The benefits arising from interactions between production enterprises, in particular relating to soil fertility, weed, pest, disease and parasite control, are much easier to achieve in a mixed than in a specialised system. In ecological terms, diversity has been argued by some to contribute to ecosystem stability, and in particular the self-regulation capacities of ecosystems, whereby if the population of one organism (e.g. a pest) starts to get out of balance, then other organisms (e.g. predators) will respond to control it. However, diversity on its own may not be sufficient to achieve this; the complexity of trophic relationships between different elements in the system is also important, for example the existence of alternative hosts for beneficial predators that will permit their survival should the main host be eliminated. The key concept of agro-ecosystem management underpinning organic systems means that not only cultural practices such as rotations and species mixtures, but also the ecosystem services provided by non-cropped habitats (e.g. field margins, hedges, scrubland) are important. The difficulties inherent in valuing the ecosystem services provided may mean that the biological advantages of diversity are undervalued relative to the economic pressures towards specialisation, even in organic farming, to the extent that organic production standards do not force producers to recognise and work with them.

Conclusions and implications for this research

At the beginning of this section, two questions relating to the application of production economic theory to this research were posed:

a) Can it contribute to a better understanding of the change process during conversion? and
b) Can it provide an appropriate theoretical focus in relation to organic production in general?

In response to (a) production economic theory does not specifically address processes of change in a multi-period dynamic context, concerned as it is with the questions of allocative efficiency in a comparative static framework. In this context, the theory's main focus relates to optimising outcomes of production decisions, whereas the main issue to be addressed with this research is the process of decision-making and implementation itself, under conditions of uncertainty, which are questions of more general interest within the discipline of farm management (Malcolm, 1990). While production economics may provide some guidance on optimising the timing of the conversion of various enterprises on the farm and the utilisation of specific practices, its application is problematic, because of the broad range of objectives and values that converting producers have, as well as the significant information barriers, including less than full information on likely yield and price outcomes or efficient use of technology.

In relation to (b), despite the possible contributions to optimising organic systems outlined above, it is necessary to recognise that the use of several external inputs is prohibited or severely restricted by organic productions standards, and are replaced by farm–internal resources and biological processes, including labour and management. In this context, lack of relevant information means that further research would be needed to identify the production relationships that are typical for organic farming, and the challenge of valuing non-market benefits provided by other production activities and the farm's ecological infrastructure would need to be faced.

In summary, production economic theory has only limited relevance to the core aim of the study and substantial practical difficulties in applying it would need to be overcome, so it has not been considered further in detail as part of this study.

Implications for the research

The review presented in this chapter confirms that the conversion process on dairy farms is likely to affect the farm as well as the farmers. The Standards for organic livestock production imply that converting dairy farmers will need to make more use of the farm's internal resources and biological processes and rely less on external resources, for example for meeting crop nitrogen requirements. Converting farmers will also need to rely more on preventive health management and avoid routine use of medication, as the use of antibiotics and other veterinary drugs is restricted and may affect the organic status of their animals. It is likely that these changes lead to additional information requirements of the farmer and may also imply changes to the use of information sources.

The review highlighted that very few studies have focused on the dynamics of the conversion process itself, but comparisons between established organic and conventional systems allow the prediction of some of the likely changes in key variables:

- Converting dairy farms are likely to undergo structural changes in terms of land use and stock numbers, whereby the level of livestock production is adjusted to the natural carrying capacity of the land, resulting in a higher proportion of area used by temporary clover/grass leys, possible reductions in stocking rates, and increases in the total forage area so that stock numbers can be maintained.
- Forage yield levels may decline during conversion, due to the withdrawal of nitrogen fertiliser, but appear to return to levels comparable to conventional farms once an organic system including legumes for biological nitrogen fixation has been established.
- Forage yields in established organic systems are determined by soil and climatic conditions (particularly rainfall), clover content in the sward and sward age.
- Converting farms, particularly those with intensive milk production and high levels of concentrate feeding, are likely to face reductions in milk production levels both per cow and per hectare.
- In line with the general principles of organic farming, converting farmers may either reduce levels of concentrate feeding per cow, or in aiming to maintain milk production levels make full use of the allowances in the Standards for feeding concentrates. Changes in concentrate feeding during conversion would have an impact on the demand for forage and the stocking rate development. In line with the principles of the Standards, converting farmers are also likely to use more home-grown concentrates, but this has not been confirmed in the literature.
- Converting commercial dairy farms are reported to suffer feed shortages during conversion, but the extent of, and the reasons for, such shortages are poorly understood. Energy deficiency in the diet may also be the underlying cause for fertility problems that have been observed on some organic farms.
- Converting dairy farms will not normally qualify for organic price premiums for at least 27 months (24 months since 2000) from the start of conversion, possibly longer depending on their conversion strategy, and are therefore likely to suffer a loss in income during conversion. Income levels should improve when price premiums for the milk can be realised, making the conversion strategy and certification date of the herd important parameters to consider. Converting farms may be able to compensate for declining output through cost savings earlier on in the conversion.

- On the basis of contradicting evidence it is not possible to predict the likely impact of organic conversion on the labour requirements and fixed costs. Given their increased suitability for organic conversion, mixed farms should achieve better incomes during conversion than more specialist farms.

Regarding the methods of empirical investigation, there appears to be a particular need to understand better the extent of and likely causes for feed shortages during conversion, as these may have negative effects on health and fertility of the herd and on farm income. The value of the stocking rate as an indicator for on-farm forage production potential needs to be further investigated, because it is also influenced by feed purchases (concentrates and forage), which may be affected by the conversion.

There appears to be a need to differentiate between production and marketing–related changes to farm income. For this it is necessary to monitor a range of biophysical as well as financial indicators on converting farms, including land use, stock numbers, forage and milk production, concentrate feeding, variable and fixed costs, and farm incomes. Conventional comparisons should be included in conversion studies so that system–specific factors can be distinguished from general trends in the industry.

Given the key questions of this study, concerns about some theoretical assumptions of production economic theory (particularly in the context of the focus on the change process itself rather than the outcome of organic conversion), and practical difficulties identified in applying it, production economics was not considered further as an appropriate theoretical framework for the study.

Together with the personal and external factors that were highlighted in the previous chapter, a considerable number of variables need to be considered to gain a better understanding of the key changes during organic conversion at the farm level. The case study method allows the consideration of many variables for a limited number of cases, in contrast to more quantitative methods which would involve few variables and many cases (Ragin, 1987). Case studies were therefore considered to be an appropriate method for the empirical research. The underlying research tradition of qualitative social science, its application in the area of agriculture and farming systems research, and the specific data collection and analysis methods of case study research are the focus of the next chapter.

Methodology and approach

Introduction

The focus of this research is the process of conversion to organic farming at the farm level, and the related information needs of farmers, with the aim of developing recommendations for information provision. Davis and Olson (1985) identified four principal approaches to studying the information requirements of farmers:

1. Direct questioning;
2. Derivation from existing systems;
3. Synthesis from characteristics of the processes being managed; and
4. Discovery from experimentation with an evolving system (prototyping).

The first two of these elements, with particular emphasis on the second, were combined for this research in a case study approach that is presented in this chapter. Systems prototyping was not considered to be suitable for this research as it implies considerable intervention on farms. The synthesis of the various processes to be managed was to some degree considered through the literature reviews in the previous two chapters.

In Chapter 2 it was argued that the conversion process at the farm level is influenced by a considerable number of personal, farm specific and external variables and that there is a lack of clear theoretical models of farmer decision-making in the area of environmental practices. The review of organic dairy farming research in Chapter 3 summarised some farm specific conditions likely to influence the conversion process, and concluded with predictions of the likely development of some farm specific variables. However, few studies have focused on the change process itself and the likely development of some variables and the relationships between many of the factors remain poorly understood.

It appears therefore to be necessary to use a research method that can consider a number of factors both as the context and as the implications of the conversion. Inductive, qualitative methods, such as case study research, are particularly appropriate for process-orientated inquiries (Patton, 1990) and allow a considerable number of variables, some of which are ill structured, to be considered, but such methods limit the number of cases that can be studied. Albrecht (1986) also saw these as particularly suitable to uncover the farmer's perspective of a problem and to draw conclusions about their information and extension needs. If rich and in-depth information is collected, a great deal can be learned from few examples (Patton, 1990).

The case study method was chosen for the empirical work of investigating the change process in depth on a relatively small number of farms. In this chapter the theory of the method and methodological choices are discussed, and the specific approach to sampling, data collection and analysis is presented. Qualitative inquiries in general and case study research in agricultural in particular, have developed during the period in which this research was carried out. Relevant references published during the study period that have corroborated the author's choices or have influenced the data analysis are identified and reviewed alongside those that influenced the data collection directly. The following sections:

1. Outline the theoretical background and the development of qualitative social inquiry and soft systems thinking;
2. Consider the use of inductive research methods (including case studies) in agriculture and organic farming;
3. Discuss methodological guidelines for conducting case studies and the reasons for the choice of the case study method for this study; and

4. Present the specific approach to the empirical work, including the author's personal background.

The research tradition of qualitative social inquiry

Qualitative social science methods aim to improve the understanding of human behaviour and social systems within a naturalistic setting, and to make sense of phenomena in the context of the meaning that people bring to them. They originated from a range of social disciplines, such as anthropology, sociology and human geography. The basic research paradigm is that of phenomenological inquiry using inductive methods. Important theoretical concepts and traditions in the development of the specific approach for this research are summarised below (4.2.1).

Creswell (1998) refers to five traditions that have contributed to the development of qualitative inquiry as: biographical research, phenomenology, grounded theory, ethnography (including fieldwork interactionism, naturalism and the Chicago school of sociology), and case study research. Patton (1990) sees case study research as a method within the tradition, and adds ecological psychology and systems thinking, including farming systems research, to the list of traditions.

The research tradition of qualitative inquiry stands in contrast to ideas that social research should follow the scientific tradition of the natural sciences (logical positivism), in which the development of hypotheses and deduction are central to the research. This epistemological debate between social constructivism (hermeneutics) and logical positivism was a typical feature of social science research. Checkland (1999) quotes a sociologist (Cohen, 1968) in saying that social theorists are more concerned with discussions about the nature of sociology and of social theory than with the nature of social reality itself. Both traditions can claim historic roots: hermeneutics originated from Aristotelian traditions, whereas logical positivism is associated with Galileo, but its origins can arguably be traced back to Plato (Wright, 1993).

But more important is the question of the key differences. In the context of researching human behaviour, social constructivism can be summarised as aiming to "understand", logical positivism as aiming to "explain". The tradition of "understanding" includes a psychological dimension, in contrast to the aim to "explain", concerned with the establishment of causal relationships in a basically mechanistic understanding of the world. However, there is also much common ground in that both traditions analyse some form of data with the aim to arrive at a coherent and transferable conclusion, so the epistemological distinction in the social sciences should not be overemphasised.

Important theories associated with qualitative inquiry

A number of theories are closely associated with the development of qualitative social inquiry and case study research. Those that have influenced the thinking of the author and the specific approach are shortly summarised here.

Phenomenologists (incl. heuristics) focus on the structure and *essence of a person's subjective experience,* a phenomenon, which they consider true for that person, although there may be common essences between different people's experiences. They describe the meaning for individuals of the lived experience, the phenomenon, and explore the structure of consciousness in human experience. The research tradition goes back to the German mathematician and philosopher Edmund Husserl (1859–1938). The essence or the central underlying meaning of an experience can be discovered through participant observation, whereby the researcher has to participate with the subjects partially to share their experiences (Creswell, 1998; Patton, 1990).

Symbolic Interactionism as a sociological theory goes back to Mead and has been further developed by Blumer (1969). Mead argues that humans are self-conscious and anticipate in their behaviour the reaction of others, because they have the ability to assume the perspective of the people with whom they interact. Three main premises to explain human behaviour are set by Symbolic Interactionism:

1. *Humans act* towards things *on the basis of the meaning* that these things have for them.
2. The meaning that things have arises from social interaction between people

3. Meaning is handled in and modified through an interpretative process that involves other human beings.

Grounded theory sees qualitative research as one important tool for the development of social theory, but in contrast to logical positivism (the theory is needed prior to any experimental work) the emphasis lies on *grounding the theory in the empirical findings*, which is reflected in the name (Glaser and A Strauss, 1965). Lincoln and Guba (1985, cited in Patton) see it as of critical importance that the design is allowed to emerge, develop and unfold. This stems from the open-ended nature of the inquiry, rather than a sloppy approach that avoids theorising beforehand. Glaser and Strauss (1965) reject the prior application of sociological theories without empirical evidence to any particular phenomenon, because this can influence an enquiry so strongly that alternative explanatory theories arising from the data may not be considered. Substantive theory, they argue, should be the outcome of sociological research, rather than the beginning. This approach is particularly appropriate if limited theory exists or if existing theory is not applicable, but may also arise because of more pragmatic considerations (Glaser and Strauss, 1965). Patton (1990) also sees the role of and the development of theory as very important in determining the choice of research methods.

Despite some differences, all three traditions have in common that they focus on the *subjective nature of human experience*. In order to study human behaviour the researcher has to adopt an empathetic perspective with the subject of the research.

Coming from a different angle and from outside the more traditional disciplines of social sciences, organisational theorists and systems analysts have also contributed to the development of research methods concerned with phenomena in their natural setting (Patton, 1990; Checkland, 1999). The tradition of **holism**, of thinking at the systems level, is characterised by the assumption that a system is more than the sum of its parts. It stands in contrast to theories and research methods based on a mechanistic understanding of the world that assumes that all relationships can be established by studying the components of systems–as a research tradition this is called reductionism, of which neo-classical economics is one example in the social sciences.

Systems research focuses on observation of a phenomenon in its naturalistic environment, rather than the manipulation of a limited number of variables in experimental settings. Systems thinkers vary in whether or not they consider the human activity as part of the system under study, and the two broad schools have been labelled as "hard" and "soft" systems thinking. "Hard" systems thinking is concerned with systems presumed to exist in nature, whereas "soft" systems thinkers consider the human activity to be a central part of a system (Bawden, 1995; Checkland, 1999).

The person associated most strongly with the development of so-called "soft" systems thinking is Peter Checkland. He saw a need to develop specialist systems thinking and research methods for problems arising at the systems level. Because of the complexity of systems in general, and of social phenomena in particular, management problems in the real world (he labels them as "wicked" problems) cannot be well understood following the traditional scientific method of logical positivism and reductionism. Checkland (1999) cites Patin (1968) who sees the limitation of the scientific method in the complexity of what he calls the "unrestricted" sciences. These are disciplines that deal with such a great number of variables and complex interactions (e.g. biology, geology, meteorology) that it is often not possible to set controlled experiments. Quantitative models become more vulnerable because unknown factors may dominate the observations.

Checkland (1999) sees the disciplines of 'social' sciences also as unrestricted, and argues that researchers are faced with the additional problem that the phenomena under study (human beings and social institutions) are generally not available for experiments. Similar to other theoretical roots of qualitative research methods, he argues that humans are active participants in a phenomenon, who attribute meaning and will influence the situation under study potentially in a unique way. This applies also to researchers, who also attribute potentially unique meaning to the subject of their study. No social scientist can therefore ever hope to achieve complete objectivity and repeatability of her or his findings.

The debate among the two traditions of systems thinking (hard and soft) bears some similarities to the quantitative/qualitative debate among social scientists, but the argument is ontological in nature (theory as to what exists) rather than epistemological (theory as to how knowledge can be derived). Table 4-1 summarises the main ontological and epistemological differences between the four broad research traditions of logical positivism, hard systems thinking, qualitative social science and soft systems thinking. "Hard" systems thinking shares with the "soft" school the ontological perspective of "holism", but like logical positivism maintains the notion of objectivity, whereas "soft" systems thinkers like qualitative researchers adopt a more "relativistic" epistemology (Bawden, 1995; Woodhill and Röling, 1998).

Table 4-1 Ontological and epistemological assumptions in different research traditions

Research traditions	*Logical positivism*	*Hard systems*	*Qualitative methods*	*Soft systems*
ontology	realist/ reductionist	holistic	holistic	holistic
epistemology	objective	objective	contextual relativism	contextual relativism
human nature	rational	rational	act on meaning	*'Weltanschauung'* of stakeholders
methodology	deductive & experimental	inductive & modelling	inductive & empirical	action research & learning cycle

Source: own summary after Bawden (1995) and Woodhill and Röling (1998)

Logical positivism and hard systems thinking sees humans as behaving rationally. The qualitative tradition and soft systems thinking see the social and historical context as important in shaping human behaviour; in the qualitative traditions this is expressed as acting on the basis of meaning (socially derived), soft systems thinkers talk about differences in perspectives of stakeholders (*Weltanschauungen*). The main difference between qualitative social research and soft systems thinking is one of methodology, rather than epistemology and ontology. Soft systems methodology is strongly orientated towards action research, aiming to make a contribution to solving real-world problems, whereas the qualitative research is more concerned with advancing the theoretical understanding of human nature and human behaviour.

In summary, two main lines of argument are common to the various theories that have contributed to the development of the holistic, inductive research tradition of qualitative social inquiry to which case study research belongs:

1. The need to account for the subjective nature of humans (including researchers) that act on the basis of socially derived meaning, introducing an element of subjectivity to every inquiry.
2. The need to study complex phenomena with many variables (including human beings) and unclear boundaries within the context of the natural setting.

The epistemological/ontological debate between different traditions is important in understanding the historic development of qualitative social inquiry, but several authors argue for a more pragmatic choice of methods, depending on the particular strengths and weaknesses with respect to a particular research question, rather than disciplinarian traditions (e.g. Patton, 1990, Yin, 1994; Silverman, 2000; Henwood, 1993). For example Yin (1994) sees case study research as able to make important contributions to questions in psychology, which as a discipline, similar to agricultural economics, traditionally would favour quantitative research approaches. His and others' arguments with respect to which type of questions are suited to case study research and their suggestions how its rigour can be improved are considered in the following section.

Inductive research in agriculture

A number of authors have discussed the use of inductive research techniques in agriculture, some before this research began in 1993. Lockeretz and Anderson (1993) argue for a rethink of the methods that agricultural researchers use in the light of the new challenges and questions that farming faces towards the end of the twentieth century. Both Norgaard (1991) and Bawden (1991) acknowledge the contribution of reductionism to technological innovations in agriculture, but see its limitations in meeting the challenge of sustainability and assessing the socio-economic and cultural implications of change, advocating a broad co-evolutionary framework. In this country Pretty (1994) argues that in wanting to understand issues of sustainability in agriculture researchers must move away from trying to establish one objective truth, as most problems are open to interpretation, depending on the particular viewpoint of a stakeholder. Duram (1998) criticises survey work with agricultural producers conducted under a positivist paradigm for placing people in 'neat' boxes and ignoring the large and complex nature of human decision-making, particularly in relation to alternative farming practices. Gafsi (1999) argues that research on farmers adopting more environmentally friendly practices has neglected the change process, in which the farmer is central, and has so far mainly focused on the question whether or not farmers adopt and what variables might influence this.

Woodhill and Röling (1998) point out that sustainability as a concept centres on human actions towards nature and the environment, and extending this to research methods Skerrat and Midmore, (2000) argue that qualitative, people-centred analysis tools provide critical insights for the development of policies for sustainable rural development. In studying farm-level decision-making related to the environment they see the main advantage of qualitative methods in encouraging farmers to use their own terms and conceptualisation, which may differ from that of the researcher or policy maker. In addition, the interaction with social and information networks and the perspective of other stakeholders on the farm (e.g. the spouse) can be considered in a better way.

With direct relevance to this study, Albrecht (1986) argues that inductive (qualitative) research methods are particularly suited to working towards a participatory, farmer-driven extension and advisory approach. He sees their main strength in uncovering the farmers' perspective and the understanding of problems (e.g. the process of generation transfer), in order to be able to draw conclusions about the information the farmer needs for the actual decision-making process.

Agricultural systems thinking and organic farming research

Systems' thinking also has a long tradition in agriculture. The concept of the farm as an interactive, independent (bounded) organism was used by Brinkman and Aereboe, the German pioneers of farm management in the early twentieth century (Dabbert, 1994). The need to maintain soil fertility, to balance forage and the use of farm labour, risk reduction and self sufficiency were seen as integrating forces for a farm, whereas location, site specific soil and climatic conditions and the personal aims of the farmer were seen as differentiating forces. Both explained the variation in the intensity of farming systems in relation to land use, labour and capital. Aereboe explained the farm organism concept by using the analogies of branches of a tree and of the organs of an animal to illustrate the relationship between the various enterprises and the need for integration. In this farm "organism" all the components– the soil minerals, organic matter, micro-organisms, insects, plants, animals and humans–interact to create a coherent and stable whole (Dabbert, 1990). This analogy of the farm as an organism is particularly widely used in the bio-dynamic agriculture movement (e.g.Koepf et al., 1976).

Other examples of systems research approaches in agriculture belong mainly to the "hard" systems tradition (Bawden, 1995), such as agro-ecosystems analysis (Altieri, 1995; Conway, 1985) or agricultural systems analysis (Dent and Anderson, 1971; Spedding, 1988), developing an agro-biological understanding of the physical and biological or ecological components of the farming system.

Systems traditions and holism have also influenced various researchers of organic farming and feature strongly in debates about appropriate research methods (Alrøe, 2000; Høgh-Jensen, 1998; Krell, 1997). Wynen (1996) even talks about a new research paradigm in the sense of Kuhn (1970). However, the reality of research in organic farming systems hardly differs from other agricultural research in the degree to which such methods are used (Lockeretz, 2000). Alrøe (2000) explains this with reference to the fact that systems-oriented approaches are considered less scientific, and to the absence of a general systemic research tradition in agriculture. Such a tradition should, according to them, embrace analytical research focused on particular components, but recognise science also as a learning process for the individual researcher and for society as a whole. During different stages of the learning cycle the researcher can adopt both a value-laden 'actor' stance and a more detached 'objective' observer stance. He uses the term of reflexive objectivity, emphasising the inclusion of and exposure to the human context of science with specific values and interests, and view research as cyclical learning experience (Alrøe, 2000)–similar to Checkland (1999) and to Bawden's (1995) critical reflection on the systems element of the farming systems research tradition (see 4.3.3). This concept has been put into practice by a team at the Danish Research Institute for Animal science (DIAS) to investigate a number of issues related to organic milk production, and includes the use of comparative analysis of case study data of commercial farms (Mogensen and Kristensen, 1999).

Case study research in agriculture and organic farming

The use of well functioning organic farms as case studies is widespread among researchers of organic farming systems (Lieblein and Østergard, 1993; NRC, 1989; Vogtmann, 1983). However, despite using the term, the majority of case studies of organic farms do not make much reference to the tradition of qualitative inquiry, to which case study research belongs. The human aspects of the farming system, the farmers' motivation for the conversion to organic production, the personal goals and perspectives are almost ignored, whereas often great detail of biophysical and financial aspects may be provided.
For example, Lampkin (1993) investigated the organic conversion of two dairy and two arable farms. He analysed the farm accounts over a long period of time and compared the results with different sets of conventional comparison data, highlighting the importance of external factors for the financial outcome of the conversion, but provided only passing evidence of their motives for conversion. Rantzau *et al.*(1990) and Freyer (1991) studied conversion issues on 14 case study farms of various types in West Germany in an action research approach. The farms were visited regularly, the researcher planned the conversion with the farmers, but the researchers fail to provide any documentation of this interaction. A large Norwegian conversion project with 30 case study farms included a sociological survey, but separate publications fail to link the different types of data (Ebbesvik and Loes, 1994; Vittersø, 1995).
As the diverse nature of motives for organic conversion is well documented (see Chapter 2), it was the intention of this research to move beyond the evaluation of converting case study farms on purely agronomic and financial grounds and to include the farmers' perspective of the process, using the tools of qualitative inquiry.
Recently, two studies using the case study approach to address similar questions to this one were published. Gasfsi (1999) used an interactive case study approach, based on regular contact with the farmer over the period of change and a combination of qualitative (including participant observation) and quantitative data, to study the process of changing farming practices to improving the protection of a water catchment area, which he developed based on methods for studying organisational change. Öhlmer *et al.* (1998) also used farm case studies to verify and expand a theoretical model of the decision-making processes on farms (see Chapter 2), using two longitudinal case studies with repeated interviews and analysis of long-term account data as well a number of more short-term cases.

The Farming Systems Research (FSR) tradition

Farming Systems Research (FSR) emerged in the 1970s, as a result of the low adoption rate of some agricultural technologies in the developing world. Founders of FSR saw the lack of adaptability of many innovations to regional farming systems and cultural traditions as one important reason for their low uptake. FSR practitioners argued therefore that agricultural research should pay attention to farming systems in their social, cultural, ecological and economic context, with the main aim to consider better the needs of resource-poor farmers in the developing world (Bawden, 1995; Gilbert et al., 1980). However, the term is more a loosely defined umbrella for different research approaches, rather than a specific method (Bawden, 1995).
The development of FSR happened in direct opposition to the dominant extension paradigm of the time, that of technology transfer, based on the notion of transferring new agricultural technology developed by scientists to the farmer (Bawden, 1995; Patton, 1990). In contrast, FSR practitioners argued that new technology should be developed with a full knowledge of existing farming systems

before it is extended (Bawden, 1995; Gilbert et al., 1980). Ideally, FSR should be multi-disciplinary and flexible, take place on farms (rather than research stations) and in interaction with farmers, be sensitive to context and orientated towards processes (Patton, 1990; Gilbert et al., 1980). However, dispatching large numbers of scientists in multi-disciplinary teams on to farms also creates problems (Maxwell, 1986).

Patton (1990) sees FSR as an example of the development of qualitative research methods, seeing farmers as central to and beneficiaries of the research effort, despite the origin from farm management and agronomy traditions. However, it appears as if the use of qualitative methods was not particularly well developed in FSR, apart from descriptions of the systems under study (see e.g. Maxwell, 1986). The lack of methodological rigour may well be associated with its pragmatic rather than academic roots.

Bawden (1995) highlights that the term **system** in FSR is used in the sense of everyday language and that the tradition could be significantly strengthened by considering the professional discourse of systems, particularly soft systems thinking. Important characteristics of systems in this sense are their wholeness within boundaries, the existence of sub- and supra-systems, the emergence of properties, the systems dynamic, and the stakeholders' perspectives. Similarly Ison *et al.* (1996) argue for the development of reflexive systems methodology considering the role of experimental learning, and for process-oriented research approaches.

As advocated by some authors concerned about questions of sustainability in agriculture, FSR adopts a broad perspective of farming as a human activity, considering social and cultural traditions and ecological circumstances. Central to the tradition appears to be inductive research on farms, rather than experiments, which includes both qualitative and quantitative data, such as direct observation, interviews, naturalistic fieldwork and inductive analysis within a systems framework (Patton, 1990). It appeared therefore an appropriate tradition for a study of the conversion process to organic farming, which could be strengthened by referring to the methodological elements of the case study research tradition.

Methodological considerations for case study research

In choosing a method, the researcher needs to consider the type of research question, the extent of control that the investigator has on the subject of study, and the degree of focus on contemporary events (Yin, 1994). The main question of this research project is how commercial farmers manage the process of conversion to organic farming and the role of information, i.e. the process over time and the interaction between the farmer and his environment (the farm and external circumstances). In this context, the case study method was identified as an appropriate choice.

Case study research belongs to the tradition of qualitative social inquiry, but is not restricted to this context alone. It has been used in a wide range of human and social science disciplines such as psychology, sociology, political science, anthropology, geography, history, economics and in medical research (Yin, 1994). Maxwell (1986) also sees case studies as a valuable tool in farming systems research.

Yin (1994) defines case study research as *'an investigation into a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clearly evident'* (P.13). Creswell (1998) sees a case study as an exploration of a "bounded system" or case over time, through detailed, in-depth data collection involving multiple sources of information rich in context (P. 61).

Other important issues in developing a case study research approach are: the researcher's control over the setting and the level of available theory; the type of data may also be an important consideration in developing the research design. These and other methodological issues of case study research are discussed in this section in the context of this study, before presenting the specific approach adopted in the concluding section of this chapter.

Complex phenomena in their naturalistic setting

Case study research is particularly suited to research questions concerning individual persons, or organisations, in which the researcher has little or no control over events, and the situations are studied as they unfold (Patton, 1990; Yin, 1994). Silverman (2000) and Guba (1978, cited in Patton) see the question of whether or not a researcher can, or does, manipulate the research setting as one of the most important choices in developing any research approach. It may well be the unique situation with ethical restrictions on experiments with humans that has led to using case studies as a way for discovery in medical research.

In purely social phenomena the historical, social and temporal context is not open to manipulation, but the same principles can be extended to the interaction of humans with their natural environment, as for example in farming. This absence of manipulation is also present when studying systems. A holistic research perspective (4.2.1) implies that the complex phenomena can only be studied as a whole, rather than through reduction to specific variables, particularly where the boundaries between phenomena and context, and the interactions between them, are not clear (Patton, 1990). Qualitative tools then allow the researcher to consider many variables, but at the expense of the number of cases (Ragin, 1987).

The process of conversion to organic farming on private, commercial farms represents such a complex process, which is influenced by a number of personal, farm specific and external factors. Central to studying the information requirements of this process is the interaction between the farmer and his/her system, i.e. the role of the human component, but the interdependent agro-ecological issues also need to be considered. This makes both the environmental and social context important for a better understanding of the process (see Chapter 2), which implies a need to study the phenomena with farmers on their farms, rather than through an experimental design or modelling.

Inductive analysis and flexibility

As phenomena are studied in their natural setting without deliberate manipulation of variables, it is not necessary to predetermine all aspects of the research at the beginning in the form of a specific hypothesis. The collection of data and analysis begins from more open research questions and it may be appropriate to reconsider the data to be collected as the initial data analysis develops. This flexible, inductive research design allows the researcher to pursue multiple hypotheses and adapt the analysis flexibly to insights that develop, reducing the predetermined constraints on the number of variables to be studied Guba (1978, cited in Patton) which is essential for more quantitative approaches.

This is illustrated by the choice of open or closed survey questions. Answering open-ended questions, the subject can answer freely according to his or her own thinking and hence direct the researcher to important issues. In semi-structured interviews, the researcher prompts later interviewees more deeply in a particular area that emerge as important in the first interviews. Closed questions, on the other hand, require a good understanding of the problem beforehand, in order to formulate appropriate questions.

This preference for inductive analysis without pre-formulated theory and hypothesis can and has been misunderstood as preventing researchers from considering existing knowledge and theory prior to the fieldwork. Yin (1994) argues, for example, that the emphasis on no prior theory in "grounded theory" and "ethnography" is misplaced and that the design of case study research should represent the form of an initial theory about the phenomena to be studied and that this should influence the choices of what data are to be collected and how they are to be analysed. This seems to represent an example of misunderstandings between researchers from different disciplinary backgrounds. Advocates of the qualitative research tradition, it seems, do not argue against the researcher familiarising herself thoroughly with the phenomena prior to entering the field. For example, the practical guide to analysis of social settings from Lofland and Lofland (1984) contains a whole chapter on familiarisation with the field and recommends using multiple sources, such as existing research, as well as the knowledge of experts in the field. What they argue against is superimposing theory on a particular field, without empirical support (see 4.2.1).

The issue of inductive analysis and flexibility is related to the choice of breadth *versus* depth. Inductive studies allow the research to go into greater depth, where theoretical perspectives do not determine the data collection. However, this has to be at the expense of sample size (see also 4.4.7). A similar choice also applies to designing case study research. Larger comparative case studies allow less detail to be

studied, implying a more selective focus of the investigation, whereas with one or a smaller number of cases more details can be documented and considered for analysis.
For this research, existing knowledge was considered extensively before conducting fieldwork, through a review of literature (see Chapters 2 and 3) and in consultation with experts. The qualitative data collection with semi-structured interviews was loosely structured around some theoretical positions emerging from the literature, but allowing the farmers to express their own experience of the process. For the quantitative data, mainly standard farm business survey procedures were used, but the emphasis of the data analysis developed during the research as further insights from the data itself and from more recent publications in the field emerged.

Contemporary, dynamic processes

Both Yin (1994) and Patton (1990) consider contemporary sets of events or processes of ongoing change, over which the investigator has little control, as particularly suitable questions for case study research. The approach therefore has to be sensitive to any qualitative change in the process, and consider several perspectives to gain further insights. Longitudinal data from farm accounts could provide such an alternative perspective into change processes, e.g. the evolution of a farming system in its natural and socio-economic environment (Maxwell, 1986). In the first instance the research should assume the uniqueness of a case, but comparative cross-case analysis can help to uncover important factors driving the process.
In studying contemporary phenomena, the researcher adopts a perspective of empathic neutrality (Patton, 1990) instead of pure objectivity, i.e. aims for a neutral stand despite the need to understand a person's particular experience of the situation. According to Becker (1966), the researcher can never totally avoid '*being on one side*', which is likely to lead to accusations of bias, particularly when the research deals with questions of political relevance. Researchers adopting the perspective of those that challenge an existing hierarchy of credibility (e.g. the perspective of deviants or peasants) are thereby more frequently accused, or accuse themselves, of bias, than researchers adopting the perspective of those who agree with the *status quo*.
Studying organic farming is an inquiry into a contemporary event, and at times a highly political subject. The frequent accusation of bias made against organic farming research may have its roots in organic principles challenging widespread views in the agricultural sector. For example Buttel *et al.* (1985) observed that scientists proposing or opposing reduced-input alternative systems came to diametrically opposed results on the same subject, and he subsequently compared their methods. Studies carried out by proponents used farm-level data for comparisons of the two systems and were accused of bias in favour of the low-input system, whereas proponents of input-intensive systems based their results on computations of experimental results. Buttel *et al.* suspected that the perspective of the authors in this political issue, rather than the methods, was the main reason for the different results.
Whilst it has to be accepted that total objectivity in studying a contemporary phenomenon is impossible to achieve (because of the human nature of the researcher and the need for empathy), the researcher should, nevertheless, try to maintain a high standard of rigour in the methods of inquiry. In undertaking this research there was a need to adopt a position of empathy towards the converting farmers in order to understand their experience of the change process. However, in the data collection and analysis, Becker's (1966) advice of guarding oneself against obvious distortions in the conclusions was considered.

Different types of data

Although the question of what data are to be collected should not alone determine the choice of method, most case study research involves the collection and analysis of unstructured or qualitative data for variables that are not well understood at the outset (Patton, 1990; Yin 1984; Silverman, 2000; Henwood and Pidgeon, 1993).
This applies particularly to human behaviour, which appears rarely to be influenced by one or two very few clear variables. Quantification of these variables implies the danger that meanings that are

inappropriate for the subject are attached to variables and subjectivity is overwritten by external systems of meaning (Henwood and Pidgeon, 1993). Qualitative, unstructured data, on the other hand, provide detailed descriptions of the case that are rich in context, and allow the capture of people's personal perspectives.

Maxwell (1986) considers unstructured data concerning the farmers' choice of farming practices as an important part of data collection for farm case studies. The minimum should be some socio-economic description of the farming family and a summary of developments over time, but Maxwell does not propose any specific methods for collection or analysis, and draws attention to the danger of overburdening the farmer. Yin (1994) talks about open-ended interviews with key informants that allow a subject to be discussed in a conversational flow to be a major source of data for any case study. Textbooks on qualitative methods discuss the means of collecting unstructured data in greater detail, e.g. diaries, conversational interviews and historic or contextual material (e.g. Patton, 1990; Silverman, 2000). According to Lofland and Lofland (1984) the naturalistic form of enquiry reflects a certain epistemology; the researcher aims to take the role of the other person, in order to acquire social knowledge. This is captured by Weber's term of "*verstehen*" (understanding), the unique human ability to make sense of the world (Patton, 1990). Lofland and Lofland (1984) argue that face-to-face interactions provide the best opportunity to participate in the mind of another human being and should therefore be the preferred methods of inquiry, for example through in-depth interviews and participant observation.

For this research, the qualitative data covers the farmers' perspectives of organic conversion and experiences with using various information sources for decision-making and implementing the changes in farming practices. They were collected through a conversational interview with some structured questions at the end, which was fully transcribed and the material coded and categorised for analysis.

There is a need for multiple perspectives in studying social phenomena. Becker and Geer (1970) argue that intensive interviewing as the only method of data collection has important limitations and should be supplement by observational data. Limitations arise from problems of communication (words and terms may have different meanings for the researcher and the interviewee) and matters that the interviewee is unwilling to talk about (embarrassment, unwillingness to reveal true feelings), and distorted lenses, such as having a different memory of an event after it occurred. Observation of the person's behaviour should allow the verification of findings from a different perspective.

However, in other subjects case study research may not be limited to qualitative data and different types of data appropriate to the particular phenomena can be considered (Yin, 1994). Such multiple types of data and perspectives allow the researcher to verify the findings through triangulation, a concept for data analysis that goes back to Denzin (1978, cited in Patton 1990). Multiple methods of observation used by the researcher thereby reveal different aspects of the empirical reality.

According to Maxwell (1986), farm case studies should contain both structured and unstructured data that provide information about initial context, the intention and the outcome of human decision-making. He argues that the minimum set of quantitative data should include a description of all physical resources and annual farm accounts.

Farming styles research (see Chapter 2) also uses a combination of quantitative (farm accounts derived) and qualitative data (van der Ploeg, 1994; van der Ploeg, 2000). In this particular approach, important insights about a farming system are gained not only by searching for commonalities, but particularly by looking for the heterogeneity among farmers in terms of goals and values, and how they are reflected in the use of inputs, technology and different marketing strategies. However, farming styles research refers to one-off classifications, rather than process–orientated inquiry.

Using a combination of structured and unstructured data was identified as a promising strategy for the current research question, which is concerned with the interactions of farmers and the environment in a process of change. For the unstructured data, the method of face-to-face interviews was used, and a short farm walk on most holdings allowed some, albeit limited, direct observations. The protocol for the quantitative data collection for this project was largely based on standard farm business survey procedures, amended to cater for some special aspects of the organic approach and issues relevant to the conversion of livestock farms (see Sections 4.5.3–4.5.6).

Data analysis

Yin (1994) and Maxwell (1986) suggest that an analytic strategy should be developed as part of the case study protocol. In this least developed part of case study research, Yin notes a shortage of clear guidelines equivalent to the clear descriptions of other research methods (e.g. experimental protocols). However, Maxwell points out that the different nature of the questions and the various perspectives of the data imply problems in developing a coherent framework for analysis and interpretation. Analysis can either be developed on the basis of theoretical propositions or emerge from the case descriptions. It should treat all available evidence fairly, rule out alternative interpretations, and produce compelling conclusions (Yin, 1994; Maxwell, 1986).

For unstructured, textual material the main tool for analysis is that of coding and categorising according to key concepts, which form the basis for the development of theoretical understanding (Lofland and Lofland, 1984). Yin (1994) identifies four basic strategies for data analysis, which he labels as pattern matching, explanation-building, time series analysis and program logic. All can be used in single and multiple case studies.

Presentation of the evidence through description needs to be part of the analysis so that the reader can follow the conclusions. A case study database should contain all the information about each case, including the field notes, which are part of the data and may represent an important intermediary step in the analysis. Theoretically, another researcher should be able to re-analyse the data, and may or may not, due to the subjective nature of the researcher himself, come to similar conclusions.

Because of the possibility of triangulation, combining various types of data can be a particular strength of case study research in order to present a more complete picture of the case (Yin, 1994) and studies relying on one method alone are more vulnerable to errors, for example through loaded questions or biased responses. Patton (1990) raises concerns about coherence of the approach in such methodological mixes, but admits that given the specific characteristic of a research question, the benefits are likely to be stronger than desire for methodological purity.

Sampling

Patton (1990) refers to the concept of purposive sampling, in contrast to the random sampling of survey research, with the main aim of getting access to information rich cases, while increasing the transferability of the findings. Several different sampling strategies emerge in a number of textbooks on qualitative methods, each with its own distinctive emphasis (Patton, 1990; Creswell; 1998, Silverman; 2000; Lofland and Lofland, 1984).

The technique of '**snowball**' sampling relies on the participants of one case supplying contacts to other people in a similar situation. Through selecting **extreme** or deviant cases, the researcher gains particular insight from cases that lie outside the norm. In '**intensity'** sampling, cases are selected that have engaged intensely in the phenomena under study and are therefore likely to provide rich data and good examples. In '**typical**' sampling, experts in the field are consulted to supply typical cases. In **'diversity**' sampling, the research identifies some criteria of diversity on the basis of theoretical considerations and existing information and aim to maximise the variety in the sample.

Yin (1994) extends and broadens the concept of diversity or extreme case sampling, when he argues that sampling in multiple case studies should refer to a "replication" logic as used in medicine or in experimental design, rather than the random sampling logic of survey research. In a study with six to ten cases, for example two could be selected to represent a literal replication (e.g. two cases of the same symptom), whereas others might be selected to represent "theoretical" replications, chosen because of expected contrast, i.e. selected to pursue different theoretical patterns. The development of some theoretical understanding of the likely variables influencing variation among the case studies is a necessary prerequisite for this sampling strategy. Similar to experimental studies such as field trials, a higher number of literal replications implies greater certainty regarding the generalisability of the findings. In both cases knowledge is transferred that is based on the experience of one or a limited number of sites or cases.

In relation to farm case studies, Maxwell (1986) recommends considering the representativeness of farms, similar to the concept of "typical case" sampling. However, he does not address the question of the reference systems that should be used to determine a "typical" farm. In research on organic dairy farms in Denmark, a typical sampling strategy was used, identifying farms with the help of advisors and other experts with the aim to represent the diversity among organic dairy producers in the country (Alrøe, 2000; Mogensen and Kristensen, 1999).

As far as sample size is concerned, Patton (1990) sees the criteria for validity of the insight gained more in the richness of the data, than in the number of cases studied and there is no clear rule on the minimum sample size of qualitative samples. Several authors suggest a criterion of saturation (point of redundancy), whereby new cases are recruited until no further new insights are gained. This theoretically convincing concept is difficult to reconcile with the reality of research budgets and the need to plan the scope of a study, particularly for long-term process studies. Farm case study programmes, according to Maxwell (1986), should be limited to a maximum of 10, because of diminishing returns in the quality of the data in larger samples.

The selection of case study farms for this study also followed broadly the rules of purposeful sampling, in aiming to select 10 typical commercial dairy producers in conversion to organic production, while representing some variation with regard to factors identified as important in the literature (Chapter 2 and 3), such as size, farm type, conversion strategy. The final sample represented a large proportion of all farms converting to organic dairy production in the Southwest of England and Wales at the time. For further details of the farm selection see section 4.5.1.

Transferability of the findings of case study research

There appears to be broad agreement that some aspects of the research paradigm are incompatible with the notion of full external validity, making this not a useful goal for case study research to aim for, whereas the aim to generate theoretical insights is much more appropriate. For example, replicability of the findings, emphasised as the heart of external validity in the quantitative traditions, cannot be achieved, as each piece of research is unique, at least to some degree, to the setting and the researcher.

However, Yin (1994) argues that such limitations to generalisation are not unique to case study research alone, but also apply to some experimental work. For example, agricultural research experiments are often conducted on a single research station and similar limitations to the generalisation of their findings apply.

However, rejecting external validity as the main goal does not mean that studies of one particular situation could not help forming judgements about other situations. The issue of external validity and generalisability has started to receive more attention in the literature on qualitative methods (Schofield, 1993). Henwood and Pidgeon (1993) argue that in talking about generating theory, qualitative researchers make this part of any research process more explicit and, along with other authors, they challenges the common view that case study research is only suitable for the exploratory phases of research projects. Stake (1995) argues that case study research may not only be undertaken for *'intrinsic'* purposes, where the researcher's interest lies with the specific circumstances, but also for '*instrumental*' purposes, with the aim of using one or more case studies to gain insights into more general questions and deal with unstudied cases, i.e. seeking to derive generalisable principles from specific examples.

This *transferability* of the findings can be facilitated through methodological choices, for example in the first instance by using a strategy of purposeful sampling (Patton, 1990; Schofield, 1993; Silverman, 2000; Yin, 1994). Researchers should also aim for high internal validity of their work by producing a coherent descriptive account of the phenomena under study and its context, and by providing sufficient detail about the research methods and their own background to the study (Schofield, 1993).

Nevertheless, findings of locally based research such as case study work, should be treated as a working hypothesis, rather than the final conclusions (Cronbach, 1975, p.487 cited in Patton, 1990). As some contemporary, complex phenomena can only be studied through such methods. This implies that such research in such fields will never move beyond the development of a working hypothesis. It appears, as was argued by Popper (1959) that this is an accurate representation of any research outcome, even within the natural sciences and the paradigm of logical positivism, as any hypothesis cannot be proved, only disproved, and may in future be challenged by new theories in the field.

The work presented has clear limitations in terms of replicability. No other farm is likely to encounter the same combination of variables that were found on the case study farms and no other researcher is likely to interpret the data in the same way. However, the farms were selected to represent typical commercial dairy farms in the UK (see Chapter 5 for a comparison of characteristics of the sample with the national dairy industry). The description and context of each case provides some understanding of some of the factors that influence the conversion process and its outcome, which are likely also to apply on other farms that may convert in the future.

The case study approach adopted for this study

The data collection on the case study farms, and some of the analysis, was carried out as part of a MAFF (now DEFRA) and EU-funded project on conversion to organic milk production and the post-conversion phase. This MAFF/EU project offered a good opportunity to investigate the process of conversion in depth over a longer period of time. The objectives of the MAFF/EU project were to generate information about conversion and organic milk production, rather than to study the information requirements of the converting farmers specifically.

In the first phase of the project (1992–1995), 10 commercial dairy farms in conversion were subject to detailed physical and financial monitoring, alongside the conversion of IGER's Ty Gwyn experimental farm. IGER carried out an assessment of nutrient and weed status, of the quantity and quality of the forage production and some general information on the breeds, housing system, calving-pattern and size and health status of the dairy herd. The farm accounts survey was carried out by ADAS under the author's supervision between 1993 and 1995 and included data for earlier years from historic records, which allowed a comparison of various indicators with a reference point prior to the registration of the conversion. At the end of this first phase all farmers/farm managers were interviewed (for further details on the first project phase see Haggar and Padel, 1996).

In the following post-conversion phase, the Institute of Rural Studies (University of Wales, Aberystwyth) continued financial monitoring of a modified sample of commercial farms, with eight farms from the first phase continuing to be monitored. The results of the second three-year phase from 1995/96 to 1997/98 were reported by Fowler *et al.* (1999b). More detailed physical monitoring, not considered for this thesis, was only carried out on the Ty Gwyn experimental farm (Weller, 1999).

Farm selection

The case study farms were selected for participation in the first phase of the MAFF/EU dairy project with the intention of selecting ten typical commercial dairy producers in England and Wales beginning a conversion to organic farming. However, at the beginning of the project in 1993, the general economic environment for dairying was not conducive to risky changes in management; the possibility of future aid schemes for organic conversion may also have led to some prospective farms delaying their decision until this question was settled. It proved impossible to identify ten farms that were at the very beginning of conversion, so that the criteria for selection therefore had to be amended to refer to commercial farms with a significant dairy enterprise that were either starting on, or were in the process of, conversion to organic production. To increase geographical likeness and to facilitate the data collection, and because the majority of organic dairy production at that time was concentrated in those regions, farms were only selected in Southwest England and in Wales.

Possible farms were identified through contact with a range of certification bodies and other organisations having contacts with organic dairy farmers. However, most organisations could not supply any information about enterprise structure or intention to convert, so the farms were contacted by letter, followed up by a phone call, for a first assessment of their suitability. A large proportion were either no longer considering conversion or the conversion was so far advanced that the farms could not be considered for that reason. Table 4-2 summarises the steps taken to arrive at the final sample. After further phone calls and visits to 15 holdings, which revealed other reasons why participation was not possible, the first sample of ten farms for the IGER study was selected. Because one farmer withdrew, and one farmer could only supply dairy costings, two other farms were identified. One of them had previously declined participation because of ill health, but was now willing to be studied. Both farmers could supply sufficient records for a socio-economic analysis of the whole conversion period (Haggar and Padel, 1996). Two farms withdrew from the monitoring at the end of first study period in 1995.

The geographical distribution of the eight farms was: two farms in Somerset, one in Devon, three in Dyfed and two in Gloucestershire/Wiltshire. As the process was partly based on self-selection it is likely that the farmers chosen are able managers and more active in seeking information. It was not the intention of selection to obatin a representative sample of organic dairy farmers. Nevertheless, the study covered a large proportion of the small population of approximately 15 farms that were in conversion to organic dairy production between 1990 and 1993 in Southwest England and Wales. This in itself is not sufficient to make generalisations, but increases the transferability of some findings.

The final sample contained a diverse range of farm sizes and types. Size had been identified as potential barrier to conversion for larger farms (see Chapter 2). A mixed enterprise structure is considered to be more suitable for an organic conversion and farm type was also found be influencing farm income in other studies of organic farms (Chapter 3 and Fowler *et al.,* 1999b; Offermann and Nieberg, 2000). Farms also varied in the conversion strategy they adopted.

Table 4-2 Summary of farm selection procedure

Action	*Comments*	*No. of farms identified*
Contact with relevant organisations (Jan. 1993)	UKROFS, the Soil Association, British Organic Farmers, the Organic Advisory Service and British Organic Milk Producers	*55*
Initial letter followed by phone call (Feb. 1993)	Farmers no longer considering conversion, or insufficient commitment	*24*
	Conversion too advanced	*14*
Visits and further phone calls (March 1993)	Two farms in very early stages and unsure of commitment	*10-initial sample*
	Ill-health	
	Dairy herd too advanced in conversion	
	One farm only dairy enterprise costings	
One farm leaves the study (Summer 1993)	Two farms added from the four rejected above, as changed circumstances no longer make them unsuitable	*10*
Second data collection period (1995–1998)	Two farms withdrew after the first data collection period	*8*

Collection and analysis of qualitative data

To gain an understanding of the farmers' personal experience of the conversion process, their reasons for conversion and the role of information, all farmers were interviewed in 1995, in the last year of the first data collection phase. The semi-structured interviews with the case study farmers represented a modified form of the approach of direct questioning that Davis and Olson (1985, cited afterHuirne et al., 1994) suggested as a method to research information requirements.

On the basis of literature, the author's previous experience in advising converting farmers, and discussions with the senior farm advisor of the organic advisory service (OAS) the initial interview guide was developed and tested on three farms in 1993 (two case study farmers and one other). Subsequent modifications included questions about the specific problems encountered, which was identified as a good way of addressing potential areas of information needs. The two case study farms of the pre-test were interviewed again in 1995, but with a shortened interview guide.

The interview guide (see Appendix 2) included questions about the motivation to convert, conversion planning, experiences with the process of conversion, problems and decisions, and support from advisors and other people important during conversion. After this conversational part of the interview, the farmers were asked to score the usefulness of sources of information provided in an open-ended list and were asked to score a list of statements of objectives identified from the literature.

The main interviews with the farmers and farm managers were carried out in the summer of 1995, the final year of the first project phase. The same visit was also used to clarify some queries regarding the financial data. On most farms, the visit included a short farm walk to gain an overall impression of the farm. Some general social data about the farmer/farm manager (age, qualifications) were collected before the interview. The interviews were conducted as conversations, lasting between one and three hours. With the permission of the farmers they were tape-recorded and completely transcribed, and the material later coded for analysis. Although any discussions during the farm walks could not be taped, the walk was important to gain the confidence of the farmer and to obtain an overall picture of the farm. In between or immediately after each visit, any additional points raised and observations were recorded.

The interviews covered most of the conversion process in retrospective, as several farms had already started their conversion prior to the beginning of the survey. This had the disadvantage of having to rely on farmers' memories of the situations. However, the farmers' experience of the conversion process generated an awareness of the problems they faced and permitted some judgement of the impact on their farm.

Interviews with the farmers at several points during the study-period would have allowed changes in the farmers' attitudes over time to be better identified, but on the other hand, such regular visits could have led to influencing the conversion process to a greater degree and to the research become more of a nuisance to the farmer.

Direct observations were limited to the author's presence in most meetings of the farmers in the first project phase and the short farm walks on the days of interview. However, the farm accounts survey provided a different perspective of the outcome of the farmers' decision-making during conversion.

For the evaluation of the interviews a computer package for the analysis of non-numeric unstructured data was used (QSR, 1995). The main advantage of using a computer in the analysis of unstructured data is the flexibility in creating new categories for the indexing of records as the analysis progresses, thus facilitating theory construction, apart from the easy handling of text retrieval (Richards and Richards, 1987).

The analysis (Chapter 6) focused on the farmers' motives for organic conversion compared to their objectives at the time of interview, the making of the decision to convert and the conversion process, including support, barriers and general problems, and the use of information sources. In support of the arguments, the presentation in Chapter 6 includes a number of direct quotations from the transcripts and a short description of the main decision-making process on each farm, in line with the need to present evidence as part of qualitative data analysis (Yin, 1994).

Quantitative data: monitoring and analysis of farm accounts

The monitoring of the farm accounts and dairy costings was an important part of the study, providing information about the initial farm context, and the impact of the conversion on the physical and financial performance of the farms. Assuming that the farmer's values and intentions influence his actions, such data provide a second and important perspective on the farm-specific experience of the conversion process, similar to the farming styles work (van der Ploeg, 1994; van der Ploeg, 2000), but using not only cross-case but also longitudinal data.

The data were evaluated using mainly standard farm management indicators (both production-related and financial), which have proved to be useful tools for comparisons over the years and between farms (Malcolm, 1990). This is common in other financial studies of organic farms, although authors frequently emphasise that this only gives a partial picture, as wider benefits that might arise to society through organic management are not included in the analysis (e.g.Bateman, 1994; Offermann and Nieberg, 2000).

Some values calculated were aimed at specific objectives of organic farmers, such as milk production from forage and the use of home-grown concentrates, on the basis of which milk production from the farms' own resources could be calculated. Some physical and financial data were compared against the performance of the conventional dairy industry, to highlight the influence of external factors on the trends of individual farms and the sample as a whole. For such comparisons standard farm business survey (FBS) indicators were used, so differences could be clearly attributed to the systems being compared and not to the data collection methods. The account data were collected in two survey periods:

- The first period between 1993 and 1995 included data collection on all farms from the last year of conventional management (between 1988/89 and 1990/91) to 1993/94 or 1994/95 data. Data collection was carried out by ADAS on the basis of completed accounts, using a spreadsheet package designed by the author (see Appendix 3). All farms but one achieved certification during this period and were visited by the author in 1995 to clarify any remaining questions (published in Haggar and Padel, 1996).

- The second survey period from 1995 to 1998 covered three financial years (1995/96, 1996/97 and 1997/98). In the second period, data for farms in England were collected by Fowler and other colleagues (1999b) using FBS methods. Three farms in Wales were monitored by ADAS using their own software for farm business evaluation. The new FBS system based data collection on bank statements, rather than accounts. On some farms the monitoring periods were adjusted in the second period of data collection.

For all farms the two study periods covered the period of conversion and several years of organic management with certification of the dairy herd, which allowed the impact of the conversion to be studied over a longer period. Due to the changing basis of the survey methods (account-based to based on bank statements), continuous data are only available on four farms where the data collection in the first period included the 1994/95 financial data.
Data were merged into continuous records for each farm (for an extract see Appendix 1). For some analysis of the impact of conversion average values for four years of organic management were calculated, covering all years for which data for all farms were available: 1993/94 and 1995/96 to 1997/98.

Physical performance indicators

The literature review in Chapter 3 indicated that forage and milk production and the use of purchased concentrates are likely to be affected by the conversion. A range of physical indicators was derived from the farm accounts and dairy costing survey and additional information was collected from the farmer/farm manager to assess the impact of the conversion in the broadest possible way (see Table 4-3).

Table 4-3 Summary of the physical indicators

Land use, such as farm size and forage area (ha UAA)	Proportion of forage area (%)
No. of dairy cows and other grazing livestock	Stocking rate per forage ha (GLU/ha*)*
Milk yield (litres) per cow and per hectare	Milk from forage (MFF, litres)
Concentrate use (kg) per cow and per litre;	Utilisable Metabolisable Energy (UME, GJ/ha)
Use of home-grown concentrate	Milk from the farms' own resources (MFR,%)

Home-grown concentrates were assessed on the basis of information from the farm manager on diets and included all cereals and pulses that were used for feeding dairy cows. The financial values have been calculated using near market values. The field records did not distinguish between the area of cereals for home-grown concentrates and that for cash crops.
Milk from forage (MFF) had to be calculated on the basis of assumed average energy values for milk (ignoring the impact of milk quality) and for concentrates, as no such actual data had been collected consistently in all years from the farms (see below).
Utilisable Metabolisable Energy (UME) as an indicator for forage productivity was calculated following procedures outlined in the GENUS milk minder report (Thomas and Perry, 1991). Calculations were based on energy assumptions in Table 4-4. Financial information on bulk feed purchases was converted into an estimate for physical purchases on the basis of an assumed average price of £50 per tonne fresh weight for various bulk feeds. Calculated values and trends for stocking rate and UME were compared against directly measured grazing yields for those years and farms where both types of

data were available, to establish the validity of UME as an indicator of forage production levels on commercial farms.

Table 4-4 Assumptions for the calculation for milk from forage and UME

Item	*Unit*	*Estimated value*
Purchase price	£/t FW	50
Energy milk	MJ/l	5.5
Energy concentrate	MJ/kg	11.2
Energy bulk feed	MJ/kg FW	2.8
Energy maintenance and pregnancy	MJ/cow	25000

Source: Thomas and Perry(1991)

Milk from farm resources (MFR) was calculated to show the proportion of milk that is produced from the farm's own feed resources: forage and home-grown concentrate. It was calculated using the same energy values as MFF and UME. MFR was calculated by adding the energy value for the milk produced from home-grown concentrates to MFF and deducting the energy value for milk produced on the basis of purchased forages. The value was expressed as a proportion of the milk yield per cow. Because the actual land area used for growing concentrates was not known, it was not possible to express this measure on a per hectare basis.

Weather data from the Meteorological Office were obtained via IGER for six farms, and data from an agricultural college were used for two of the farms (see Haggar and Padel, 1996).

Financial and income indicators

The comparison included enterprise specific and whole farm indicators. The gross margin (output minus variable costs of production) is based on the assumption that there are certain variable costs that vary in proportion to the scale of production (e.g. number of hectares or animals) and can be directly related to a marketable product or service. The gross margin of one specific enterprise shows by how much the profit of a farm would increase if this enterprise is extended by one unit assuming that all other resources are unlimited (Lloyd, 1970; Steinhäuser et al., 1978). Gross margins, developed mainly for farm planning purposes, are also useful for comparing enterprises with similar resource requirements (e.g. various cereals in arable rotations) and are frequently used for horizontal and vertical farm comparisons.

However, the costs that are assumed to vary in proportion to the level of production and are included in gross margins varies, as illustrated by a great number of different margins in use in the field of milk production: MOC (margin over concentrate), MOPFF (margin over purchased feed and fertiliser), gross margin excluding forage costs, and gross margin including forage costs. Depending on conventions of country or time, gross margins might or might not include all or parts of the machinery costs and some costs for casual labour. For cross farm comparisons the cost labels (*variable* and *fixed*) are misleading, as any survey of a number of farms will show that there is substantial variation in fixed costs between farms (BIAC, 1987; Fowler et al., 1999a). Typical for organic farming is the substitution of external (variable) inputs to a large extent with farm-derived ones, such as biological N-fixation in fertility building crops and farm-produced forage rather than purchased nitrogen and concentrates. This is likely to result in higher demands on the farm resources, as was shown in some studies of the changes in labour use during the conversion process on the dairy farms (see Chapter 3).

Developments over time on converting farms, like comparisons between organic and conventional farms, based on gross margins alone are therefore questionable, although they do allow more physical and specific financial information from a particular enterprise to be considered for analysis. Of all possible dairy margins, the *dairy gross margin* allowed the fairest comparison between farms of the different intensity of milk production and utilisation of home-grown feeds.

Table 4–5 gives a summary of the financial information that was collected from the farms, following FBS procedures. A detailed definition of the categories is presented in Appendix 4.

Table 4-5 Summary of the financial information collected

- Standard set of FBS accounts (outputs, costs, assets and liabilities) for each year of the conversion period and the year before the conversion started
- Allocation of specific livestock costs to major enterprises such as the dairy herd, suckler herd and replacement stock
- Allocation of specific crop costs to major enterprises such as arable and forage crops and grassland
- Calculation of dairy cow gross margins, total farm gross margin, net farm income, management and investment income and other performance indicators

Fixed cost data were evaluated in categories of general farming costs, labour, machinery costs and other. Due to the difficulty with data collection from historic sources, particularly in the first part of the study, no consistent data on Annual Labour Units could be obtained.

Net Farm Income (NFI) was used as the main income indicator and for comparison with conventional trends. It allows for comparison between farms, irrespective of land, labour and capital resource endowment, because of the inclusion of notional charges, such as imputed rent and charges for unpaid labour. However, the adjustments may result in farms that actually break even or make a profit appearing as making a loss under this definition.

Rent equivalent (RE) (actual rent and interest) per hectare and as a proportion of total output was used as an indicator of business health, because the net worth data showed major inconsistencies between years. Rent equivalent is supposed to be closely related to net worth development (Crabtree, 1988; Griffis, 1988; Warren, 1997).

To support the trend analysis for some indicators, averages for groups of four farms similar with respect to farm type, farm size or intensity prior to conversion were compared for the years 1990/91 to 1993/94 and 1995/96 to 1997/98 using a two-factor ANOVA. Years were treated as replications and the least significant difference between the groups and between the years at p=0.05 could be established, and some indication of the statistical significance of the observed difference given. Due to the small number of farms the statistical analysis was not carried out at higher levels of confidence.

To identify other factors that influence the outcome of the conversion, groups of farms with the highest and lowest gross margins per cow and NFI per farm were compared with the average for all farms, and some simple correlation of NFI with other indicators were carried out. However, the main emphasis of the study was to document and analyse the trends on individual farms over time and the analysis of group averages was only seen as an additional tool to come to some conclusion regarding a possible relationship between farm type and trends during the conversion process.

Conventional comparisons

A range of external as well as internal factors substantially affects farm revenues and costs. There is therefore a need to compare the economic performance of each case study farm with data from conventional production. Furthermore, comparisons with conventional data generate information about organic farming for other farmers to assess the impact that conversion might have on other farms.

The underlying question for a comparison of farms with conventional data is to establish what income or financial performance the farm would have achieved, had it been managed conventionally. To be able to answer this question effectively it would be necessary to compare the farm against a hypothetical situation. There are effectively four options that have been used to deal with this issue (Lampkin, 1994; Offermann and Nieberg, 2000).

- A representative sample of organic farms of similar type can be compared against a similar group of conventional farms (BMLF, 1998; Padel and Zerger, 1994).
- Each farm can be paired and compared with an equal-sized, similarly managed conventional farm (Mühlebach and Mühlebach, 1994). However, the difficulties in selecting and monitoring farms

with a satisfactory degree of likeness for each of the ten original farms were felt to be too great for this study.

- A farm can be compared against a group of selected farms to match its characteristics, for example selected from a larger sample by cluster analysis (Fowler et al., 2000; Schulze Pals, 1994). This comparison is particularly suited if the farms under study fall on the boundaries of farm type or business size classes. The method was used in both phases of the MAFF-funded project (Fowler et al., 1999b; Haggar and Padel, 1996), but it was not possible to use the same cluster over the whole period that is analysed here.

- Converting farms can be compared against their own performance prior to their conversion (Freyer et al., 1994; Lampkin, 1993). The main advantage is that for the comparison no assumptions about how the farm would have been managed conventionally need to be made. The main disadvantage arises from the fact that income trends in the conventional industry are not static and the differences become more marked the longer the time since conversion.
- A farm can be compared against published time series data of farms of similar type, such as FBS accounts (Lampkin, 1993).

In this study, the last two options were used. Trends on each case study farm were compared against the pre-conversion situation, against hypothetical income development using the NFI index and against data from some conventional farms from the Manchester Dairy Enterprise Costings Study–DECS (Franks, 1999). Published data were favoured over the more accurate match that cluster data could provide, because of the length of the study period and problems in maintaining the same cluster over the whole period.
NFI projections were based on the NFI index trends for conventional farms as published by MAFF in the annual Farm Income report (MAFF, various years). For the comparison the MAFF index (based on an average between 1989/90 and 1991/92) had to be converted to an index that sets the last conventional year of each farm as 100%. With this converted index (I_c) the Net Farm Income for each year after conversion (NFI $_{y\,(1\ldots n)}$ was then calculated as follows:

$$NFI_{y(1\ldots n)} = ABS(NFI_{y0}) * (I_c - 1).$$

Each farm was compared against the NFI trend for the FBS category, in which the farm would have fallen it its last year of conventional management.
In some cases, this differed from the farm type in which the farm was grouped in the study. Farm 9 was treated in this study as a mixed farm (because of the proportion of income from other enterprises), but would have been classed as a dairy farm under FBS classification, based on land use and stock numbers and standard enterprise gross margin value. For this reason it was compared against dairy farms in England. For Farm 7 the category of dairy farms in Wales was chosen, because no NFI index for mixed farms in Wales is published.
This comparison gives some indication of the income trend that might have been achieved had the farms stayed under conventional management. It has also been used to calculate an indicator of the financial impact of a five-year conversion period and for four years of organic management. The hypothetical income was used to calculate "costs" of conversion by calculating the difference between the actual and the hypothetical income.
Secondly, the farms were compared with the development of Net Farm Income for dairy farms from the Manchester Dairy Enterprise Costings Study–DECS (Franks, 1999). For each farm the most appropriate comparison group in terms of a similar NFI in the final year under conventional

management was chosen and the real NFI income values per hectare from the DECS study are shown in the second chart for each farm.

Comparative analysis of qualitative and quantitative indicators

The final analysis brought together the human, production-related and financial data from the case study farms. The farmers' motivations for conversion, objectives and steps in the decision-making process were contrasted with the development of the physical and financial indicators of the farms. The analysis further explored relationships between attitudes and farm specific variables and identified specific goal-orientations that were driving the farm development in a similar approach to that of farming styles research. Various actions that took place on the case study farms during conversion were compared against theoretical phases of the conversion process, leading to conclusions about the nature of information needs in each phase, which could be compared against the case study farmers' experiences in using information sources.

The author's personal background

As the researcher is likely to shape the analysis and interpretation of the data, it is considered good practice in qualitative research to provide some personal background (Silverman, 2000; Skerrat and Midmore, 2000). The author developed an interest in issues of organic extension and farmers' information requirements during conversion while working as an advisor for organic and converting farmers in Germany in the 1980s. She was the first point of contact for information about organic farming and conversion and felt that knowledge was missing concerning the conversion process itself. Returning to University in 1991, she reviewed a number of publications, but questions regarding the structure of the decision-making process and the use of information remained unanswered (see Padel, 1994; Padel and Lampkin, 1994). The opportunity to pursue the topic empirically arose in 1993 as part of the MAFF/EU-funded project on conversion to organic milk production, which had the main aim to produce physical, financial and environmental data in support of the development of organic milk production in Britain and resulted in a number of published and unpublished reports, from which some material presented in this thesis has been taken (Fowler et al., 1999b; Haggar and Padel, 1996; Padel, 2000).

Summary

The approach for the empirical work of this thesis was developed drawing on the traditions of case study research as a method of qualitative social inquiry and Farming Systems Research (FSR). At the time when the research began the theory regarding farmer decision-making in the area of environmental practices was limited and the number of potential variables was considerable, which influenced the choice of inductive methods.

FSR, which originated in the developing world from a need to consider the cultural as well as production and financial dimension of farming, was identified as an appropriate tradition to study a strategic change process leading to more sustainable practices at the farm level, which is associated with attitudinal as well as practical changes. Maxwell (1986) described farm case studies as a useful method for FSR, and is also widely used in the studying organic farms.

The author refers to Checkland (1999) and Bawden (1995) in conceptualising the soft systems aspect of a farming as a human activity system, and to the broader tradition of case study research to compensate for the lack of methodological rigour that is associated with FSR. Case study research was considered to be a particularly appropriate method for the following reasons:

- The main aim of the research was the conversion process itself as it develops over time, rather than the outcome of the process and the method is suitable for process-orientated inquiries (Patton, 1990).

- The literature shows that the conversion process is influenced by a considerable number of farm-specific and external factors related to the social, biophysical and financial context of the farm. Research should therefore be conducted in the natural setting of a phenomenon while considering both structured and unstructured data.
- At the time when the research began, the small number of dairy farms engaging in an organic conversion limited the number of cases that could be surveyed.

The process of conversion to organic farming was studied on eight commercial farms using a combination of intensive interviews with the farmer or farm manager, covering their personal experience of the conversion process including motivation, problems encountered and their use of information, and through an analysis of their farm accounts. The farms were selected using a purposeful sampling strategy with the aim of representing typical UK dairy farms that were converting to organic production at the time, and to reflect variation in terms of size and enterprise structure. The aim of the analysis of the farm data was to provide a different perspective on the outcome of farmers' decision-making and implementation, as well as to generate some information about the impact of organic conversion on farms.

In the next chapter some structural and social characteristics of the farms are introduced (including a short description of the pre-conversion situation) and the sample is compared with the national dairy industry. In the following chapters (6–8), the results are presented according to themes of human, production-related and financial aspects, facilitating cross-case comparisons, before the various aspects of the conversion process on each farm and the different types of data are brought together in Chapter 9.

Introduction to the case study farms

This chapter provides a short introduction to the eight case study farms. It presents some information about the personal background of the farmers such as age and education, and some key variables of the farms before the beginning of conversion, as well as important dates. The sampling process for the case study farms was characterised in the previous chapter as following the rules of purposive case study sampling, aiming to select typical commercial dairy producers that were converting to organic production and to represent variation in regard to some key factors identified from the literature. To document the outcome of the selection procedure in terms of representing typical dairy farms the sample is compared with the UK dairy industry.

This chapter begins with a short summary and discussion of some personal and farm characteristics of the eight case study farms, in comparison to other studies of organic farmers and the UK dairy industry, followed by a brief summary of the conversion process on each farm. In the following three chapters the interaction between the human aspects and the impact of conversion on production-related and financial indicators of the farms are presented by themes, before the whole conversion process of each farm is brought together in Chapter 9 and discussed with reference to the findings of other studies in Chapter 10.

Characteristics of the case study farms

All case study farmers were commercial dairy producers that were at the beginning or in the process of conversion to organic farming when the study began in 1993 (see Chapter 4). Potentially suitable farms were identified through contact with various organic sector bodies, the final sample representing a large proportion of all farms that were in the process of conversion southwest England and Wales at the time.

A summary of some social characteristics of the farmer/manager and of the physical resources of the farms is presented in Table 5-1 (key indicators are reported in Appendix 1). To safeguard confidentiality, farm size and the number of dairy cows have been rounded to the nearest 10, and in the descriptions of the case study farms pseudonyms have been used. All case study farmers were members of the Soil Association (SA), the largest organic producer organisation in the UK.

Personal characteristics

The majority of the farmers were between 30 and 40 years of age when the conversion of the farms began. All but one farmer had agricultural training, either from university or college, and all farmers had several years of practical experience in farming prior to their conversion. On three farms (Farms 2, 3 and 7) the spouses were very actively involved in the farming. Farms 2, 3 and 9 had been taken over by the current owners shortly before the conversion, although in the case of Farms 3 and 9 the farm had remained within the same family. The majority of farmers had no direct personal experience of organic production, apart from Farms 9 and 11 where another member of family had grown organic vegetables, and on Farm 1 a conversion experiment had been carried out on a small block of land.

In their social characteristics the farmers showed some similarities but also some differences from organic farmers in other studies. On average the case study farmers had 13 years' experience of farming, remarkably similar to the 14–15 years reported for a large sample of organic producers at the time by Murphy (Murphy, 1992). Where the farmer's age is known, this value can be converted into age of entering into farming. The average for all farms of 23 years is lower than the value found by Burton (Burton et al., 1999) for 86 registered and unregistered organic horticultural producers in the UK, compared with 151 conventional producers.

The high proportion of case study farmers with higher qualifications corresponds well with other studies (see Chapter 2), but among the case study farmers a specific agricultural training was dominant, whereas in other studies a wide range of professional backgrounds were represented. With five out of eight (62.5%) under the age of 35 when the study began the case study farmers were younger than the average farming population in the EU, where in 1995 on average only 20% of farmers fell into this age group (Eurostat, 2001).

Among the farms, also, considerable variation with regard to the strategy of the conversion process is represented, from converting all land in one year (Farms 11 and 12) to a very long conversion process of more than 7 years on Farm 1, with the remaining farms taking between 2 and 4 years to enter all their land into the organic conversion.

Farm resources

Pre-conversion the farms fall into two different groups regarding the proportion of forage area. Farms 2, 3, 11 and 12 were growing forage crops on more than 80% of their land area and have, in this study, been categorized as specialist dairy farms. Farms 1, 5, 7 and 9 grew less forage crops on less than 75% of land area and were categorized as mixed farms. In most cases the categorisation would correspond with a standard method classification based on the proportion of output from the dairy (more than 75% as specialist). Only on Farm 11 was the relative output from the dairy lower, due to a conventional pig enterprise that was not converted. In this study this farm was treated as a specialist dairy farm.

Table 5-1 Characteristics of the eight case study farmers and farms [3]

	Farm / Unit	*1*	*2*	*3*	*5*	*7*	*9*	*11*	*12*	*Av.*
Age of farmer/manager	years	32	39	34	30	46	33	27	47	36
Qualification	code#	2	3	2	2	1	2	1	2	n/a
Recent take-over			yes	yes	(yes)		yes			n/a
Years in farming	years	13	6	7	9	22	13	12	23	13.13
Entry into farming	years	19	33	27	21	24	20	15	24	22.88
UAA *	ha	430	50	90	510	70	370	270	60	230
Forage area	% of UAA	58	95	98	53	71	67	85	92	77
Dairy cows*	number	110	40	90	100	50	320	270	70	131
Milk yield*	litres/cow	5000	5000	6000	5400	4800	5400	4800	5500	5238
Concentrate use	kg/cow	1435	1115	1705	2340	605	1325	550	2015	1386
Dairy output	% of total	38	79	95	34	62	68	62	80	65
Milk yield per ha	l/ha UAA	2472	4199	6168	1089	3805	4939	6274	7427	4547
Stocking rate	GLU/ha	2.3	1.7	2.0	1.7	1.9	1.5	1.6	1.8	1.8
Begin of conversion	Year	1989	1990	1989	1991	1990	1991	1990	1991	n/a
Conversion steps	n	7	3	4	4	3	2	1	1	n/a
Certification of herd	Year	1993	1993	1992	1994	1992	1993	1996	1992	n/a

* rounded to nearest 10/100, average based on original data.
\# 1= University degree in agriculture, 2 = other agricultural training, 3= practical experience only
Source: Own data

For a number of key indicators the trends for the groups of mixed and specialist farms have been compared to investigate the impact of farm type on the conversion. There appears to be a tendency for a more rapid conversion in association with increasing proportion of dairy, as part of total output, illustrating that enterprise structure may be one factor in the farms' choice of conversion strategy. As milk is the only product for which they can get a premium and having at least 50% organic forage available in the diet is a condition for certification of the herd, the specialist farmers tend to convert the land more rapidly.

The farms also fall into two distinct groups according to their size: Farms 1, 5, 9 and 11 are bigger than 250 ha; Farms 2, 3, 7 and 12 are all smaller than 100 ha. Farm size was identified as a potential barrier to conversion, which was considered to be more difficult for larger farms.

[3] The missing numbers had been allocated to farms that did not continue the full term of investigation: Farm 6 dropped out during the first year of investigation and was replaced by Farm 12, Farms 4 and 10 were only monitored for three years, Farm 8 provided only dairy enterprise data and to make the original sample up ten, Farm 11 had been recruited. Of these Farms 4 and 10 have been only partly considered for this research

Comparison of the average values with conventional data

Although the selection procedure was not based on random sampling, the average value for all case study farms was compared with results of the DECS (Dairy Enterprise Costing Study of Manchester University) to allow some judgement about the transferability of the findings (see Table 5-2). The DECS was based on a sub-sample of dairy farms studied by the FBS considered to be representative of the population of dairy farms in England and Wales (Franks, 1999).

Table 5-2 Comparison of the sample of with conventional data

	Case study farms (pre-conversion)	*DECS (1988/89)*
Herd size (No.)	131	68.8
Stocking rate (LU/ha)	1.8	1.7
Milk yield per cow (litres)	5,240	5,229
Milk yield per ha (litres)	9,392	9,246
Dairy output (£/ha)	1,125	1,023
Total output (£/ha)	1,427	1,340
Total inputs (£/ha)	1,350	992
NFI (£/ha)	174	348

Source: Own data and (Franks, 1999)

The average herd size of the case study farms was larger than the average for the national dairy industry, and stocking rates prior to conversion were slightly higher, but lower than for dairy farms monitored by GENUS (Harper and Jones, 1998). The average milk yield per cow and milk production per hectare were comparable to the DECS results. Prior to the conversion the average dairy output and output per hectare for all case study farms was higher than that of the farms in the DECS study, but overall spending was also higher leading to overall lower NFI per ha than in the DECS study.

Conversion process on each farm

In the following three chapters the presentation of the results is structured according to the themes of human, production-related and financial aspects. This facilitates the comparative analysis of the cases, but leaves little room for narrative description, which begins in this section. Further small sections of a case narrative are included in Chapters 6 and 8, so that the reader gradually gets to know each farm (with some more detailed material presented in Appendix 4). A summarising account of the conversion process on each farm in Chapter 9 concludes the descriptive presentation of evidence of the case study research.

Farm 1

The farm is part of a large estate and, although the owner is not directly involved in its running, the decision to convert the farm clearly originated from him. Pre-conversion the farm was orientated towards arable production, although the dairy herd was larger than the national average (110 Ayreshires). Beef and sheep enterprises were mainly kept to utilise the permanent grassland, with quite a high stocking rate on the forage area.

Early in the 1980s a conversion experiment of arable crops was set up on approx. 20% of the land. In 1988, the base year for this study, a substantial part of the farm was gradually converted, followed by the livestock enterprises. The mixed rotation contained short- and medium-term leys, cereals, field beans and initially maize, which was later dropped and the beef and sheep enterprises were expanded.

An increase in farm size during conversion made the evaluation of the effects of the conversion process on indicators per hectare difficult. All farm staff are employed, including William the manager, and staff also work on some conventional share farming land to reduce overheads; this was not included in the case study data.

Farm 2

Harry and Sue bought their farm in 1988, having gained experience with farming on a smallholding. The conversion of the farm began in 1990 and was staged over three years: at first a small proportion of the grazing land was converted, followed by half of the remaining land in the next two years. A mixed rotation with some lucerne, grass-clover ley and cereals was introduced. Alongside the conversion went a gradual build up of the dairy herd, which qualified for organic status in July 1993.
A small proportion of the farm is grassland of low productivity but of high conservation value and compared with the other specialist case study farms this one was fairly extensive. Even before conversion a substantial proportion of concentrates were home-grown.

Farm 3

Farm 3 is a tenanted farm that Betty and Dave had taken over after agricultural college from Betty's family, two years before the beginning of the conversion in 1989. Prior to conversion the farm had a relatively high stocking rate (2.0 LU/ha) compared with the other case study farms.
The farm was converted in four stages, starting with a relatively small proportion of the land in the first year, followed by larger blocks in the second and third year. Home-growing cereals for the dairy was stopped as part of conversion and a rotation with mainly short and medium-term leys were introduced. Between 1993/94 and 1995/96 the farm lost approximately five hectares due to the building of a road.

Farm 5

This farm is the largest in the study, owned by a family partnership, from which the farming enterprise rents land and buildings. Chris, one of the family partners, initiated the development towards sustainable agriculture, and remained actively involved in the farm throughout the study period, despite having another profession. He participated in the first pre-test interview in 1993. All regular farm staff are employed, including Nick, a full-time farm manager who is responsible for the day-to-day running of the farm.
Like Farm 1 the farm had a strong arable orientation pre-conversion, as well as a dairy herd (100 cows) and a beef and sheep enterprise. As part of the conversion, which began later than on most farms, the five-year set-aside programme was taken up on more than half of the cultivated land to improve soil fertility. This land was released from the back into production during the second data collection period. The remaining land was converted gradually, usually beginning with a fertility-building crop. The rotation contained red and white clover grass leys and various cereals. The overall farm size increased gradually as more land from the remaining estate was converted.

Farm 7

This mixed farm with dairy, sheep and cropping, run by Luke and his family, is the only small farm with a mixed enterprise structure, and as a result the dairy herd was one of the smallest of all case study farms. The land was converted in three stages in 1989: 55% in the first year, 30% the second year, and the remaining land in the third year. Already before conversion the farmer was aiming to produce milk from home-grown feeds, including cereals, and this continued.

Farm 9

Farm 9 was among the larger farms and had the largest dairy herd in the sample. Also owner-occupied, it was taken over by Daniel in 1989, only a few months before he decided to convert the whole farm, and invest substantially in building resources at the same time. The land was converted in two main stages: all grassland in the first year and most other land in the second year, apart from a few fields where conventional cereals continued for another year. Prior to conversion the farm did not use any home-grown cereals for feeding, but this was introduced as part of the conversion.

Farm 11

Farm 11 was the only large farm in the group of specialist farms. It belongs to and is run by a family partnership, with partners responsible for different enterprises. Before the main conversion the farm had a dairy, a vegetable and a pig enterprise; this last was considered unsuitable for organic conversion and was maintained conventionally at a reduced level for some time and then given up.
The first step into conversion had already been taken several years before the study began, with an organic vegetable enterprise that started in 1986 and was grown as part of an arable rotation on approximately 20% of the land. The monitoring mainly focused on Walter's decision to convert the remaining land and the dairy herd.

Farm 12

Eric and his wife on this owner-occupied farm had diversified into agri-tourism before the organic conversion. However, the dairy herd remained important to the farmer. The whole farm was converted in one step in 1991, but for different reasons from Farm 11. Eric felt, because he had farmed extensively before and the swards were rich in clover, that this strategy would work and he did not encounter the same problems as Farm 11. The farm qualified for a reduced conversion period on the land and the herd was the first achieving the organic symbol, towards the end of the second year of conversion. During conversion, the total forage area decreased slightly, as the farm introduced cereals for the livestock into the rotation.

Concluding remarks

The aim of this chapter was to introduce the sample of case study farms, to document variety among the farmers and farms, and to compare some structural variables with the national industry. Age and education of the case study farmers were similar to organic farmers in other studies, who are generally assumed to be younger and better educated than the average for the industry, and also younger than the average for European farmers. Compared with the findings by Burton *et al.* (1997) for horticulture it appears that the case study farmers had a more traditional farming background, indicated by high prevalence of agricultural training, substantial practical experience and a relatively young age of entering into farming. In Burton's study (1997), also, a high proportion of female farmers had been identified, but none of the case study farms was run by a female farmer, although on three farms the spouses were very actively involved.
The sample showed considerable variation regarding specialisation and size, and for both variables the case study farms could be divided into two groups of four farms, which will be used in the following chapters to explore the different impact of conversion on farms of different type and size.
Compared before conversion with a specialist dairy survey carried out by Manchester University (Franks, 1999) the average herd size of the case study farms was larger, but the farms were of similar intensity in terms of stocking rate and milk production per cow, leading to a similar output per hectare. It is likely therefore that, despite the small number of case study farms and the lack of random selection, the results are of relevance to conversion on other dairy farms.
The short description of the case study farms illustrates considerable variation between the case study farms in terms of their conditions before an approach to conversion. How this variation influences the various indicators during the conversion process will be investigated further in the next three chapters, before in Chapter 9 the whole farm conversion process, the interaction between the variables and the role of knowledge and information is further analysed.

Personal aspects of conversion on the case study farms

Introduction

This chapter introduces the case study farmers' perspectives of their conversion process. The literature reviews of farmer decision-making and studies of organic farmers and conversion (Chapter 2) identified a number of specific questions related to the personal factors that are likely to influence the decision-making, such as the farmers' motivation for the conversion, their attitudes to farming, the nature of the decision-making process including the importance of the trial and evaluation phase and planning, and the role of knowledge and information from various sources.

These issues were studied with the help of in-depth interviews with each case study farmer or farm manager in 1995, when all case study farms had been in conversion for several years. Answers that relate to the situation before conversion are therefore e based on the farmers' recollection. The first section is concerned with the farmers' original motivation to go organic compared with their attitudes to farming at the time of interview, some years into conversion. It was thereby not the intention to generalise about personal attitudes from such a very small sample, but to allow the conversion of each case study farm to be investigated in the context of the farmers' conceptual boundaries. This is followed by a section about the farmers' recollection of the process of decision-making and conversion, personal support, barriers and problems. The next section examines the particular sources of information the farmers consulted and how useful they were found to be, including conversion planning. This is followed by a summary of the main issues and some tentative conclusions, which will be taken up again jointly with other results in the context of the whole farm conversion process in Chapter 9. Each section contains a descriptive presentation of the results, to allow the reader access to some evidence in support of the conclusions in this and in later chapters. The farmers' experience of specific production-related and financial aspects of conversion, which were also discussed in the interview, has been included in the following two chapters together with the results of the monitoring of the farms.

Interview method and data analysis

The interview guide contained mainly open questions covering the farmers' motivation for and experiences of the conversion process as well as the role of information, followed by a short section with prompting statements about preference for information sources and farmers' attitudes (see Appendix 2). It was pre-tested on two case study farms in 1993, and with both farmers (Farms 5 and 7) a second shorter interview was conducted in 1995. The results of a third pre-test on a farm that was not part of the study were not included in the analysis.

On several farms a second person joined all or parts of the interview: on Farm 3 both spouses (Betty and Dave) participated for the whole time; on Farm 2 the farmer's wife (Sue) participated for parts of the interview; on Farm 5 a member of the owning family partnership (Chris) was present for parts of one interview. Interviews were also carried out on two farms (Farms 4 and 10) that left the study in 1995. Bill (Farm 4) was not interested in further participation because of the additional workload related to the financial monitoring and Bert and his wife Pat (Farm 10) moved to a new farm. Their views have been included in this chapter where they added an additional perspective.

The interviews, lasting between one and two hours, were taped and fully transcribed, and the material was analysed using OSR*Nudist, a computer package for the data analysis of unstructured data which assists with the indexing and retrieval of passages. In each section some direct quotes have been included to illustrate particular points. To allow the reader to make reference to the farm circumstances the farm number is included in brackets after each name.

Motivations and attitudes to farming

This section is concerned with the question of what motivated the farmers to convert to organic production and what were their attitudes to farming at the time of interview, so that the conversion process could be further investigated in the context of the farmers' specific goals. At the beginning of the interview the farmers were asked to give reasons why they converted their farms to organic management. The answers were intertwined with general ideas about the running of the farm, a theme returned to in the last section of the interview using pre-formulated statements about the importance of objectives in farming.

Motivation to convert to organic production

Most farmers talked about a range of issues and pointed out that conversion happened because of a combination of several and not just one issues. The answers were usually embedded in a discussion about the whole process of the conversion.

General environmental concerns were important issues in deciding to convert the farm. These included feelings about negative environmental impacts of conventional agriculture and specific interests in conservation issues on farms.

> William (F1): "I was not happy with the things in conventional farming. You know I was managing an intensive dairy and arable farm (before), with lots of sprays in the cereals, and I never felt very comfortable about that. ...They were very much into ripping out everything, all the hedgerows, and they ended up with massive fields. I can always remember sort of arguing at 6 monthly meetings against doing it, because I just did feel it was not right to pull hedges."

On the majority of farms financial reasons were also seen as a very important reason for the organic conversion. Organic farming was seen as a way to save costs (three farms) and or as a way to get higher returns for the products through an organic premium for the milk (on five farms).

> Bill (F4): "I just saw it as a way of growing grass without fertiliser, saving costs, really."

> Dave (F3): " (Name of company) were looking to buy milk at 26 p a litre and we thought that was great. It looked as if we were going to get out of conversion, just as they were going to need the milk."

Two farmers (Farms 3 and 12) expressed an interest in direct marketing as a way to secure a premium for the organic milk, but only one farm went this way (see Chapter 8). Grant aid did not feature greatly, because at the time when most farmers converted, no specific conversion aid programme was in place in the UK. Farm 5, however, used the five-year set-aside to finance entering into the conversion with a long-term fertility-building phase on a relatively large proportion of the land.

On seven farms the decision in favour of organic conversion was discussed in the context of the farm structure. Two farmers felt that the structure of the farm was particularly suited to organic conversion. For example, Daniel (F9):

> "The farm was quite well suited, good balance of crops and stock that made it possible."

In two other cases the farmers saw the organic system as a way to simplify their systems, particularly to reduce the cereal area on the farm. For example Betty (F3) said:

> "We wanted to have a grassland farm as well, coupled with our own interest in using herbal medicines ourselves and our sort of political and philosophical feeling about life, it all seemed to come together."

This contrasted with Farms 1 and 5, which saw going organic as a way to diversify away from the mainly cropping orientation of the farm before conversion.

Four farmers stated that they had always preferred extensive systems. So said Harry (F2):

> "So we had 24 cows on a hundred acres and so we did not really need to use any nitrogen, and so we started clover farming. Then we decided that we go for the whole hog and go for organic farming."

Farmers also mentioned concerns about the health status of the animals and, in two cases, the decision to convert the farm to organic methods was taken after some changes in the management of the herd had been made.

> Bert (F10): "Basically, how we got into the homeopathic side of things, I used a homeopathic remedy (myself and) that made a big difference. So that swore me on the homeopathic side and away from the antibiotics."

Important personal motives for conversion for three farmers were health issues and experiences with complementary medicine. On some farms there was also long-standing interest in organic farming among members of the family, and some saw the conversion as a challenge to husbandry skills and wanted to further the organic sector. Chris (F5):

> "The organic world … has an extreme image and hopefully we can prove that it has very strong practical ground. That's what we are going to do."

As part of the analysis, the answers were grouped according to the categories identified in other studies (see Chapter 2) presented in Table 6-1, with all farmers mentioning multiple reasons for conversion. General concerns, financial issues, a favourable farm structure and preference for extensive agriculture were widespread reasons, mentioned by more than half of the case study farmers, whereas personal health, interest in direct marketing and the husbandry challenge were only important to a smaller number of farms. There does not appear to be a substantial difference in motivations between mixed and specialist farms, apart from the husbandry challenge, more widespread among the mixed farmers, and concerns about animal health, only expressed by two specialist dairy farmers.

Table 6-1 Categories of motivation for conversion

	Mixed				*Specialist*						***No***
Farm	1	5	7	9	2	3	4*	10*	11	12	
General concerns	✓	✓	✓	✓	✓	✓		✓		✓	**8**
Farm structure		✓	✓	✓	✓	✓	✓	✓			**7**
Financial issues			✓			✓	✓	✓	✓	✓	**6**
Preference for extensive farming	✓				✓	✓		✓		✓	**5**
Husbandry challenge	✓	✓		✓					✓		**4**
Personal health		✓				✓		✓			**3**
Interest in direct marketing		✓				✓				✓	**3**
Concerns about animal health								✓		✓	**2**

* Farms did not continue in the study;

Source: Own data.

Attitudes to farming

In the structured part at the end of the interview the farmers were prompted with a list of pre-formulated statements about farm-related goals. The list included statements about a number of areas that had been identified from the literature, such as technical aspects of farming (crop and livestock production) and financial goals, related to diversification and lifestyle. The farmers were asked to score each attitudinal statement with a number from 0 (not important for them) to 5 (very important for them). Any additional comments were taped and provided in some cases a background to the answers. In
Table 6-2 the statements are sorted according to their average score and the number of farmers for whom a particular statement was important or very important (score of 4 or higher).
Nearly all farmers (eight out of ten) considered the improvement of crop production to be important, whereas only five farmers gave the same score to the statement about livestock production. This result was somewhat surprising, as it was expected that dairy farmers would be equally concerned about crop and animal production, but may indicate that the farmers considered that animal production was not in need of *further* improvement. This appears to be the explanation for the low score that was attributed to improvement of animal housing conditions, when farmers stated that they had recently already carried this out.

Table 6-2 Scores of importance to attitude statements of the case study farmers (1=not important, 5 = very important)

	Mixed farms	*Specialist farms*	*Av.*	*No.*

Personal aspects on the case study farms

	Farm Number	1	5	7	9	2	3	4*	10*	11	12		scores >4
1	Improve crop production	4	4	4	4	4	5	5	5	2	3.5	**4.1**	**8**
2	More time for the family	5	1	2	3.5	4	5	5	5	5	4	**4.0**	**7**
3	Improve livestock production	4	4	2	5	3	5	4	5	2	3.5	**3.8**	**5**
4	Increase our income	5	4	2	5	3	4.5	4	3.5	3	3	**3.7**	**5**
5	Improve marketing	4	4	2	4	1.5	5	1	5	4	5	**3.6**	**5**
6	Have less work	4	1.5	5	2	3	3	4	4	4	2	**3.3**	**4**
7	Less financial worries	3	1	2	5	1	4	4.5	5	0	3	**2.9**	**4**
8	Diversify the farming business	1	3	1	0	0	5	5	5	4	1	**2.5**	**4**
9	Improve the housing conditions	3	3	2	2	1	5	2	5	1	1	**2.5**	**2**
10	Process on the farm	4	4	0	0	0	0	0	3	4	3.5	**1.9**	**3**
	Average score per farm	3.2	2.9	2.4	3.3	1.9	3.7	3.1	4.1	3.3	3.5	2.9	

* Farms did not continue in the study Source: Own data.

The second most important objectives (based on the average scores and number of farms scoring 4 or above) were ‘to improve livestock production’, ‘increase our income’ and ‘to improve the marketing’. Despite the general interest in income improvement the farmers were selective about the means by which to achieve this and reluctance to get involved in on-farm processing and direct marketing was widespread. Despite the high score for ‘more time for the family’ the second statement addressing the work situation from a different perspective (‘have less work’) did not score as highly. This, and other comments made, gave an indication that although labour-related issues can be a problem on converting farms, it is not so much the work situation that the farmers see as difficult, but the lack of time that they have for their families. It also confirmed the importance of lifestyle-related goals.

> Daniel (F9): "I enjoy working a lot, I don't like lounging about, not very much, my wife would like me to, and the children would too. "
>
> Luke (F7): "Yes, but more I suppose wanting to live that sort of life, because I have been brought up on a farm and I was interested in doing things outside and so on."

The diversification of the farming business was considered to be important on four specialist dairy farms. Low interest was shown in on-farm processing, which only three farmers considered as a future option: two of those were farming on large estates.

Comparison between motivations and attitudes related to objectives

To get an indication of any change of goals and attitudes during conversion it is interesting to compare the answers to the open questions about motivation at the beginning and the scores given to pre-formulated objective statements at the end, although this is difficult given the different method of questioning. Motives and objective statements were both sorted into categories identified from the literature (technical, financial and personal) and the number of farmers who either mentioned motives in a particular area or agreed with the related statements could be compared (see Table 6-3).

Although approximately half the farmers only mentioned technical issues as a reason for conversion, related statements were considered to be important by the majority of farmers, particularly in the case of improvement of crop production. This could either indicate technical problems or the need to pay greater attention to technical details in order to be successful: comments made by some farmers supported the second interpretation.

> Harry (F2): "Well I think we are pretty much there, … It is just fine-tuning it, really."

And Betty (F3) expressed their dedication further to improve their system:

"We are obsessed by farming and more so by organic farming. We must be quite boring to anybody who is not interested in it."

It appears as if the attitude to financial issues was less influenced by the progression of the conversion, with approximately equal numbers of farmers mentioning it as a motive for the conversion and as a farming objective. Of particular importance at the time of interview, supported by comments made, was the improvement of marketing, reflecting the farmers' interest in achieving a premium for their products. However, the number of farmers who were concerned about the reduction of financial worries in 1995 was relatively low, which gives some indication of the overall financial success of the conversion (see Chapter 8). So said Bill (F4):

"It (income) has got to increase, to keep up with inflation, I have not got great ambitions, but obviously, we need to improve, we need to keep on top of things."

The area of 'general concerns', which were quite widely represented among the conversion motives, had not been considered in the list of statement of attitudes that were presented to the farmers so no comparison is possible.

Concluding remarks

All ten farmers (including two who were not monitored throughout) mentioned multiple reasons for their conversion, such as general environmental concerns, doubts about certain aspects of conventional farming systems and financial reasons, with production-related reasons less frequently mentioned.

Financial issues were important for farmers in their decision to go organic, particularly the prospect of selling milk for a premium. It appears that the motives for the case study farmers were similar to those of later converters in the literature review (see Chapter 2), with environmental and financial reasons most frequently mentioned. A shift in motives between earlier and later converters may indeed have happened well ahead of the growing interest in organic conversion later in the decade. This contrasts with a widespread view in the organic movement that financial motivation for organic conversion has become important since the introduction of aid schemes, whereas earlier converters mainly acted on the basis of their personal conviction. An alternative explanation may be related to the strong farming background of the case study farmers compared with other organic producers (see Chapter 5).

However, although financial issues were clearly important for the case study farmers, all had other technical, personal and lifestyle-related motives for conversion and objectives influencing their decision-making.

In response to attitude statements the farmers considered a variety of objectives related to technical, lifestyle and financial issues important. A greater importance of technical aspects in the attitudinal statements (particularly 'to improve crop production') compared with the farmers' motivation may indicate a shift towards greater attention to technical details as the conversion progresses. This may be a result of the growing awareness that organic farming favours a preventive rather than curative approach, and gives an indication that personal attitudes may be influenced by experiences that are encountered during conversion. In Chapter 9 the theme of farmers' motives and objectives will be taken up again, setting it relation to the impact of conversion on each of the case study farms.

Table 6-3Comparison of the motives for organic and farming related attitudes to objective statement of the case study farmers

	No. of farmers who mentioned particular area or agreed with objective statement						
	2	*3*	4	*5*	*6*	*7*	*8*
Technical motivations							
Farm structure	******	******	******	******	******		
Concerns about animal health	******						
Husbandry challenge	******	******	******				
Technical objective statements							
Improve the crop production	******	******	******	******	******	******	******

Improve the livestock production	****** ****** ****** ******
Improve the housing conditions	******
Financial motivations	
Prospect of premium	****** ****** ****** ******
Financial cost cutting	****** ******
Interest in direct marketing	******
Financial objective statements	
Increase our income	****** ****** ****** ******
Improve of the marketing	****** ****** ****** ******
Less financial worries	****** ****** ******
Personal motivations	
Personal health	******
Personal objective statements	
More time for the family	****** ****** ****** ****** ****** ******
Have less work	****** ****** ******

Source: Own data

Decision-making and conversion process

The literature review in Chapter 2 highlighted the potential importance of trial and practical evaluation for farmers' decision-making, but also difficulties that are associated with experimenting with a systems change, such as organic farming. The interview guide contained a range of questions relating to the decision to go organic, which were developed with reference to the phases of decision-making in the adoption/diffusion model. Of particular interest was whether a phase of trial and evaluation could be identified, given the problems of experimenting with a whole systems approach on small parts of the farm. The interviews also aimed to record the farmers' personal experience of their conversion process, the support received and their particular reasons for choosing a conversion strategy.

The section begins with a short descriptive summary of the decision-making and conversion process on each farm, including Farms 4 and 10 which did not continue in the study. In the following two sections particular attention has been paid to the support that the farmers received for this decision, but also to barriers that they encountered and the conversion strategy that was chosen.

Summary of the decision-making and conversion process on each farm

On Farm 1 the decision to convert to organic farming was taken by the owner, but a large number of people were involved in the management of the farm and implementation. As a result of a conversion experiment on a small block of land various staff gradually became more confident about the feasibility of converting more land, followed by the livestock.

> William (F1): "I mean the whole thing has always been a confidence building thing, and it is a lack of confidence that probably holds people back, and the more you get into it, there are less problems."

However, it was not until approximately 10 years after the beginning that the decision to convert the whole farm was taken in 1991, and then rapidly implemented, which in the manager's opinion made everything much easier.

The dairy herd was considered to be most difficult to convert and was therefore left until last, but proved to be easier than the beef and particularly, due to the challenge of developing clean grazing systems, the sheep enterprise. According to the manager William the appointment of a new herdsmen made the conversion of the dairy herd much easier.

The conversion of this large farm began with an experiment and was truly staged over more than seven years. It appears that the attitude of the various farm staff was one important element influencing the decision-making process, but in the interview in 1995 William considered all farm staff to be fully committed to organic management.

Harry and Sue on Farm 2 had moved with a small number of cows from a smallholding to their current farm. As the stocking rate was relatively low for the size of the farm, they felt that it would not be necessary to use any nitrogen fertiliser, and therefore started with a clover-based milk production system, from which conversion to organic management was seen as a natural progression. Harry did not anticipate any problems with the grazing land, but was more concerned about the forage for conservation.

> "The grazing fields were growing clover well, so it was just a question of getting the clover into the silage fields and have the confidence that we would get enough silage."

A staged conversion over a period of three years allowed Harry gradually to gain more experience and confidence in the organic system.

Betty and Dave on Farm 3 had been thinking about organic farming for a while, as they felt it was in line with their general attitudes and preferences. However, because of high overheads they had perceived their farm not to be suitable, and after taking over the tenancy they at first attempted to improve their income through intensive use of inputs. Concrete steps in the direction of a conversion were prompted when they were accused of damaging somebody's garden through spray-drift.

The family consulted the Organic Advisory Service who carried out a feasibility assessment, which was later taken forward to a detailed conversion plan. The plan envisaged a slow, staged conversion, beginning with only 10% of the land area in the first year. According to Harry the final decision to convert the whole farm was not taken until the end of the second year of the conversion. Thereafter all remaining land was converted over the subsequent two years, faster than originally envisaged. The actual implementation of the conversion was similar to Farm 2, but the decision-making process leading to this was different.

The farmers on Farm 4 which did not continue in the study, stated that the decision-making process had been quite long. In the farmer's opinion the farm had not received enough quota for viable milk production on the land, as the farm had only entered into milk production two years before quotas were introduced. The farmer was therefore seeking other ways to improve income. One option he considered was organic production, for the first time in 1985, but at that time he opted for diversification, and started to process the milk on the farm. He gave this up again because of the workload and his continued interest in organic production led him to experiment without inputs on two fields. His remaining scepticism towards organic production was overcome with the help of an organic advisor in 1991 and by gaining further experience with the organic system on the farm itself:

> Bill (F4): "Once we were through 1991, I could see that the profits would not be too badly damaged, I was confident that we would go through ok. … Some of the management techniques they were telling me to do … It was almost a revitalisation of the farm, by using the rye and kale."

All remaining land was converted in the second year. Bill left the study because of the workload involved in preparing for the data collection and uncertainties about the prospect of receiving a premium and maintaining the organic certification of the herd.

On Farm 5 the decision to go organic also goes back to the owners, a family partnership, but was largely put into practice by the manager and the other farm staff. Chris, a member of the family who lived on the farm, introduced the idea for an organic conversion and commissioned a feasibility study from the Organic Advisory Service (OAS) which helped him to convince the other partners and was later developed into a conversion plan.

> Chris (F5): "Well, my argument was from the heart, so if you really believe in. But then they met (the advisor) and obviously were happy with his feasibility study."

The five–year set aside on a large proportion of the arable land was seen as preparation for the conversion, while the remaining land carrying the dairy and other livestock enterprises was converted gradually. As on Farm 1, the conversion process for the whole farm was long, but in this case the decision to convert the whole farm was taken at the beginning, on the basis of the feasibility study.

Early in the conversion period and probably also because he was not happy with the way things were going, the previous manager left. The current manger, Nick, was appointed in 1991. He was interested in organic farming which he saw as a challenge, but he had no previous experience with it. A newcomer to organic farming himself he experienced some problems with the other staff, who looked to him for clear directions, while he felt he was still learning himself.

Luke on Farm 7 had developed some interest in environmental matters after his agricultural training at University, prior to taking over his farm. Members of his family also had contact with one longstanding organic dairy producer in his area. However, lack of technical knowledge and financial considerations stopped him from taking this option any further at that time.

More distinct steps towards the conversion were only taken once it appeared more likely that an organic premium for the milk would become available. On the basis of information from various sources and some rough calculations, Luke and his family decided to convert. Only then did they contacted the OAS advisor for help with conversion planning, intending that all the land should be converted within two years. However, under the misapprehension that it would not have any implications for his certification date, Luke applied some nitrogen on one field, which effectively prolonged the conversion to a three-year period and delayed the certification of the herd.

In contrast to most other farms, Daniel's decision-making period on Farm 9 was relatively short. He had taken over the farm suddenly due to family circumstances and a few months later had already decided to go into conversion, but his brother had grown organic vegetables on a small part of the farm before. The rapid decision-making process was also reflected in a relatively short conversion process, but he was well aware that the organic conversion involved many changes and learning about new things, and used a range of people in helping to plan the actual conversion.

> Daniel (F9): "Once I have made up my mind, there was not much that stops me. I get on and do it. I rapidly jump into planning on how to do it, even though it might be completely the wrong thing to do."

The family of *Farm 10* who moved to a new farm during the study period also mentioned a long thought process starting approximately in 1985, until the decision to convert was taken in 1991. Bert started thinking about different ways to farm while farming in partnership with his father. Moving to organic farming he broke the partnership and took over one of the family's holdings as a tenant. He calculated that for him the most profitable way of farming would be not to use inputs intensively, and organic farming appeared to be best option.

> Bert (F10): "We still had not made a final decision, it is not something that we jumped into, it took two or three years."

His cows had experienced some acute problems with mastitis, and the vet pointed out the low natural immune status of the cows. This prompted some contact with homeopathy, which was thought to have helped both the cows and the farmer. The farmer also lost several calves to low iodine supplies, which he attributed to the intensity of his farming and imbalances in the trace element supply. To address this the farmer used what he called semi-organic fertilisers, which were rich in trace elements. The chance to get a premium for the milk finally prompted his decision to convert. All land was then entered into organic management in two stages. After the first data collection period the family moved to their second holding, which was again converted to organic management. Because of the discontinuity of the location the data have not been used for the following analysis.

On Farm 11 the decision for the conversion involved several members of the family. At first one partner grew organic vegetables, sold directly to consumers through a farm shop. Then local demand for organic milk prompted Walter to convert the remaining land in one year.

> Walter (F11): "They said that there was going to be this premium available, I did my sums and I thought, I can make it work, so we took the whole farm in."

On Farm 12 the decision to convert was influenced by the local homeopathic veterinary surgeon who organised a lecture about organic farming. He helped the farmer with contacts to other organic farmers, and homeopathic treatment of the cattle was introduced before the decision to go organic. Through the lecture and a visit to a nearby organic dairy producer the farmer developed a better understanding of organic production.

> Eric (F12): " I knew that you weren't allowed to use fertilisers or sprays, but I did not know how to go about it. He gave me a bit of an insight."

As some premium appeared more likely and after further consultation with the OAS the whole farm was converted in one year.

> Eric (F12): "I had been reducing the amount of spreading of fertiliser over the years and they thought that because I was not using a lot of sprays or soluble fertilisers probably move the whole lot in at once. "

Social support for the decision-making

While talking about the conversion process of their farm several farmers mentioned personal contacts with other people who supported them in their decision to go ahead with the organic conversion, which is discussed further in this section. The information role of some people as an information source is taken up in Section 6.4.

Members of the family and friends were very important for the decision-making process. Most important was the spouse, but also other members of the family that were or were not actively involved in running the farm.

> Betty (F3): "They have been very supportive. Lots of them are in the green movement, and there has been a very comfortable feeling. All our friends that matter to us, all are very very supportive."

> Daniel (F9): "My wife had been pressuring me as a consumer."

On two farms other family members were growing organic vegetables before the whole farm and the livestock was converted.

Visiting other farms was also an important step and most farmers went to see at least one organic farm before the beginning of their own conversion (see also 6.4.1).

Five farms (one of which did not continue) made contact with the OAS (organic advisory service) before they made the decision to go ahead with the conversion and mentioned the advisor as a very important person supporting their decision (see 6.4.3).

Overall, it appears that the farmers received social support for their decision from a variety of sources, particularly from members of their own family and friends, but also from other organic farmers and specialist organic advisors (see also below).

General experiences and problems

The overall experience of the conversion period was positive, but several problems and uncertainties were encountered during the process. On the positive side farmers mentioned learning new skills (e.g. how to use homeopathy for treating the cows, learning to grow a wider variety of crops), but also the attention that the farms were receiving from others.

Asked what the biggest problems were, one farmer mentioned the financial situation in the first year, for which he was not prepared.

> Luke (F7): "I suppose the financial worry. We did have to reduce our stocking and our cereals quite a lot and it did happen to coincide with a dry summer in 1990, so we really did have quite terrible cereal yields and very little straw as well. … The loss of output the first year did not make it very encouraging."

Other problems mentioned included forage shortage and rations, animal health problems, problems with labour and staff management as well as more general problems with learning how to run the farm under the new system (see Chapter 7). Marketing of organic milk also proved a major problem in Devon, where none of the farms had access to a special outlet (see Chapter 8).

Farm staff

William made it very clear that the staff had at first been quite sceptical about the step to go organic:

> William (F1): "The only thing they are not particularly keen on is manual work, but that was their expectation, that they have to go out and hoe and pull weeds. And as that has not really happened, they were quite surprised, really."

William and Nick (F5) agreed how important it was to give the staff a clear sense of direction, to which in one case the conversion plan had contributed, and to keep them involved in what was going on. Two farmers pointed out that the success of preventative health management relies on the skills of the herdsman, and in one case the herdsman was taking the initiative in learning about homeopathic treatment of the cattle. It was suggested that the farm staff should be given opportunities to make up their own minds by being invited to go to farm walks or talks about organic farming, and that the need for staff training was ongoing.

Barriers to conversion

Several farmers mentioned what had prevented them from going organic earlier. In two cases the reasons were financial:

> Betty (F3): "We had always been interested in organic farming, but when we were at college, we were told that when you have borrowing and you were a tenant, that it would be quite impossible."
>
> Luke (F7): "Oh, the, I suppose the financial consideration … and the lack of knowledge. I did not really know, how much would be involved and we did not really feel secure enough. I suppose, to take the first step, which obviously in the first year or so did involve a loss of income, without any evidence of any sort of premium at the end of the day."

The second quote also illustrated the widespread lack of technical knowledge and the fear of how to manage without certain inputs that had been used before, for example in the area of animal health.

> Eric (F12): "Well my biggest fear was with the cows, how to manage them without use of antibiotics."

Finally, several farmers mentioned contact with other people, who they felt were not very supportive to their decision and in some cases clearly aimed to discourage them, for example members of the older generation on the farm. One farmer did not even discuss the decision with his mother.

> S: "Your mother, she did not know about it when it was happening?"
>
> Eric (F12): "No."
>
> S: "What did she say afterwards?"
>
> Eric (F12): "We have not talked about it."

In one case, the contact with the nearest organic farmers was not very positive as the farm was not perceived to be an example of good farming practice. Several farmers expressed some concern about the organic movement's lack of willingness to co-operate with conventional farmers and the perception of an "*us and them*" situation. They were determined to maintain the links with the local agricultural community after the conversion. For example Bert (F10) said:

> "And I am still a conventional farmer that has changed over. I feel, I am not truly integrated into the organic system."

Particularly one family felt that they had received no support from their (conventional) dairy advisor, who clearly tried to discourage the family.

> Betty (F3): " He was really abusive, he had to slag D and me off, for about three quarters of an hour, in front of each other. …, I mean he was really offensive … His last thing was saying, I hope, I still have got space for you, when you want to come back to me."

So overall, barriers were named as general financial and technical concerns, lack of support among close members of the family, particularly the older generation and farm staff, and the difficult relationship between the organic movement and conventional agriculture, including in some cases, the conventional advisors. It appears as if farmers see conversion as a change of camps, which they perceive as difficult. They do not want to loosen their ties with the wider agricultural community, of which they need to feel part.

The barriers mentioned give some indication of the considerations that influenced their decision-making process and broadly confirm the categories of barriers identified in the literature. However, the fact that all these farmers converted their farms shows that such barriers can be overcome.

Concluding remarks

The whole process from first contact with organic farming to the final decision to go ahead with the conversion lasted over a period of several years, although there were some notable differences between the farms. During this period the farmers' confidence that organic farming was the right option for them increased. Their decision-making was influenced by their personal attitudes and they were supported in various ways through a number of personal contacts, especially the spouse, and other close family members and friends. Visits to and talking to other organic farmers acted as a source of personal support, but also as an information source (see below).

However, the decision-making process was also furthered through experiments on the farm itself, such as converting blocks of land, treatment of cows with complementary medicines, or assessing the financial feasibility of an organic conversion. In many cases the final decision to go organic was not made until a substantial proportion of the land had already been converted or changes in stock management had been introduced successfully. Once the decision had been made it was generally implemented fairly rapidly.

Resistance to the decision to go organic came also from members of the family, specifically the older generation. Several farmers felt that a critical attitude among friends in farming towards their organic conversion was worsened by the negative attitude of some parts of the organic movement towards conventional farmers. Some resistance to the conversion decision came from farm staff: for example on one farm the manager did not agree with the owner's decision to go organic and decided to leave the farm, so that a new manager was appointed. One family mentioned specifically the negative attitude of their conventional advisor.

Not in all cases was the actual conversion similar to what had been planned. The small mixed Farm 7 needed a longer conversion period, because of a misjudgement about the long-term consequences of a N fertiliser application. On the other hand, Farms 1 and 3 shortened the planned conversion period as confidence grew. The couple on Farm 3 had effectively kept their options open, although they submitted a cropping plan to the certification body that showed how all land was to be converted. Once they had decided that it would work for them, the remaining land was converted more rapidly than originally planned.

The interviews confirm a number of internal and also external factors for the farmers' decision-making, such as motives and personal objectives, technical and financial factors, and personal contacts with friends and family. On several farms a longer period of consideration of going organic had preceded the actual decision and implementation. However, all farmers appeared to have learned a great deal about organic farming through implementing aspects of it on their own farm. The conversion process of each farm will be taken up again in Chapter 9, where it is set against the financial impact of conversion on the case study farms and discussed in the context of a model of the phases of conversion.

Use of information sources

The literature review (Chapter 2) highlighted the importance of information for the adoption process in general and it was argued that as organic farming is considered to be information intensive, it is likely to be of particular importance for the conversion process. The literature further indicated that the farmers' use of information sources over time is likely to change and that organic farmers may prefer different information sources from farmers in general. In particular, they may show a greater preference for learning from other organic farmers.

All farmers were given a list of possible information sources and were asked to assess their usefulness by scoring each source on a scale between 1 (not useful) and 5 (very useful). This list was divided into two sections:

(1) General information sources for organic farmers and agriculture which included mainstream providers of advice and information, and
(2) Secific providers of information and advice to organic agriculture, like the Soil Association and the Organic Advisory Service (OAS) at Elm Farm Research Centre (EFRC).

The farmers were also encouraged to add further sources to the list and to state the time when a source had been particularly useful (before or during conversion) although farmers could not in all cases accurately remember this. The tape recording continued, picking up any specific comments they made, and the material gives a good indication about the usefulness of various information sources during the conversion process (see Table 6-4).

The information sources in each of the two sections are arranged according to the number of farmers that expressed on opinion on a particular source. Other organic farmers were found to be most useful among the general information sources, followed by books on organic farming. Farming magazines were read by the majority of the farmers, but in most cases not considered to be useful. Half of the farmers mentioned members of the family and general books on agriculture as important information sources. Not quite so frequently consulted but still regarded as useful were other farmers at a similar stage of conversion. Less important as information sources were agricultural scientists including organic farming specialists, ADAS, on-farm experiments and the mass media. Nearly all farmers were keeping some sort of a diary, but the majority did not appear to be referring to that or other notes on their observations as a source of information. None of the farmers had given a high score to general farm business consultants or conservation advisors from FWAG (Farming and Wildlife Advisory Group) as a relevant information source, although one farmer mentioned a visit from a FWAG consultant to the farm.

Of the specialist sources, publications such as the EFRC technical bulletin, organic farming magazines and leaflets were used by most farmers and considered useful. Most farmers (6) had also used specialist services of the OAS (direct advice, organic dairy farmers group) and gave them a high score. A similar value was given to the magazine "New Farmer and Grower", the technical publication of British Organic Farmers/Organic Growers Association.[4]

A smaller number of farmers expressed an opinion on the remaining specialist sources, but scores given were also relatively high. Farmers also added books about homeopathy to the list as very useful; one farmer added his GENUS advisor and one the local grassland society as very useful sources of information.

Overall the list shows a preference for sources that specifically address issues of organic farming, whereas mainstream source of information for agriculture were considered less important. This may well be a reflection of the situation at the time, where mainstream agricultural services were paying little attention to organic farms. As useful before the farm's own conversion were organic farmers, books, members of the family, and direct advice on the farm. The following section presents some more comments regarding the usefulness of specific sources.

Other farmers

Other organic farmers were considered important both as a source of social support for the decision-making and during conversion (see 6.3.2) and as an information source. The farmers were positively surprised about the openness and felt they benefited greatly from visits to organic dairy farms. For example, Harry (F2) said:

> "Well, we did a farm walk on D's place. He runs a very simple system, oats and red clover and it works well and he has kept the same system for a lot of years. So if he could do it, why should not we be able to do it, you could go there and see it working."

Table 6-4:Farmers' assessment of the value of information sources before and during conversion to organic farming based on i

		Scale score						*Useful time*	
	No.	*Av.*	*1*	*2*	*3*	*4*	*5*	*before*	*during*
General sources									
Other organic farmers	8	4.8				2	6	4	1
Organic farming books	7	3.4	1		3	1	2	5	1
Farming magazines	6	2.8	2		2	1	1	3	1

[4] Since then this organisation has formally become part of the Soil Association and the magazine is now called *Organic Farming*.

General books agriculture	5	4.0		1		2	2	3	
Members of the family	5	3.2	1	1	1		2	4	
Friends	4	2.0	1	1	1			3	
Other farmers in conversion	3	3.7		1			2		
Scientists in general	2	1.5	1	1				1	
Diary and on-farm observations	2	4.0			1		1	1	1
ADAS	3	2.3	1		2				
Mass-media	2	1.5	1	1					
Organic farming scientists	1	2.0		1					
On-farm experiments	1	2.0		1				1	1
FWAG	-							1	1
Financial and business consultants	-								
Homeopathy books	2	5.0					2		
GENUS	1	5.0					1	2	1
Local grassland society	1	5.0					1		
Specific organic information of advisory providers									
EFRC[1]bulletin	8	4.8			1		7	2	1
Organic farming magazines and technical leaflets	7	4.6			1	1	6	2	1
OAS[2] Dairy group	6	5.0					6		2
OAS[2] Direct advice on farm	6	4.6			1		4	6	2
Magazine: "New Farmer & Grower"	5	4.4			1	1	3	3	
OAS[2] Seminars	3	4.0		1			2	1	1
SA[3] Regional groups	3	4.0		1			2	2	
SA[3] Standards	2	4.0			1		1	2	
BOF/OGA[4] conference	3	3.7	1				2	1	
SA[3] Leaflets	2	3.0	1				1	1	
Personal contact with leaders	1	5.0					1	1	1

[1] EFRC–Elm Farm Research Centre; [2] OAS– Organic Advisory Service;
[3] SA– Soil Association; [4] BOF/OGA–British Organic Farmers/Organic Growers Association.

However, the farms visited were not always comparable with the system at home and hence did not all have a positive influence on the decision-making. There was also reluctance to contact other organic producers directly, particularly before the conversion, unless this was an arranged visit, for example farm walk or events. Farmers expressed the view that they would have liked to have more contact with other organic farmers in their area. For one family from the southwest, the first farmers' meeting of the Trawsgoed Dairy Project was the first opportunity to meet other farmers in a similar situation, and other farmers had very few contacts with other converting farmers in their area. On one farm the local vet helped in arranging meetings with other organic farmers, on another one it was an advisor. This made organic farmers less important as a source of information prior to conversion.

However, once they had met a farmer and felt they knew him a little bit, the contact developed over time and organic farmers were later considered to be an extremely valuable information sources, as well as having become friends. Six case study farmers regularly attended meetings of the OAS dairy discussion group, which included farmers from all over England and Wales, and the group scored highly as an information source. It also had an important role in facilitating contacts with organic dairy producers, although one farmer was concerned about the long distances involved.

The question whether conventional farmers were a relevant source of information for the case study farmers led to several interesting discussions about the image of organic farming amongst conventional farmers. Some farmers enjoyed the attention that their farms had received since going organic and hoped their farms would become well-respected examples of organic farming. The majority of farmers were trying to maintain their contacts with conventional neighbours, but they did not consider them to be an important source of information.

Publications

Publications specifically related to organic farming were used by the majority of the farmers and ranked quite highly as an information source, in particular specialist magazines. Farmers particularly liked the short and informative style of the Elm Farm Bulletin reporting on ongoing research and general news with relevance to organic farming, whereas books, although important to start with, were considered less relevant for the actual running of the farm.

Most farmers continued to read the general farming press, but found it not useful as a source of information. At the time of the interview general farming magazines contained very few technical articles about organic farming. So said William (F1):

> "Less so these days, I find them slightly boring. I used to read them a lot. I still get them every week, but they are so biased."

One farmer stated that he had found the information in agricultural textbooks written before 1965 quite relevant to organic stock farming.

Conversion planning and specialist organic advice

On most other farms the conversion process was planned in some ways. Farms 3 and 5 contacted the Organic Advisory Service (OAS) for a feasibility study, later developed into a more detailed conversion plan. On Farms 1, 10 and 11 the farmer or farm manager himself drew up some financial assessment of the feasibility of a conversion or a conversion plan with varying degrees of help from other people. On the remaining farms, the farmers contracted the Organic Advisory Service (OAS) to carry out conversion planning once the decision to go organic had been made.

Conversion plans produced by the OAS for seven farms followed the broad principles outlined in Chapter 2. One or several farm visits of the advisor led to a document outlining a target rotation(s), and a detailed cropping plan with the time at which each field was to be converted, and management recommendations for all major enterprises. A financial assessment of the conversion was an optional extra (Measures, 1999, personal communication). Plans developed by the farmers themselves would not necessarily follow the same layout.

Most farmers broadly followed their plans and were generally positive about the benefits of it, specifically mentioned were:

- Help to achieve the symbol status and understand the certification process (two farms), and
- Guidance for the farm staff about the direction of the conversion (two large farms).

The written plan was useful for one estate, but on the owner-occupied farms the discussions during the visit appear to have been more important. For example, on one farm a broad financial assessment was attached to the written plan, but had not been discussed with the advisor. At the time of the interview the farmer did not remember anything about it and was surprised to re-discover the attachment, whereas he could re-call other details of the advisor's recommendation very accurately.

Several farmers were also critical about the delay in delivering the written plan, the farm conversion having already begun by the time the document arrived.

> Nick (F5): "We had two draft versions of the plan, but we are still waiting for the final version. They were talking about changing the yards in the first draft…, but I had already done it by the time we got to the second draft."

Despite the importance of financial motives for the conversion, not all farmers carried out detailed financial planning prior to the conversion. With the benefit of hindsight however, several farmers considered this to be quite important. So said Luke (F7):

> "… rather more on the financial implications of the conversion, because that was not covered at all. It was mentioned, but only in passing. We had not asked for it to be included, but I think it would have helped."

Farmers were also critical about some recommendations, for example the need to invest in a new muck-spreader or to purchase weeding equipment for the small arable area on the farm, and not all management recommendations were actually considered. With regard to problems with forage supply in the first year Luke (F7) said:

> "I mean the OAS did certainly emphasised … that we would have to reduce stocking rate and the cereal acreage in the first year. Perhaps we did not take enough notice then of what they said."

On some farms the contact with the Organic Advisory Service during their conversion resulted in an on-going advisory contract with an agreed number of farm visits per year and phone support. Others, however, did not really see any long-term benefit in paying for advice. They were concerned about the costs of the advice, approximately £300 per day, and felt that their contribution in providing information to others was not recognised. One farmer in Wales was particularly concerned about the distance and would have preferred a local advisor.

Overall the organic advisory service was a very important information source for most of the case study farmers during the actual conversion, but less important in the decision-making phase as in most cases the OAS was first contacted when the decision-making was quite far advanced. The farmers saw the benefit of conversion planning, although in several cases this could have been enhanced by better financial planning, and considered the services offered to be valuable. However, towards the end of their conversion they became more reluctant to maintain an ongoing relationship as they were concerned about the distances and the cost of the advice.

Advice from conventional advisors

The number of farmers who mentioned conventional advisors as a source of information was relatively small, and the spectrum of experience ranged from very negative to very positive.

Farm 3 had experienced direct opposition to their decision from their specialist dairy advisor, who threatened to terminate the contract if they converted the farm. This may have influenced Betty's very critical attitude towards this dairy costing service:

> "These people are expensive and they only tell you the obvious thing anyway, and for that effort I can find it out myself."

However, the same farm later contacted a dairy nutrition specialist and found his recommendations to be very useful in optimising the feed rations within the limits of the organic system. Eric (Farm 12) had a similarly negative experience and changed consultant, but continued with the same company.

On the other hand, Daniel (Farm 9) considered the contract with the conventional specialist dairy advisor as extremely valuable, particularly for ration planning and general business management, and he also involved the advisor in planning the conversion:

> "They are extremely good. The fact that they are not involved in organic as such is irrelevant. I actually find it good to have somebody not organic doing something like that, because they bring you back to earth and stops you getting carried away… "

On two other farms the experiences were more in the middle ground. Bill (F4) had consulted his dairy consultant about the conversion and found him supportive, but felt he did not understand the likely problems, while Luke's general conventional advisor had passed him on to the OAS, but had had no further input in the conversion of the farm.

The veterinary surgeon

The relationship to the vet was also influenced by the conversion. In one case the vet was knowledgeable about homeopathy and supported the farmer right from the beginning of the conversion. In several other cases the vets were described as sympathetic and helpful, but not very knowledgeable in alternative solutions, leaving some farmers unsure at times about what to do. One farmer described the vet as learning from him and several organic farmers in the area, so that he introduced a herbal remedy among his other clients. Some vets respected the fact that the farmers knew more about homeopathic remedies. So remembered Betty (F3):

> "When Dave was away for three weeks last year, they came around and said sorry, we have to use antibiotics. "

One farmer considered changing surgery and others saw the role of the vet changing, using them now mainly for diagnosis rather than for treatment. Several farmers also consulted vets outside their normal surgery for specific information, with or without the knowledge of the main surgeon.

Concluding remarks

The farmers at the time of interview were fairly clear about which information sources they preferred. However, this would not be the case for a farmer at the beginning of conversion. As one farmer pointed out he would not then have been in a position to judge the quality of the information he received.

Walter (F11): "I found information, but whether that was good information, I don't know."

At the time of the interview, which took place after the formal registration of the farm as in conversion, the most important sources of information for the case study farms were those specific to organic farming, such as other organic farmers, specific technical publications, and the OAS. Earlier on, farmers had been more reluctant to approach other organic farmers, although they found those contacts they had very valuable. The OAS also carried out conversion planning for several of the farms, which was found to be helpful in achieving certification and helping the farmer to see the direction in which the farm was going.

Of lesser importance were general agricultural information sources. Farmers experienced prejudice against organic farming from conventional farmers and advisors, while farming magazines were seen as biased and had little technical coverage of organic farming. However, a number of farmers clearly saw the benefit of some specialist knowledge, e.g. in dairy nutrition, if applied within the context of the organic system.

The relationship to the vet was also affected by the conversion, mainly in terms of a shift from treatment to a diagnostic service, whilst the farmers became more knowledgeable about alternative treatments. The theme of the farmers' preference for information sources is taken up again in Chapter 9 in the context of a phased model of the conversion process and in developing recommendations for the provision of information for converting farmers in Chapter 11.

Summary and conclusions

This chapter described the farmers' or farm managers' perspective of the conversion process as expressed in the interviews, covering a broad range of topics, such as motivation for the conversion and farming objectives, the decision-making process and the use of various information sources. Production-related and financial experiences are covered together with the results of the farm monitoring in the following two chapters.

All farmers mentioned a variety of motives for conversion and considered a range of farm related objectives important. The majority cited general environmental concerns and financial motivations as reasons for the conversion, and improvement of the financial situation of the farm remained an important objective to most farmers. Less frequently quoted were technical reasons for the conversion, but for most farmers the improvement of the crop and livestock production was very important at the time of the interviews. This may indicate a shift in attitude towards greater attention to detail, which is required by preventive approach to farm management, such as organic farming. Several of the case study farmers had close links with the local agricultural community and were concerned about maintaining these. They did not agree with a very critical attitude of parts of the organic movement towards conventional agriculture.

The length of time of the conversion process between the first contact with the idea of organic farming and the decision to go organic varied from a few months to several years. Confidence that this was the right choice grew with experience. A range of personal contacts including members of the close family and friends supported the farmers, but also other organic farmers, for example on farm walks. Resistance and scepticism towards the conversion was also experienced from close family members, mainly the older generation, but also from friends and advisors in conventional agriculture.

The interviews confirmed a number of other factors influencing the decision-making, such as personal attitudes (preference for extensive systems, concerns about the environment and issues of conservation), but also contacts with other organic farmers, the vet, organic and general advisors and support from member of the family and friends. For most case study farmers the likely availability of organic premiums for the milk in the near future and the financial situation of the farm were important motives for conversion, but the case study farmers converted before conversion support payments were introduced in the UK.

Several farmers undertook experiments in preparation for the conversion, or converted some land, before the final decision to convert the whole farm had been made. It appears as if, despite information and technical support, the farmers needed to gain some practical experience with organic farming on their own holding. Most farms had carried out some form of conversion planning, which included a cropping plan showing at what time a particular field would be converted. Most farmers found this helpful for understanding and achieving certification and to give direction to farm staff, but a lack of financial detail in the planning routines was noted.

The farmers used a variety of information sources. Their evaluation and ranking indicates a leaning towards the more specialist organic information sources (such as other organic farmers and specialist magazines and publications) and away from the well-established sources that are typical for the agricultural industry in general (farming press and consultants). All case study farmers had regular contact with a specialist organic advisor and with their veterinary surgeons.

The analysis of information sources further indicated a change in the use of particular sources over time. Initially farmers were reluctant to contact other organic farmers unless prior contact had been made, whereas later they became not only a very important information source but also personal friends. Conversion also had an impact on the relationship with the vet: some farmers changed veterinary surgeon, while for other farmers the diagnostic service of the surgeon became more important than treatment, as most vets were considered by the farmers not to be very knowledgeable about alternative treatments.

The following two chapters present the results of the monitoring of the production and financial indicators of the farms, and set them, where appropriate, directly in the context of the farmers' observations and problems that were mentioned in the interviews, thus providing an improved understanding of the influencing factors. In Chapter 9 the relationship between the farmers' personal motives and objectives and the farm conversion process are further explored, and the decision-making process of the case study farms and their use of information sources is discussed in the context of the stages of conversion (Chapter 2).

Land use, forage and milk production on the farms

It was the aim of the research to analyse the impact of organic conversion on forage and milk production and to draw conclusions about the likely information requirements arising from this. In support of this aim this chapter presents the results of the monitoring of the case study farms for a range of production-related, biophysical indicators.

The Standards require the converting livestock producer to use legume fixation as the main source of nitrogen for cropping and forage production, and prohibit or restrict the use of other non-organic and organic fertilisers. Restricted, but not entirely prohibited, is also the use of purchased concentrates, shifting the emphasis towards the farm-based nutrition of animals, and farmers also need to apply preventive health management, which leads to additional and different information requirements. The literature review (Chapter 3) highlighted that these changes are likely to also have a direct impact on production. The themes emerging from the literature review of organic grassland and dairy farming (Chapter 3) – possible implications of the conversion on land use, forage and milk production, including use of concentrates – form the basis for the structure of the presentation and in each section the key findings of the literature review are briefly summarised and the monitoring data are contrasted with farmers' observations in the interviews to improve understanding of the factors influencing the process. Full time-series data of key indicators for each farm and short descriptions of some trend developments are presented in Appendices 1 and 5.

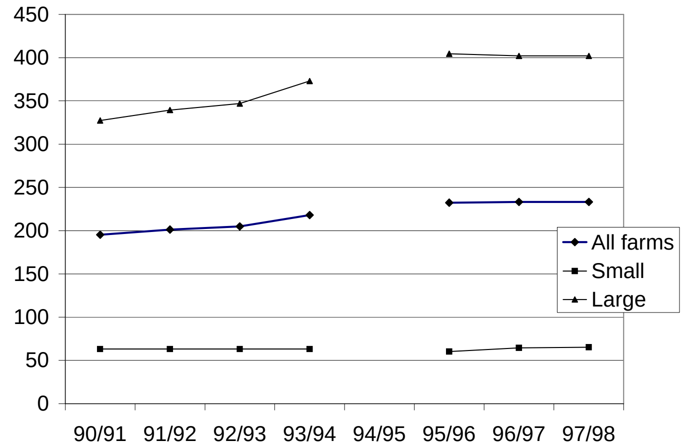
Farm size and land use

The literature review (Chapter 3) showed that converting dairy farms are likely to undergo structural changes in terms for land use, whereby the cropping area used by temporary clover grass leys increases. There was some further indication that converting farms compensate for reductions in forage production through increases in size and in the forage area, so that stock numbers can be maintained.

Prior to conversion the eight case study farms fall in two size categories, a group of small farms between 48 and 85 ha (Farms 2, 3, 7 and 12) and a group of larger farms between 235 and 435 ha (Farms 1, 5, 9 and 11).

On six of the eight farms size increased, ranging from 10% to 90%, whereas two of the smaller farms (Farms 3 and 7) reduced their size by up to 6% for reasons that were not related to the conversion. This resulted in increased average farm size for the whole group, mainly in the first study period. The increases in size during conversion were more marked (40%) for the larger farms than for smaller farms (7%, see Figure 7-1). On the large Farms 1 and 5 more land belonging to the estates that was previously not considered suitable was converted, but other changes in size did not appear to be related to the conversion.

Figure 7-1Average farm size (ha) of eight organic dairy farms together and in two different size groups



The development of forage area shows a trend similar to farm size. In both groups – small and large farms – the forage area increased mainly in the first data collection period. Average increases for forage area were smaller (7%) in the group of small farms than of larger farms (63%, see Figure 7-2). In each group one farm (Farms 7 and 9) did not increase the forage area; the trend was similar for the proportion of forage of total UAA.

The proportion of forage area was also used as an indicator of farm type (see Chapter 5). Farms 2, 3, 11 and 12 were classified as specialised farms, Farms 1, 5, 7 and 9 as mixed farms. All but one small farm (Farm 7) were specialist dairy with more than 95% forage area and grew cereals on 5% or less of their land. All but one large farm (Farm 11) had a more mixed enterprise structure and grew cereals on 13% or more of their total land area.

There was a slight tendency for reduction of the relative forage area during the conversion on the specialist farms, whereas it increased on the mixed farms related to the conversion of land in arable rotations with fertility building crops. Differences between these groups were significant in most years (see Table 7-1).

Figure 7-2 Development of forage area of two size groups (n=4) of eight organic dairy farms

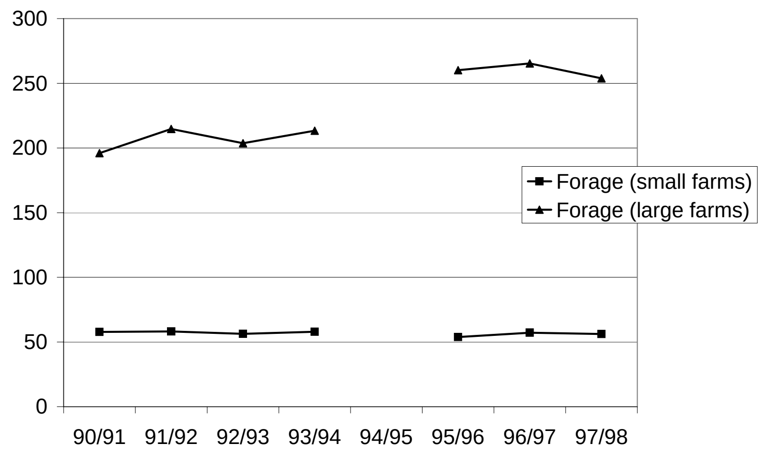


Table 7-1Average farm size (ha) and forage area (as % of total UAA) of eight organic dairy farms, grouped according to farm ty

	*Year 0**	*90/91*	*91/92*	*92/93*	*93/94*	*95/96*	*96/97*	*97/98*	*97/98 rel.#*
Farm size (ha)									
Average all	184.0	195.2	201.3	205.0	218.0	232.4	233.2	233.2	119%
Specialist	96.5	97.8[b]	97.8[b]	97.8[b]	97.8[b]	117.2[b]	121.4[b]	121.4[b]	118%
Mixed	271.5	292.6	304.7	312.2	338.2	347.5	345.1	345.1	124%
[a]significantly different from 90/91 at p=0.05 (LSD=78) [b]significantly different from average of mixed farms at p=0.05 (LSD=147)									
Forage area (% of UAA)									
Average all	74%	79%	81%	77%	78%	78%	78%	76%	102%
Specialist	94%	99%	98%	96%	99%	92%[a]	89%[a]	90%[a]	96%
Mixed	54%	58%[b]	63%[b]	58%[b]	58%[b]	64%[b]	66%[a,b]	62%[b]	114%
[a]significantly different from 90/91 at p=0.05 (LSD=6%) [b]significantly different from average of specialist farms at p=0.05 (LSD=12%)									

*Last year of conventional management; # 1997/98 as percent of Year 0 level

Forage production

Introduction

The literature review (Chapter 3) identified forage production as one of the areas which might be influenced significantly by the conversion, as the farmers change to a forage production system relying on nitrogen fixation from legumes. This was confirmed by several farmers mentioning feed shortages as problems of their conversion.

The IGER study included silage cuts and grazing yields in the first data collection period for the 1993, 1994 and 1995 growing seasons. However, as several farms had started conversion before the study began, the years for which samples were taken did not coincide in all cases with the early conversion years. The measurements were also only taken on some fields and did not cover the forage production of the whole farm. It therefore appeared important to try and assess the changes in the total forage production on the basis of the available material over the whole length of the study period.

Testing of indicators

Stocking rate (LU per forage hectare) is a commonly used simple indirect indicator of the forage production on farms, particularly where no other data are available, and frequently used to forecast stock-carrying capacity during conversion (Measures, 1999, personal communication). Utilisable Metabolisable Energy (UME) is an indicator for forage productivity that can be calculated on the basis of information in the farm accounts and dairy costings (see Chapter 5). To test the validity of these two indicators whole farm indicators were compared against direct measurements from IGER. It was assumed that although the data reported different observations, factors that influence forage production should act on both indicators in similar way (see Haggar and Padel, 1996 for description of methods, Table 7-2).

The comparison was hampered by the fact that on most farms one data set had gaps so that continuous trends could only be compared between grazing yields and indirect indicators on three farms (1, 7 and 9). However, the data clearly indicate some similarities in the trends of physical forage measurements and indirect indicators. The calculated UME values were also correlated with grazing yield measurements for those farms and years where both were available, which shows again a significant (p= 0.01) correlation based on the 18 observations (see Figure 7-3). Although this comparison does not allow the establishment of whether UME values truly represent the net energy production on each farm, the indicator corresponds relatively clearly with direct forage yield measurements that were taken. Trends in the indicator development can therefore be used to assess the development of forage production during conversion.

Table 7-2 Forage yield measurements (t/ha#) compared with indicators (1993-1995)

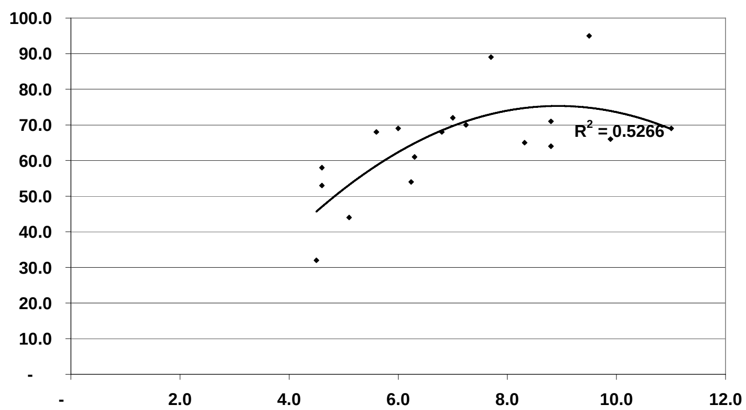
	Mixed Farms					*Specialist farms*			
	Crop* /indicator	1993	1994	1995		Crop* /indicator	1993	1994	1995
Farm 1					Farm 2	WC/PR	7.4	8.1	6.9
	RC/IR	10.7	11.3			RC/IR	8.0	7.7	
	Lu/PR					Lu/PR			9.2
	Grazing	6.8	8.8	5.1		Grazing	6.2	9.1	7.2
	UME	68.0	71.0	44.0		UME	54.0		70.0
	LU/ha	1.7	1.7	1.5		LU/ha	1.2		1.6
Farm 5	Lu/PR		10.4	8.5	Farm 3	WC/PR	6.8	7.3	7.0
	Grazing	4.6	6.3	4.5		Grazing	9.9	11.9	8.3
	UME	58		32.0		UME	66.0		65.0
	LU/ha	1.4		0.8		LU/ha			
Farm 7	WC/PR	6.6			Farm 11	PR/WC	n/a	8.4	6.9
	RC/PR		11.1						
	Lu/PR	8.9	11.6						
	Grazing	7.7	9.5	5.6		Grazing	n/a	9.3	6.0
	UME	89.0	95.0	68.0		UME	70.0		69.0
	LU/ha	1.9	1.9	1.4		LU/ha	1.7		1.8
Farm 9	WC/PR		8.4	6.9	Farm 12				
	RC/IR	10.5							
	PR/Lu	6.7	7.1						
	Grazing	8.8	7.0	6.3		Grazing		11.0	4.6
	UME	64.0	72.0	61.0		UME	58	69	53.0
	LU/ha	1.6	1.7	1.7		LU/ha	1.7	1.8	1.5

*WC=white clover; PR=perennial ryegrass; RC=red clover; IR=Italian ryegrass; LU=lucerne.

silage yields: two or three different fields per farm of different clover/grass crops; likely grazing yields: estimates of yields based on exclusion cages in the best and worst fields

Source: IGER (unpublished) and own data

Figure 7-3 Relationship between grazing yields (t/ha, x axis) and UME value (GJ/ha, y axis)



Source: IGER (unpublished) and own data

Development of stocking rate and UME on case study farms

The literature review (Chapter 3) showed that on converting livestock farms forage production might initially decline and that converting dairy farms are likely to adjust the livestock production to the natural carrying capacity of the farm. On the case study farms this was monitored through the development of UME and stocking rates.

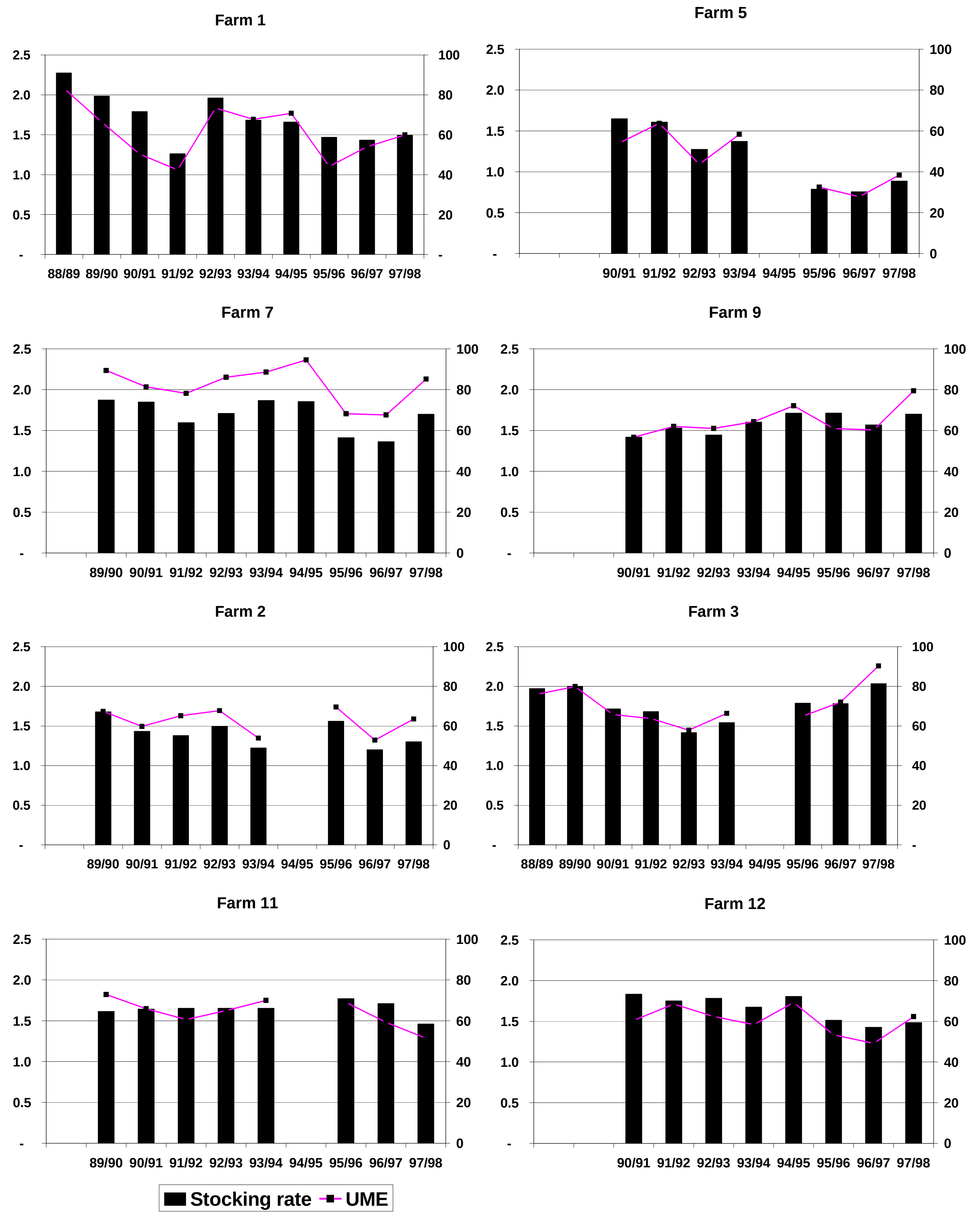
Figure 7-4 and 7–5 show the development of both indicators for all farms, the mixed farms presented on the top of the page, the specialist farms at the bottom. In Figure 7-5 UME is shown in relation to the annual rainfall.

The development of the stocking rates shows substantial fluctuation on Farms 1, 5, 7 of the mixed and 2 and 3 of the specialised farms. Farms 1 and 5 illustrate that stocking rate development is related to the need for fertility building in more arable orientated rotations and not only influenced by changes in the stock numbers in response to forage supply. For example, on Farm 1 declines in stocking rate coincided with the beginning of conversion of a large block land with a fertility-building forage crop. Stocking rates appeared to be related to preferences of the farmer (Farm 2 saw this as a health prevention scheme) and income needs (Farm 3 aimed to re-establish pre-conversion stocking rate levels, despite problems with forage supply in some years). Stocking rates on the predominantly dairy farms 2, 11 and 12 were relatively stable, apart from initial reductions on Farm 2 as the farm size increased.

Declining UME values in the early conversion period (first and/or second year) were observed on the mixed Farms 1 and 7, and the specialist Farms 2, 3 and 11. On Farms 1 and 2 this was a result of the reduced stocking rates. Farms 3, 7 and 11 reported feed shortages that they had not anticipated and had to purchase additional forages. Only the Farms 2, and 12 show a relatively constant figure for UME production.

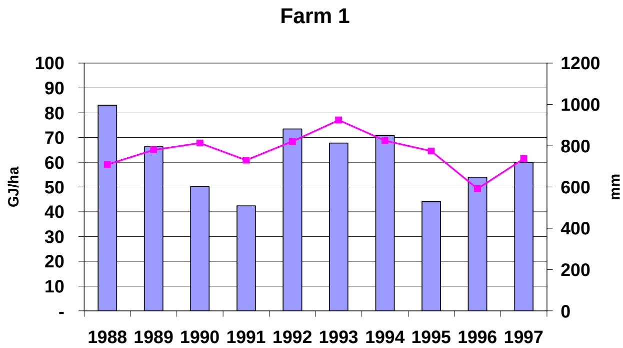
On most farms, UME production in the final years under organic management was lower than pre-conversion. The fluctuation in UME values between 1993/94 and 1997/98 (those five study years when the dairy cows were certified) illustrate that also under organic management forage production continued to fluctuate. On most farms UME appears to be closely related to rainfall, particularly in the second period (see Figure 7-5), which confirms the relationship between forage yield and annual rainfall that was found in other studies also under the conditions of organic management (Halberg and Kristensen, 1997; Newton, 1995). It illustrates that on those farms where conversion coincides with dry periods the forage supply may be particularly problematic, but on the basis of the available data (most farms in the small sample had either locations and/or different start dates of conversion) it was not possible to use statistical methods to isolate these factors.

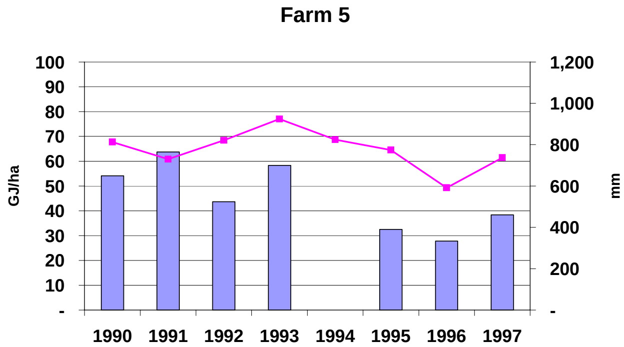
Figure 7-4Stocking rate (LU/ha on left axis) and utilisable metabolisable energy (UME in GJ/ha on right axis) of eight organic

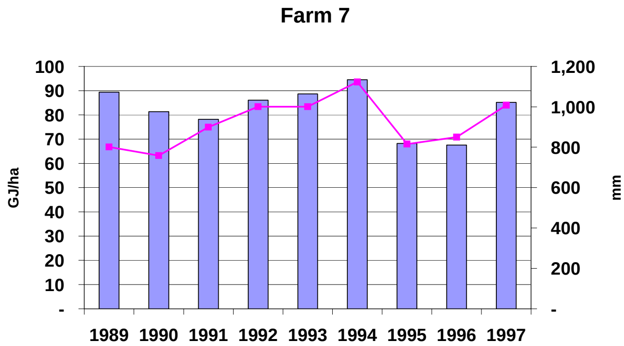


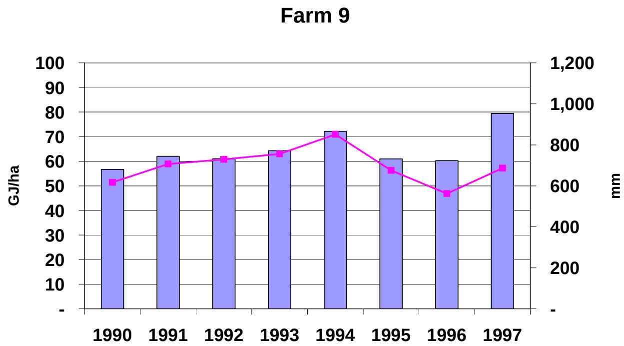
Source: own data

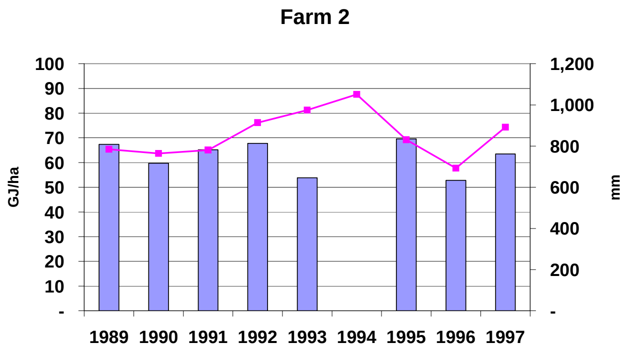
Figure 7-5Development of UME (GJ/ha) in relation to rainfall (mm per year) on eight case study farms from 1988 to 1997

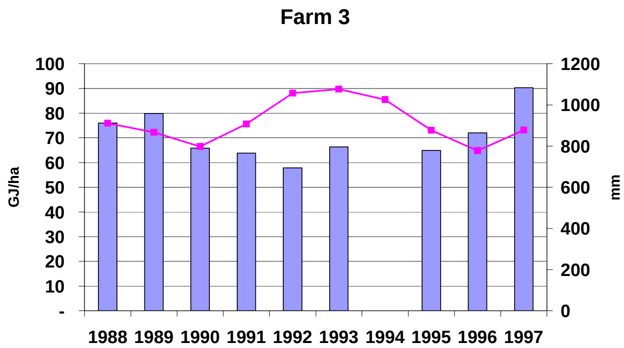


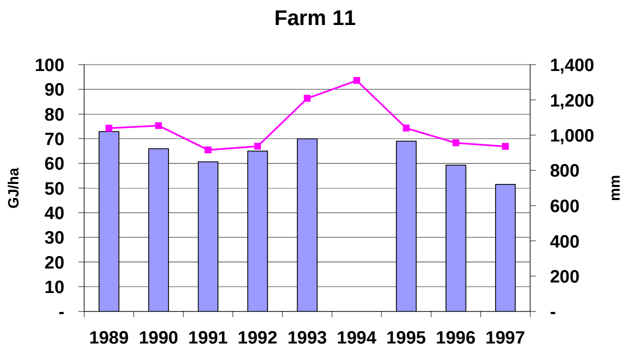


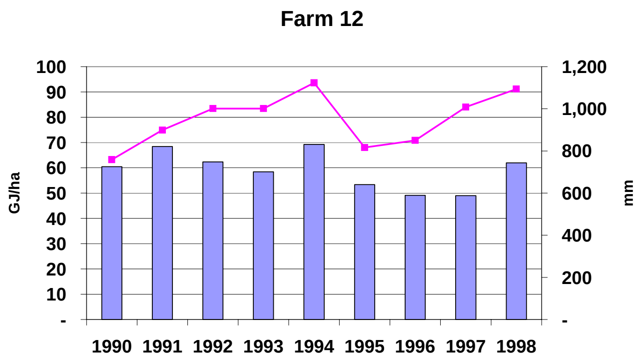












Source: Met office from MAFF project organic milk production; RAC Circencester home page (2000) and own data

UME – calculated as an indicator per hectare on the basis of stocking rate – is also indirectly influenced by factors such as fertility building and farmers' preference, which could also explain some variation in UME values, particularly on the mixed farms with considerable fluctuation in stocking rates. UME is also likely to be influenced by pest problems as illustrated by Farm 3, where a substantial decline in UME in the third to fifth year did not appear to be explained by rainfall. The farmer attributed the forage yield reduction to problems with slugs. Slugs were also considered to be a problem on Farm 7. Both were uncertain what to do about it, as they had not been able to identify any effective field-scale control mechanism that was allowed under the Standards.

Farmers' technical experience with forage production

There were also very positive experiences with the success of growing new crops.

> Daniel (F9): "Great success with the leys, clover, particularly red clover, lucerne, the variety being quite enjoyable, doing something different. "

However, in Walter's (Farm 11) opinion the forage shortage that he experienced was made worse because he did not anticipate a different growth pattern of the organic silage crop and he felt that there was a need to reconsider what he had learnt about silage making:

> "I would say, the biggest thing which was successful, was actually putting off the silage cutting date. And then, you just forget about getting this high quality silage, and just go for bulk, which is what you have to do, you just have to get this big pile of silage."

This need to adjust to the later growth pattern of the clover grass crops was mentioned by several others. For some, spring became the most stressful time of the year for the first few years and Luke (Farm 7) applied synthetic N on a field that was already been in conversion, because he was worried about not having enough forage.

Some farmers also mentioned eelworm and weed control as a problem with forage crops. In particular the control of docks was mentioned (particularly on Farm 9) and annual weeds after the establishment of forage and cereals crops (e.g. charlock). However, it is impossible, based on this subjective perception of farmers alone, to determine the impact on yields and the whole farming system. Farmers may perceive a particular weed to be a problem simply because they know that use of direct control is limited, and may anticipate the negative effects in terms of yield loss, forage quality, seed banks to be greater than in reality.

The labour needed for hand weeding was the reason why one farmer gave up fodder beet after conversion (Farm 12), whereas Farm 9 was, at the time of interview, planning to introduce fodder beet in order to improve forage intake and milk production from forage.

Farmers were uncertain about the establishment of permanent pastures, fields that could not easily be ploughed up and reseeded, although the potential benefits of a higher legume content were clearly recognised.

> Bill (F4): "The stitching in of clover, I could see that it has got potential. I mean, if we could get higher production, higher clover in these permanent pastures that would be amazing. ".... " They (the organic advisory service) did advise that we should stitch it in. We did actually try by hoeing and broadcasting the clover, it was not successful, it just never took."

Clover establishment was also a problem in leys. Farmers experienced too vigorous growth of an under-sown red clover in barley and poor establishment as a result of a late sowing date after a late cereal harvest. Despite the greater emphasis on legumes in the swards and the introduction of red clover on several farms, no farmer mentioned any problems with bloat, which has traditionally been seen as one of the main problems with clover–farming.

Analysis of impact of conversion on stocking rate and UME

Across all farms the stocking rate fell by 16% from 1.8 LU/ha to an average value of 1.5, which is significantly lower than the pre-conversion value (Table 7-3). Specialist farms (Farms 2, 3, 11 and 12) would be expected to have a higher stocking rate than the group of mixed farms (Farms 1, 5, 7 and 9) as their main income is derived from the dairy enterprise. However, there were no significant differences in stocking rates between the two groups throughout, although there was a greater tendency towards reduction on the mixed farms, and towards re-establishing pre-conversion levels in the second study period on the specialist farms.

Table 7-3Average stocking rate (LU/forage ha) of eight organic dairy farms, grouped (n=4 per group) according to farm type a

Stocking rate	*Year 0**	*90/91*	*91/92*	*92/93*	*93/94*	*95/96*	*96/97*	*97/98*	*97/98 rel.*[#]
Average all	1.8	1.7	1.6	1.6	1.6	1.5[a]	1.4[a]	1.5[a]	84%
Specialist	1.8	1.7	1.6	1.6	1.5[a]	1.7	1.5[a]	1.5[a]	87%
Mixed	1.8	1.7	1.5[a]	1.6	1.6	1.3[a]	1.3[a]	1.4[a]	80%
Low LU/ha	1.6	1.5[d]	1.5	1.5	1.5	1.5	1.3[c]	1.3[c,d]	84%
High LU/ha	2.0	1.8	1.6[c]	1.7	1.7	1.5[c]	1.5[c]	1.7[c]	83%

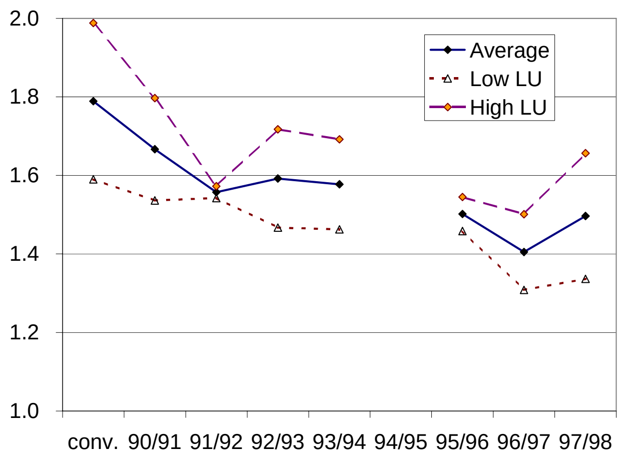
[a] significantly different from 90/91 at p=0.05 (LSD=0.14)
[b] significantly different from average of group specialist farms at p=0.05 (LSD=0.26)
[c] significantly different from 90/91 at p=0.05 (LSD=0.13)
[d] significantly different from average of group high at p=0.05 (LSD=0.25)

[*] Last year of conventional management; [#] 1997/98 as percent of Year 0 level

The differences are significant, if the farms are grouped according to stocking rate prior to conversion (see Figure 7-6 and Table 7–3). The average for the group with low stocking rate (Farms 2, 5, 11 and 9) remains lower in most years than for the group of farms that were stocked high prior to conversion (Farms 1, 3, 7 and 12); the difference is significant (p=0.05) in most years. More intensive farms (e.g. Farms 3 and 7) with high stocking rates prior to conversion aimed to re-establish a higher stocking rate later on.

This confirms that stocking rate levels are influenced by other factors, such as personal preference and income needs. However, under organic management the variation in stocking rate is less marked than pre-conversion. Six of the eight farms have stocking rates close to the average for all case study farms in the four years of organic management (1993/94, 1995/96-1997/98); Farm 3 had a higher stocking rate and Farm 5 a lower one.

Figure 7-6Average stocking rate (LU/forage ha) of eight organic dairy farms, grouped (n=4 per group) according to stocking ra



Source: Own data

The average UME value for all farms fluctuates less than the stocking rate (Table 7-4, Figure 1-7) and did not show the same average reduction between 1990/91and 97/98. Low UME values in 1990, 1991, 1995 and 1996 coincide with low rainfall, whereas low values in 1992 and 1993 could possibly be related to the conversion, similarly high UME production in 1994 coinciding with high rainfall. Average UME data for 1997/98 were similar to 1990/91, but approx. 8% lower than pre-conversion in Year 0. The reductions were similar for both groups of mixed and specialist farms. If the farms are grouped according pre-conversion stocking rates, the UME values are slightly higher for the group with high values, but the difference between the groups are still not significant.

The conversion reduction in average values in UME value is lower (8%) than for stocking rate (16%), but as with stocking rate the variation between the farms in considerable. In four farms the UME declined, whereas two farms show increases and two show relatively constant values. Three of the farmers with declining UME values at some stage during conversion also reported unexpected feed shortages.

Table 7-4Average UME (GJ/ha) of eight organic dairy farms grouped (n=4 per group) according to farm type and stocking rat

UME	*Year 0**	*90/91*	*91/92*	*92/93*	*93/94*	*95/96*	*96/97*	*97/98*	*97/98 rel.#*
Average all	70.0	61.8	63.0	64.6	65.9	57.8	55.4	64.7	92%
Specialist	69.2	63.0	64.5	63.2	62.1	64.2	58.3	63.6	92%
Mixed	70.9	60.6	61.6	66.0	69.7	51.5	52.4	65.7	93%
Low LU/ha	62.8	59.1	62.9	59.3	61.6	58.0	50.0	58.2	93%
High LU/ha	77.3	64.5	63.2	69.9	70.3	57.7	60.7	71.1	92%

[a] significantly different from 90/91 at p=0.05 (LSD=8.51)
[b]significantly different from average of group high farms at p=0.05 (LSD=13.46)

* Last year of conventional management; # 1997/98 as percent of Year 0 level

Figure 7-7Average UME values (GJ/ha) of eight organic dairy farms, grouped (n=4 per group) according to stocking rate prior

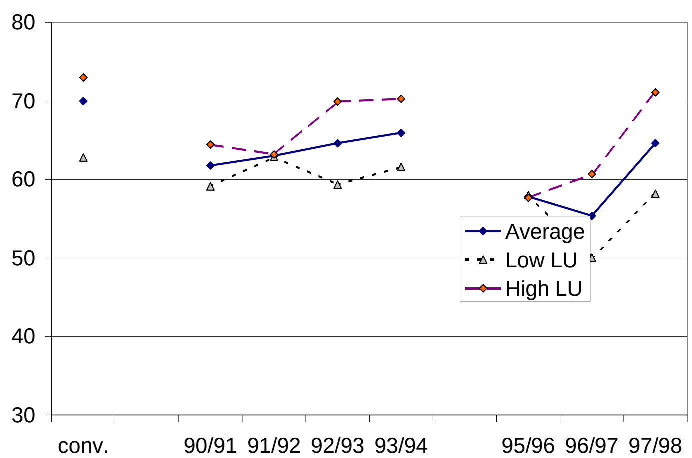
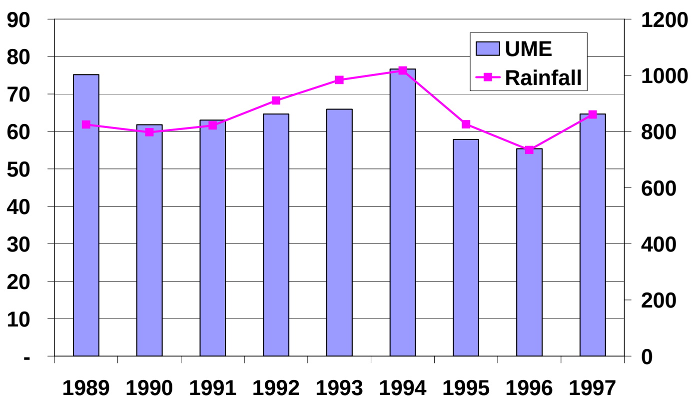


Figure 7-8Average UME production (left axis, GJ/ha) of eight organic dairy farms, compared with annual rainfall (right axis, m



Source: Met Office, RAC Cirencester home page (2000) and own data

UME values appeared also to be closely related to rainfall, particularly in the second study period, whereas some forage yield reductions in the first study period appear to be attributable to the conversion of the farms. The potential risk of unexpected forage yield reductions is confirmed by the reported feed shortages on three farms. In two cases early conversion coincided with dry years, and on one farm the problem was made worse by the crash conversion of all land in one year.

The development of UME shows that variations in the range of up to 25% around average values for the four years of organic management were common, while higher variation of up to 30% below average values was observed on one farm. UME under organic management is also influenced by other factors. Like stocking rate – which is used in the calculation of UME – it is also influenced by the need for fertility building and by the farmer's preference for stocking rates, which makes this indicator of forage production less suitable for mixed farms.

Concluding remarks

The results confirm that forage production on the case study farms is likely to have been affected by the conversion, at least initially, but that forage production was also affected by factors that had been identified elsewhere, such as climatic conditions. The farmers attributed forage yield declines also to problems with pests (slugs, eelworm and rabbits) and weeds, but it was not possible to verify this. The limitation arose from the difficulty of monitoring forage yields directly on the commercial farms throughout the study period, so that the forage production could only be evaluated based on the monitoring of indirect indicators, i.e. stocking rate and UME. The results illustrate that these are not only influenced by forage production and factors that influence it (such as conversion and climate) but also by the need for fertility building in arable orientated rotations and that farms with high pre-conversion stocking rates are more affected by decline. It is, however, not possible on the basis of the data to come to firm conclusions about the magnitude of the conversion impact on forage yields.

Milk production

Introduction

The literature review (Chapter 3) indicated lower milk production on organic farms compared with conventional, but results of farms outperforming conventional ones were also reported. It also showed a tendency of organic farms towards lower use of concentrates, in line with the principal aim of organic systems of reduced reliance on external inputs. No data on the use of home-grown concentrates could be identified in the literature.

On the case study farms, the physical levels of milk production and concentrate use were recorded on the basis of sales and estimates for internal transfers of milk used for feeding calves and home-grown concentrate production. Where possible these results were reconciled with the annual rolling average from milk control records and/or dairy costings, discussing obvious differences with the farmer. The values were used to calculate milk from forage (MFF) and milk from the farm's own resources (MFR) (see Chapter 4 for details).

Development of milk yield, concentrate use and milk from forage on the case study farms

Figure 7-9 shows the development of the total milk yield and milk from forage per cow and per forage hectare for each farm. The mixed farms are presented at the top of the page, followed the specialised farms. The following section summarises the development in the context of other parameters and by making reference to the more detailed milk production data and farm descriptions presented in the appendices and average values for four years of organic management.

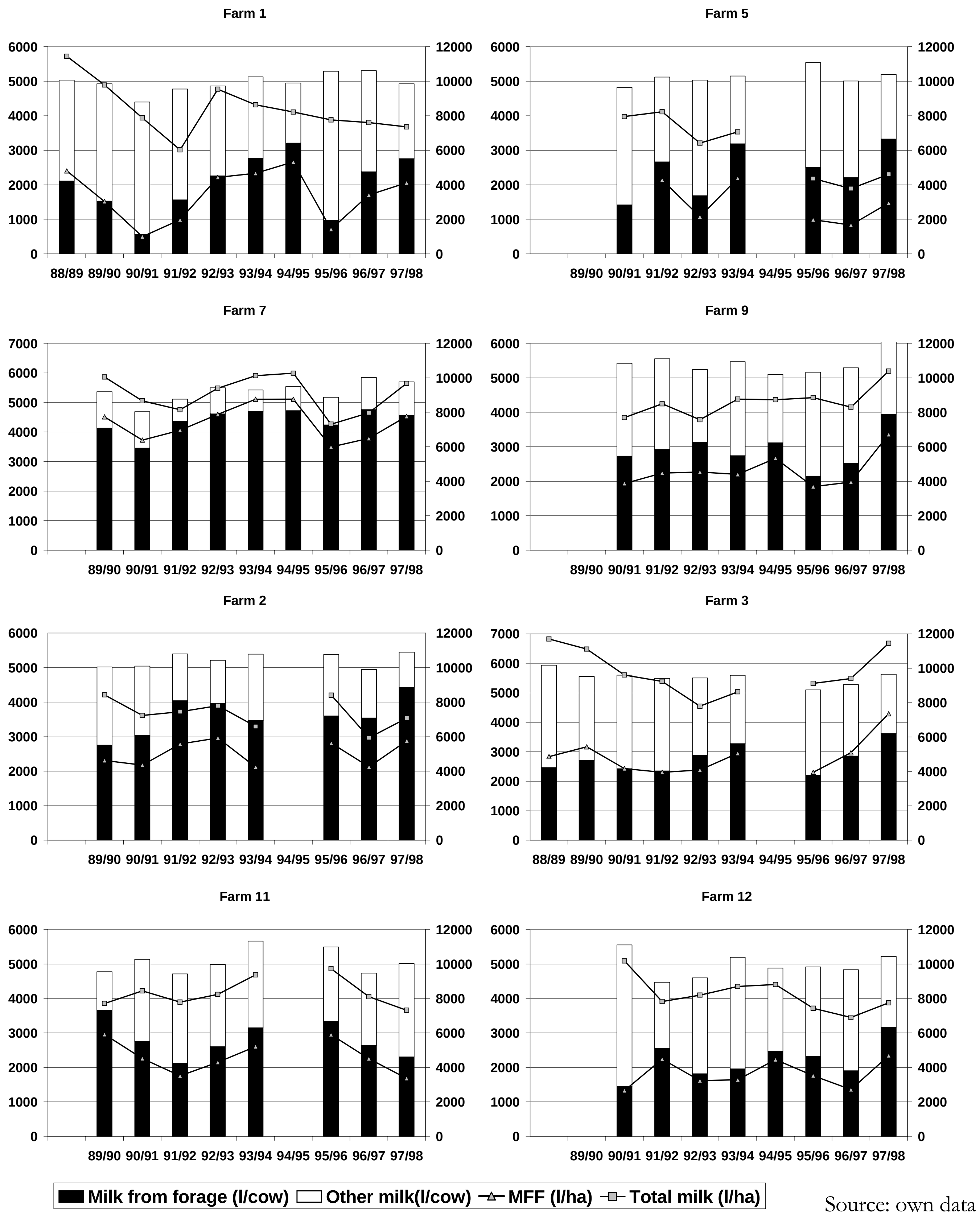
On the Farms 1, 3, 7 and 12 milk yield was reduced early in the study period, which is likely to be related to the conversion, whereas on Farms 5, 2, 9 and 11 the milk yield development showed an initial increase. Two farms with higher than average milk yields prior to conversion (Farms 7 and 9) reached pre-conversion level in Year 1 and Year 3, whereas the Farms 3 and 12 never reached this.

During conversion the concentrate feeding on Farms 1, 5, 9, 11 and 12 was adjusted with the aim of maintaining milk production levels, whereas on Farms 2, 3 and 7 the concentrate levels were strategically reduced during the conversion period. This resulted on Farms 2 and 7 in very low levels of concentrate use under organic management – less than 1000 kg per cow or between 0.1 and 0.15 kg per litre.

Subsequently, the milk from forage values show greater fluctuation between farms than milk production levels. Low milk production per cow from forage, and on several farms also low total milk production, occur later on in the study period in the dry years of 1995/96 and 1996/97. This indicates that milk production under organic management could be affected by changes in climatic conditions that affect forage production.

The use of home-grown concentrates increased on most farms during the conversion and study period, but the variation between farms was considerable. Pre-conversion home-grown concentrate was only used by Farms 2 and 7; Farm 3 stopped growing barley for the cows during conversion, but took it up again in the last year. By the end of the study seven of the eight farms fed some home-grown cereal; average increases ranged from 0 to 75 percent of concentrates for the four years of organic management.

Figure 7-9Development of total milk yield and milk from forage in litres (per cow left axis and per ha right axis) on eight case s



Source: own data

Farmers' experience with feeding systems and dairy cow rations

Several farmers said that at first they found it difficult to understand fully the dietary requirements of the Standards for dairy cows. On two farms, the separation of forage into 'organic' and 'in-conversion' was found to be very difficult.

The Soil Association Standards at the time required that each field had to undergo two conversion years. Forage grown 'in-conversion' and 'organic' forage had to be separated in the clamp, so that the cows could be fed a diet that contained at least 50% 'organic' and not more than 30% to 35% 'in-conversion' feed. The remaining 15–20% could come from conventional sources, but had to be non-solvent extracted (SA, 1997). These principles remain the same in 2001, but the 'conventional' allowances have been further reduced (see Chapter 3).

On most farms changes in the diet were necessary to fulfil the requirements of the Standards, but the farmers experienced few difficulties in implementing them. On Farms 1, 2, 3, 7, 9 and 12 the supplementary feeding before conversion had been based on a blend of straights. The main change was using approved components within the allowance for conventional feedstuffs, such as prairie meal, full-fat soya, brewers grains, maize gluten, wheat feed, but there was no need to change the feeding system. Some farms fed their own cereals before conversion, and continued to do so, apart from Farm 3 that moved to a wholly grass based system. Farm 9 introduced and Farm 12 stopped growing fodder beet.

The farmers who used a ready-made concentrate before conversion (Farms 3, 4, 5), either alone or in combination with other feeds, replaced this with other products that complied with the Standards. The farmers had to change suppliers, but after they had obtained contact details of suitable companies they had no difficulty in getting what they wanted. Nick the manager of Farm 5 wanted to move to straights instead of cake, but experienced problems with feeding it in the parlour, so he returned to purchased ready-made pellets.

Nick (Farm 5) also reported some problems with trace element supply for the young stock. On the other hand Bill (Farm 10, only monitored in the first period) was convinced that he eliminated the problems with low iodine supply through conversion.

In summary, once the farmers had understood the dietary requirements for dairy cows in the Standards, and had received contact details of companies that could supply them with products fulfilling these requirements, they experienced few problems in implementing them.

Analysis of impact of conversion on milk yield, concentrate use and milk from forage

Average milk yield development for all farms showed an initial reduction, followed by a steady increase leading to a 2% higher average value in final year compared with Year 0.

For further analysis of the impact of conversion on milk yield the farms were grouped according to farm type, and pre-conversion milk yield. The average milk yield per cow for the specialist farms showed substantial fluctuations, whereas the average for the group of mixed farms rose after an initial decline, but these results are statistically significant in only two years (Table 7-5). The significant difference between the groups in 1990/91 is likely to reflect changes that occurred during conversion and affected the groups differently. Reductions in the average yield in 1996/97 are mainly caused by two specialist farms (2, 11). They can no longer be attributed directly to the conversion process and are likely to be related to changes in forage production, as both farms also show notable reductions in UME production in the same year (see previous section).

If the farms are grouped according to pre-conversion milk yield, the average for the group with low milk yields (Farms 1, 2, 5 and 11) increased initially, whereas the high yielding group showed yield reductions (Farms 3, 7, 9 and 12) (see Figure 7-10). This trend was reversed in the last three years, where the averages for the group with low milk yields prior to conversion showed a reduction, and the average for the group with high milk yields showed an increase. The average yield for the group of farms with high yields returned to pre-conversion levels in the last year of data collection, whereas the lower yielding farms increased their yield by 5%. However, apart from 1995/96 and 1997/98, the differences between the groups were not statistically significant.

Average milk production per forage hectare for all farms showed a 14% reduction between Year 0 and 1997/98 and reached an all-farm average of approximately 8100 litres per ha in 1997/98. Although some differences between the specialist and mixed group could be observed, these were not statistically significant.

Concentrate use per cow fell on average by 22% between Year 0 and 1997/98; the average level of concentrate feeding in 1997/98 is 982 kg per cow (Table 7-6). On average for all farms and for both groups of mixed and specialist farms, concentrate use is in several years significantly lower than in 1990/91, but the differences between the groups are not significant, so that farm type does not appear to influence concentrate use. A similar trend applies to the reductions in concentrate use per litre, but again no significant differences between the two groups could be established.

Table 7-5Average milk yields (litres per cow and litres per ha) on eight organic dairy farms, grouped (n=4 per group) according

	Year 0*	90/91	91/92	92/93	93/94	95/96	96/97	97/98	97/98rel#
Milk yield (litre per cow)									
Average all	5,240	5,082	5,077	5,117	5,376	5,257	5,155	5,356	102%
Specialist	5,321	5,333[b]	5,015[a]	5,074[a]	5,460	5,222	4,948[a,b]	5,230	98%
Mixed	5,159	4,831	5,139[a]	5,159[a]	5,292[a]	5,292[a]	5,361[a]	5,482[a]	106%
Low milk yield	4,911	4,849	4,999	5,022	5,332	5,425[a,c]	4,997	5,143[a,c]	105%
High milk yield	5,569	5,315	5,155	5,211	5,419[a]	5,089[a]	5,313	5,569[a]	100%

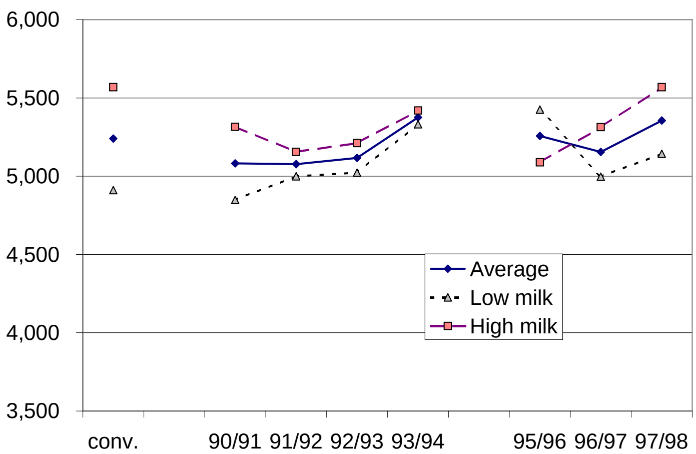
[a]significantly different from 90/91 at p=0.05 (LSD=181)
[b]significantly different from average of group mixed farms at p=0.05 (LSD=339)
[c]significantly different from average of group high farms at p=0.05 (LSD=330)

	Year 0*	90/91	91/92	92/93	93/94	95/96	96/97	97/98	97/98rel#
Milk yield (litres per ha)									
Average all	9,392	8,454	7,897	8,118	8,482	7,870	7,248[d]	8,096	86%
Specialist	9,501	8,862	8,071	8,005[d]	8,318	8,670[e]	7,584[d]	8,185	86%
Mixed	9,284	8,046	7,724	8,231	8,646	7,071[d]	6,912[d]	8,007	86%

[d]significantly different from 90/91 at p=0.05 (LSD=809)
[e]significantly different from average of group mixed farms at p=0.05 (LSD=1514)

* Last year of conventional management; # 1997/98 as percent of Year 0 level

Figure 7-10Average milk yields (litres/cow) of eight organic dairy farms grouped (n=4 per group) according to milk yield prior



Source: Own data

The use of home-grown concentrate feeding increased between Year 0 and 1997/98 from 80 to 200 kg per cow, which represents an increase of 260%. As was to be expected due to greater availability on mixed farms, the average increase was more marked for these farms. On average, during years of organic management the mixed farms used between 25 and 75% of home-grown concentrates, compared with between 0% and 27% on the specialist farms and an all-farm average of 22%.

Table 7-6Average concentrate use on eight organic dairy farms grouped (n=4) according to farm type

	Year 0*	90/91	91/92	92/93	93/94	95/96	96/97	97/98	97/98rel#
Concentrate use per cow(kg/cow)									
Average all	1,263	1,402	1,107[a]	1,104[a]	1,090	1,272[a]	1,132[a]	982[a]	78%
Mixed	929	1,371	1,110[a]	1,098[a]	954[a]	1,388	1,176	900[a]	69%

Specialist	1,267	1,433	1,104[a]	1,110[a]	1,226	1,156[a]	1,088[a]	1,064[a]	84%

[a]significantly different from 90/91 at p=0.05 (LSD=225)
[b]significantly different from average of group mixed farms at p=0.05 (LSD=421)

Concentrate use per litres (kg/l)									
Average all	0.25	0.28	0.22[a]	0.22[a]	0.20[a]	0.24	0.22[a]	0.19[a]	76%
Mixed	0.29	0.22	0.22	0.18	0.26	0.22	0.17	0.29	67%
Specialist	0.27	0.22	0.22[b]	0.23[b]	0.22[b]	0.22	0.21[b]	0.27[b]	84%

[a]significantly different from 90/91 at p=0.05 (LSD=0.05)
[b]significantly different from average of group mixed farms at p=0.05 (LSD=0.08)

Home grow concentrate use (kg per cow)									
Average all	79	71	37	89	153	202	255	204	258%

* Last year of conventional management; #1997/98 as percent of Year 0 level.

Figure 7-11Average milk from forage (litres per cow) on eight organic dairy farms grouped (n=4) according to farm type

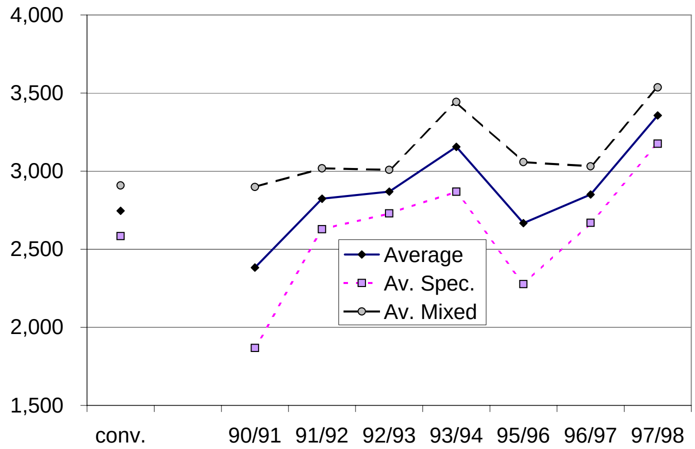


Figure 7-12Average milk from forage (litres per hectare) on eight organic dairy farms grouped (n=4) according to farm type

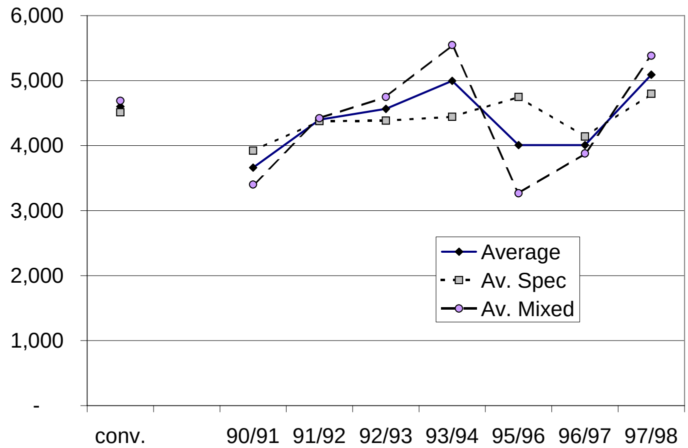


Table 7-7Average milk from forage (MFF) and milk from farm resources (MFR) on eight organic dairy farms grouped (n=4) ac

	*Year 0**	*90/91*	*91/92*	*92/93*	*93/94*	*95/96*	*96/97*	*97/98*	*97/98 #*
	MFF (litres per cow)								
Average all	2,746	2,383	2,823	2,869	3,155a	2,667	2,850	3,356a	130%
Mixed	2.908	2,898	3,018	3,008	3,443a	3,058	3,031	3,536a	125%
Specialist	2.583	1,867b	2,628a	2,729a	2,868a	2,276	2,669a	3,176a	134%

[a]significantly different from 90/91 at p=0.05 (LSD=512)
[b]significantly different from average of group mixed farms at p=0.05 (LSD=958)

MFF (litres per ha)									
Average all	4,601	3,661	4,400	4,567	4,997a	4,008	4,009	5,091a	111%
Mixed	4,689	3,400	4,422a	4,749a	5,548a	3,267	3,879	5,385a	115%
Specialist	4,513	3,922	4,378	4,384	4,445	4,748	4,139	4,798	106%

[a]significantly different from 90/91 at p=0.05 (LSD=942)
[b]significantly different from average of group mixed farms at p=0.05 (LSD=1762)

MFR (% of litres per cow)									
Average all	53%	47%	57%	58%	63%a	54%	61%a	68%a	129%
Mixed	53%	47%	57%	59%	67%a	59%	68%a	77%a	147%
Specialist.	53%	46%	56%	58%	59%a	50%a	54%a	58%a	110%

[a]significantly different from 90/91 at p=0.05 (LSD=12%)
[b]significantly different from average of group mixed farms at p=0.05 (LSD=22%)

* last year under conventional management, #1997/98 as percent of Year 0 level.

The development of the average milk yield from forage (MFF) per cow and per hectare showed an increase across all farms, both in litres per cow and litres per ha (Table 7-7). The increase appeared less steady per hectare, where notable reductions occurred in 1995/96 and 1996/97, a similar pattern to UME. On average, there was a tendency for the group of mixed farms to perform better in terms of MFF per cow (not per hectare), but the differences between the groups were not significant.

Table 7-7 also shows the average development of the milk produced from the farms' own resources (MFR), which was calculated in a similar way as MFF (see Chapter 4). All-farm average for MFR increased by 29%, from 53% to 68% of milk production per cow. The increase was greater on the mixed farms and smaller on the specialist farms, but differences between the groups were not statistically significant.

Milk yield, concentrate use and MFF under organic management

Under organic management (based on four–year averages) the case study farms had an all-farm average milk yield of 5280 litres per cow. Values on Farms 3 and 9 were substantially higher (approximately 5400 and 5510 litres per cow), whereas the average milk yield of the Farm 12 (4880 litres per cow) was markedly below the all-farm average.

In Table 7-8 average farm type data from above are summarised for 4 years of organic management, ignoring the impact of the early conversion period. The organic specialist farms showed a slightly better performance in milk production per forage hectare, whereas the mixed farms performed better in terms of MFF per cow. No influence of the farm type on milk yield, concentrate use and milk from forage per ha could be identified.

Table 7-8Comparison of averages* (4 years of organic management (1993/94, 1995/96 to 1997/98) of indicators of organic mi

	Milk yield (l)		*Concentrate us (kg)*		*Milk from forage(l)*		*MFR*
	per cow	*per ha*	*per cow*	*per litre*	*per cow*	*per ha*	*(%)*
All farms	5286	7953	1102	0.21	3007	4526	66
Specialist as % of average	99	**104**	100	100	**91**	100	100
Mixed as % of average	101	**96**	100	100	**109**	100	100

*Group averages are expressed as a proportion of the overall average for all eight farms,

Concluding remarks

The monitoring of the case study farms showed that conversion had a negative impact on milk yields, at least on farms with above average pre-conversion yields. Several case study farms reduced concentrate feeding strategically during conversion and some farms clearly maintained a policy of feeding concentrates to achieve a target milk yield, which resulted in increased use in some years. Average milk production from forage per cow and per ha increased. However, the farms with highest concentrate use were not identical to the farms with above average milk yield. Five farms introduced home-grown concentrate in the rations, so that in the final year seven farms fed between 7 and 75% of home-grown concentrates and produced between 52% and 92% of milk from farms grown feeds. Factors influencing milk yield development during conversion and under organic management appear to be the levels of production before conversion, strategic reductions in concentrate feeding, and the farm forage supply.

Farmers' experience with other aspects of milk production

The following section covers the farmers' technical experience with other aspects of milk production that are related to information needs, but for which no additional farm data were collected.

Livestock housing

Half of the case study farms had straw bedded cubicles (Farms 2, 3, 9, 10 and 11) before conversion and on the other farms (1, 4, 5, 7 and 12) the cows were loose housed. On one farm loose housing was introduced as part of the conversion, but this specialist farmer later saw the cost of the straw as a problem.

> Eric (F12): "The biggest problem with loose housing is the cost - straw. I think after, labour and concentrates and the straw is our third biggest cost."

The farmers did not consider further changes to the housing conditions as very important to them at the time of the interview (see Chapter 6). The farmers felt that improvements had already been carried out in the recent past. On two farms financial issues were mentioned as an obstacle to further change.

Animal health

The practice of maintaining animal health by using preventative management as required by the Standards was identified as potentially one of the great obstacles for dairy farmers in conversion to organic farming.

One farmer stated his greatest worry in the whole conversion process was how the cows would cope without antibiotics. On the other hand, health problems of the cows, or the dislike of conventional medication for animals and family were important reasons for the first step into conversion (see Chapter 6).

Several farmers mentioned some animal health problems during conversion, for which alternative treatment or management changes had been identified as solutions: clinical mastitis and summer mastitis; internal parasites; trace elements (copper and iodine); Bovine Spongiform Encephalopathy; feet problems.

The greatest challenge in the area of animal health occurred once the preventative use of medication had stopped, particularly antibiotics in dry cow therapy.

Farm 1 implemented what the William called a "dress rehearsal", where the staff tried to manage the herd in line with all health requirements in the Standards for some time before the envisaged date of the certification for the herd.

Looking back Walter (F11) said:

> " I mean the mastitis was a nightmare once we had stopped using antibiotics…. But in the end our cows are pretty healthy now."

He went "back to basics" in terms of prevention, testing the milking machine, culling cows with problems and paying more attention to cleanliness of the cubicles. Two farmers used herbal preparations for mastitis. One farmer observed that contrary to his expectation, the number of mastitis cases had actually dropped since dry cow therapy was no longer used.

The most frequently mentioned alternative to conventional treatments was homeopathy. Several farmers made an intensive effort to learn about homeopathy, using books and contacting other organic farmers and in some cases the local vet.

> Dave (F3): "Yeah, we had one or two problems with mastitis. I did a steep learning curve on homeopathy."

The farmers would generally allow themselves a certain period of experimenting with homeopathic remedies before calling out the vet and resorting to antibiotic treatment.

Farmers were also not afraid to experiment with alternative treatments, some rather unusual.

Nick (F5): "At one stage we even had a holly bush hanging up, because I was told that male holly controls ringworm, so we thought, well, try it out, very christmassy… "

The prevention of parasitic infections, for calves and for sheep, was also considered a challenge on most farms, particularly implementing clean grazing systems which required planning the grazing several years in advance. However, Harry (Farm 2) and William (Farm 1) considered the low or reduced stocking rates as way to lower infestation and/or disease pressure.

The experiences of the case study farmers confirm the great challenge that lies in the required animal health regimen, particularly the withdrawal of dry cow therapy and reduced levels of anthelmintics. Farmers referred to going back to their knowledge about prevention, and learning about alternative treatments, particularly homeopathy. The change also affected their relationship with their veterinary surgeon (see Chapter 6).

The clinical perception of mastitis as a problem on the farms is confirmed by animal health data from the farms that were monitored in the first data collection period. Weller and Cooper (1996) reported large differences between the farms in the number of cases of clinical mastitis on most farms and overall the levels were found to be slightly higher than on comparable conventional farms. The farmers also mentioned some animal health problems in the dairy for which the farmers had not really been able to find satisfactory solutions, including the drying off period, fly control (particularly in the parlour) and the control of ringworm.

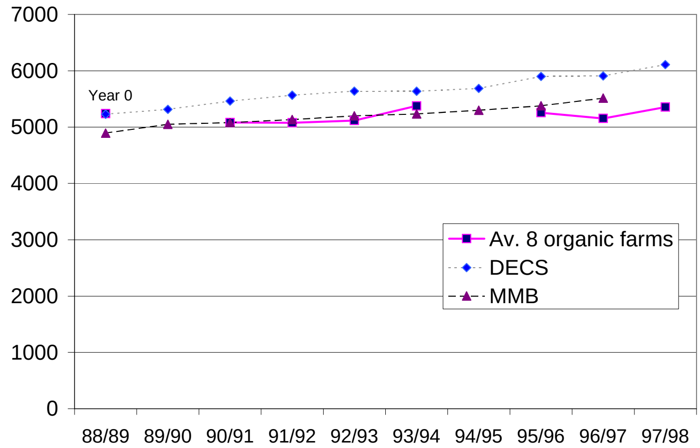
Comparison with conventional data

In the following section the stocking rate and milk production values are compared with conventional data (see Chapter 4 for further details).

Stocking rate levels under organic management of on average 1.4 to1.5 LU/ha in the final three years of data collection are substantially lower than those reported for conventional dairy farms, e.g. 2.3 LU/ha on all farms monitored by Axient (Harper and Jones, 1997), 1.7 to 2.2 LU/ha (Farrar and Franks, 1998; Franks, 1999).

A trend comparison of milk yields with results of the long-term evaluation of Dairy Enterprises Costings Study (DECS) from Manchester University (Franks, 1999) and MMB data referred to in the same report is shown in Figure 7-13. The initial reduction in yield levels introduces a difference between the average value for the case study farms, compared with DECS monitored farms in England and Wales. Yield levels of the case study farms thereafter are comparable with a national average reported by MMB. Average milk production per cow prior to conversion of the case study farms and at the end of the study period were similar, which is clearly different from continuously increasing trends for conventional herds.

Figure 7-13Average milk yield development (litres per cow) for eight organic dairy farms compared with DECS and MMB



Source: Own data and Franks (1999)

Table 7-9 shows a comparison of further production related indicators on the case study farms with the results of the Manchester study. The stocking rate on the organic case study farms was 5% higher prior to conversion, if average for the last year of conventional management of all farms (Year 0) is compared with the annual average of 1988/89 in the long-term dairy study from Manchester. The organic farms on average reduced stocking rate to 1.5 LU/ha, whereas that of the conventional ones remained more or less unchanged, apart from an increase to 1.9 LU/ha in 1994/95.

Concentrate use per cow on the case study farms was reduced by approximately 20% (25% per litre) between Year 0 and 1997/98 and was approximately 30% lower than on farms monitored in the Manchester study in 1996/97.

Overall the comparison shows that the conversion influenced the reliance on external inputs by reducing the levels of total concentrate feeding, compared with the dairy industry in general, and by using higher levels of home-grown concentrate, although self-sufficiency was not achieved.

There was a greater tendency towards specialisation on the smaller farms (50–85 ha), whereas most large farms (200–450 ha) had a more diverse enterprises structure. Structural changes were less marked on the smaller and more specialised farms.

Table 7-9Comparison of the results of eight organic case-study farms with long-term conventional data

		Y 0	*89/90*	*90/91*	*91/92*	*92/93*	*93/94*	*95/96*	*96/97*	*97/98*
Stocking rate	org.	1.79		1.67	1.56	1.59	1.58	1.50	1.40	1.51
(LU/ha)	conv.	1.7	1.8	1.73	1.69	1.71	1.89	1.89	1.72	
	%	105%	0%	96%	92%	93%	83%	79%	82%	
Milk production	org.	9,392		8,454	7,897	8,118	8,482	7,870	7,248	8,096
(litres per ha)	conv.	9,246	9,513	9,410	9,347	9,565	10,635	11,117	10,155	
	%	102%	0%	90%	84%	85%	80%	71%	71%	
Concentrate	org.	1,263		1,402	1,107	1,104	1,090	1,272	1,132	982
(kg per cow)	conv.	n/a	n/a	n/a	n/a	n/a	1,832	1,822	1,640	
	%						60%	70%	69%	
Home-gr. conc.	org.	0		81	32	43	128	202	255	204
(kg per cow)	conv.	n/a	n/a	n/a	n/a	n/a	119	95	100	
	%						107%	212%	255%	
Concentrate	org.	0.25		0.28	0.22	0.22	0.20	0.24	0.22	0.19
(kg per litre)	conv#	n/a	n/a	n/a	n/a	n/a	0.33	0.31	0.28	
	%						62%	78%	79%	

*Average pre-conversion value for organic farms, year 1988/89 for conventional
#Concentrate reported in DECS only since 1993/94 Source: Own data and Franks (1999)

Summary and conclusions

The aim of this chapter was to describe the performance of the case study farms in terms of farm size and land use, indicators of forage production and milk production. The observations showed considerable variation in the impact of conversion between the case study farms, confirming that indeed the process can take quite different courses. However, reference to other farm parameters, cross-case comparisons and simple statistical data analysis of groups of farms and the farmers' observations helped to identify trends and highlight factors influencing development. The farmers' experience highlights further production-related information requirements.

Conversion had an impact on **farm size** mainly on the larger estates that gradually took more land into conversion, but there is no indication that farm size or forage area increased to compensate for forage yield reductions. There appeared to be a tendency for greater specialisation on the smaller farms. The total impact of conversion across all farms on land use was small, but the impact was greater on farms with a mixed enterprise structure as more fertility building crops were introduced, and was marked on the specialist dairy farms, where on some farms cereals were introduced in the rotation.

Conversion clearly had an impact on **stocking rate levels**, which were on average reduced by 15%, and fell from 1.6-2.0 LU/ha pre-conversion to 0.9-2.0 LU/ ha in 1997/98. Initially higher reductions (of approx. 30%) occurred on some farms. Average values under organic management on six of the eight farms were close to the overall average (between 1.4 and 1.6 LU/ha); one farm had a lower and one farm a higher value. Stocking rate development varied substantially between the individual farms and appeared to be influenced by the need for fertility building in arable rotations and by the farmers' preference, as well as by the adjustment of stock numbers in reaction to forage supplies. Stocking rate reductions were more marked on farms with higher values prior to conversion, but these farms aimed for higher rates under organic management.

No direct measurement of **forage yield** was carried out, but the impact of conversion on forage yields was considered using stocking rate and UME as indirect indicators. Of these stocking rate has the advantage that it is easy to calculate, well known to farmers and has been used to provide a guidance for converting farmers (Measures, 1998, personal communication). However, the development trends on farms indicated that changes in stocking rate were influenced by the need for fertility building on arable land and by farmers' preferences for particular stocking rates for various reasons.

Utilisable Metabolisable Engery (UME) is calculated as a residual difference between the energy requirements of milk production and supplies by off-farm sources. A significant correlation between the calculated values and grazing and silage yields measured on the case study between 1993 and 1996 could be established.

Average UME level showed reductions of 8% during conversion, with higher reductions on some farms, indicating that conversion may indeed have led to decline in forage yields, but not of the same magnitude as stocking rate decline suggests. However, UME also fluctuated under organic management (up to 30% variation from average values) and appeared to be influenced by annual rainfall and by pest problems, although the farmers' observation of damage caused by slugs in particular could not be independently verified. UME was also influenced by factors influencing stocking rate, as this is considered in the calculation.

The results also show that conversion had a negative impact on **milk yield development**, which was, at least initially, more marked on farms with pre-conversion yields above average, whereas yields on low pre-conversion farms rose. The trend was reversed later on and several high yielding farms achieved pre-conversion levels in the final year of data collection. From comparison with conventional data it appears as if the conversion has interrupted an otherwise steady trend for increasing levels of milk production that applies both to organic and conventional farms.

The results also show that the case study farms reduced **concentrate use** on average by approximately 20% per cow or 25% per litre of milk. However, the variation between the farms was substantial and some farms clearly maintained a policy of feeding concentrates to achieve a target milk yield, resulting in increased use in some years, whereas other farms strategically reduced concentrate use.

Five farms introduced **home grown concentrate** in the ration during their conversion, and in the final year on seven of the eight farms it constituted between 7% and 75% of total concentrates, resulting in between 52% and 92% of total milk being produced from the farm's own resources.

Milk production from forage per cow and per ha increased on average by 40%, with greater increases for mixed farms than for specialist farms. Milk from forage trends correspond closely with UME values and hence annual rainfall data.

Factors influencing milk yield development during conversion and after conversion can be summarised as pre-conversion levels, farm forage supply (and factors that influence this) and reductions in concentrate feeding.

The unexpected experience of **feed shortage** on several farms clearly confirms the importance of information about forecasting the likely forage supply and demand for the converting farmer, as feed shortages may have knock-on effects on milk production levels and potentially herd fertility. However, feed shortages could be exaggerated by reduced levels of concentrate feeding, leading to a higher demand for forage.

However, the farmers that experienced feed shortages had been advised to reduce stocking rates, but dismissed the warnings. This highlights the fact that farmers do not believe all information given to them and confirms the opinion that in some areas farmers may need to make their own mistakes.

The trend analysis found greater fluctuation in milk yield per cow on the **specialist farms,** and under organic management lower levels of MFF per cow. Taken together this could indicate that specialist organic dairy farms, particularly those with high stocking rates, have no forage reserves to compensate for other factors influencing forage production, such as rainfall or pest damage, and have to increase concentrate feeding if forage production declines.

The farmers mentioned actual **technical information needs** or experienced problems that could be related to a lack of information in the following areas.

The farmers found it difficult at first to understand the diet rules in the Standards and two farms experienced problems with the separation of "in-conversion" and "organic" silage that is necessary according to the rules once the herd is converted.

Apart from the control of slugs and other pests, other technical information needs related to forage production, especially clover crop establishment (leys blank or undersown, and permanent pasture). The farms grappled with the adjustment to the later growth pattern of clover-based swards, which required them to discard some of their previous knowledge, and some perceived weed control (docks in particular) to be an unsolved problem. In the area of animal production the greatest information needs arose in relation to health management, particularly mastitis control and the drying off period. Also mentioned were problems with trace element supply, the introduction of a clean grazing system and control of ringworm. No farmer mentioned any particular problem with herd fertility.

This chapter presented the impact of the conversion on the farms structure, forage and milk production of the case study farms and identified some influencing factors. The following chapter present the financial impact of conversion on the case study farms. The discussion of the results in the context of other studies in Chapter 10 will provide the basis for conclusions about production related areas of information requirements for converting dairy farms.

Financial results

Introduction

This chapter presents the results of the financial monitoring of the case study farms from before conversion until the financial year of 1997/98, when all farms had been certified organic for at least four years. The literature review in Chapter 2 had identified lack of information about the likely financial impact of conversion as a major barrier. It was therefore one aim of the financial monitoring to analyse the impact of conversion on dairy enterprise gross margin performance and on the incomes of the case study farms, and to analyse the importance of farm types and conversion strategy and to identify other factors of influence.

Chapter 3 highlighted the importance of premiums for the financial output of the organic dairy enterprise and whole farm income, particularly early in conversion when farms do not qualify for it, but also the potential for savings in variable costs. The evidence regarding changes in labour requirements, fixed costs, and the income of converting dairy farms was inconclusive, although income decline early in conversion appeared likely. From the principles of organic farming it appeared as if farms with a mixed enterprise structure were more suited to organic conversion than more specialist farms.

The main financial indicators used to evaluate the account data were standard farm management tools, such as dairy enterprise gross margin (including several output and input categories), total output, variable and fixed costs, and Net Farm Income (NFI) with particular emphasis on the role of purchased and home-grown concentrates. The amount of data generated by the monitoring of eight case study farms over eight to ten years was considerable, so that full time-series data of key indicator for each farm and short descriptions of trend developments are included in the Appendices.

Most sections of this chapter begin with a short summary of factors that appear to have influenced the development on the individual farms, whereby specific observations or experiences of the case study farmers help to improve the understanding. This followed by a comparative analysis of (a) all-farm average trends of indicators during conversion and differences between mixed and specialist case study farms; (b) cross-farm comparisons of average values under organic management, and (c) comparison of all-farm averages with conventional data to distinguish the impact of conversion from general trends.

The first section presents the development of dairy gross margins, including the farmers access to organic market outlets. A section follows on whole farm outputs and labour requirements and costs, and other overhead costs. The third section discusses the income trend on each individual farm aiming to identify various factors that appear to have influenced the development, and comparing each holding with the average conventional trend for farms of similar type. This is followed by some further comparative analysis of the income trends and factors influencing it, including a calculation of the costs of conversion, followed by a short summary of the results in the final section. In the following chapters the financial results will be set against other aspects of the conversion process and discussed in the context of the literature.

Dairy enterprise gross margins

Introduction

From the literature (Chapter 3) it was clear that an organic premium is important for the gross margins per cow on organic farms, which were found to be generally lower than conventional, if no premium was available. It was expected that the case study farms would have been in this situation for least 27 months, depending on their conversion strategy, as this was the minimum conversion period for dairy farms in the Standards at the time. However, the literature also indicated that cost savings in variables in range of 13–25% occur, which could take effect right from the beginning of conversion, i.e. as soon as inputs are no longer applied. Dairy gross margins per hectare were frequently found to be lower because of the lower stocking rate.

A variety of different margins are used to evaluate the dairy enterprise, such as the margin over concentrate, margin over purchased feed, and margin over purchased feeds and fertiliser. The dairy cow gross margin combines most aspects and was therefore chosen as the main indicator for analysis.

Marketing of organic milk on the case study farms

During the study period the market for organic milk developed. Several case study farms in the southwest of England (1, 3, 5 and 9) were founder members of the Organic Milk Suppliers Co-operative (OMSCo, see Chapter 3) and were able to sell all their organic milk with a premium towards the end of 1994. The farms in Wales (2, 7 and 12) could initially sell only some of their milk to two regional processors, but marketing improved later on. One attempt to process organic milk by a dairy in the southwest failed that had influenced the decision to go organic on Farm 11, leaving this farm initially without a premium market for their milk, and Farm 4, which left the study after three years.
The situation that not all case study farms could sell all their milk with an organic premium as soon as their herds had fulfilled all Standards requirements was reflected in the interviews. Farm 11 delayed the application for a symbol for the dairy herd until marketing opportunities arose. However, Walter did not regret the decision to convert the farm.

> "I think we are producing milk as cheaply as anyone, but we are fortunate in having a large number of acres, so that we have the possibility of running an extensive system.... I think the whole business is very stable, and that is what I want to do."

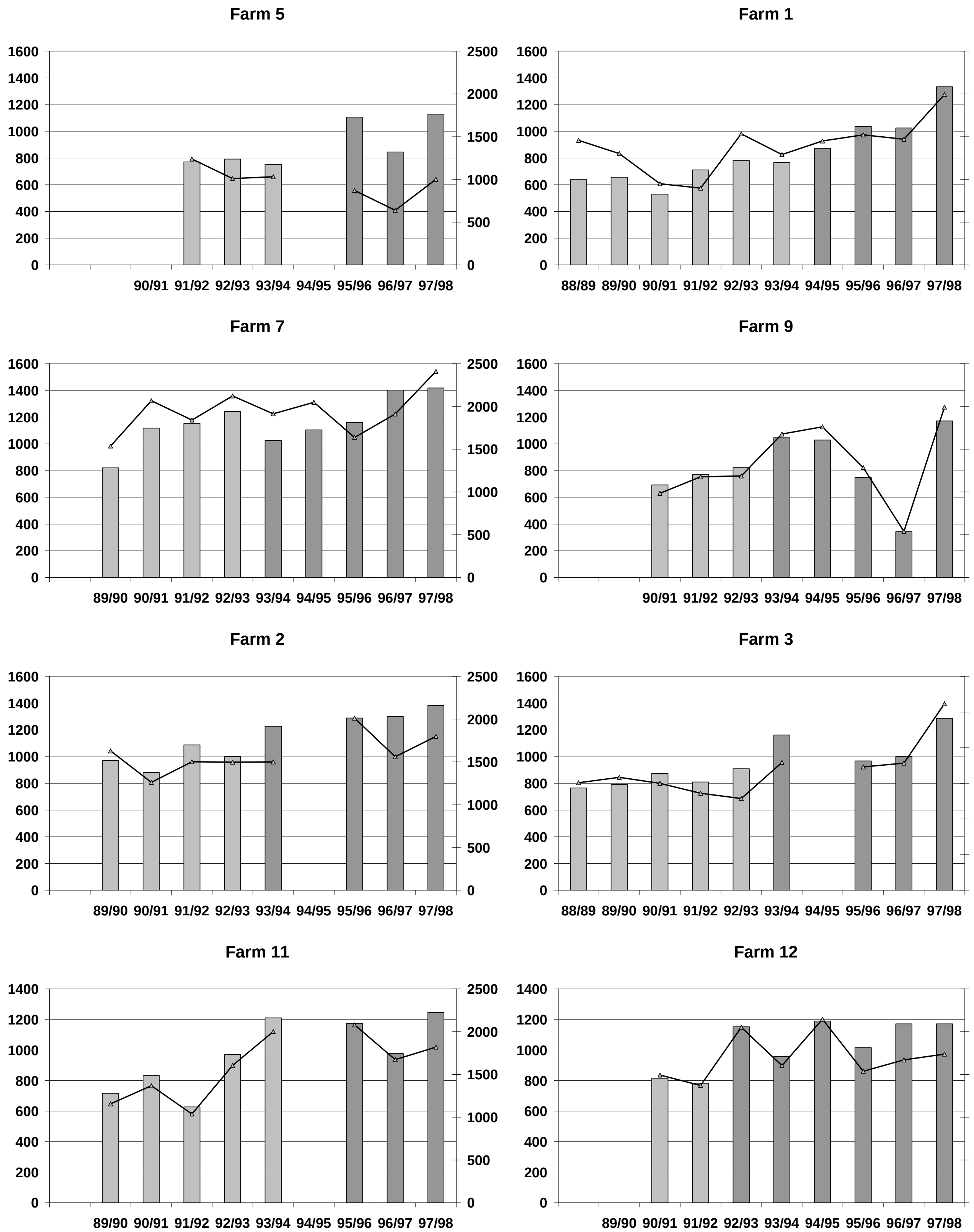
Given this background it is understandable that the farmers saw the improvement of the marketing as a very important objective, but with the prospects of greater marketing opportunities for organic milk, direct marketing or on-farm processing was no longer of such high priority.

> Betty (F3): "Actually initially we thought that we would probably market our own milk, and have a milk round. Because we thought that that perhaps was one way of doing it and having an edge on the market. But as the time went by, we realised, if we could possible sell it in bulk, it would be a lot easier. "

Of the three farms that had mentioned direct marketing among the reasons for their conversion, only one farm had established it in 1995.
Development of dairy enterprise gross margins on the individual farms

Figure 8-1 shows the development of the dairy cow gross margins on the mixed case study farms at the top of the page; the specialist dairy farms are at the bottom. Data for the values per cow are shown as columns and the values per ha are added as lines. A darker bar colour was used for the years when the farms realised a higher price for their organic milk (see Appendix 5 for a more detailed description and explanation of the trends).
Farms 1, 2, 3 and 7 showed relatively steady increases, although the upward trends are interrupted several times. Increases could be attributed partly to milk price, increases in milk yield and other outputs (for example quota transaction), and changes in the variable costs.
Other abrupt changes in margins illustrate a number of factors that influence the dairy gross margin, some of which appeared directly related to the conversion process. For example, a low value on Farm 11 in 91/92 could be attributed to the "*crash*" conversion of the farm. In this year high expenditure for purchased forage and costs for re-seeding of the swards coincided with poor performance as a result of feed shortages.

Figure 8-1Development of dairy enterprise gross margins (£/cow left axis and £/ha right axis) on eight organic dairy farms



Source: own data.

The substantially increasing values on Farm 5 in the second data collection period illustrate the effect of access to an organic premium, although the farm incurred some quality-related price penalties in the following year. The dairy cow gross margins are also influenced by changes in milk yield (see Chapter 7). On several farms the low margin coincided with years of low milk production, which can be seen in the context of unfavourable weather conditions and/or low forage supplies. Other variation is explained by specific circumstances and conditions on individual farms – for example changes of the gross margins on the Farm 7 and 9 were related to quota transactions – and hence is of particular concern for this study of conversion.

Analysis of dairy enterprise output

The comparison of the average development of the dairy output per cow for all farms shows a more or less steady increase of 50% between the first year of conversion and 1997/98 (Table 8-1). Trends are similar for both farm type groups, with average increases being slightly higher for the mixed farms and lower for the specialist farms, but differences between the groups are not significant in most years apart from 1993/94 and 1996/97.

Table 8-1Analysis of average of dairy output per cow (£/cow) for eight organic dairy farms grouped according to farm type (n=

	*Year 0**	*90/91*	*91/92*	*92/93*	*93/94*	*95/96*	*96/97*	*97/98*	*97/98 rel#*
Dairy output (£ per cow)									
All	1, 125	1,139	1,112	1,238[a]	1,307	1,527[a]	1,465[a]	1,652[a]	147%
Specialist	1,195	1,159	1,088[a]	1,247[a]	1,438[a]	1,532[a]	1,544[a]	1,662[a]	139%
Mixed	1,056	1,119	1,136	1,228[a]	1,175[b]	1,523[a]	1,385[a,b]	1,642[a]	156%

[a] significantly different from 90/91 at P=0.05 (LSD=79.4); [b]significantly different from average of group mixed farms at p=0.05 (LSD=148.6)

* Last conventional year; # 1997/98 compared with Year 0

Table 8-2 shows that the year from which each farm was able to sell organic milk varied and that there was also some variation between farms in terms of the organic premium paid, depending on the milk buyer. This was mainly a question of location of the farm, as there was no choice between different milk buyers at the time.

Table 8-2 Milk price development on the case study farms (Year 0 to 1997/98)

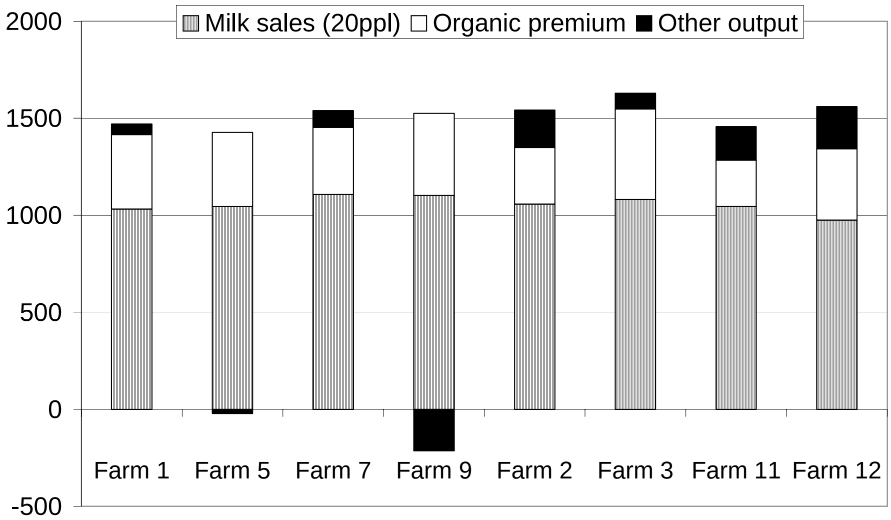
	*Year 0**	*90/91*	*91/92*	*92/93*	*93/94*	*95/96*	*96/97*	*97/98*	*97/98 rel#*
Farm 1	18.23	20.84	19.78	19.88	19.89[o]	29.97	28.59	31.25	171%
Farm 2	19.29	19.78	19.96	21.13	22.99[o]	24.80	26.29	27.97	145%
Farm 3	17.91	19.00	18.33	18.60[o]	23.87	29.67	29.77	31.52	176%
Farm 5	19.51	19.51	21.75	20.52	20.13[o]	30.65	27.73	30.54	157%
Farm 7	18.97	18.11	17.71	17.01	22.61[o]	26.85	27.09	28.24	149%
Farm 9	18.48	17.30	18.91	21.57[o]	24.63	27.21	29.87	31.65	171%
Farm 11	18.34	18.85	18.20	19.13	21.53	25.17[o]	25.11	26.68	145%
Farm 12	21.94	22.10	27.14[o]	27.30	28.98	26.11	27.53	27.25	124%
Average	19.08	19.44	20.22	20.64	23.08	27.55	27.75	29.39	154%

* Last conventional year; # 1997/98 compared with Year 0; [o] Organic certification for the dairy herd

In Figure 8-2 the individual farms are compared on the basis of average values for four years of organic management (1993/94 and 1995/96 to 1997/98), with the mixed farms to the left of the chart and the specialised farms to the right. A constant standard sales price of 20ppl illustrates the influence of the organic premium on the dairy output. Variation in dairy output between farms is caused by small variations in average milk yield between farms, differences in the premium (the amount of revenues raised for the organic milk above the hypothetical milk price of 20 ppl) and in values for other output (net quota transactions, stock sales, replacement costs, valuation charges). On some farms (e.g. Farms 2, 7, 9, 11 and

12) income from leasing unused dairy quota has helped to compensate for lower output through sales to a varying degree. Overall, it appears that the variation in premium and other dairy output accounts for a large proportion of the variation in total dairy output and hence explains some of the variation in the dairy gross margins.

Figure 8-2Average dairy output (£/cow) of eight organic farms (four–year organic management, 1993/94, 1995/96 to 1997/98



Analysis of dairy variable costs

Contrary to the expectation of savings in variable costs Table 8-3 shows a slight increase in the all-farm average variable costs between Year 0 – the last year of conventional management – and 1997/98, which is not significant. The increase in variable costs is slightly higher for the average of the group of mixed farms, but the difference between the groups is not significant.

Reductions, however, were observed for the costs of concentrate per cow, which declined by 10%, in line with the average reduction in use of approximately 20% (see Chapter 7); this lower reduction was a result of the higher prices for organic concentrate. There was no variation in trends between mixed and specialist farms.

In Figure 8-3 the average variable costs per litre for four years of organic management of the case study farms are compared, broken down into categories. Total variable costs are low on Farms 2, 7 and 11, all of which have relatively low use of concentrate per cow and per litre. Concentrates account for more than 50% of the total variable costs on Farms 1, 3, 9 and 12. High costs on Farms 1, 9 and 12 were related to high use of concentrate compared with the other farms, whereas Farm 3 paid the highest average price for concentrates. Concentrate costs therefore appear to be of relatively high importance for the financial costs of organic milk production.

Table 8-3Analysis of average variable costs per cow (£/cow) for eight organic dairy farms grouped according to farm type (n=4

	*Year 0**	*90/91*	*91/92*	*92/93*	*93/94*	*95/96*	*96/97*	*97/98*	*97/98 rel#*
Variable costs (£/cow)									
Average all farms	351	325	273	279	288	465	456	385	110%
Specialist	378	309	261	239	299	421	431	390	103%
Mixed	324	341	285	318	278	510	481	379	117%

[a] significantly different from 90/91 at p= 0.05 (LS=79.4);
[b]significantly different from average of group mixed farms at P=0.05 (LSD=148.6)

Concentrate cost (£/cow)									
Average all farms	186	198	164	158	147	189	212	167	90%
Specialist	193	189	163	141[a]	157	174	212	175	91%
Mixed	179	206	164[a]	175	137[a]	205	212[a]	159	89%

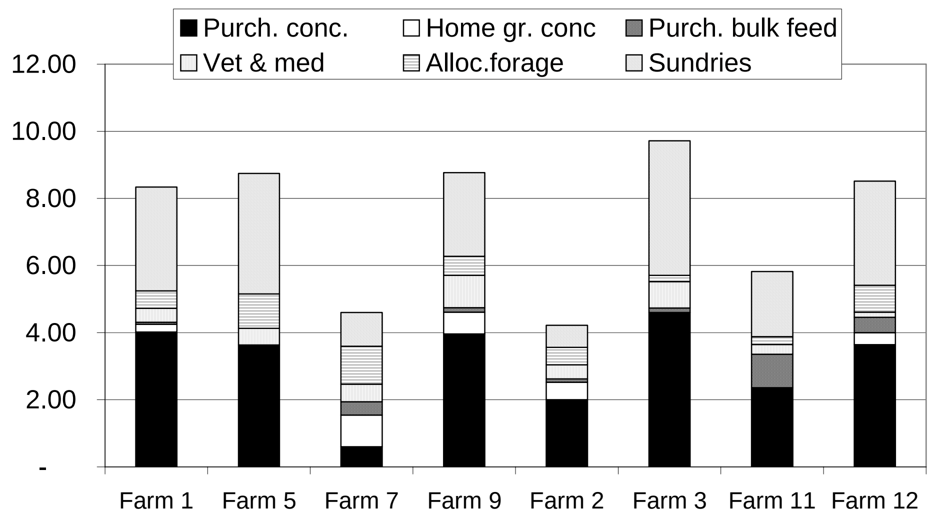
[a]significantly different to 90/91 at p=0.05 (LSD=37.9);
[bs]ignificantly different to average of group mixed farms at p=0.05 (LSD=71.4)

* Last conventional year; # 1997/98 compared to Year 0.

Spending for veterinary treatment (ranging from £7 to £53 per cow) and allocated forage costs (£12 to £62 per cow) also varied between farms. The average highest spending for vet & med. occurred on Farm 9, whereas average costs were very low on Farm 12. These are also the farms with the highest and lowest milk yields, but it is unlikely that there is a direct connection between milk yield and veterinary spending. Allocated forage costs appear to be higher on the mixed farms, possibly a result of greater use of short-term leys for fertility building. However, compared with concentrate costs and other dairy expenses the impact of variation in vet. & med. and forage costs on the total variable costs appeared to be relatively low.

Expenses for dairy sundries of more than £160 per cow or more than 3 ppl were particularly high on Farms 1, 3, 5 and 12, but low on Farms 2. Like in standard recording FBS recording the category covered all expenses attributable to the dairy enterprise, which do not belong in any other category of variable costs. More detailed records of some farms indicated that these costs – at least in parts – are caused by additional levies or charges related to milk marketing, which should be directly related to the level of premium. However, as the level of variation in this cost category had not been anticipated from the literature, the data recording was not detailed enough for further breakdown of the category for all farms and all years.

Figure 8-3Average variable costs for dairy production (ppl) of eight organic farms (four–year organic averages, 1993/94 and 19



Analysis of the development of gross margins by farm type

The comparison of the average trends for the dairy cow gross margin (Figure 8-4) showed a clear upwards trend – the value is 65% higher in 1997/98 than pre-conversion – confirmed by statistical analysis for all years (see Table 8-4). There was a tendency for the specialist farms to achieve higher gross margins per cow, but the differences between the farm type groups were significant only in two years (1993/94 and 1996/97). The average trend was very similar for the dairy gross margin per litre, and although for this indicator the mixed farms showed a slightly better performance, the difference between the groups were statistically significant also in only two years. The average increase was smaller for the dairy gross margin per forage hectare, and in this indicator the differences between the groups of mixed and specialist farms were not significant. Overall, it appears as if the variation in dairy gross margin is not related to the farm type.

Figure 8-4Average of dairy GM (£/cow) of eight organic dairy farms grouped according to farm type

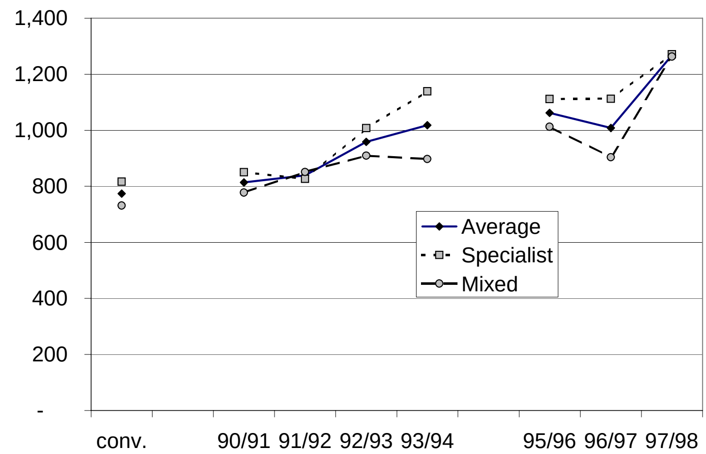


Table 8-4Analysis of averages of dairy cow gross margins of eight organic dairy farms grouped according to farm type

	Year 0*	90/91	91/92	92/93	93/94	95/96	96/97	97/98	97/98 rel#
Dairy GM (£ per cow)									
Average	774	820	839	959[a]	1,018[a]	1,062[a]	1,008[a]	1,267[a]	166%
Specialist	817	850	827[a]	1,008[a]	1,139[a,b]	1,112[a]	1,113[a,b]	1,272[a]	160%
Mixed	731	778	851[a]	910[a]	897[a]	1,013[a]	904[a]	1,263[a]	173%
[a]significantly different from 90/91 at p=0.05 (LSD=105); [b]significantly different from average of group mixed farms at p=0.05 (LSD=196)									
Dairy GM per litre (ppl)									
Average	14.72	15.95	16.52	18.79[a]	18.87[a]	20.18[a]	19.60[a]	23.78[a]	162%
Specialist	15.48	15.92	16.60	17.52	16.90[b]	19.12[a]	16.67[b]	23.22[a]	157%
Mixed	13.97	15.99	16.44	20.06[a]	20.84[a]	21.24[a]	22.54[a]	24.34[a]	166%
[a]significantly different from 90/91 at p=0.05 (LSD=1.94) [b]significantly different from average of group mixed farms at p=0.05 (LSD=3.63)									
Dairy GM per forage hectare (£ per ha)									
Average	1,375	1,358	1,303	1,537	1,601[a]	1,584[a]	1,406	1,913[a]	139%
Specialist	1,446	1,406	1,317	1,610	1,724[a]	1,839[a]	1,672[a]	1,977[a]	137%
Mixed	1,304	1,310	1,289	1,463	1,478	1,329	1,139	1,849[a]	142%
[a]significantly different from 90/91 at p=0.05 (LSD=212) [b]significantly different from average of group mixed farms at p=0.05 (LSD=396)									

* Last conventional year; # 1997/98 compared with Year 0

Table 8-5 provides some indication of the factors that influence the dairy gross margin under organic management by comparing the average dairy gross margin data of the three best farms (in terms of margins per cow, per litre and per hectare) and the three worst performing farms (per cow), with the overall average (for individual farm values see Appendix 1).

Table 8-5Averages for three farms with low and high dairy gross margin per cow, high margin per litres and per ha (4 year av. o

	Unit	*Bottom 3 per cow*	*Average (8 farms)*	*Top 3 per cow*	*Top 3 per ha*	*Top 3 per litres*
Farms		*1,5,9*	*all*	*2,7,11*	*3,7,11*	*2,7,12*
Dairy gross margin	£/cow	942	1095	**1235**	1169	1226
Dairy GM per forage ha	£/ha	1285	1651	1867	**1952**	1827
Dairy GM per litre	ppl	17.84	20.79	23.08	21.70	**23.42**
UAA	ha	437	229	128	140	56
Cow number	No	178	131	116	135	50
Milk yield	l/cow	5297	5277	5350	5388	5234
Stocking rate	LU/ha	1.37	1.50	1.52	1.67	1.50
UME	GJ/ha	54	62	67	71	65
Concentrate use	kg/cow	1314	1102	797	942	842
Concentrate use	kg/litre	0.25	0.21	0.15	0.18	0.16
Milk from forage (MFF)	litres/cow	2622	3033	3726	3470	3519
Milk from farm resources (MFR)	%	60	62	71	63	73
Milk yield per forage ha	litres/ha	7289	7953	8133	9017	7827
MFF per forage ha	litres/ha	3610	4589	5653	5786	5259
Dairy output % of total	%	54	74	83	82	84
Av. farm milk price	ppl	27.42	26.86	25.45	26.52	26.42
Av. concentrate price	£/t	161	149	118	137	130
Dairy output	£/cow	1395	1489	1513	1541	1547
Milk sales	£/cow	1456	1418	1361	1428	1381
Standardised milk sales*	£/cow	1059	1055	1070	1078	1047
Replacement costs	£/cow	163	127	105	117	91
Total variable costs	£/cow	453	394	278	372	321
Total concentrate	£/cow	209	177	114	152	138
Allocated forage costs	£/cow	37	33	34	28	43
Dairy sundries	£/cow	173	144	81	136	104

*@20ppl

The three farms in the category with *low gross margins per cow* were mixed (Farms 1, 5 and 9) whereas the group *top three producers per cow* consisted of two specialist (Farms 2 and 11) and one mixed (Farm 7). The top producers had on average a higher milk yield per cow, but due to lower sales prices per litre (2 ppl lower than on the farms with low gross margins) average milk sales per cow were lower, illustrating that the level of premium is not the only factor that determines the financial success of the organic dairy enterprise, but that costs are equally important. The top farms used less concentrate and paid less for it, so that the total concentrate costs and also total variable costs were considerably lower. Milk production from forage and from farm based resources was higher on these farms. This would indicate that there is no particular secret to good dairy gross margins for organic cows, apart from basic good husbandry combined with some sensible awareness of the input costs, particularly as prices for organic concentrates are high.

Farms with higher than average gross margin per cow also clearly show higher values for dairy gross margin per ha and per litre. If the farms are grouped according to *highest dairy gross margin per forage hectare*, Farm 3, the farm with the highest stocking rate per hectare, replaces Farm 2. The average for the farms with highest GM per ha shows higher than average milk yield per cow, stocking rate and milk production per hectare, and high milk output. Milk from forage per cow is also higher than for the average of all farms, but not as high as for the three farms with highest gross margin per cow. Concentrate use per cow and per litre is higher than for the group of farms with highest GM per cow, but lower than for the overall average, while variable costs are also higher, but not as high as for the farms that come last in terms of dairy gross margins.

The three farms with the *highest gross margin per litre* are the specialist Farms 2 and 12 and Farm 7, which makes Farm 7 the only one that is represented in all three groups of producers with the highest gross margins. These farms with high margin per litre have a milk yield and stocking rate similar to the overall average, but low concentrate use and lower than average variable costs.

Overall it appears as if a combination of milk yield, concentrate use (and as a result) and variable costs account for the success of those farms that achieve high dairy cow margins. Getting a premium is important, but level of premium is not the only factor that the organic dairy should aim to influence. It appears as if in addition to the gross margin milk production from forage might be a possible indicator of profitable organic milk production.

Comparison of organic dairy cow gross margins with conventional data

Although the case study farms were not selected as a representative sample, the all-farm average trend was compared with two sets of conventional data to isolate the impact of the conversion from general trends. The comparative data were taken from the dairy enterprise costs study (DECS) carried out on behalf of MAFF by Manchester University (Franks, 1999) and – for the last three years – the MAFF farm income report (MAFF, 1998 and 1999). As data collection on the eight case study farms followed FBS guidelines, full comparability between the different data sets can be assumed.

The case study farms achieved broadly similar dairy output per cow and – despite average increases of 10% – had lower variable costs than the conventional farms (Table 8-6). This led to a similar trend of the dairy gross margins (DGM) per cow (Figure 8-5) and per litre. DGM per cow on the case study farms was, on average, approximately 10–20% higher than DECS, and per litre 15–30% higher. Trends differ for the dairy cow gross margins per forage hectare (Figure 8-6). In the first data collection period the case study farms showed similar results, but in the second data collection period – as stocking rates were gradually reduced on the case study farms – their margins per hectare also fell.

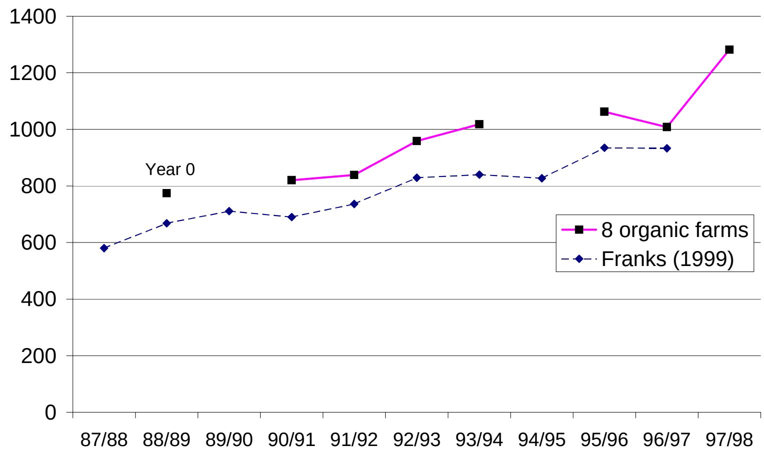
Table 8-6Comparison of dairy cow gross margin of eight organic dairy farms with Dairy Enterprise Costings Study (DECS, 198

	Y 0* 88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98
Dairy output (£/cow)										
organic	1,125	n/a	1,140	1,112	1,238	1,307	n/a	1,527	1,465	1,652
DECS	1,023	1,103	1,097	1,147	1,239	1,314	1,336	1,486	1,479	n/a
conv.=100%	110		104	97	100	99		103	99	
Concentrate costs(£/cow)										
organic	186	n/a	198	164	158	147	n/a	189	212	167
DECS	205	224	224	2,189	230	257	253	272	251	n/a
Conv.=100%	91		88	7	69	57		70	85	
Total variable costs(£/cow)										
organic	351	n/a	320	273	279	288	n/a	465	456	385
DECS	355	392	407	411	410	474	509	551	547	n/a
Conv.=100%	99		79	66	68	61		84	83	
Gross margin(£/ cow)										
organic	774	n/a	820	839	959	1,018	n/a	1,062	1,008	1,267
DECS	668	711	690	736	829	840	827	935	933	n/a
Conv.=100%	116		119	114	116	121		114	108	
Gross margin(£/litres)										
organic	14.7	n/a	16.0	16.5	18.8	18.9	n/a	20.2	19.6	23.8
DECS	12.8	13.4	12.6	13.2	14.7	14.9	14.6	15.9	15.8	n/a
Conv.=100%	115		128	125	128	127		127	124	
Gross margin(£/ha)										
organic	1,375	n/a	1,358	1,303	1,537	1,601	n/a	1,584	1,406	1,913
DECS	1,147	1,273	1,191	1,242	1,416	1,587	1,600	1,768	1,602	n/a
Conv.=100%	120		115	105	109	101		90	88	

* last conventional year for organic farms; # 1997/98 relative to Year 0

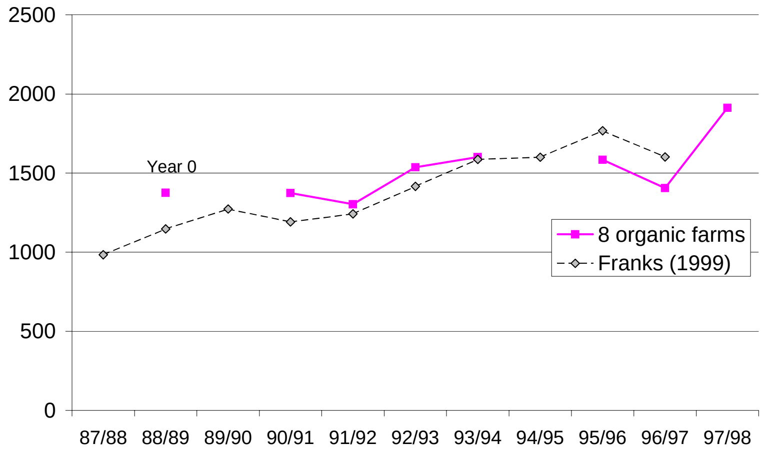
Source: Franks (1999) and own data.

Figure 8-5Comparison of dairy gross margin development per cow of eight organic farms with conventional data



Source: Franks (1999) and own data.

Figure 8-6Comparison of dairy gross margin development per hectare of eight organic farms with conventional data



Source: Franks (1999) and own data.

As the DECS did not cover the final year of case study data, Table 8-7 shows a comparison of the average DGM values of the case study farms (1995/96 to 1997/98) with data from Farm Income Report (MAFF, 1998, 1999). The organic case study farms have lower milk yields (10–13%), but – as a result of 10 to 40% higher prices – achieve similar or higher milk sales per cow. Total variable costs were 10–16% lower; particularly the costs concentrate feeding (15 to 30% lower). Allocated forage costs were also substantially lower (55–65%) reflecting the savings of the case study farms on fertiliser. Costs for purchased bulk feeds were lower in only two years, the higher costs in 1996/97 confirming the difficulties that several farms experienced with forage production in this year (see Chapter 7). Substantial differences between the case study farms and the conventional comparison occurred in the category of dairy sundries, but apart from charges related to milk marketing in one case, the data recording on most farms did not provide any further explanation for this difference.

Table 8-7: Average dairy gross margins for eight organic dairy farms compared with MAFF data (1995/96 to 1997/98)

		Organic (Av. 8 farms)			*Conventional*			*Relative (conv.=100%)*		
	Unit	*95/96*	*96/97*	*97/98*	*95/96*	*96/97*	*97/98*	*95/96*	*96/97*	*97/98*
Milk yield	l/cow	5,257	5,155	5,430	5,849	5,909	6,110	90	87	89
Milk price	ppl	27.57	27.74	29.69	25.00	25.03	21.28	110	111	140
Output	£/cow	1,527	1,465	1,655	1,411	1,419	1,256	108	103	132
Milk sales	£/cow	1,450	1,432	1,615	1,461	1,479	1,300	99	97	124
Net quota	£/cow	38	18	-48	-50	-54	-54	n/a	n/a	n/a
Var. costs	£/cow	465	456	374	514	486	447	90	94	84
Concentrate	£/cow	190	212	157	270	251	213	70	85	74
Purch. bulk	£/cow	16	21	9	37	15	10	42	139	87
Forage	£/cow	34	45	34	96	100	98	35	45	35
Vet	£/cow	29	29	31	36	37	34	90	90	90
Sundries	£/cow	196	149	140	74	85	89	265	175	157

GM	£/cow	1,062	1,008	1,281	897	933	809	118	108	158

Source: MAFF (1999) and own data.

Similarly the case study farms, once organically certified in the final years, achieved 10–20% higher gross margins per cow than the conventional average, apart from the last year, where margins on the organic farms were substantially higher again, mainly resulting from the widening gap in terms of milk price per litre.

Concluding remarks

Over the whole study period the dairy gross margins show an upward trend, but most farms experienced reductions and unstable development in the first years of conversion, before organic premiums were obtained. However, Farms 2 and 3 illustrate that continuous improvements of margins per cow right from the start were also possible.

The development of the average variable costs per cow did not show the expected decline. However, the lower increases in variable costs compared with conventional confirmed the potential to save costs through conversion, particularly in relation to allocated forage costs and costs of concentrates. The variation between farms was considerable, as was the category of concentrate costs and other dairy expenses, and this explained some of the difference between farms with highest and lowest gross margin values per cow.

Farms appeared to achieve high gross margins per cow through a combination of high milk yield, low concentrate use and low variable costs; the level of premium compared to other farms was of lower importance. Increases in the gross margin per hectare were lower than per cow (39% compared with 66%) reflecting the decline in stocking rates during conversion.

As a result of the organic premium, the dairy output per cow on the case study farms was at the end of conversion higher than conventional, despite lower milk yields. The case study farms had approximately 10–20% higher gross margins per cow in the later years of organic management.

The data from the case study farms confirm the importance of organic premiums for the financial success of converting dairy farms, but also illustrate that the financial success of organic milk production is not only influenced by the level of premium alone, by also by level of milk yield, other dairy output, variable costs and other dairy expenses. It appears possible that high variable costs on some farms may be a consequence of the particular marketing outlet and future financial recording on organic dairy farms should investigate this further. However, the gross margin data do not reflect changes in overheads and should therefore been seen in the context of the whole farm results presented in the next sections.

Whole farm output, variable and fixed costs

In this section whole farm output, total variable and fixed costs per hectare of the case study farms and the development of business health are analysed with regard to the influence of farm type, and to isolate conversion-related effects from general trends they are compared with conventional data. This supplements the sections on the dairy enterprise on the one hand and whole farm income development on the other by investigating one area that has so far received little attention in research in terms of the likely impact of conversion.

Key factors that appear to have influenced the development of output, variable and fixed costs on the individual farms were – apart from those identified in the previous section – restructuring of the farm enterprises and investment related to increasing stock numbers (Farms 1 and 5), investment and buildings not directly related to the conversion (Farm 9), and the employment of additional labour (Farm 3). On Farm 12, difficulties of separating farming-related fixed costs from costs for a non-farming enterprise make the quality of the data less reliable. The time series for the individual farms can be found in the Appendix 1 alongside short trend descriptions in Appendix 5.

Output and variable costs

Average output increased by approximately 30% across all case study farms over the whole study period (Figure 7-7). Output was higher and the increasing trend was more marked for the specialist than for the mixed farms, but statistical analysis of the data confirmed a significant difference between the groups only in two years (see Table 8-8).

Figure 8-7Development of average output (£/ha UAA) of eight organic grouped according to farm type (n=4 per group)

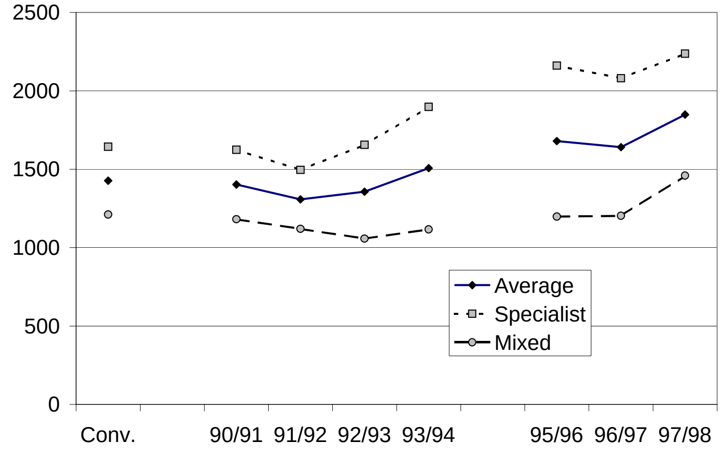


Table 8-8Development of total output and variable costs (£/ha) on eight organic dairy farms, grouped according to farm type (

	*Year 0**	*90/91*	*91/92*	*92/93*	*93/94*	*95/96*	*96/97*	*97/98*	*97/98 rel#*
Output (£/ha)									
All farms	1,427	1,402	1,308	1,357	1,507	1,680	1,641	1,848[a]	130%
Specialist	1,664	1,624[b]	1,496	1,656[b]	1,898[a,b]	2,161[a]	2,080[a]	2,237[a]	136%
Mixed	1,211	1,181	1,120	1,058	1,117	1,198	1,203	1,460[a]	121%

[a] significantly different from 90/91 at p=0.05 (LSD=226)
[b]significantly different from average of group mixed farms at P=0.05 (LSD=423)

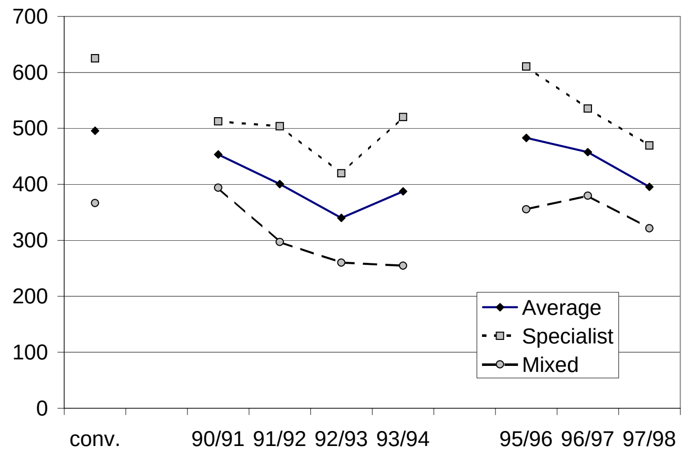
Var. costs (£/ha)									
All farms	496	453	400	340	387	483	458	395	80%
Specialist	625	512	504[b]	420	520[b]	610[b]	535	469	75%
Mixed	367	394	297	260[a]	255[a]	355	380	321	88%

[a]significantly different from 90/91 at P=0.05 (LSD=104)
[b]significantly different from average of group mixed farms at P=0.05 (LSD=194)

* last year of conventional management; # 1997/98 relative to Year 0.

The development of average total variable costs on the eight farms shows an overall reducing trend (by approx. 20%), a greater reduction than for variable costs of the dairy enterprise, a further illustration of the cost saving potential of organic management. However, the trend is far from steady, with an increase in variable costs between the first and second study period, before another period of reductions (Figure 8-8). The variable costs were in three years significantly higher for the group of specialist farms than for the mixed case study farms (see Table 8-8), indicating that farm type may be one factor with impact on the costs of organic production.

Figure 8-8Development of variable costs (£/ha) on eight organic dairy farms, grouped according to farm type (n=4)



Labour

In the literature review (Chapter 3) labour was identified as one farm resource that may potentially be affected by the conversion, although the available evidence on dairy farms was inconclusive. This was confirmed by several case study farmers, who said that the labour situation had changed and several farmers had appointed additional staff or were considering it – either students or trainees or full-time farm staff (see Table 8-10).

Some farmers attributed increases in labour requirements to changes in weed control and cow management, although with regard to the latter the opinions were contradictory. Bill (Farm 4), who found the cows to be a lot more work since the beginning of conversion, attributed this mainly to the drying off period and the need to monitor the cows regularly, while not using dry-cow therapy. Bert (Farm 10), on the other hand, found the work involved with the cows much easier after the conversion.

As far as the quality of work is concerned several farmers stated that they enjoyed their work and also that their farm staff were relatively happy to work on an organic farm, for example because of the reduced likelihood of exposure to sprays. The managers on the larger estates with responsibility for several staff saw their skills as important for the success of the whole conversion and highlighted the need to consider the staff training needs and to keep everybody well informed about changes.

The farmers' perception of increasing labour requirements was reflected in the use of labour in Annual Labour Units (ALU) per farm – based on an estimate by the farmer of the hours worked converted into the full time equivalents – which increased on average by approximately 20% during conversion, ranging 10–30% (see Table 8-9).

Table 8-9 Development of labour (ALU) and total labour costs (£/ha) on the case study farms

ALU	*Year 0**	*1990/91*	*1991/92*	*1992/93*	*1993/94*	*1995/96*	*1996/97*	*1997/98*	*97/98rel#*
Farm 1	6.5	6.5	6.5	6.5	6.5	6.9	6.9	7.6	117%
Farm 5	5	5	5	4.5	4.5	2.2	5	6	120%
Farm 7	2.3	2.3	2.3	2.3	2.3	2	2.5	2.5	109%
Farm 9	8.5	8.5	9	9	9		12	11	129%
Farm 2	1.5	1.5	1.5	1.5	1.5	n/a	1.9	1.9	126%
Farm 3	2.05	2.05	2.05	2	3.3	2.2	n/a	2.2	107%
Farm 11	4.5	5.5	5.5	5.5	5.5	n/a	5.8	5.8	129%
Farm 12	1.2	1.2	2.1	2.2	2.1	n/a	n/a	N/a	n/a
Average$	4.3	4.5	4.6	4.5	4.7	3.3	5.7	5.3	121%
Cost £/ha	*Year 0*	*1990/91*	*1991/92*	*1992/93*	*1993/94*	*1995/96*	*1996/97*	*1997/98*	*97/98rel#*
Farm 1	280	275	266	302	249	266	297	315	112%
Farm 5	252	239	254	260	273	455	338	317	126%
Farm 7	279	267	241	210	305	282	440	461	165%
Farm 9	266	349	361	432	480	362	388	494	186%
Farm 2	245	239	254	260	273	455	338	317	129%
Farm 3	151	183	217	177	365	412	461	292	193%
Farm 11	215	244	262	247	250	208	264	252	117%
Farm 12	254	349	361	432	480	362	388	494	195%
Average	243	268	277	290	334	350	364	368	153%

* last year of conventional management; # 1997/98 relative to Year 0; $ excluding Farm 12

Source: own data.

In addition, the total labour costs per hectare increased, on average by 53% (range 12–95%) (Table 8-9). The labour costs data per hectare include costs for casual and regular labour and notional charges for farmer and spouse labour. Differences from the trend of ALU per farm are explained by cost increases for paid labour, but point also towards the possibly that family labour (low notional value) was gradually replaced with paid labour at higher costs.

Fixed costs

Average fixed costs for all farms increased (Figure 8-9) by 26%. As for variable costs, the trend appears more marked for the group of specialist case study farms, but differences between the groups are not significant, apart from in one year (see Table 8-10).

Apart from the increase in labour costs referred to above, a further breakdown of fixed costs into cost categories (Figure 8-10 and Table 8-11) shows that general farming costs also increased (by 63%) whereas machinery costs declined by 6% over the same period. General farming costs include the certification charges and costs for advice. Other fixed costs, a category that includes rents, rates and other land-related charges, increased by 33% in the tenant type category. Total rent and interest charges declined between Year 0 and the 1997/98 data collection by 18% (see below).

Figure 8-9Development of fixed costs (£/ha UAA) of eight organic dairy farms, grouped (n=4 per group) according to farm ty

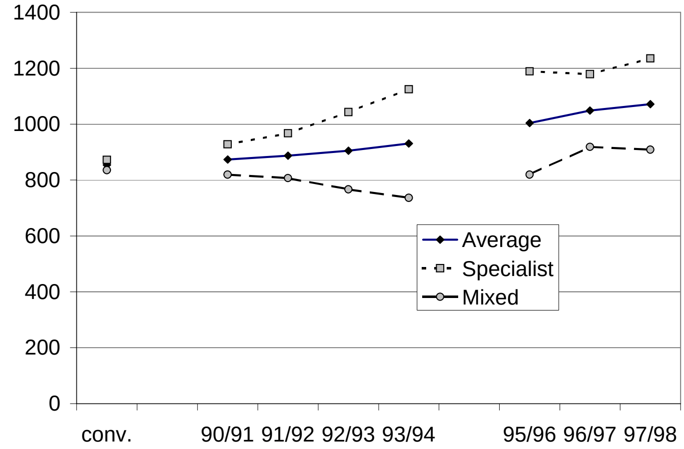


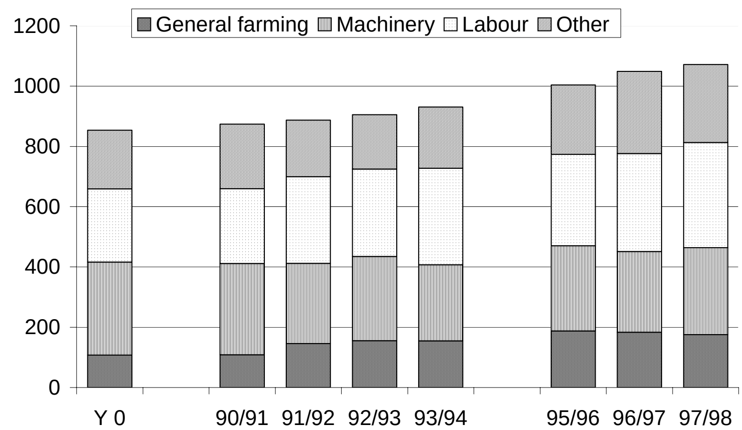
Table 8-10Development of total fixed costs (£/ha) on eight organic dairy farms, grouped according to farm type (n=4)

	Year 0*	90/91	91/92	92/93	93/94	95/96	96/97	97/98	97/98 rel#
All farms	854	874	887	905	931	1,004	1,049	1,072	126%
Specialist	873	928	967	1,043	1,125[b]	1,189[a]	1,179[a]	1,235[a]	142%
Mixed	835	819	807	767	737	819	919	909	109%

[a]significantly different from 90/91 at p=0.05 (LSD=206)
[b]significantly different from average of group mixed farms at p=0.05 (LSD=385)

* last year of conventional management; # 1997/98 relative to Year 0.

Figure 8-10Development of total fixed costs*, labour costs, machinery costs, general farming costs other fixed costs on eight o



* total fixed costs are represented by whole column

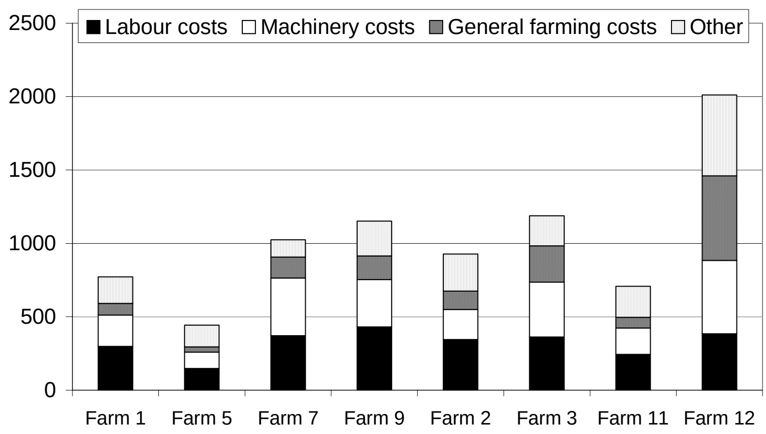
Table 8-11 Development of other fixed costs on eight organic farms, Year 0 to 1997/98

	*Y 0**	*90/91*	*91/92*	*92/93*	*93/94*	*95/96*	*96/97*	*97/98*	*97/98 rel#*
General farming	107	108	146	155	155	187	183	175	163%
Machinery	309	303	266	279	252	283	268	289	94%
Other	195	214	188	180	203	230	272	259	133%
Total fixed costs$	854	874	887	905	931	1,004	1,049	1,072	126%
Rent and interest	184	179	185	162	143	120	131	151	82%

* Last conventional year; # 1997/98 compared with Year 0; $including labour costs

The fixed costs on case study farms farm have been compared with each other on the basis of the averages of four years of organic management, showing substantial differences between the farms in all total fixed costs and between categories (see Figure 8-11). Farms 5 and 11 had lower than average fixed costs. Farm 12 showed values well above the average for all farms, which are likely to be related to the non-farming enterprise on the farm. Differences between the farms in terms of fixed costs were also related to farm size. A significant ($p=0.01$) correlation between farm size and fixed costs per ha could be established ($r^2= 0.3943$). This may also explain the observed difference in fixed costs between the group of mixed and specialist farms, as the former contains mainly large, the latter mainly small farms.

Figure 8-11 Average fixed costs for four years of organic management * (£/ha)



* total fixed costs are represented by whole column

Business health

The ratio of rent and interest (rent equivalent) as a proportion of total output was calculated using actual farm data as an indicator for business health (Griffis, 1988), because the net worth data did not appear to be reliable (see Chapter 4). All but two farms reduced this ratio during the conversion (see

Table 8-12) and improved business health, if judged by this measure. On the two farms where the value increased (Farms 5 and 9) considerable investment in buildings was undertaking during conversion. There was no difference in development of the ratio between the groups of mixed and specialist farms.

Table 8-12Development of rent equivalent as a proportion of total output on eight organic dairy farms (Year 0 to 1997/98)

Farm	*Year 0**	*90/91*	*91/92*	*92/93*	*93/94*	*95/96*	*96/97*	*97/98*	*97/98 rel#*
Farm 1	13	12	12	11	12	0	0	0	1
Farm 5	15	15	16	21	30	11	14	16	102
Farm 7	4	2	4	1	1	2	1	0	6
Farm 9	3	3	5	5	6	7	13	12	355
Farm 2	33	32	24	19	12	2	3	13	38
Farm 3	18	22	24	23	14	9	15	10	53
Farm 11	7	7	9	8	6	6	7	5	73
Farm 12	12	12	18	12	10	14	10	10	78
Average	13	13	14	13	11	6	8	8	62

* Last conventional year; # 1997/98 compared with Year 0

Source: own data.

Comparison of output and inputs with conventional data

To distinguish conversion-related from general trends, average outputs and input costs of all case study farms were compared with conventional data (MAFF, various years, see Table 8-13). Using the published data for England and Wales an average value for dairy farms in both regions was calculated and used for comparison. The specialist dairy study (DECS) from Manchester University, that was used in other sections, did not provide a breakdown of whole farm data into output and input categories. For completeness NFI data from this source are also presented in the Table, and are covered in more detail in the following sections.

Total output per hectare of the case study farms before conversion (Year 0) was comparable to the average for dairy farms in England and Wales in 1988/89 and showed similar increases of approximately 25–30%. However, the trend for the case study farm increased gradually, whereas the trend for the conventional farms increased more sharply until 1996/97 and declined thereafter.

Before conversion, the level of total inputs per hectare on the case study farms was substantially higher (35%) than the average for conventional dairy farms, which is likely to be a reflection of the different representation of farm types in both samples, as well as the particular situation of the case study farms. However, the more relevant comparison of the development trends of the two samples shows that total input per hectare increased over the same period (1988/89 to 1997/98) in both systems, but at a lower rate (10% compared with 40%) on the case study farms, confirming again the cost-saving potential of the conversion. Unfortunately the conventional data source does not provide data for the category of total variable costs. On the basis of the comparison of dairy variable costs (see above) it appears likely that a reduction in variable costs is one reason for the lower increase of total costs. Of interest also is the comparison of machinery and labour costs. Machinery costs and depreciation increased on conventional farms by about 30%, whilst the value on the converting farms declined. Labour costs increased in both samples, but at higher rate (approximately 20%) on the case study farms.

Table 8-13Input costs of eight organic dairy farms (average £/ha) compared with conventional data for England and Wales, 19

	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	97/98 rel#
Total output (£/ha)											
Case study farms	1,427*		1,402	1,308	1,357	1,507		1,680	1,641	1,848	130%
MAFF dairy	1,340	1,469	1,431	1,594	1,668	1,786	1,722	1,967	1,946	1,670	125%
conv.=100%	*107*		*98*	*82*	*81*	*84*		*85*	*84*	*111*	
Total inputs(£/ha)											
Case study farms	1,350*		1,327	1,288	1,245	1,318		1,487	1,506	1,467	109%
MAFF dairy	992	1,112	1,147	1,228	1,217	1,295	1,359	1,473	1,526	1,391	140%
conv.=100%	*136*		*116*	*105*	*102*	*102*		*101*	*99*	*106*	
Machinery & depreciation (£/ha)											
Case study farms	309*		303	266	279	252		283	268	289	94%
MAFF dairy	153	167	175	186	181	200	203	205	212	197	129%
conv.=100%	*202*		*173*	*143*	*154*	*126*		*138*	*126*	*146*	
Labour costs (£/ha)											
Case study farms	243*		268	277	290	334		350	364	368	153%
MAFF dairy	138	145	72	162	154	164	175	185	190	184	134%
conv.=100%	*176*		*372*	*171*	*188*	*204*		*189*	*192*	*200*	
NFI (£/ha)											
Case study farms	174*		175	121	216	299		304	240	454	261%
MAFF dairy	348	362	283	366	453	491	363	494	418	280	80%
conv.=100%	*50*		*62*	*33*	*48*	*61*		*62*	*57*	*162*	

* Year 0 =average for last year under conventional management # 1997/98 compared with Year 0 or 1988/89

Source: MAFF (1990-1999) and own data.

Concluding remarks

The results show that the conversion-related changes affected not only individual enterprises, but also the organisation of the whole farm. At the same time – illustrated clearly by the comparison of the data with average trends for the conventional dairy industry – the converting case study farms are also affected by the same factors that have an impact on the dairy industry in general. For example, the dairy industry experienced increases in output, which were also shown by the case study farms. In the case of labour all farms incurred increasing costs, but on the case study farms a greater rate of increase illustrated the impact of conversion on labour requirements and costs. On the other hand, trends in total input and machinery costs on the case study farms were clearly contrary to the industry in general, and therefore more likely to be mainly a result of conversion.

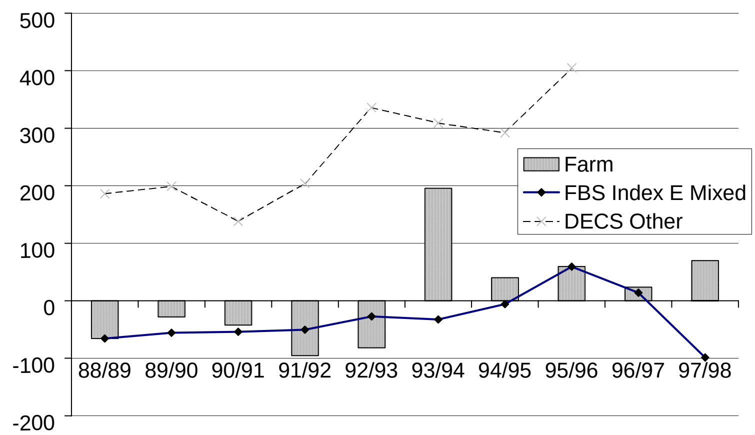
From the data it can be concluded that conversion may lead to increases in overhead costs in the categories of labour, general farming and other fixed costs. Planning of conversions should therefore include appropriate safety margins for these cost categories. On the other hand, converting farms can realise cost savings, as illustrated by reductions in the categories of variable and machinery cost, which would make a contribution towards maintaining income levels, even in the absence of price premiums.

Net Farm Income development on the case study farms

Empirical data in the literature were limited and inconclusive regarding the likely income development of converting dairy farms. Given the better suitability for organic conversion of more mixed systems, it appeared likely that mixed farms may achieve better incomes than more specialist farms.
This section presents the development of Net Farm Income (NFI) on each of the case study farms. NFI per hectare was chosen as the main income indicator for presentation of the trends and for comparisons between the farms and with conventional trends, because it allows a fair comparison of farms of different tenure and capital endowment. However, because NFI includes notional charges, it does not reflect the profit situation in the same way, as the farmer would experience it.
The income development of each farm is discussed in this section in the context of other indicators and for each farm a point at which the income development reached some stability is defined. Such stable income development was considered to be reached when farm income exceeded pre-conversion levels or, on farms with negative incomes during conversion, in the first year when income remained positive. The farms are further compared regarding their income levels under organic management, i.e. the outcome of the conversion on the basis of four-year averages. The NFI trend of each farm was further compared with two sets of conventional data (see Chapter 5.5.5): NFI projection based on the NFI index published by MAFF (various years) and data from Manchester DECS (Franks, 1999).
Farm 1 (mixed, large, staged conversion)

On this farm a small block of land was already organic in the first year of data collection, and the farm had a negative NFI to start with. Further reductions in the income values per hectare (1991/92) reflect increases in farm size, as well as the conversion of major blocks of land, increases in stock numbers and stronger integration between livestock and arable enterprises, including investment in fencing. The impact of the dairy enterprise on the total income of this farm was lower than for most other case study farms, due to the mixed enterprise structure. Income levels appeared to recover in 1993/94, but a further decline in output and increasing fixed costs led to further reductions, apart from 1997/98 when they again reached higher NFI values. Overall, the farm income development did not really stabilise during the study period, but remained positive from Year 5, more than 10 years after the conversion of first block of land. The average income under organic management remained relatively low compared with the other case study farms.

Figure 8-12 Development NFI (£/ha) of Farm 1 compared with conventional trends



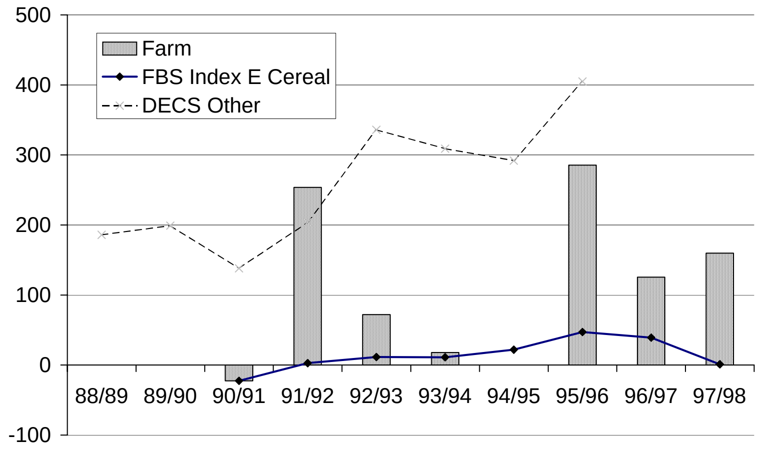
Source: Own data, MAFF (1999 and 1995/96) and Franks (1999).
The income development of Farm 1 was compared against the NFI index for mixed farms in England (see Figure 8-12). Assuming the farm income would have followed the NFI index if managed conventionally, the farm should have experienced increasing income until 1995/96, whereas actual income levels fell initially, while the hypothetical income should have declined thereafter, whereas actual income increased. Farm 1 showed considerably lower income levels per hectare than the category of other farms (non-specialist with dairy) in the DECS.

Farm 5 (mixed, large, staged conversion)

At the beginning of the conversion of this estate, a large area was put into five-year set-aside. The remaining land was converted with a focus on forage production for the dairy and beef and sheep enterprises, and the dairy herd itself was converted in 1994. In the second data collection period some land was gradually released from the set-aside programme and more income from cropping returned to the farm.

An initial increase in gross output and NFI in 1991/92 was caused by sales of the remaining conventional cropping output (see Figure 8-13) without associated costs for re-establishment of crops. After that NFI per ha on Farm 5 showed substantial reductions during the conversion period. Income levels appeared to have recovered in Year 5 (1995/96), but another decline followed in 1996/97. This coincided with reduced milk yields and reduced output from the dairy, while variable costs increased. Average values of NFI per hectare under organic management on Farm 5 were relatively low compared with the average for all case study farms.

Figure 8-13 Development NFI (£/ha) of Farm 5 compared with conventional trends



Source: Own data, MAFF (1999 and 1995/96) and Franks (1999).

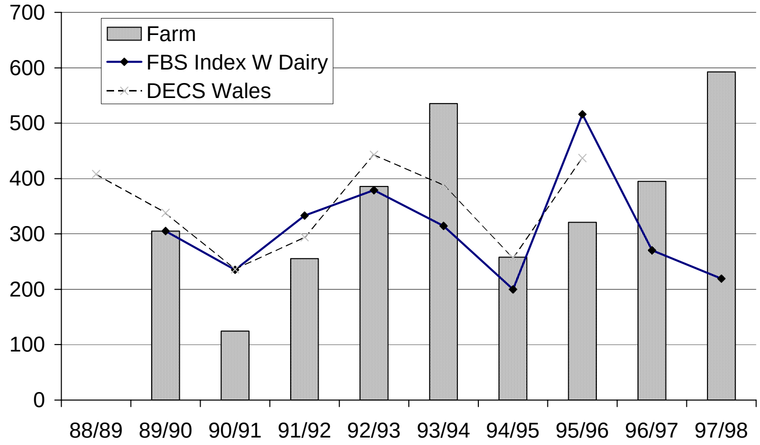
NFI of Farm 5 was compared with cereal farms in England, which was the correct classification for this farm, before, but not during or after, the conversion. The income development on the farm was very different from the conventional trend in the first years, but the low pre-conversion value of income implied a low multiplying effect on the index projection. Similarities were greater in the second study period, when the NFI declined in line with conventional data between 1995/96 and 1996/97, albeit values were substantially higher and – unlike the projection – actual NFI recovered in the following year. This illustrates that the conversion with major restructuring initially had a substantial effect on this farm.

Farm 7 (mixed, small, staged conversion)

Output values per ha on this family farm followed closely the development of the dairy cow gross margin per forage hectare (see Figure 8-1). NFI per ha on Farm 7 showed two short periods of decline between 1989/90 and 1991/92 and between 1993/94 and 1995/96 (see Figure 8-14). It is difficult to identify a point of income stability; a higher than pre-conversion income was, for the first time, reached in the third year. Despite ups and downs, the farm showed an increasing income trend and average NFI for four years under organic management was above the average for the whole group.

Although categorised as mixed in this study, Farm 7 was compared with the national average for dairy farms in Wales because the NFI index does not include a category of mixed dairy farms in this region. Until 1995/96 the income development broadly corresponded with the NFI projection and DECS data, although the farm experienced a more substantial income decline in 1990/91, which was more likely therefore to be attributable to the conversion. The data do not provide a clear explanation for the diverging income trend thereafter.

Figure 8-14 Development NFI (£/ha) of Farm 7 compared with conventional trends

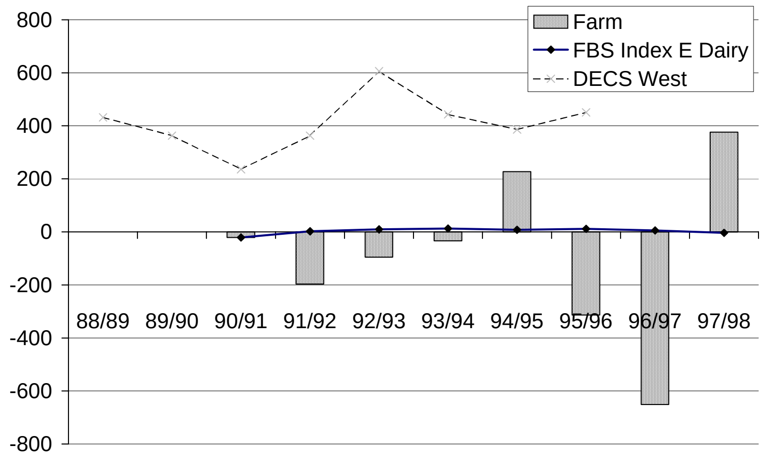


Source: Own data, MAFF (1999 and 1995/96) and Franks (1999).

Farm 9 (mixed, large, staged conversion)

Taken over by the current owner shortly before conversion, this farm was monitored during a period of major change. The initial two dairy herds were merged and moved into one new housing facility. Total output per ha on Farm 9 broadly followed the trend for the dairy cow gross margin per hectare (see Figure 8-1 and Appendix 1).

Figure 8-15 Development NFI (£/ha) of Farm 9 compared with conventional trends



Source: Own data, MAFF (1999 and 1995/96) and Franks (1999).

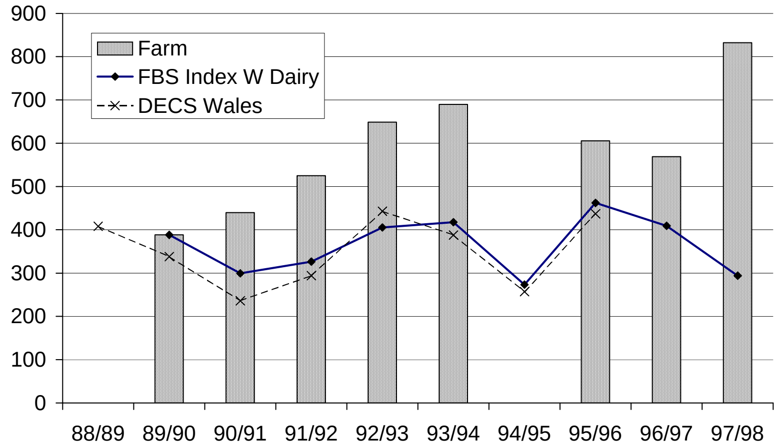
Variable costs declined in the first data collection period, but showed a substantial increase in 1995/96 and 1996/97, when fixed costs also increased. It is likely that both cost increases were related to the building work and move of the dairy. NFI per hectare on Farm 9 (see Figure 8-15) also showed an initial decline in the first and a substantial decline in the second data collection period. Average NFI values under organic management were negative.

Farm 9 was compared against the development of dairy farms in England. The low absolute value of income per ha before conversion had a low multiplying effect for the NFI index projection, but the DECS data give an additional comparison. The income development on Farm 9 was unstable compared with average income for dairy farms in England, which is likely to be caused by the structural changes. Positive income level in the last year (97/98) could indicate an improved situation after 7 years, but further monitoring would be necessary to determine the long-term impact of the conversion and organic management on this farm.

Farm 2 (specialist, small, staged conversion)

This specialist farm was of relatively low intensity compared with the other case study farms and had been taken over by the farmer and his wife two years before conversion began. The income development showed hardly any disruption during the staged conversion. Steady increases in income were due to reductions in variable fixed costs and increasing cow numbers (from 37 in 1989/90 to 45 in 1993/94). The farm achieved a high NFI under organic management compared with the other case study farms and the conversion did not lead to any loss of income, and arguable a point of stability was already reached in Year 1.

Figure 8-16 Development NFI (£/ha) of Farm 2 compared with conventional trends



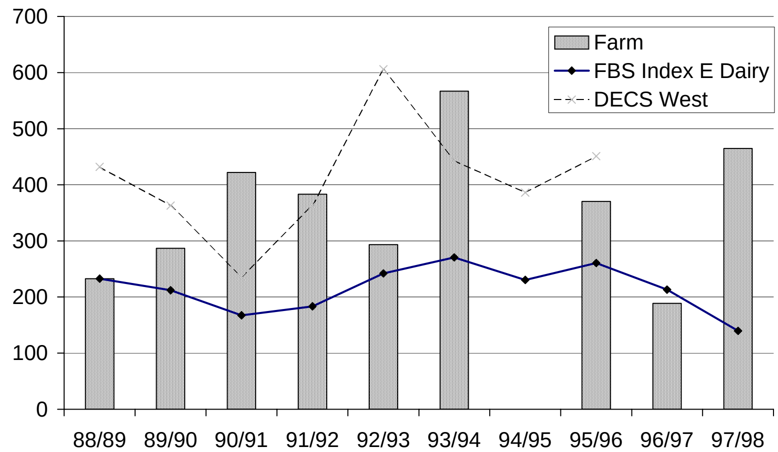
Source: Own data, MAFF (1999 and 1995/96) and Franks (1999).

Farm income was in all years substantially higher than the projected conventional income and the DECS data for dairy farms in Wales. In the first data collection period the farm did not mirror a general income decline. Particularly in the last two study years the income trends for this farm increased substantially, whereas conventional trend declined.

Farm 3 (specialist, small, staged conversion)

The initial income trend during the staged conversion on this tenanted farm was positive, but reverted between 1991/92 and 1992/93 when the farm experienced problems with feed shortages (see Figure 8-17). After recovery the income showed a further decline in the second data collection period, as a result of the continuous increases in fixed costs per hectare. As for Farm 2 it is difficult to identify one year as a starting point for stable income development; pre-conversion income was already exceeded in Year 1. Despite high average values for output and dairy cow gross margin the average NFI under organic management remained similar to the all-farm average.

Figure 8-17 Development NFI (£/ha) of Farm 3 compared with conventional trends



Source: Own data, MAFF (1999 and 1995/96) and Franks (1999).

Income trends were compared with dairy farms in England, and in most years the farm did better than a projected income. The comparison with the conventional farms also showed that the income increase in

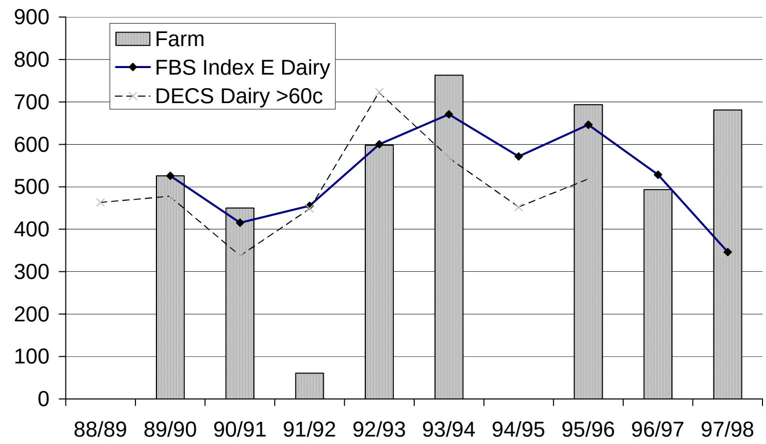
1990/91 and reductions in 1992/93, 95/96 and 1996/97 were not explained by trends in the dairy industry, and were likely to be caused by the system change.

Farm 11 (specialist, large, crash conversion)

On this farm all land (apart from a small block that had carried an organic vegetable rotation before) was converted in one year. Output reductions caused by feed shortages in the second year after conversion (1991/92) coincided with increases in variable costs for pasture improvement and purchases of forage, leading to a substantial income decline in that year (see Figure 8-18).

A period of recovery of income in 1993/94 due to increases in whole farm output did continue in the second data collection period. During this period the conventional pigs enterprise that was still producing some income in the first study period was given up.

Figure 8-18 Development NFI (£/ha) of Farm 11 compared with conventional trends



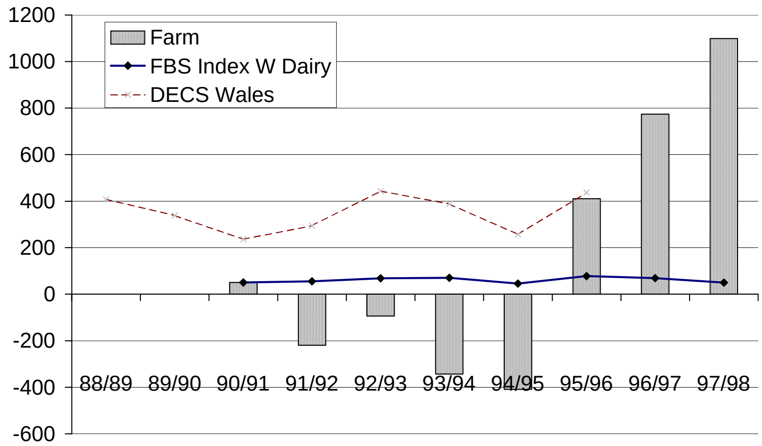
Source: Own data, MAFF (1999 and 1995/96) and Franks (1999).

Overall the NFI development per hectare followed closely the development of the dairy enterprise gross margin. Due to relatively stable development of fixed costs, pre-conversion income levels were exceeded in Year 3. The farm achieved the second highest NFI per ha under organic management. Income data for Farm 11 were compared against dairy farms in England, and the trends show some similarities, for example declines in 1990/91 and 1996/97, which are hence less likely to be related directly to the conversion.

Farm 12 (specialist, small, crash conversion)

This small, diversified farm continued dairy farming, but a non-farming enterprise increased in importance during the study period. The figures are likely to misrepresent the actual situation, because NFI does not include non-farming which was very important to the farm. Furthermore, it was difficult to separate the spending for other activities clearly from farming related costs, which explains large above average fixed costs values. The NFI (see Figure 8-19) was low compared with other farms and reduced even further during conversion, resulting in negative figures for several years. Pre-conversion income was for the first time exceeded in Year 5 (1995/96).

Figure 8-19 Development NFI (£/ha) of Farm 12 compared with conventional trends



Source: Own data, MAFF (1999 and 1995/96) and Franks (1999).

As with Farm 9 the low NFI values prior to conversion give a low multiplying effect for the index-based projection. The DECS comparison indicates that the farm was initially doing worse but recovered in 1995/96.

Concluding remarks

Most case study farms showed some income decline in the first years of the conversion and substantial increases thereafter, but income development varied considerably between farms.

The trends on the case study farms appear to be influenced by structural changes on some farms, such as changes in farm size (Farms 1 and 5), investment and restructuring (Farms 1, 5, 9 and to a lesser degree Farm 11), and increases in herd size (Farm 2). On several farms the income development reflects changes in the dairy enterprise, such as milk yield, dairy output and gross margin (Farm 2, 5, 7, 9, 11). This illustrates that factors identified as influencing the financial success of the dairy enterprise (milk yield, milk price, other dairy output, costs of concentrate feeds, other dairy costs) can have a noticeable impact on the whole farm results. For example, the income development on Farms 3 and 11 appeared to be influenced directly by feed shortage that, in the case of the Farm 11, was likely to have been related to the very rapid conversion of most of the land in one year.

Fixed cost increases explain the declining income values on four farms, but not all of these changes can be clearly attributed to the conversion. The manager of Farm 1 attributed fixed cost increases directly to the conversion, such as costs for additional fencing and buildings for increasing livestock numbers in the beef and sheep enterprises. On Farm 9 fixed costs changes were also related to investment in buildings, but the farmer did not relate this to the conversion. He saw it in relation to his recent 'taking over' of the farm. Fixed cost changes on Farm 3 were caused largely by the employment of additional labour, which is very likely a consequence of the conversion, whereas the situation of Farm 12 is mainly characterised by other non-farming activities, again not related to the organic conversion.

On several farms income trends correspond closely with the industry in general, illustrating that the income development of the converting farms are not in all cases fully attributable to the conversion process itself. For example on Farms 7 and 11 income declined in the second/third year of conversion in line with the industry in general, in both cases probably because of the weather, but the converting farms were affected by the decline to a higher degree.

The impact of the conversion on income development of the case study farms lasted between one and more than seven years. On several farms it was difficult to identify a point after which income development appeared to be more stable. The direct impact of conversion on income lasted longer on three large mixed farms (1, 5 and 9), which reached a point of some stability between five and more than 10 years after the beginning of the conversion. The direct impact seems to be shorter on the two small specialist farms (Farms 2 and 3) that showed no initial income decline at all, and had arguably already reached stability in the second year. The small mixed Farm 7 with a short staged conversion period and one large specialist farm with crash conversion (Farm 11) reached greater income stability in the third year of conversion. Farm 12, also with crash conversion, did not reach any income stability until the fifth year, although the non-farming enterprise may have overshadowed the impact of conversion to some extent.

Analysis of income development

Income development for all farms and for groups of mixed and specialist farms

The comparison of all-farm average NFI per hectare with pre-conversion level showed increases in most years after 1992/93 and was 60% higher than Year 0 in the final year (see Figure 8-20 and Table 8-14). The increase was more marked for the group of specialist farms, for which values after 1995/96 were significantly higher than 1990/91, and different from the average of the mixed group in 1991/92 and after 1993, which confirms some influence of farm type on the income development.

Figure 8-20Development of average NFI (£/ha UAA) of eight organic grouped (n=4 per group) according to farm type

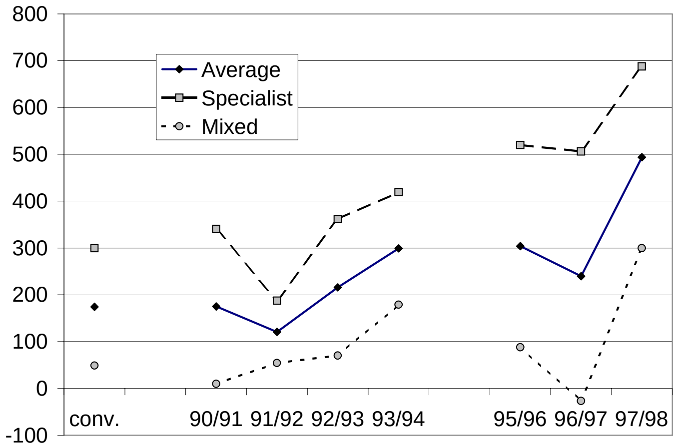


Table 8-14Analysis of averages of NFI development (£/ha UAA) of eight organic dairy farms grouped (n=4 per group) accord

	*Year 0**	*90/91*	*91/92*	*92/93*	*93/94*	*95/96*	*96/97*	*97/98*	*97/98 rel#*
Average	174	175	121	216	299	304	240	494[a]	261%
Mixed	49	10	54	70	179	88	-27	300[a]	611%
Specialist	299	340[b]	187	362[b]	419	520[a,b]	506[a,b]	688[a,b]	220%

[a]significantly different from 90/91 at p=0.05 (LSD =153)
[b]significantly different from average of group mixed farms at p=0.05 (LSD=287)

* last conventional year; # 1997/98 compared with Year 0.

The comparison of average NFI development per farm confirms a similar trend of steady income increases on the specialist farms (see Figure 8-21 and Table 8-15), but the difference to the trend per hectare also illustrates that size may be one influencing factor. Average incomes per farm for the mixed farms showed a decline after 1992/93 and were significantly lower in 1996/97 than in 1990/91. However, the differences between the two groups were not significant in most years.

It can be concluded that, apart from initial decline, the conversion led to increases in income. Farm type appears to be one influencing factor with specialist farms outperforming the mixed farms in most cases, but it is difficult to separate this from the effect of size on income values per hectare, as most of the mixed farms were larger than 200 ha.

Figure 8-21Development of average NFI (£ per farm) of eight organic dairy farms grouped according to farm type (n=4)

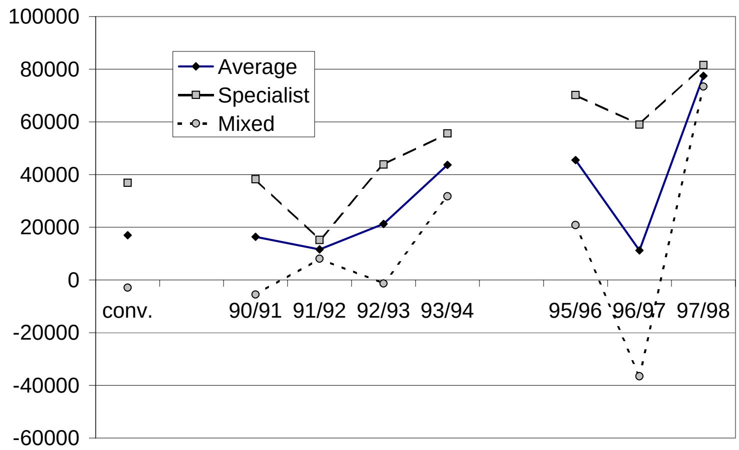


Table 8-15Analysis of averages of NFI development (£ per farm) of eight organic dairy farms grouped (n=4 per group) accordi

	*Year 0**	*90/91*	*91/92*	*92/93*	*93/94*	*95/96*	*96/97*	*97/98*	*97/98 rel#*
Average	17,006	16,369	11,621	21,245	43,679	45,504	11,200	77,483[a]	480%
Mixed	-2,902	- 5,525	8,063	- 1,370	31,726	20,834	- 36,563	73,394[a]	n/a
Specialist.	36,914	38,264	15,180	43,859	55,632	70,175	58,963[b]	81,573[a]	251%

[a] significantly different from 90/91 at P=0.05 (LSD=38,519)
[b] significantly different from average of group mixed farms at p=0.05 (LSD=72,063

* last conventional year; # 1997/98 compared with Year 0.

Analysis of organic income averages of farms with highest and lowest NFI

For a further analysis of factors influencing income levels under organic management (independent of size) the averages of three farms with the highest and lowest NFI per farm were compared with the total average (Table 8–16, for average values of the individual farms see Appendix 1).

The group with *highest NFI per farm* includes the two specialist Farms 2 and 11 and the mixed Farm 7 and is identical to the group of farms with the highest gross margin per cow. Compared with the all-farm average these farms are smaller, but have a similar stocking rate. Total output per hectare and dairy gross margins (per cow and per ha) are higher, and variable costs and fixed costs are lower, although the difference in labour costs is very small.

The group with *lowest NFI* (per ha and per farm) includes the three large, mixed Farms 1, 5 and 9 and is identical to the group of farms with low dairy gross margins per cow. Their average size is larger than the all-farm average, total output and dairy gross margin are lower than for all farms. Fixed costs are also lower, so that the low income appears to result mainly from a combination of poor productivity and higher variable costs, rather than higher fixed costs.

Table 8-16Comparison of farms under organic management (1993/94 and 1995/96 to 1997/98) for all farms with groups of fa

Farm No.	*Unit*	*Average*	*Top 3* 2,7,11,	*Bottom 3* 1,5,9
Size (approx.)	ha UAA	226	128	429
Stocking rate	LU/ha	1.52	1.52	1.42
Dairy GM	£/cow	1,073	1,235	903
Dairy GM	£/ha	1,624	1,860	1,257
Total output	£/ha	1,654	1,703	1,110
Variable costs	£/ha	428	386	305
Fixed costs	£/ha	1,028	887	789
NFI	£/ha	306	598	22
ONI	£/ha	245	614	-51
NFI per farm	£/farm	41,115	79,443	15,768
Rent and interest	£/farm	25,476	11,747	42,221
Labour costs	£/ha	323	320	292
Machinery costs	£/ha	287	259	215
General farming costs	£/ha	180	114	93
Rents, rates and other	£/ha	238	194	188
Rent and interest	£/ha	147	82	98

Factors influencing income variation

To investigate factors further that appear to explain some variation in income on farms their relationship to NFI was tested with a correlation, using the annual individual farms' data under organic management as observations (see Table 8–11). The significance was tested with the help of t-test. A highly significant (p=0.01) correlation could be established between the dairy cow gross margin per cow, the farm size (UAA in hectare) and the farm type represented by proportion of forage area (% of UAA), and the milk production from forage (MFF in litres per cow). The correlation between NFI per ha and milk from the farms' own resources (MFR in % of milk production per cow) was of lower significance (p=0.1), whereas between UME production (GJ per ha), the rent equivalent (RE), the stocking rate (LU/ forage ha) and fixed costs no significant correlation could be found.

Table 8-17 Relationship between NFI (£/ha) and other factors (31 observations, 1993/94 and 1995/96 to 1997/98)

	DGM	*Size*	*% forage*	*MFF*	*MFR*	*UME*	*RE*	*LU/ha*	*Fixed c.*
R^2	0.55	0.2408	0.2057	0.1953	0.0642	0.0477	0.0109	0.0003	0.0064
t-value	5.954	3.033	2.740	2.653	1.411	1.205	0.565	0.093	0.432
Significance	***	***	***	***	*				

Costs/gains of conversion

To establish the actual costs or gains of the conversion the annual NFI per ha of each case study farm was subtracted from the NFI Projections (see Figure 8-12 to 19). The conventional projection showed the farm income in the hypothetical situation of continuous conventional management. Table 8-18 shows the differences between the actual NFI values and the projections for three different periods: a three-year conversion period reflecting approximately a minimal conversion period of land and stock, a five-year conversion period reflecting the current length of support under the organic aid scheme, and four years of organic management showing the long-term impact of the conversion. Positive values represent costs, whereas negative values represent gains, i.e. better actual performance than project income.

For five farms (1, 7, 9, 11 and 12) the table shows costs during the first three years of the conversion: for three farms (9, 11, 12) this situation remained the same if costs were calculated for a five-year conversion period. For the final period of four years of organic management all but one farm achieved higher average incomes under organic and projected conventional management. Only Farm 9 sustained an even higher loss, due to the particular circumstances of investment in buildings, although on this farm also income levels in 1997/98 were higher than for the conventional projection.

Table 8-18Costs/gains of conversion for eight organic diary farms, based on difference between actual NFI (£/ha) and NFI pr

	Conversion strategy (steps)	*Conversion 3 years**	*Conversion 5 years**	*Organic 4 years**
Mixed farms				
Farm 1	staged (7)	**2**	–33	–102
Farm 5	staged (4)	–106	–39	–123
Farm 7	staged (3)	**61**	–20	–131
Farm 9	staged (2)	**117**	**91**	**162**
Av. Mixed		*18*	*–25*	*–48*
Specialist farms				
Farm 2	staged (3)	–194	–214	–278
Farm 3	staged (4)	–176	–175	–177
Farm 11	all at once (1)	**121**	**68**	–110
Farm 12	all at once (1)	**283**	**194**	–419
Av. Specialist		*8*	*–32*	*–246*
Av. All farms		*13*	*–29*	*–147*

***bold** shows costs, negative values represent gains through conversion
Source: Own data and MAFF (1999 and 1995).

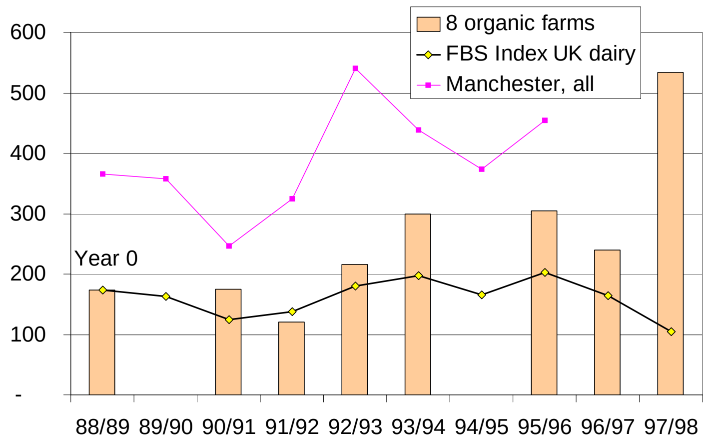
The results suggest that a rapid conversion strategy may be more costly during the conversion itself, as three of the farms with conversion costs in the three-year period and all three farms that incurred costs in the five-year period converted the whole farm in one or two years. However, for both of these farms with crash conversion special circumstances apply, and this result should not be over-interpreted.

Based on this calculation, it can be concluded that for most of the case study farms the decision to go organic improved income per hectare in the long term, although the majority of farms incurred some costs of conversion. The conversion represented an investment in the classic sense of the term. Assuming the farms would have converted later, payment rates under the organic aid scheme or organic farming scheme would have largely offset the calculated costs on all but two farms. Current organic aid scheme payments in England and Wales are £70–90 per hectare and year for improved land (depending on the IACS eligibility of the land) on average for a five-year payment period (Lampkin and Measures, 2001).

Average income trend compared with conventional data

The comparison of income trends of the individual farms highlighted in some cases similarities with the income projections and other comparative data, which are reflected in the trend for the all-farm average compared with the national NFI index for dairy farms (see Figure 8–22). The case study farms experienced a decline in incomes in 1991/92, when average incomes for mixed and dairy farms in England and Wales were moderately increasing, reflecting the impact of the conversion. The following periods of increasing income (1990/91 and 1993/94) and of decline between 1995/96 and 1996/97 corresponded with general trends. However, the case study farms did not mirror the continuing decline in conventional incomes in 1997/98, leading to a substantial difference in values in the final year of the study.

Figure 8-22Average income development (NFI in £/ha) of eight organic dairy farms in England and Wales compared with inco



Source: Own data, Franks (1999) and MAFF (1999 and 1995/96).

Concluding remarks

On most farms conversion led to improved income levels in the long term, but caused initial declines. As had been expected from the literature the comparison of NFI trends showed some influence of farm type. However–contrary to what had been expected on the basis of the principles of organic production favouring mixed enterprise structure–income values per hectare were higher and increased more steadily on the specialist farms. Apart from the larger size of the group of mixed farms, lower income values are likely to be a result of a greater tendency for further restructuring, compared with the specialist farms.

Apart from farm type and size, important profitability factors under organic management were identified as the dairy cow gross margin and milk production from forage. Farms with above average NFI per farm were identical to those with above average dairy gross margins and were characterised by below average variable and fixed costs, whereas low average NFI per farm appeared to be the result of poor productivity and low output per ha.

Summary and conclusions

The main aim of the financial monitoring was to assess the impact of the conversion process on the dairy enterprise, whole farm overheads and farm income, and to identify factors that influence the financial success during conversion and under organic management.

In Table 8-19 trends for some key parameters compared with conventional data are summarised. Most farms showed an initial decline in dairy output and gross margins early in conversion before premiums applied, which was in most cases reflected in the income. Later on during conversion, a combination of premiums and other output helped to compensate for the decline in milk production levels per cow and the dairy output per cow increased. Average variable costs in the dairy did not show the expected decline, but did not increase at a similar rate as on conventional farms either, while costs for concentrates were reduced. Together with the development of the conventional milk price this led to higher increases in gross margins per cow and per litre on the case study farms than for the conventional comparisons.

On average, conversion did not lead to substantial savings in total input costs, but increases were smaller than for the conventional averages. Some redistribution of costs between categories could also be observed: variable and machinery costs fell, whereas labour, general farming and other costs increased.

The income development showed some similarities with conventional trends, but an initial decline on the case study farms could be attributed to the conversion. A following period corresponding with general trends shows that the case study farms continue to be influenced by factors that affect the dairy industry, such as climatic conditions. The organic case study farms did not however mirror the income decline of the conventional dairy industry in 1997/98, which was caused by falling milk prices.

The majority of the case study farms (five of eight) incurred costs of conversion in the first three years, but three gained financially right from the start, if compared with a hypothetical income for continuous conventional management. It appears as if, at least in the short term, the rapid conversion strategy was more costly than the staged approach. Higher costs of this strategy were related to feed shortages causing additional expenses for purchased feeds and pasture improvement, but the potential benefit of earlier access to premiums could not be assessed on the basis of the case study data.

Under organic management all but one farm achieved better incomes than they would have done conventionally, based on a comparison of their income with a projection of the NFI index trend. Farm income for the one exception (Farm 9) was negatively affected by major investment in buildings during the study period. Initial costs of conversion can therefore be seen as a true investment in improved profitability of the farms in the long term. Had the farms converted after 1994 when conversion aid payments were introduced in the UK, the calculated costs would have largely been covered by the payments.

Table 8-19Summary of the trends of development for key parameters between Year 0 and 1997/98 compared with convention

		Case study farms	*Conventional*
Dairy output	£/cow	+47%	+25%
Dairy variable costs	£/cow	+10%	+23%
Concentrate	£/cow	-10%	+5%
Dairy GM	£/cow	+66%	+21%
Dairy GM	£/ha	+39%	n/a
Dairy GM	£/litre	+62%	+5%
Total output	£/ha	+30%	+25%
Total input costs	£/ha	+10%	+40%
Labour use	ALU/farm	+20%	n/a
Labour costs	£/ha	+53%	+35%
Machinery costs	£/ha	-6%	+30%
NFI per ha	£/ha	+160%	-20%

Source: Own data, Franks (1999), MAFF (1999).

Under organic management high gross margins per cow were identified as one important profitability factor on the case study farms. These were achieved by farms with above average production levels and low variable costs, particularly for concentrates but also dairy sundries. High dairy cow gross margins per cow appear to be related to high milk production from forage, whereas it is of lower importance financially whether or not the concentrate is grown on the farm. Other factors influencing farm income under organic management were farm type with, contrary to expectations, specialist farms outperforming mixed farms. It appears that declining stocking rates during conversion imply that the performance per cow becomes more important for the overall financial success of the system.

This chapter has provided some information on how key indicators of the financial performance of dairy farms are likely to be affected by the organic conversion and what factors appear to be influencing income development. In the next chapter the financial development of each farms will be set in the context of the personal objectives of the farmer and the process of conversion, before the results are discussed in the context of the literature in Chapter 10.

The whole farm conversion process and the role of information

Introduction

The aim of this research was to investigate the process of conversion to organic milk production and its impact on production and farm incomes, in order to identify converting farmers' information needs and to develop recommendations as to how these information requirements can best be met. In researching this question, it was necessary to establish a theoretical framework for the conversion process, drawing on existing concepts of farmer decision-making and change processes on farms (see Chapter 2). It was argued that in studying conversion, it is necessary to consider the farmers' subjective and personal experiences of conversion to organic farming as well as the personal, farm-specific and external context. The empirical research was conducted through eight case studies. The in-depth investigation of the conversion process on each farm referred to a simple three-stage process, information gathering, trial/evaluation and adoption, until a stable new organic farming system is achieved. The research focused in particular on the second and third stages and on personal and farm-specific variables, which were reported in Chapters 6 to 8. In this chapter the human, production-related and financial aspects within which the case study farms were studied are brought together and contrasted with the theoretical model.

In Section 9.1, the motivations and objectives, the decision-making process and the experience of the conversion process of each individual farmer or manager (Chapter 5) are contrasted with the development of some of the physical and financial indicators (Chapters 7 and 8) from each farm.

These case-specific accounts of conversion are then compared with the theoretical framework that was developed in Chapter 2. Section 9.3 explores relationships between attitudinal and farm-specific variables by setting the physical and financial performance of each farm relative to the group average in the context of the farmers' goals and personal attitudes, whereby different personal orientations of the farmers are clearly identified. Section 9.4 compares the various actions on the case study farms during conversion with the key stages of the conversion process and their function.

The final Section 9.5 uses the concept of the key stages of conversion to consider the nature of the information requirements and the farmers' preferences for information sources, and summarises specific areas of technical and financial information requirements that had been highlighted in the previous chapters. This forms the basis for recommendations regarding the provision of information for converting dairy farmers that are presented in the final chapter of the thesis.

The physical and financial results of the case studies in the context of farmers' perspectives

Farm 1

On Farm 1 the main motive for the conversion was the owner's general environmental concern, which resulted in a vague preference for sustainable agriculture or biological agriculture. William (the manager) shared this critical view of some aspects of conventional agriculture, although he considered himself to be firmly rooted in agriculture and saw the conversion as a challenge to his skills.

The farm conversion process began in 1981 with a small experiment on a block of land to evaluate the feasibility of growing organic crops. The next significant step was not taken until 1988, when more land was converted, followed by the livestock enterprises, first beef and sheep, than the dairy herd. The final decision to convert all remaining land was taken in 1991.

William's objectives at the time of interview were balanced between the four categories of technical, financial, diversity and lifestyle-related statements, leaning slightly towards income and lifestyle.

At the end of conversion, the farm had below-average milk yields, combined with a relatively high use of concentrates, and was in the category of farms with the lowest dairy gross margins. In achieving financial objectives, the conversion of Farm 1 cannot be considered as entirely successful. According to the manager, the low and sometimes negative NFI can to a degree be attributed to diversification and the high and rapid depreciation charge of some new investments in livestock housing and fencing to accommodate increasing stock numbers.

Farm 5

On Farm 5, the decision to go organic also goes back to one of the owners, who, with the help of a feasibility study, convinced the family partnership that this was the right way to go. His motives were similar to Farm 1; general environmental and personal health concerns resulted in a preference for sustainable agriculture. In his case this was combined with a strong interest in direct marketing. Nick, the manager, saw conversion as a challenge, but like William was also concerned about losing friends in farming.

The feasibility of a conversion was assessed theoretically prior to implementation and then planned carefully with input from the OAS. However, not all aspects were strictly implemented, for example the dairy herd conversion had initially not been planned until organic cereals would be available from the farm itself, but was moved forward to 1994 as marketing opportunities arose. In his objectives the manager was leaning towards technical improvements and further diversification and direct marketing, but financial objectives were also quite important.

Farm 5 did not fully achieve the technical objectives, at least as far as the dairy herd is concerned, where the farm also fell in the category of farms with very low dairy enterprise gross margin. Similarly, the financial objectives cannot be considered as fully achieved. The farm's NFI was also low during most of the conversion period, apart from one year where the remaining output of the conventional arable enterprise was sold. The use of the five-year set-aside premium for some land helped in reducing the costs of conversion. Clearly achieved was the objective of greater diversification.

Farm 7

This small family farm with mixed enterprise structure is owner-occupied. Luke and his wife had bought the farm about 20 years prior to going organic, after his agricultural degree, because they liked the lifestyle and farming. Apart from the dairy, the farm has sheep and grows cereals and potatoes. Luke had always preferred a more mixed farm structure and had been thinking about environmentally friendly farming for some time. The likely premium for organic milk made him consider more seriously, before a visit to an organic farm and his own calculations convinced him that this was the right way to go. Luke planned his staged conversion carefully with the help of an organic advisor, revising and refining himself the planned rotation and cropping.

His interest in issues of production is reflected in the high scores he gave to the statement about crop production, but more important was his desire to have less work, whereas financial issues and diversification were not so important to him. Luke was very concerned about maintaining links with the local farming community (e.g. active member of the grassland society) and would clearly have preferred to have organic advice available locally.

The staged conversion was made more difficult by dry conditions in the first year. Luke had underestimated the loss in forage production during conversion and had to purchase forage for the first time in many years and, because he was nervous about the late spring growth, he also applied synthetic N-fertiliser on one field.

Despite the low score for the objective of further improvement of livestock production, the farm had the highest average gross margin per cow, per hectare and per litre. The low score can possibly be explained by the fact that the farmer thought he had achieved a good performance already. Compared with the other farms under organic conditions, the herd had the highest average milk production and the lowest concentrate use. In milk production from forage, the farm substantially outperformed all other farms (4500 litres per cow on Farm 7 compared with an average MFF of 3300 for all eight farms) and had the highest level of milk production from the farm's own resources (92%). Probably because of the moderate stocking rate of approximately 1.6 LU/ha, the farm was able to compensate for weather-related forage yield losses without experiencing a similar loss in dairy gross margin as was experienced by Farm 3 when forage production declined.

This strategy of relatively cheap milk production from forage (with average variable costs of less than £300 per cow over the last four years) seems to have paid off financially, as the farm was among the three farms with the highest NFI per hectare. As a result of the decision to go organic, the farm incurred some income penalty in the first two years, but clearly benefited financially thereafter, which coincides with the financial motivation that the farmer expressed for the conversion, alongside more general environmental concerns.

Farm 9

This large mixed family farm with a large dairy herd was taken over by Daniel very shortly before he decided to convert the whole farm, although he had some organic experience from the small vegetable enterprise of his brother. As prime motives for conversion he mentioned suitability of the farm, in terms of structure and financial stability, alongside the challenge and general environmental concerns.. Like William (F1), Nick (F5) and Luke (F7), he was concerned about maintaining links with the local agricultural community, and he was the only one of the case study farmer who continued to use regularly a specialist dairy consultant. Daniel was very critical of the attitude that some people in the organic movement expressed towards conventional farmers. He enjoyed growing a range of forage crops including fodder beet, but was concerned about dock control and wanted to maintain a tidy farm.

The farm was categorised as mixed in the study, but the dairy herd remained clearly the most important source of income throughout the conversion. Compared with other mixed farms, Farm 9 was converted relatively fast, in two steps, although the impact of the process was felt for several years thereafter. It had been stocked relatively low prior to conversion, at less than 1.5 LU/ha, and did not suffer feed shortages throughout the conversion. After a relatively low income during conversion, the income improved in 1994/95.

Daniel considered all production-related objective statements as important, alongside the improvement of marketing and income (income had not been mentioned as a motive for the conversion), but had no interest in further diversification. The high score for livestock production corresponded with the physical production data; the farm achieved the second highest milk production per cow, but the relatively high concentrate use (0.24 kg/l) meant that not only was milk production from forage low, but so was milk production from the farm's own resources. Combined with high variable costs and quota transaction costs this led to very low dairy gross margins per cow.

During the study period Daniel decided to merge the two dairy herds into one and move the cows into new purpose-built facilities. With this merger the farm had one of the largest organic dairy herds in the UK and Daniel seemed to enjoy the publicity that came with this. The building of the new dairy was partly financed by the sale of milk quota, which limits the comparative interpretation of the financial figures. For example, in the calculation of costs/gains of conversion the farm suffered a greater financial penalty also under organic management than in the first three years of conversion. Improved income in the final year may indicate that the decisions will pay off in the long run, although it is clearly too early to say.

Farm 2

Harry and his wife Sue bought this small, specialist family farm after the sale of their smallholding, because they enjoyed the lifestyle of farming as a profession. They mentioned general concerns for the environment as the main reason for their conversion, and because they felt that the farm structure was very suitable for this type of extensive, clover farming, neither of them mentioned any financial motives. The farm was converted in three years, first the grazing land, followed by the silage land in two stages. Growing silage organically was for Harry the test that the system would work on his farm.

Technical and lifestyle-related objectives were fairly well balanced, but overall Harry appeared not very ambitious and the further improvement of farming income was of low importance. Only the improvement of crop production was considered as of importance. These low scores correspond with the extensive way in which the farm is managed. Under organic management the milk yield was close to the average of all farms, with relatively low concentrate use. Harry grew some, but not all, of his own concentrates, so that milk production from the farm's own resources was above average. On average over four years of organic management, the farm had the lowest variable costs per cow and per litre, and was among the three farms with the highest gross margin per cow and per litre. Despite the lack of economic motives, the decision to go organic was highly profitable for the farm, which did not face any conversion-related income penalty. However, Harry and Sue perceived the labour situation on the farm as unsatisfactory and they were trying to find alternative solutions so they could spend more time with the family. Higher spending for employment is the main reason for declining incomes in 1995/96 and 1997/98.

Farm 3

The couple on this tenanted, medium-sized specialist dairy farm decided to go organic because of a general commitment towards environmental issues, a dislike of sprays, the likelihood of an organic premium for the milk and personal health problems in the family. The decision was made despite what they considered to be relatively high borrowings (pre-conversion the farm had a rent equivalent (RE-ratio) of approximately 18% of output). To avoid any unnecessary risks and to keep their options open, they planned a staged conversion with the help of an advisor, not making a final commitment until, in their eyes, the conversion of the first plot of land had been successful. Due to output reductions the RE ratio rose even further in the first three years of conversion, but increases in output at a later stage and the transfer of the loans to an ethical bank, where they qualified for a lower interest rate because of their organic status, made the payments far more manageable.

Before doing it, the family had associated going organic with the development of direct marketing. In the interview both spouses considered all production and financial objectives as very important, which was followed by diversification of marketing, whereas lifestyle-related goals were less important. The diversity of the farming system increased in the final year through the introduction of home-grown cereals into the rotation.

The couple's dedication towards production, possibly influenced by high rent and the need to service the overdraft, corresponded with relatively high production indicators compared with other farms. On average in the last four years of organic management, the farm had the highest stocking rate and second highest milk yield per cow and was among those with the highest dairy GM per forage hectare, but not per cow. However, the farm suffered problems with forage production due to slugs and because of the high stocking rate had to maintain production with a relatively high input of concentrate of 1.2 t per cow, for which the farm paid the highest average concentrate price, resulting in the highest spending on concentrates in the last four organic years.

Farm 11

Walter, the dairy farmer of this family partnership, was attracted to conversion by the likelihood of a premium for milk, but had been aware of organic farming through the vegetable enterprise of another partner on the farm for several years. He saw conversion as a challenge to his skills, and converted the remaining land in one step, apart from the pig enterprise, which was later given up. Walter was hoping that early access to herd certification and premiums would pay the transition costs and ignored several warnings against such a rapid conversion. The gamble went wrong, the premium did not materialise and the relatively low rainfall in the first year of the conversion, together with the lack of preparation of the land in terms of clover establishment, led to severe feed shortages in the first year. These were clearly reflected in the income development in the second year of conversion, where increased variable costs for purchased feed and forage to make up for the shortfall coincided with spending on clover seed and lime and P&K fertiliser, in order to improve the productivity of the grassland in the longer term.

Despite all this, Walter was quite relaxed and did not consider it very important to improve crop or livestock production. The most important objectives for him were related to lifestyle and diversification. This is reflected in an average milk yield per cow, but stands in slight contrast to the fact that the farm was among the three with the highest gross margin per cow and per hectare in the four years of organic management, mainly because of relatively low variable costs for milk production.

Walter thought it most important to have more time for the family and to have less work. He also considered it to be important to improve the marketing of his milk, which is clearly explained by the lack of market outlet for organic milk at the time of the interview. The intention to diversify further, or possibly even develop processing on the farm, was explained by Walter as aiming for a similar idea to the vegetable box scheme of his brother. This was not realised throughout the study period, but the milk was sold at a premium in the second data collection period.

Farm 12

On this small, owner-occupied family farm, the dairy was the largest enterprise pre-conversion, apart from non-farming diversification into agri-tourism. The farmer became interested in the possibility of conversion through contact with the local homoeopathic vet who facilitated contact with other organic producers, one of whom had just set up a cheese-making enterprise. Eric was concerned about the health of his cows, and was also motivated to convert by financial concerns and an interest in developing direct marketing. The whole farm was converted in one step, planned with the help of an organic advisor, who suggested that the low intensity of N fertiliser use prior to conversion and the well-established clover would allow a very rapid conversion.

For this farm the conversion strategy worked well and no feed shortages were experienced. The most important objective to Eric, the farmer, was to improve the marketing, which corresponds very clearly with the development of a farm shop, cheese-making and on-farm tourism. Second most important to Eric was to have more time for the family. This is not surprising given the likely workload due to the diversification. Improvement of the crop and livestock production came in third place, which corresponds relatively well with the performance of the dairy herd. The average milk yield for the four years of organic management was the lowest of all farms, despite the second highest use of concentrate per litre. Financially, the farm made up for it through an above average price and high income from quota leasing. The dairy cow gross margin per cow was similar to the average for all eight farms; per litre it was among the highest for all farms. The net farm income does not show the farm development very well, because the income from the tourist enterprise is not included, whereas some of the tourist-related expenses that could not properly be isolated from the farming business are included.

Interactions between personal and farm-specific variables

It was argued in Chapter 2 that the conversion process is influenced by three categories of variables–personal, farm-specific and external. In this section the relevance of this categorisation for the determinants of adoption is discussed on the basis of the case study farmers' motives and reasons for conversion to organic farming.

In Chapter 2 it was also shown that organic farmers differ in their objectives and personal attitudes, and cannot be regarded as one homogeneous group. It was further argued that these differences are likely to lead to different choices in farming practices (similar to styles of farming that were established among conventional producers), but among organic or converting farmers a link between attitudes and farm management, which could have implications for the information requirements, had not been investigated. The search for such interactions between the personal motivations for conversion, the farmers' attitudes and the conversion of the case study farms is the aim of this section.

Determinants of organic production

Although variables determining the conversion decision were not a main focus of the study, the farmers were asked in the interview what had prompted their conversion. Most farmers quoted general environmental and specific concerns about the impact of conventional agriculture, as well as a number of personal preferences (see Chapter 6). Similar to other studies, this confirms that farmers with concerns about the environment are more likely to be interested in organic production. However, several farmers had expressed that they had been interested in organic conversion for some time before they converted. Such general statements did therefore not appear to represent the main reason for the conversion decision at the time when it was taken. Motivations that appear to represent the important triggers of the actual conversion decision can be grouped using the categorisation of variables that was proposed in Chapter 2:

- **External factors,** e.g. the likely availability of a premium for organic milk;
- **Farm-specific circumstances**, e.g. the taking over of the farm or problems with animal health;
- **Personal circumstances**: e.g. being accused of spray drift, personal health, growing confidence in the system.

The perception of a change in external circumstances, in particular the likely availability of an organic premium for milk, was a very important trigger of the conversion-decision for the majority of the case study farmers, which coincided in several cases with changes in personal attitudes or circumstances. This confirms that the decision to convert the farm at a particular time is triggered by changes in one or more of the three domains.

Interaction between personal attitudes and farm development

The results of the interviews (Chapter 6) showed considerable variation both in terms of motives to convert the farm, and in attitudes to farming. Their discussion in the context of the production-related and financial results of each individual farm in the first section of this chapter highlighted similarities and differences between the approach to conversion and to organic farm management. These are further analysed in this section, which contrasts attitudes with actual farm results.

For this analysis the farmers' objectives as represented by the scores given to the attitudinal statements were grouped in the broad categories of financial, production-related, diversification, marketing and lifestyle-related objectives. These were compared with a selection of farm indicators related to the same categories. The analysis is an attempt to establish whether the apparent relationship between the farmers' objectives and the farm development in the qualitative farm description (9.1) can be confirmed in a more formal way. However, the analysis is explorative and does not intend to prove firmly any cause and effect relationships.

In Table 9-1 scores to attitude statements are compared with farm indicators under organic management (based on four-year average values unless indicated otherwise). All farm indicators are expressed as relative to the average for all case study farms as a reference point. In the financial category the scores of each farmer to the attitude statements 'increase our income' and 'have less financial worries' are compared with average Net Farm Income per hectare and the business health indicator (RE-ratio) expressed as a percentage of the all-farm average. In the production category the average scores for statements 'improving crop and animal production' are contrasted with key indicators of farm production, such as relative milk yield, UME production and dairy cow gross margin. Scores for the statements 'diversify the farming business' and 'process on farm' are set against indicators of land use and output diversification, the forage area and dairy output as a percentage of the total area and output respectively. The score for 'improve marketing' was set against the average milk price that represents in a way the success of each farmer in securing a premium market. In the category of lifestyle the scores for the statements 'have less work' and 'more time for the family' are compared with labour use (ALU/per hectare) and labour costs (The farms are grouped according to what appear to be the two most important objectives in relation to the farm development (see Table 9-1).

Table 9-1Farmers/manager objective scores, by category, compared with related performance indicators under organic manage
(all- farm average = 100%)

Driving objectives	*Production and Marketing*		*Diversification and Marketing*			*Diversification and Low cost*	*Low cost and Lifestyle*	
Farm No.	*9*	*3*	*1*	*5*	*12*	*7*	*2*	*11*
Av. score financial	***4.7***	***4.5***	*4.0*	*3.0*	*3.7*	*2.0*	*1.8*	*2.3*
NFI per ha	24%	87%	3%	39%	124%	122%	**178%**	**174%**
RE as % of total output	91%	147%	40%	182%	129%	**10%**	79%	**62%**
Av. score production	***3.7***	***5.0***	***3.7***	***3.7***	*2.7*	*2.7*	*2.7*	*1.7*
Technical indicators[b)]	**106%**	**108%**	97%	81%	94%	**114%**	98%	99%
Dairy GM per cow	76%	101%	96%	88%	99%	**115%**	**119%**	106%
Av. score diversification s	*0*	*2.5*	*2.5*	***3.5***	*2.3*	*0.5*	*0*	***4.0***
Specialisation indicators[c)]	82%	120%	**77%**	**67%**	99%	92%	127%	113%
Av. score marketing improvement	*4.0*	***5.0***	*4.0*	*4.0*	***5.0***	*2.0*	*1.5*	*4.0*
Milk price	**107%**	103%	95%	103%	**106%**	99%	96%	93%
Av. score lifestyle	*2.8*	*4.0*	***4.5***	*1.3*	*3.0*	*3.5*	*3.5*	***4.5***
Labour use and wages[d)]	**118%**	104%	97%	43%	n/a	**126%**	**122%**	73%

a) 4-year averages unless state otherwise
b) Average value of milk yield and UME production relative to all-farm average
c) Average value of forage area as % of total UAA and dairy output as a percentage of total output relative to all-farm average

d) Average value of ALU/100 ha in the final year and labour costs per hectare (4-y av.) relative to all-farm average
The two or three farms with highest score/best performance in each category are highlighted in **bold.**
Source: Own data.

As the table shows, variation in farmers' attitudes appears related to personal objectives appear to reflected in the performance of the farm's at the end of the study period and the farms have been grouped according to main objectives that appear to be most strongly related to the farms performance. The objectives could therefore be considered as representing the key orientations of the farmer. While grouping the farms, the overall impression of each farm obtained through the study was considered alongside the answers to the pre-formulated attitudinal statements.

Farms 3 and 9 share the strong dominance of production and marketing-related objectives for the overall development, although the farms differ regarding diversification. The production goals are in both cases (but to a varying degree) achieved at the expense of income, which contrasts with and may be an explanation of the importance attributed to financial objectives. In the case of Farm 9, the scale of production (size of the herd) was also important to the farmer. In both cases the relatively poor income situation was explained as being due to special circumstances (problems with forage crops and investment in buildings). In both cases the strong orientation towards marketing is associated with above average milk prices, although in the case of Farm 3 the desire for the development of direct marketing was reduced as organic outlets became available.

The owners of Farms 1 and particularly Farm 5 are clearly committed to and achieved further diversification of their large farms during conversion. In the case of Farm 1, the process was already far advanced at the time of interview and is therefore no longer reflected in the statements. Both farm managers express a relatively strong orientation towards technical, income and marketing improvement, but most of these are not fully achieved, making the objectives of diversification and marketing the most dominant ones for farm development.

The situation is in many ways similar on Farm 12. On this farm the low score of diversification is explained by the fact that the farm is an example of diversification into non-farming rather than farming enterprises (not reflected in these attitude statements) and the farmer did indeed consider direct marketing and on-farm processing as very important. However, the indicators based on FBS-style reporting exclude non-farming activities and do not capture this whole farm system very well, so that the classification is extremely tentative.

Farm 7 conformed to the 'ideal' of an organic farm already with a diverse structure prior to conversion, to which the owner is clearly committed. This is accurately reflected in his answers, as no *further* diversification of the farm was needed. Also not well reflected in the answers to the pre-formulated statements is the farmer's strong orientation towards farm-based production. The balance between various enterprises leads to above average technical and financial performance, which may be the reason why the farmer considers further technical improvements as not so important. However, the relatively high score that the farmer gave to lifestyle-related objectives and the levels of labour requirements (143% of all farm average for this indicator alone) indicates one potential limit of this farming system, the above average labour use.

The owners of Farms 2 and 11 share, despite differences in farm and herd size, the preference for an extensive, low-cost dairy production system. For both, lifestyle-related goals are relatively important, less so technical and financial goals. However, both farms achieve (despite relatively low milk prices) above average incomes. The owner of Farm 11 is particularly proud of his extensive system that allows him to produce milk cheaply and leaves him time for family and hobbies. His high score for marketing is related to the lack of premium at the time of interview, which the farmer achieved in the following year.

It is important to recognise the tentative nature of the categorisation as the analysis is weak in several ways. The table is based on a comparison between attitude statements with farm indicators whereby the decision which indicators are related to what objective was taken by the author. The case study farmers', however, could have interpreted the attitude statements in a different way as the objectives referred to could have had a different meaning to each of them. Furthermore, objectives of high priority may be a consequence of the farms performance at the time and existing problems rather than a principal orientation of the farmer. Thus, below average farm performance in a particular area may not necessarily be indication that farmers' with certain expressed objectives have failed to achieve them, but rather that the objectives arose because of the farm situation. It should therefore not be over-interpreted that not all categories of objectives appear to have an equally strong correlation with the management and development of the farms.

Given the limits of this analysis only tentative conclusions can be drawn. The key personal objectives that drive the development of the case study farms can be summarised as follows:

- Diversity and diversification;
- Dedication to production (regarding level, intensity, herd size);
- Low cost and low input production (extensification);
- Marketing;
- Lifestyle.

It appears as if on none of the case study farms was the development driven exclusively by financial or income orientation. Although the improvement of income was considered to be important, particularly on those farms with below average NFI, the objectives of diversification and dedication to high levels of production appeared more important that income-related ones. Related to farm income is also the objective of the improvement of marketing, which was associated with above average milk prices, but did not automatically translate into better incomes. The farms that achieved above average incomes are mainly those with low-cost and farm-based production orientation, but did not attribute great importance to the financial objectives, possibly because performance in this area was not felt to be problematic.

These variables representing personal objectives are similar, but not identical, to those identified in other studies of farmer decision-making where a range of personal goals, including lifestyle, stewardship and business-related goals, were identified (see Chapter 2). Of the variables identified the *low cost* and *input* orientation is also found in other studies (Noe, 1999; Peters, 1997) as is the orientation towards *marketing* (Peters, 1997), whereas the category *flexibility* that was found by Fairweather and Keating (1990) appears to be missing, which may be related to the farm type studied, i.e. dairy farms, which have less flexibility in decision-making due to the nature of their key enterprise, but could well be represented if organic farmers of other farm types would be studied.

Several of the orientations that can be identified among the case study farms also appear similar to the styles and groups of farms in other studies. Of the styles that van der Ploeg (1994a) identified among dairy producers in the Netherlands, the *cowmen* (dedicated producer) and *the huge farmers* appear to be represented by Farms 3 and 9. Farms 2 and 11 show similarities to the *economic* producer (van der Ploeg, 2000). Not represented in this study are Ploeg's dairy producer styles: *the greedy farmer, the intensive farmer* and the *cow breeder*.

The comparison of the farms illustrates that there is considerable variation of goal orientations among the case study farms, which has an impact on the performance of the farms and possibly could explain some of the variation in performance between the farms. However, the variety of styles in this small sample of converting producers did not reflect the whole range of value orientations that are present among dairy farmers. This could indicate that not all conventional producers are equally likely to covert, but given that the sample was not selected to be representative, this conclusion has to be treated with care. It is, however, likely that if a greater number of farmers converts, then the number of farming styles and goal orientations among them would further increase.

Interaction between farm-specific variables and attitudes

In Section 6–2 a difference was observed between the presence of technical motivations for the conversion and the importance given to the technical attitude statements. It was concluded that during conversion technical aspects of production appear to become more important to the farmers. This, it was argued, may indicate a shift in the farmers' attitudes to production issues during the conversion process. As a result of the increased experience with the organic system, the farmers learn and are forced to pay more attention to technical details. Under organic management, which is based on prevention of problems, there is less room to correct any mistakes that the farmer may make.

The data related to production indicators in Chapter 7 also highlighted a potential influence of production on attitudes. For example, declining forage production and the experience of feed shortages led some farmers to make adjustments to their sward management, such as adopting a later cutting date, reseeding with clover or (permitted) fertiliser applications, which illustrates the important learning process that farmers undergo based on the experiences of implementing organic methods on their farms. The data also highlight potential feedback effects in the production system itself, for example there appear to be links between forage and milk production levels and in turn income, which are also likely to lead to changed attitudes towards how to produce milk organically in the long term.

In summary the results suggest that personal attitudes not only influence the farm development, but may also be influenced by it, certainly in relation to enterprise or whole farm management, but possibly also in more general terms. However, to investigate this point in greater depth it would have been necessary to collect attitudinal data using a consistent method at several points during the farm conversion, which was not envisaged at the start of the research based on what was known or hypothesised at the time.

Conclusions

The combination of personal, physical and financial data allowed a broad assessment of the impact of the change process on the farming systems, whereby the farm development can be seen as an outcome of the day-to-day decision-making of the farmer, i.e. an expression of the farmer's behaviour. The results shed some more light on the interactions between some variables in the different domains and highlight that the change process itself is evolutionary rather than a pre-determined step change.

The investigation of variables determining organic production levels was not of key concern for the research, but the motives for and process of conversion on the case study farms permits some limited conclusions. On these farms, the conversion decision was triggered by a perception of change in the external circumstances (organic milk premium likely), or by changes in farm-specific (e.g. recent take-over) and personal circumstances (e.g. personal health). Of the personal attitudes mentioned in other studies (see Chapter 2) it appears as if general environmental concerns and concerns about the future of conventional agriculture explain a general interest in organic production, but not necessarily the actual decision to convert the farm at a given time.

This study clearly showed that there is link between the personal objectives of farmers, managers and owners and the farm development. The following objectives can be identified as important drivers for farm development: diversification, marketing, low-cost and low-input production, dedication to production (level and size) and lifestyle, whereas none of the case study farms appears to be influenced only by income objectives. The case study farms were grouped in four orientations, but the value of grouping such a small sample is clearly limited. Key objectives driving development in studies of conventional farms (flexibility of decision-making, cow breeding, profit maximisation) were not represented among the case study farms, but could well influence the development of farms converting currently or in the future.

With regard to the method, it can be concluded that the data on the personal context of the farmers' motivations and personal objectives provided valuable material for a better understanding of the conversion of each farm, and showed clearly the explanatory value of a knowledge of the farmers' objectives for farm development. As far as the choice of different data collection tools is concerned, the method of pre-formulated statements did not in all cases fully reflect the value dimensions that had been expressed by the farmer in the conversational interview. This confirms the value of non-structured data in studying personal values and experiences, particularly where the farmers' likely conceptualisation of a problem is not known in advance, but contrasting these with the quantitative data from farm accounts remains difficult. Research into farmers' attitudes has moved on considerably since the interview guide was developed, so that for future research of this kind improved attitude statements could be prepared and a more rigorous analysis of the correlation between attitudes and farm performance than the one presented here would be possible. The implications of this section regarding the farmers' information requirements are considered in the final section of this chapter.

The structure of the conversion process

In Chapter 2, the three key stages of conversion are outlined as information gathering, trial/evaluation, and adoption, which is compared in this section with the conversion processes on the case study farms. Table 9-2 summarises the various actions that were represented on the case study farms according to the three key stages and illustrates the functions that they appear to fulfil.

Information gathering

The presence and importance of the phase of *Information gathering* for the organic conversion has been identified on the basis of several surveys, which came to the conclusion that the lack of technical and financial information remains an important barrier to conversion (Chapter 2). The interview data confirmed this, and provided some further insight into this stage of the decision-making process, although the awareness phase was not the main focus of the study. Several of the case study farmers stated that they had been thinking about organic farming for some time (implying periods of several years), but did not specify the exact length of time that this phase lasted for them. However, for various reasons the farmers had not taken the conversion any further at that time. They mentioned financial concerns, a lack of technical knowledge, fear of weeds and animal health problems, and/or experienced opposition in the family or had difficulties with the relationship of the organic movement to conventional agriculture.

Table 9-2 Elements of the decision-making functions on the case study farms

Phase	*Actions on the case study farms*	*Function*
Information gathering	Experience from small holding	*Consideration*
	Visit other organic farms on farm walks	
	Contact with local veterinarian	
	Support from family and friends	
	Preference for low input farming	
Trial & evaluation	Block experiment	*Partial*
	Vegetable enterprise	*Implementation*
	Clover production	
	Alternative treatment of cattle	
	Gradual conversion of land	*Enterprise conversion*
	Feasibility study and budgeting	*Evaluation*
	Profitability first year	
	Enough silage / feed shortage	
	Growing confidence	
	Reseeding and fertiliser application	*Adjustment*
	Further reductions in stocking rate	
Final adoption	Detailed conversion planning	*Full implementation*
	Conversion of land (1 to 7 years)	
	Conversion of livestock	
	Rapid implementation	
Stable systems	Organic certification	
	Premium in marketing	
	Income stability	

Gradually they gathered more information about organic farming in various ways, for example through reading publications, visiting other organic farms, and through local contacts (the veterinarian, advisors). Farmers also mentioned the influence of friends and family during this phase of considering organic farming as a future option for the farm, alongside preferences for low-input farming and concerns about the environment.

As outlined above, what prompted the farmers seriously to consider the organic option was a combination of changes in external, farm-related or personal circumstances.

Trial and evaluation

Following the information-gathering phase, the specific evaluation of organic farming by the individual farms involved in most cases some form of partial implementation. On two farms, the decision in favour of conversion was taken on the basis of theoretical considerations, in one case a feasibility study by the OAS, in the other case budgeting calculations by the farmer himself, as well as on what had been seen on other farms. On all other farms, the *Trial and evaluation* phase included partial implementation in a number of ways: introduction of alternative treatments for the cows, clover-production, block experiment, small organic vegetable enterprise, or gradual conversion of the land. This phase therefore involved any one or a combination of the following four different types of actions on the case study farms:

1) **Feasibility assessment:** theoretical evaluation based on calculations and visits;

2) **Extensification**: de-intensification of the management of an enterprise;

3) **Block experiments**: experimentation with organic management on parts of the land;

4) **Gradual conversion** of land.

On only two farms did the adoption phase begin on the basis of the feasibility assessments alone. In many cases the second option of gradual extensification of the management took place before the farm registered as 'in-conversion' and could have potentially influenced the pre-conversion income of the farm that was used for the comparisons in Chapters 6 and 7 (see below).

Under the third and fourth options, the farms were registered as 'in conversion' with a certification body, although the decision to convert the rest of the land to organic farming had not been made. The registration process required the drawing up of a conversion plan outlining the order in which land and livestock enterprises were to be converted. Under these options the distinction between the phases of *Trial and evaluation* and subsequent *Adoption with full implementation* is difficult.

The farmers evaluated the success of options 2 to 4 on the basis of technical feasibility (e.g. forage supply) and/or profitability in the following year. This led to further adjustment of the management of specific enterprises (fertiliser application on grassland; concentrate feeding of cattle), and/or the farm structure (reductions in stocking rate) as well as growing confidence in the organic approach.

For the majority of farmers the *Trial and evaluation* phase appeared to require the gaining of some practical experience with organic farming on their own farm, before they could enter into the following phase of *Adoption with full implementation*. The farmers thereby used particular indicators for assessing the feasibility of organic farming on their own farm, such as forage supply, animal health and profitability, which also provided them with further insight into *how* organic farming could best be implemented on their farms, leading to adjustments to both specific enterprises and whole farm management, i.e. enterprise structure.

It appears as if on the case study farms the choice of *conversion strategy* (all at once or staged) was not only influenced by farm type (i.e. the importance of the dairy enterprise for the whole farm and the resulting incentive to convert land more rapidly so that the herd would qualify for certification) but also the stage of the decision-making/adoption process that the farmer had reached.

Adoption phase

The trial and evaluation phase (with or without partial implementation) resulted in the decision to adopt fully organic farming and implement it on the whole farm. At this point, if it had not happened before, the farm was registered with a certification body and a conversion plan was drawn up, with or without the support of an organic advisor. On farms where some land had already been converted, the remaining land was usually now converted more rapidly, as the farmer was convinced that this was the right way to go, i.e. the final decision had been made and they no longer wanted to have to consider two different ways of running their farms, which makes clear that uncertainty about the decision may be an important reasons for farmers to opt for a staged approach to conversion.

The development of production and farm income that was reported for the case study farms in Chapters 7 and 8 referred to both the previous *Trial and evaluation* phase and the *Adoption* phase and showed clearly the impact of conversion on various indicators.

Length of the conversion process

The length of conversion process varies, depending on what processes are considered to be part of it. Assessing the length of the conversion process of the farm is relatively straightforward, if the registration with a sector body as 'in-conversion' of part of the farm is taken to represent the beginning, and the farm certification taken to represent the end. This farm conversion period lasted between one and seven years after conversion of the first fields (excluding the block experiment and vegetable enterprise on two farms), until all land was in conversion, and between one and six years until the herd was also certified and was mainly influenced by conversion strategy and timing of the herd certification. However, the experience of the case study farmers raises the question whether the point of first registration can really be considered as the start of the actual conversion process as, for example, one farmer (Farm 12) had already started to convert land before applying for certification and was subsequently granted a reduced conversion period.

The period becomes considerably longer, and the variation between the farms greater, if the beginning of the *Trial and evaluation* phase is taken to represent the beginning (thus including pre-registration experiments) and the completion of the implementation process (see below) is considered. In Figure 9–1, the length of the *Trial and evaluation* phase (before and after registration) was estimated based on the farmers' explanations in the interview, how long before registration the evaluation of organic farming had begun on the farm. The end of this stage was considered to have been reached at the time, when the farmer had finally decided to convert the whole farm. Regarding both dates the answers were sometimes vague so that Figure 9–1 is only an illustration of the length of time involved.

The length of the *Adoption* or *Implementation* period was determined by:

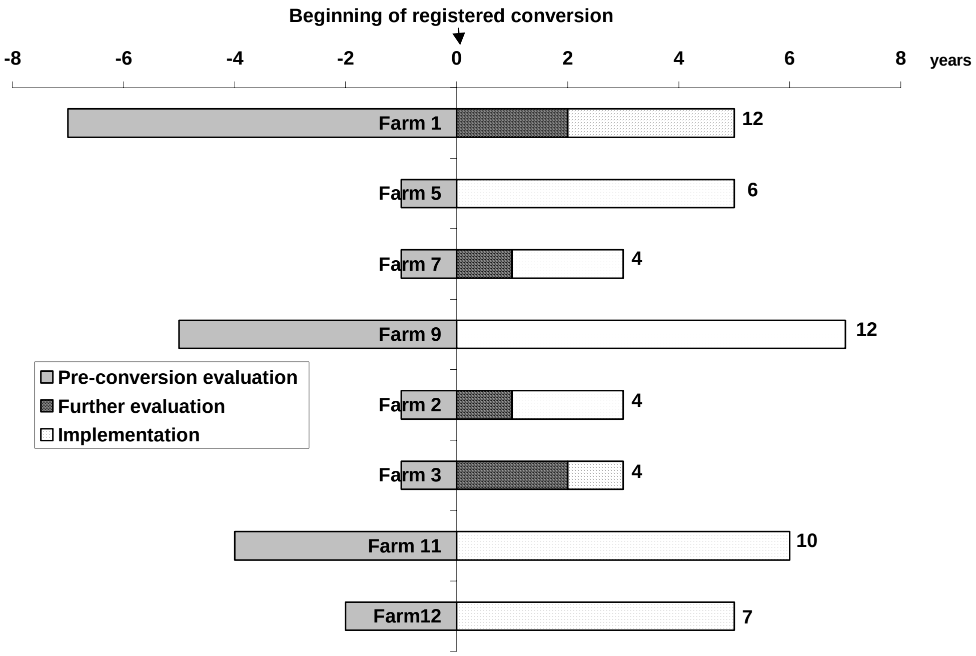
1. the date of herd certification (on farms 2, 3 and 11, see Chapter 8-3) or
2. the achievement of a stable income with product marketed as organic (farms 1, 5, 7, 9 and 12, see Chapter 8-5), depending on which date of achievement was the latest.

The length of the conversion process in Figure 9-1 does not consider the awareness and information phase, because most farmers only made vague statements about the length of this period.

The lengths of farm conversion process assessed on the basis of the stage model, as lasting from the beginning of *Evaluation* to completed *Implementation* took between four and twelve years on the case study farms. The longest periods were observed on the mixed Farm 1 and the specialist Farm 11. In the case of Farm 1 this was due to a staged conversion and a long period of evaluation, both prior to and after registration. On Farm 11 this was due to a combination of the earlier conversion of a vegetable enterprise and the lack of certification of the herd for several years, because of a lack of a marketing outlets, although the actual conversion of the land was implemented in one year.

The shortest period of 4 years was observed on Farms 2, 3 and 7, where shorter full implementation periods followed initial gradual implementation and evaluation. Even shorter conversion periods could have been expected on the farms with very rapid conversion strategies (Farms 11 and 12), but this was not the case. However, on both farms very specific circumstances apply, so that this result cannot be attributed to the conversion strategy alone. The income development on Farm 12 is to a large degree influenced by the fixed costs of the non-farming enterprise, which could not be separated sufficiently.

Figure 9-1 Length of the evaluation and implementation periods



Source: Own data.

The evaluation period, covering evaluation both prior to and after the registration of the farm with the sector body, lasted on average for about three years, ranging from approximately one year on Farm 5 to approximately 9 years on Farm 1. The implementation period on the farms lasted on average approximately 4 years, ranging from one year on Farm 3 to seven years on Farm 9. However, the length of the process is based on various estimates and gives therefore only approximate guidance as to how long the phases of the process last.

Discussion and conclusions

The results confirm that on the case study farms key stages in the conversion process can be distinguished, similar to those proposed on the basis of the literature review in Chapter 2.

The *Information gathering* phase can stretch over several years, until a change in personal, farm-specific or external circumstances triggers the next phase of evaluation. Whether or not improved information provision could help to trigger the evaluation phase sooner is an interesting question and that would need to be addressed in a different study.

A phase of *Trial and evaluation* as proposed in the adoption model (Rogers and Shoemaker, 1971) is also important for the adoption of organic farming. It appears that the evaluation of the new system on the holding itself is very important for the decision-making process of converting farmers. It can take place in four different ways: theoretical assessment of feasibility, through gradual extensification of enterprises, block experimentation on parts of the farm and gradual conversion of the land. Farmers have to gain experience with the new approach, evaluate it specifically for their own holding, and develop the necessary confidence that the system will work for them, before they are willing to make a more long-term commitment. Specific to this phase (compared with that of *Information gathering*) is that the evaluation specifically considers the farm situation rather then the more general acceptance of organic ideas that preceded it.

This *Trial and evaluation* phase can last from approximately one year to nearly 10 years, and can continue after the farm's registration as "in-conversion" with a certification body. It is likely that during this phase further changes in the personal, farm-specific or external circumstances, e.g. the lack of availability of premiums, could trigger a re-conversion of the holding to conventional agriculture. It also appears possible that this phase may even continue after the full certification of the farm, possibly resulting in re-conversion to conventional agriculture, although this did not occur on any of the case study farms.

During the phase of *Adoption* of organic farming, the conversion of the whole farm either begins or, if the previous phase involved gradual implementation, continues. It is likely that in the latter case the implementation will now be progressing rapidly. The changeover process concludes with a more stable organic system, whereby the whole farm with all enterprises is registered as 'organic' with the certification body and income levels have more or less stabilised. This phase can last from one up to seven years, depending on how many changes were implemented before and when organic certification for all enterprises and/or income stability is reached.

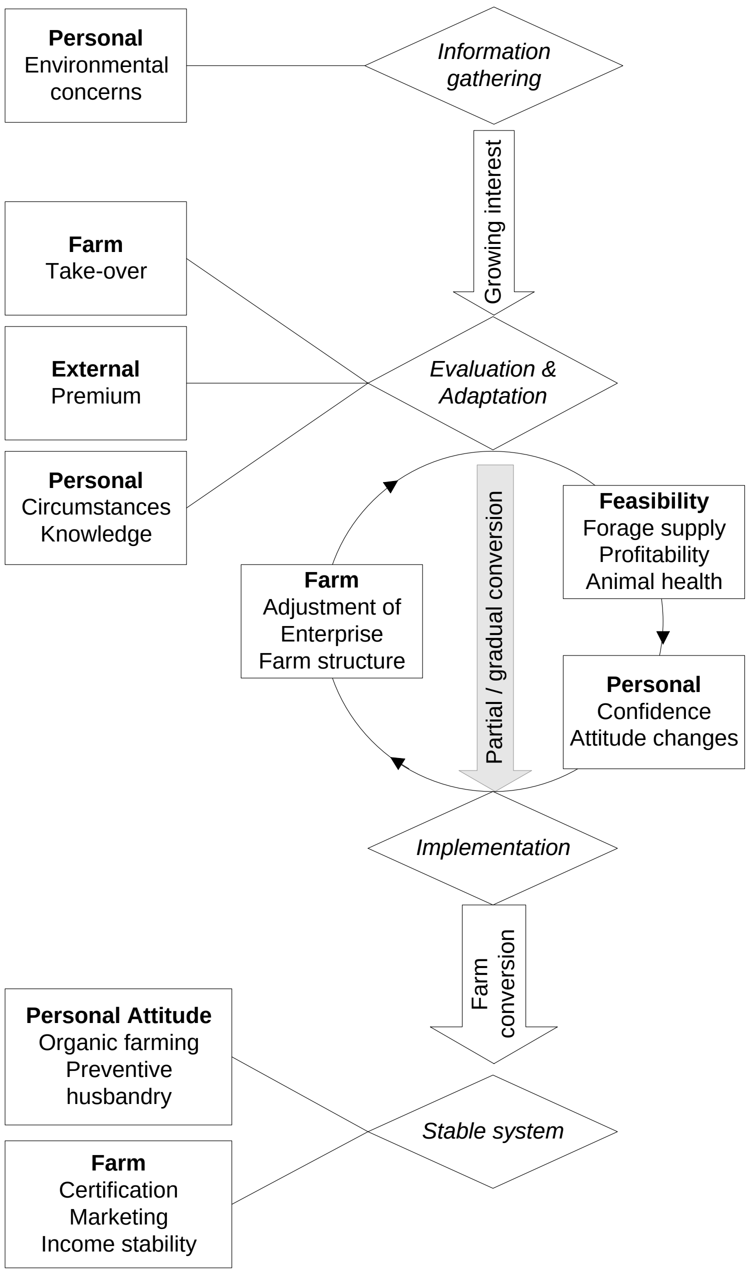
The conversion process referred to in the literature in Chapter 2 appears to refer mainly to the two phases of *Trial and evaluation* and *Adoption.* The registration of the farm with a sector body and the technical conversion of enterprises thereby does not indicate the stage of decision-making of the farmer, which begins with *Information gathering* (See Figure 9-2). The phase of *Evaluation* with the partial implementation is likely to begin before and continue after the registration, and particularly on farms with staged conversions, registration does imply that the final decision has been made. It is therefore difficult to distinguish clearly between the two phases of *Evaluation* and *Implementation.* In such cases it might be helpful to find out what function a particular action has for the farmer (e.g. consideration, evaluation, adjustment, implementation).

The model of the conversion process in Figure 9-2 shows the categories of variables (personal, farm specific, external) alongside the phases of decision-making. It also highlights the feedback from gradual implementation leading to adjustments in enterprises and farm structure.

The *Trial and evaluation* has therefore been relabelled as *Evaluation and adaptation.* During this phase of gradual implementation of organic farming, the functions of evaluation and adjustments to the system go hand in hand. The farmer finds out *whether* organic farming is right for him/her, and, at the same time, explores *how* the system works best on his/her farm and what adjustments may be necessary for the further implementation This circle of partial implementation with evaluation of the feasibility and adjustment could be undergone several times. The farmer learns about the new management requirements, the learning is supported by the experiences with partial implementation, and this is likely to be the main learning phase of the conversion process. As a result the farmer becomes more confident that (and how) organic farming will work on his/her farm. S/he progresses now to more rapid and full *Implementation*, which results in greater stability (as the experimentation activities decline and fewer mistakes are made) and the full certification of the whole farm. The final phase of adoption has therefore been relabelled as *Implementation* to express that the change process continues beyond the point of decision-making.

Figure 9-2 Variables and phases of the conversion process *

The conversion in the context of the whole farming system



* Rectangles show variables; Diamonds refer to phases of the conversion process

The role of knowledge and information during the conversion of dairy farms

One important aim of this research was to investigate the role of information and knowledge during conversion to organic dairy farming. The literature had given an indication that information is of crucial importance to the wider diffusion of this 'software' innovation. Lack of information was frequently identified as a barrier to conversion, but, and that was the main focus of the research, information was also a key input during the conversion. It appeared likely that, as in other decision-making processes on farms, the use of information sources changed in different phases and that the importance of other organic farmers increased during conversion.

In this section the various findings of the study are analysed regarding their meaning for the information requirements of farmers and particularly dairy farmers during conversion. The model of the conversion process, as developed in the previous section, is used to improve the understanding of the principal nature of the information requirements in the various stages and by setting the farmers' preferences for the various information sources in context. This section further summarises specific information requirements on dairy farms that were highlighted in the various chapters and provides some first recommendations.

Information requirements during the phases of conversion

During the *Awareness and information* phase, farmers are likely to consider general information about organic farming without specific reference to their own system. Those with general concerns about the environment and the environmental impact of agriculture are more likely to look favourably on organic farming as a future option. The phase can last from several months to several years, before a change in the personal, farm specific or external circumstances triggers the move to the more specific phase of *Evaluation*.

Changes in the first domain of personal variables that could trigger the further progression into conversion, in particular changes in farmers' attitudes, could be influenced by information. Surveys of conventional farmers highlight a lack of technical, financial and marketing information as a barrier to the wider uptake of organic farming systems (e.g. Midmore et al., 2001) and addressing these information gaps could help farmers to gain more confidence that organic farming is a possible alternative.

Possible changes in the third domain (external circumstances) that could lead to conversion are policy changes (e.g. the introduction of conversion aid programmes) and changes in agricultural prices, for both products and inputs, whether conventional or organic–these were important reasons for the conversion on several of the case study farms. However, farmers need information to become aware of such changes, and act on their subjective perception of external events rather than the events per se.

In the following phase of *Evaluation & Adaptation* farmers consider whether organic farming is suitable for them and their specific holdings and they learn about how best it can be implemented. The information requirements become more specific to the farm itself and the main purpose of the frequently observed partial implementation (through extensification, block experiments or gradual conversion) is to provide the farmer with more knowledge and information on whether and how the system works on his farm.

In the final *Adoption* phase, the farmers are likely to be quite positive about organic farming and the information requirements become even more specific, related to the further refinement of the technical implementation of organic farming, alongside questions about the certification process and the search for marketing outlets for the organic products.

Information sources of the case study farms in the context of the phases of conversion

The evaluation of the case study farmers' preferences for various information sources (Chapter 6) can be set in the context of the stages of conversion and the resulting information requirements (see Table 9-3). What the farmers referred as before conversion refers not only to the *Information gathering*, but also the early *Evaluation* phase before registration, but given that the interviews were carried out during the farm conversion period, the recollection may not have been fully accurate.

Table 9-3 Information requirements and sources during the phases of the conversion process

Phase	*Information requirements*	*Information sources*

Information gathering	*General*	
	Technical	Specialist magazines
	Economic	Organic farming books
	Market development	Farm walks on organic farms
	Standards	Friends and family
		Advisors
Evaluation	*Tailored to the farm*	
	Marketing outlets	Certification body
	Financial feasibility	Organic advisors
	Technical feasibility	Conversion plan
and Adaptation	Standards constraints	Specialist consultants
	Technical refinements	Other organic farmers
Adoption	*Implementation*	
	Technical refinement	Organic consultants
	Achieving certification	Magazines
	Marketing outlets	Books
		Specialist consultants

Information gathering

For several of the case study farmers, the useful sources of information during this phase were *publications*, such as organic farming books, and *personal contacts*, such as members of the family, other organic farmers and direct advice on the farm. It is, however, possible that the farmers mentioning specialist organic advisors were referring to the early *Evaluation* rather than the *Information gathering* phase. During the *Information gathering* phase several farmers also had contact with their conventional advisors and the experiences ranged from vehement opposition to being pointed in the right direction about where to find out more about organic farming.

Those that had visited other organic farms in their area prior to conversion felt they had benefited from it and these became even more important information sources later on. However, to the case study farmers–as newcomers to it–the community of organic producers appeared initially like a closed network, which was difficult to enter. Also not all farm visits were considered useful, less beneficial were visits to farms that were in some ways very different (structure or approach to management). Farmers possibly would have benefited from more opportunities (farm walks, demonstration farms) to visit local organic farms with similar conditions to their own, so that the experience would be more transferable.

Evaluation and adaptation

All case study farmers had regular contact with a *specialist organic advisor* in this phase. This is a very high proportion, compared with the number of farmers in the organic industry who actively consult advisors (Measures, 1999, personal communication). This may be a result of the involvement of the OAS in the identification of the sample, i.e. recommending farms known to them, but could also be an indication of the high need for well targeted information in this phase. Most farmers found the advice provided very helpful, particularly the conversion planning, but some were concerned about the long distance to the nearest consultant and the difficulties in calling out the advisor at short notice.

Farmers who made use of conventional dairy advisors, particularly for feed advice and ration planning, but also for general business management, did this in addition to the specialist organic advice that they received or were still receiving.

All case study farms carried out some form of *conversion planning* exercise, the majority with involvement of the organic advisor. Most plans were written round about the time of registration with the certification body. The conversion plans of the OAS covered a target rotation, a cropping plan, management recommendations for all major enterprises and optional financial budgeting. Most farmers followed broadly a planned approach, but as the experience of some case study farmers illustrated, some recommendations were either forgotten about (as was the case with the financial budgeting on one farm) or were dismissed (as was the recommendation to reduce stocking rates on two farms). Several case study farmers made it clear that they themselves had modified the rotation or other aspects of the planned approach subsequently, and that conversion had moved on, by the time the written document arrived. The financial assessment of the conversion was an optional extra in the plans drawn up with the help of the advisor and had not been chosen by most farmers, but with the benefit of hindsight, several farmers would have preferred better financial planning of their conversion.

However, the farmers were positive about the planning and found it particularly helpful in achieving the symbol status and understanding the certification process. For some farmers the visit of the advisor to discuss the recommendations was very important, others frequently referred back to the document itself.

If they had wanted to evaluate the financial impact themselves, the case study farmers would have had difficulties in gaining access to organic planning data as, before the publication of the first results from this project (Haggar and Padel, 1996: Padel, 1996) and the first organic farm management handbook (Lampkin and Measures, 1994), no standard data for the financial planning of organic dairy farms had been published in this country. However, one of the farmers, who did not continue in the study, had planned the conversion financially by using farm account data from conventional management and making allowance for all expenses that would not have to be paid in future and for losses in production, a way of planning that was clearly very targeted to the specific situation of the farm.

The fact that for the case study farmers other *organic farmers* became an even more important source of information does not really correspond with the more farm-specific nature of the information requirements in the phase of *Evaluation*. It is therefore likely that the preference for other organic farmers was related to the function of *Adaptation* of the organic farming system to the specific farm, to which the other farmers contributed knowledge about the technical refinement of the system. The case study farmers also benefited from contact with other organic producers in terms of social support. This could have also been provided through a regional network and meetings with farmers at similar stages of conversion, but these were considered less important as an information source, mainly because contact networks did not exist in most regions at the time when the farmers converted. In one region, the case study farmers themselves subsequently took the initiative in developing a milk marketing co-operative.

Given the emphasis on farm-specific information in the *Evaluation and adaptation* phase, it is surprising that so few case study farmers rated their *own information sources* (diaries, stock and field records, farm accounts) as important. The answers may relate to the quality of their record keeping. The information derived from partial implementation and evaluation phase appears to be highly significant for the decision-making process on most farms, but it may not have been recorded in writing.

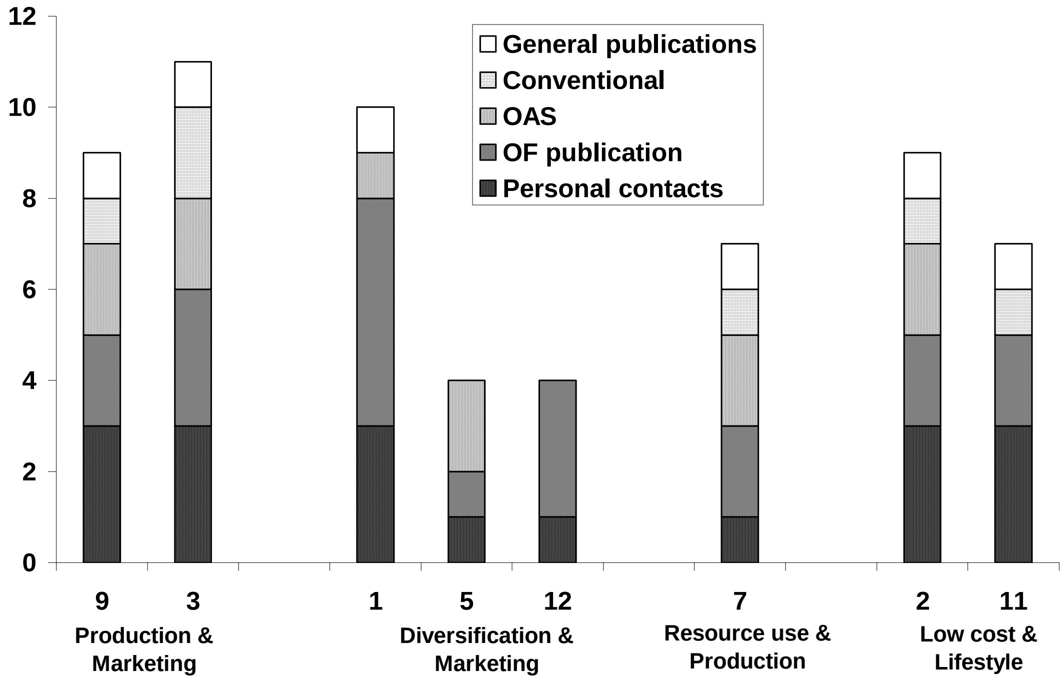
Adoption

In the final phase of implementation of the organic conversion, the preference of the farmers moved to more specialist sources, as the *how* question became more important and the farmers were aiming to fine-tune their systems. They were generally positive about having received the information they wanted from the *specialist organic advisor*. Some farmers also made further use of dairy and nutritional consultants, feeling now confident in setting this specialist knowledge into the context of the organic approach themselves. Of greater importance during this phase was also the question of how to prepare and get through the certification process, for which the conversion plans were found to be very valuable.

Case study farmers' goal orientation and use of information

This section explores the question whether the goal orientations of the case study farmers (see 9.3.2) influenced their use of information and preference for specific information sources. For each farmer all preferred information sources (scores 4 and 5) were summarised into categories such as organic farming publications, Organic Advisory Service (OAS), conventional extension agents, personal contacts, as shown in Figure 9-3, where farms with similar goal orientation are placed next to each other.

Figure 9-3 Profiles of preferences for information sources of the case study farmers*



* The Y axis shows the number of preferred information sources grouped in to categories
Source: Own data

In some information source categories, e.g. OAS, the differences between farms and orientations are negligible, in others they are more apparent. For example, all three farms with an orientation towards *Diversification and marketing* did not make use of any conventional advice and their preference for general publications was low. All other farms, which had some orientation towards *Production* (either *dedication* to intensity, level or size or to low-cost production), consulted conventional sources and general publications and also appear to have made more use of personal contacts. This gives a tentative indication that the value orientation of farmers may also influence their preference for particular information sources, but further research on this would be needed, before any firm conclusions can be drawn.

Differences in information requirements between goal orientations may also arise, because farmers may request specific information to further specific objectives, but also because of the strengths and weaknesses of the resulting systems. Farmers are likely to benefit from information in areas that would normally be outside their main focus of attention. For example, the farms with a *Production and Marketing* orientation achieve above average production, but could be in danger of ignoring the cost and resource use aspects of their production systems. For example Farm 3, in aiming for a high stocking rate, may run into financial problems as the organic standards restrict the purchase of forage from non-organic sources and in absence of a market for organic forage, feed shortages could jeopardise the organic status of the herd. Similarly, farms with a *Diversity* or *Diversification* orientation may look for more information about further diversification and new enterprises, but could possibly benefit from greater attention to detail in the area of production or resource use. Farms with *Resource Use* and *Low Cost* orientations showed up relatively well financially under current circumstances, but could possibly benefit from further information about marketing to be able to adapt to changing circumstances.

Overall the results indicate that the specific goals of farmers may indeed influence their preference for specific information sources and the information they require to achieve their goals and further to improve and fine-tune their systems, but because the evidence is not strong and conclusive and this conclusion would need to be treated with caution.

Specific areas of information requirements during the conversion of dairy farms

The interviews with the case study farmers, as well as the analysis of the production-related and financial data, highlighted a number of specific areas of information requirements.

Standards and certification

Some of the farmers initially experienced some problems in understanding the Standards, particularly regarding dairy cow feeding and the permitted organic and in-conversion proportions of the rations.

Standard-setting bodies could do more to make the Standards easier to understand and they need to provide farmers with assistance in interpreting the requirements for their particular farm. Later on during conversion, the focus moved from a more general understanding of the Standards to specific questions about the certification procedure and the case study farmers found their conversion plans particularly helpful in achieving symbol status.

Forage crops and yields

The farmers had no problems in obtaining seed mixtures for legume-based forage crops, but they mentioned a lack of experience with the handling of organic forage crops. Specific issues included: adjusting to the slightly later growth pattern of clover-based swards in the spring, the establishment and use of clovers in leys and permanent pasture, silage making from clover-rich swards, and the prevention of bloat. One farmer referred to having to re-learn the rules for silage making whereby aiming for more bulk became more important than aiming for high quality.

The production data indicate that avoiding problems with feed shortages is important, and that to do this the farmer needs to be able to predict the forage yield development during conversion as well as the changes in the forage demand resulting from concentrate reductions.

As further areas of information requirements and possible future research, the farmers also mentioned control of permanent weeds (docks), and the control of slugs, eelworm and rabbits.

Milk production

On most farms some dietary changes in the dairy ration were necessary to meet the Standards' requirements and several farmers had to change their concentrate supplier, but none found it particularly difficult to obtain the necessary information.

The analysis of the data showed a relationship between high financial returns and high milk production on the case study farms. This highlights a need for information about how to improve the milk production from forage, without encountering situations of low energy supply to the cattle and the associated fertility problems that have been identified in other studies (Baars and Buitink, 1995; Steinwidder, 2000)

Animal health

Information about animal health was important to case study farmers before and during conversion, particularly controlling mastitis without the routine use of dry cow therapy, and preventing parasite infestations. Other animal health problems mentioned were the supply of minerals and trace elements and the control of ringworm.

Information requirements were particularly noted regarding use of alternative treatments (especially homoeopathy), which several case study farmers taught themselves with the help of other organic farmers, books and homoeopathic vets. The role of the local vet changed from the provider of treatment to that of a diagnostic service.

Financial information

An area of concern for the farmers was how to find suitable outlets for their milk that would pay a premium. Several case study farmers would also have liked better financial information before and during the early part of their conversion, including cash flow budgets. The financial results indicate considerable difference in Net Farm Income indicating that some farms would have benefited from further financial advice when starting and also during the later stages of their conversion.

Summary and conclusion

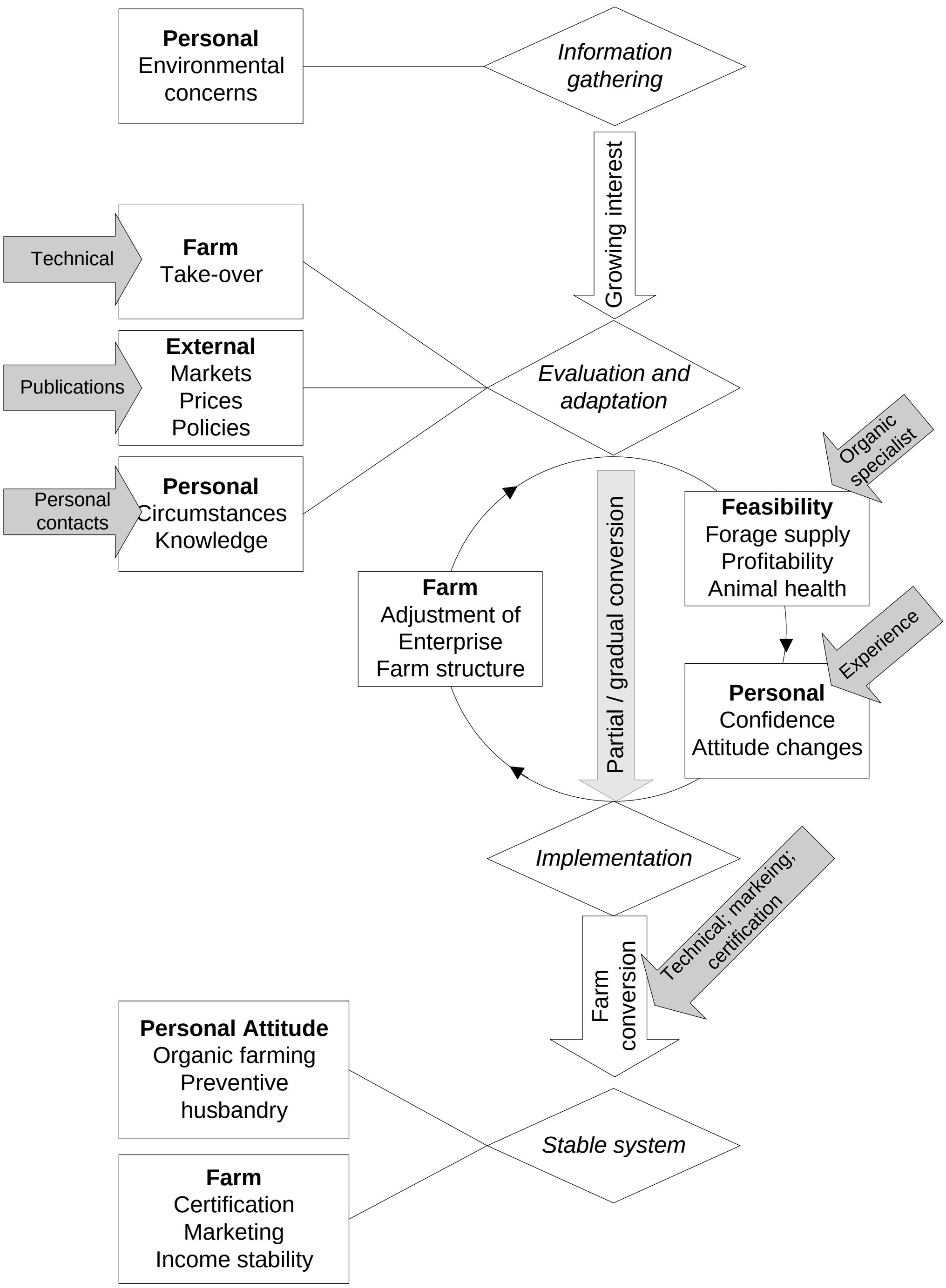
The model of the conversion process and further insight into the importance of farmers' goals for their decision-making process have helped to improve the understanding of the role of information and knowledge during conversion and have provided a basis on which recommendations about the provision of information during conversion can be developed.

In progressing through the three key stages of the conversion process, *Information gathering*, *Evaluation and adaptation* and *Implementation,* the farmers' information requirements change from a general to a specific nature.

The general acceptance of organic farming as a possible option is followed by a change in either the personal or farm-specific situation, or in the farmers' perception of the external situation. This change can

trigger the next stage, the farm-specific evaluation of organic farming, which goes hand in hand with practical experimentation and adaptation, followed by full implementation in due course (see Figure 9-4).
In the *Information gathering* phase the information needs relate to general technical knowledge, relative financial performance and the likely future direction of external circumstances, such as direction of policy and market development (see Figure 9-4).
General technical information can be provided through publications (organic farming magazine and books, electronic information sources). It is likely that a greater presence of information about various aspects of organic farming, including market development and financial information, in general agricultural information media would have a positive impact on farmers that are in this stage, as they are unlikely to have identified the information providers that are more specific to organic farmers, such as specialist magazines.

Figure 9-4 Role of different types of information during conversion



However, it appears as if personal contacts are also very important at this stage, including members of the family and friends, as well as contact with conventional and organic advisors, visits to organic farms and possible attendance at seminars and regional meetings. These could be more effective in leading to changes in farmers' attitudes and possibly in correcting misconceptions about organic farming that are likely to persist, given its long history and the sometimes heated political nature of the debate. Training opportunities in organic farming for various agricultural professionals (e.g. consultants, bank managers, veterinarians) may be useful in this context, but further research would be needed to study the role and impact of various information sources in this stage.

In the *Evaluation adaptation* stage the farmers' information requirements become specific to the context of the farm itself and the farmer gains more knowledge from the partial implementation on the farm as well as from external sources and develops the confidence to make the decision to continue with the implementation of organic farming on the farm.

Of particular importance to this phase, however, is for the farmer to make full use of the knowledge that is gained by experimentation on the farm itself.

The farmer is likely to value highly visits from specialist organic advisors who can interpret principles and standards in the context of the specific farm situation, but equally important appears to be the experience and knowledge that results from experimentation. The technical and financial feasibility assessments of the conversion of a particular holding, possibly exploring a range of different alternatives, could reduce the need for practical experimentation and the risk of costly mistakes (see recommendations for conversion planning in Chapter 11).

Visits to other farms (particularly in similar situations) may act as mirror and provide a forum where ideas can be discussed and explored, i.e. a forum where learning takes place. How such social learning can be facilitated should be further explored. Personal contact with other organic and converting farmers at this stage is also likely to provide social support, and possibly the basis for collaborative marketing initiatives.

Depending on farm type, the areas of technical information requirements during this stage will vary (see above). It is likely that specialist organic advisors are one important supplier for such information.

In the final *Implementation* phase the requirements become more specific, but the farmer also becomes more knowledgeable and more confident in interpreting information from non-organic sources in an organic context. Questions regarding the certification and the marketing of organic products become more important. Farmers may seek specific information in pursuit of their personal objectives, but could potentially benefit from broader information provision.

The section has shown that by providing information about organic farming through a particular source, different stages of the conversion process are likely to be stimulated. Publications (including new electronic media such as the Internet) are likely to raise awareness and the general level of information about organic farming and can provide the farmers with answers for very specific technical questions during implementation, but are likely to be less important in influencing the evaluation phase.

Demonstration farms and organised farm walks on organic farms provide a further way to raise awareness. Organic farmers remain an important source of information later in the conversion process. It is therefore important to recognise farmers not only as receivers but also as provider of information. Networks of producers also provide a forum for social learning and social support.

Providing farmers with better access (for example through subsidised advice) to specialist organic advisors is likely to have a greater impact on evaluation and adaptation phase. It could reduce the need for practical experimentation and costly mistakes during conversion.

Such specialist organic advisors need training in organic farming, not just in terms of principles and practices, but also standards and regulations. They need working experience with established organic producers, as well as good and efficient access to new production-related research, information on the likely future development of external circumstances (e.g. policy and marketing developments) and financial skills.

The chapter has brought together the human, production-related and financial aspects under which the conversion process of the case-study farms was studied. The chapter showed that there appears to be a clear link between the personal and farm specific variables, but the limitation of the analysis of different types of data permitted only very tentative conclusions and further development of such methods is needed. The chapter also brought together the case study results with the theoretical concepts of decision-making and change processes on farms, which resulted in a model of three key stages –one objective of the research. This and the findings related to the other objectives of the research are discussed in the following chapter.

Discussion

The aim of this research was to investigate the process of conversion to organic milk production and its impact on production and incomes of farms, in order to identify converting farmers' information needs and to develop recommendations as to how these information requirements can best be met.

The recommendations are intended for those, who are –for whatever reasons–interested in a more widespread adoption of organic farming, such as farmers, policy-makers, organic sector bodies, and in particular advisory organisations that offer support to organic and converting farmers. The environmental and other benefits of organic farming and the growing consumer demand as reasons why policy-makers and others are interested in more widespread conversion to organic farming have been discussed elsewhere (e.g. Lampkin et al., 1999; Michelsen et al., 1999; Padel et al., 2002; Stolze et al., 2000; Zanoli et al., 2000).

In order to investigate the role of information and to develop information-related recommendations, it was necessary to gain a better understanding of the conversion process itself. In the absence of a clear theoretical model of farmer decision-making in the area of environmental change or of the organic conversion process, there was a need to conceptualise the process as such, drawing upon literature about farmer decision-making theory, studies of conventional and organic farmers and empirical observations on converting farms.

Other important objectives of the research discussed in the following sections were: to develop and apply an integrated approach to analysing personal and farm-specific changes on farms and explore linkages between variables in different categories, to obtain a better understanding of the farmers' perspectives of the conversion process; to analyse the impact of the conversion on production and farm income on dairy farms; and to develop recommendations about the information needs of converting dairy farmers, for information providers and for further research in organic dairy farming and conversion.

A theoretical framework for organic conversion

The objective of developing a theoretical framework for understanding conversion to organic production at the farm level was addressed by comparing basic concepts of change processes on farms and farmer decision-making theory with studies of organic farmers and refining the framework in the light of the empirical observations on the case study farms.

Improved understanding of change-processes on farms can have two broad aims (a) to influence farmer decision-making for the benefit of society (e.g. adoption of new technology to secure or increase food supplies, protect the environment and the economic development of rural areas) and (b) to benefit the individual farmer (achieve personal goals such as improved profitability). A number of theoretical perspectives have been used.

One field with a strong interest in both aims was agricultural extension research that has over time gone through a number of phases, and has been influenced by various theories, even if the aims and mandates of extension services were not always clearly defined (Haug, 1999). Extension research developed the first theoretical framework of change processes on farms during the 'green revolution', aiming to encourage farmers to increase productivity through the use of modern inputs.

The main area of adoption/diffusion research was concerned with the innovativeness of farmers, judged by some personal and social characteristics (Rogers and Shoemaker, 1971; Rogers, 1983). This resulted in the technology transfer approach to agricultural extension which sees science as a source of innovation that has to be extended to farmers (e.g. Albrecht, 1974; FAO, 1984). This diffusion model describes some aspects of the wider diffusion of organic farming relatively well. For example, the first organic farmers shared personal characteristics with typical innovators of other environmental innovations, and faced problems typically associated with the early diffusion stages, such as opposition and social isolation, so that the differences between organic and conventional farmers could be interpreted as that between innovators and later adopters (Padel, 2001). This justifies the consideration of the model for the study of conversion of organic farming even if the background for its development was the height of the productivity paradigm for agriculture, which organic farming with its wide range of environmental and sustainability objective challenges. Of relevance to this research were the key stages of the farmers' adoption decision that the model describes.

Agricultural economists have used production economic theory aiming to predict as well as influence farmers' decision-making, focusing on the optimisation of resource use with respect to utility or profit maximisation, but have not specifically addressed the change processes as such. However, the need to simplify the complex process of decision-making has led to models applicable only under very specific circumstances (Sutherland *et al.*, 1995; Willock *et al.*, 1995). Some of the underlying assumptions, for example the producers' state of perfect information, are questionable. In the context of changing practices, it is particularly problematic to ignore – as comparative static production economic theory does to a large extent – the dynamics and time dimensions of change. Similar to the technology transfer approach to the normative use of models, the role of information remains broadly 'mechanistic'. If the farmer is given the right information, this would lead to the adoption of the 'best' practice (Jacobsen, 1994).

However, the lack of success in influencing farmers' behaviour and the challenge of agricultural sustainability led to the recognition of the short-comings of these concepts both for research (e.g. Bawden, 1991; Norgaard, 1994) and for technology transfer in agricultural extension (Russel et al., 1989). Alternative frameworks, such as Farming Systems Research and Soft Systems Methodology consider farming as a human activity system with its conceptual boundaries (e.g. Maxwell, 1986; Bawden, 1995; Checkland, 1999; Woodhill and Röling, 1998). These frameworks resulted in the recognition of the farmers' role not just in receiving, but also in generating information, putting the 'Farmer First' (Chambers et al., 1989). These ideas are relevant to organic farming, which has–to a large degree–been developed by farmers jointly with researchers and consumers, rather than by scientists alone. The knowledge-intensive nature of sustainable land management led to a new focus on the role of institutions, knowledge-networks of human actors (Larson and Duram, 2000; Morgan and Murdoch, 1998; Röling and Jiggins, 1998) and very recently a re-orientation towards a perspective of farmers' learning (e.g. Röling and de Jong, 1998).

Similar thinking is also reflected in using qualitative and more descriptive research approaches to understand farmer decision-making (Jacobsen *et al.*, 1994; Sunderland *et al.*, 1995; Öhlmér *et al.*, 1998). Social scientists, in particular, stressed the importance of attitudes and values (Weber, 1994; Willock *et al.*, 1999; Gasson and Errington, 1993), which were also reflected in the organic production standards (e.g. IFOAM, 1998).

The theoretical framework for the organic conversion process used in this study drew on a number of these theoretical perspectives. The basis for the structure of three phases in the farmers' decision-making process was taken from the adoption model (Rogers and Shoemaker, 1971), modified in the light of research about organic farmers and conversion (see Figure 10-1). It was argued that, as in other adoption processes, different sources of information would be important during the key stages of the conversion process. The literature showed a reduced reliance of organic farmers on agricultural extension agencies and increased importance of organic producers as information sources (Blobaum, 1983; Luley, 1996), but only one study looked at this issue in the specific context of conversion (Wynen, 1990).

The empirical research confirmed the basic structure of the model and contributed further understanding about the length of time of the various phases and the farmers' preference for information sources. The following section discusses the three key stages of the conversion process: *Information gathering*, *Evaluation and adaptation* and *Implementation*, and their relationship to personal variables. The impact of conversion to organic farming on farm variables, i.e. production and farm income of dairy farms, is discussed subsequently.

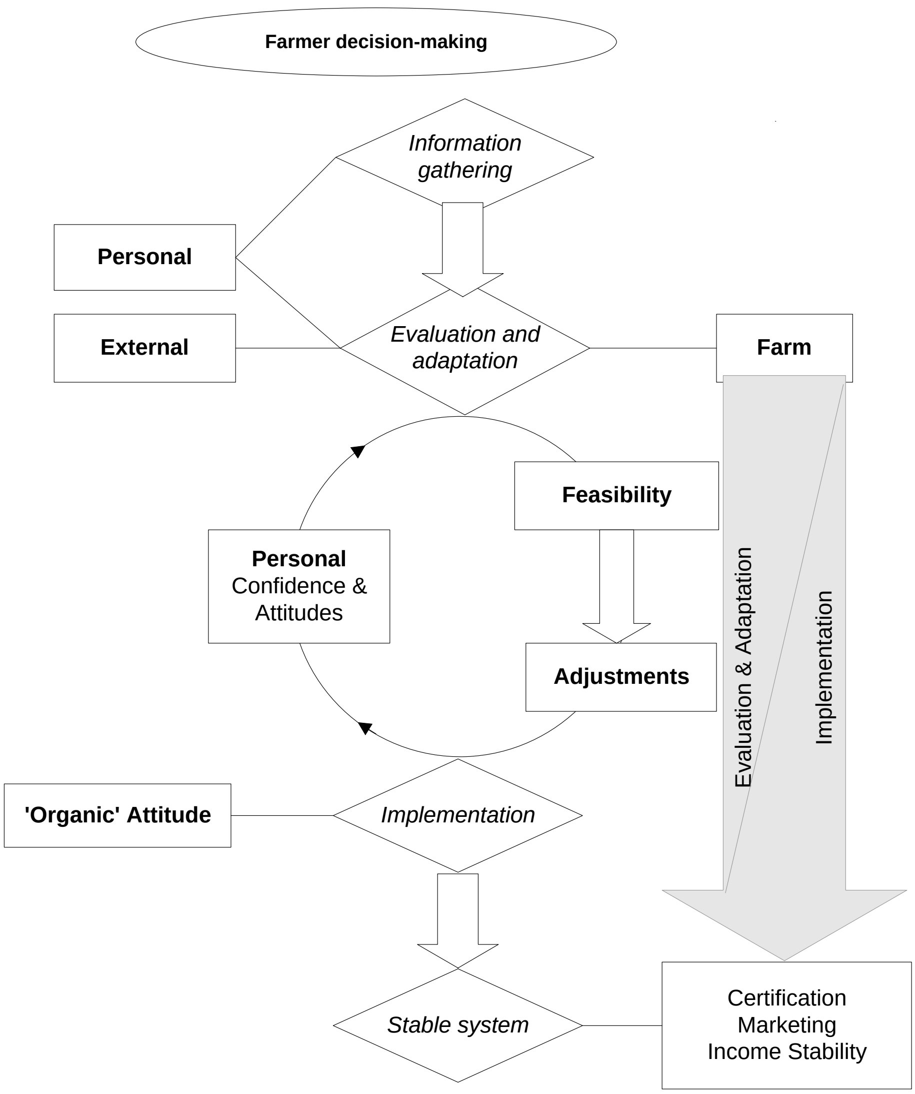
Information gathering

Acknowledging the now widespread awareness of organic farming among farmers, the first and second phase of the adoption model (Awareness and Information) were merged into one stage of *Information gathering.*

The literature confirmed a diversity in attitudes both among conventional and organic farmers (e.g. Fairweather, 1999; van der Ploeg, 1994b), whereby farmers with broader environmental concerns and a positive attitude to challenge and change appeared more likely to consider organic farming as a potential alternative (Maurer, 1997, Duram, 1999). The numbers of farmers with an interest in organic farming was found to be considerably greater than the number of farmers that have adopted or actively enquired about organic farming, highlighting the potential role that better technical, financial and marketing information could play in influencing farmers' attitudes in taking further action in pursuit of their interest (Fairweather, 1999; Midmore *et al.*, 2001; NatWest, 1992; SA, 2000).

A review of many studies of conventional and organic farmers (Chapter 2) established that changes in the categories of *Personal*, *Farm-specific* and (additional to those considered in the adoption model) *External* factors are likely to influence whether a farmer progresses to the next key stage. The empirical research on the case study farms confirmed the potential impact of variables in all three categories: a change in *personal attitudes* was related to health experiences, the farm circumstances changed for example in terms of the generation transfer, and for most farmers the move towards conversion was prompted by a change in external factors, in this case the likely future availability of organic premiums for milk. Other external factors confirmed as influencing the wider uptake of organic farming are: changes in conventional agricultural prices, food and farming scares and, in most European countries, financial support payments for conversion and organic management, which have the additional effect of raising the profile of organic farming (Loibl, 1999; Michelsen et al., 2001; Padel et al., 1999). Farmers thereby do no act directly to external events, but on their perception of them, which explains the subjective and personal element in farmer decision-making. However, this personal opinion about external events is formed on the basis of information that is available to farmers, which should therefore be considered as influential on attitudes. Whether improved information provision really would help to shorten the information gathering stage and trigger the evaluation phase sooner is an interesting question, and whether this would indeed be desirable, would need to be addressed in a different study.

Figure 10-1: Model of the process of conversion of farmer and farm



Source: Own data

Evaluation and Adaptation

The second phase, *Evaluation and adaptation*, is of particular interest in understanding whether and how the strategic, system-level change of organic conversion–in contrast to the step changes on which most adoption research had focused–is practically evaluated on farms. The experiences of the case study farmers confirmed the importance of on-farm evaluation for the decision-making process, although it was in many cases difficult to distinguish clearly between this and following phase of *Implementation*.

Unlike a Canadian model of conversion that proposed a two-staged approach to change at this level: 'improvements of the conventional system' and 'gradual de-intensification' (MacRae *et al.,* 1989 and 1990), the case study farmers were found to have evaluated organic farming in four different ways:

1. gradual extensification (e.g. clover production before conversion; homeopathy for cattle),
2. block experiments (e.g. organic farming on a block of land, organic vegetable enterprise),
3. gradual implementation (staged conversion), and/or
4. theoretical evaluation (financial feasibility assessment and conversion planning).

On the majority of the case study farms (six out of eight), organic farming was evaluated practically in one of the three different ways. It appears as if–as was postulated in the adoption model (Rogers and Shoemaker, 1971)–most farmers need to gain some practical experience with a new system before they can make a firm decision and can confidently progress to the next stage of full *Implementation.*

Another important outcome of this practical *Evaluation* of the new system found on the case study farms was the adaptation of the organic approach to suit the personal objectives and farm resources, as expressed in the labelling of this key stage. The importance of this adaptation function was also highlighted in research on changes in farming practices in the catchment area of a water company, which identified a stage of on-farm experimentation and gradual adaptation of solutions (Gafsi, 1999), and in the context of Australian Landcare initiatives (Vanclay, 1997).

Two case study farms making a decision in favour of conversion on the basis of theoretical evaluations highlight the potential that conversion planning could have at this stage (see also recommendations for conversion planning below) in reducing the need for practical experimentation and hence the risk of costly mistakes, apart from its potential role in the subsequent *Implementation* stage. Conversion planning could be further improved through the development of better tools (e.g. computer program for conversion planning), the training of consultants, and grants for conversion planning to farmers, as currently available under Farming Connect in Wales (OCW, 2001). However, further research would be needed to assess the impact of widespread availability of conversion planning on farmer decision-making.

The length of the *Evaluation and adaptation* phase can vary from one to approximately ten years, i.e. ten years of experimentation and gradual conversion before the decision to implement organic farming fully is made. Particularly the second and third option of practical evaluation listed above will involve registration of the farm or part of the farm as 'in-conversion' with an organic sector body, even if the final decision, whether or not to proceed into the next phase of *Implementation,* has not been made. It is likely that farms where only one part is registered as organic (e.g. the poultry unit with continuous conventional arable enterprises) also have as their main reason a very long *Evaluation and adaptation* stage of the farmer. External incentives, such as conversion aid payments, might increase the likelihood of registration of farms in this stage and may even force farmers into implementing organic farming on the whole farm before they themselves would have reached this point. The German programme, for example, prescribes a full conversion of the whole farm in one year for it to qualify for payment (Lampkin *et. al*, 1999), but this may not necessarily influence the decision-making process at the same time. The fact that the farmers had not fully accepted the new choice is illustrated by the re-conversion of a number of certified farms in Austria after the end of the first five-year conversion support period (see Kirner *et a.l,* 1999a,b).

The distinction between the *Evaluation and adaptation* stage and the following *Implementation* stage is based on farmers' attitudes, on their confidence that organic farming is the right choice for them, and the knowledge how it would work under the specific circumstances of their farm, including the confidence that products are likely to be marketed with an appropriate premium. This illustrates that attitudes do not only influence the propensity to consider conversion, but are also important for further progression. However, it also highlights that the experience of practical experiments and gradual implementation influences the farmers' attitudes as was pointed out by Willock *et al.* (1999) in a more general sense. It is therefore possible that the attitudinal differences found between organic and non-organic producers (Beharrell and Crockett, 1992; McCann et al., 1997) reflect the outcome of this attitudinal change process that farmers undergo when they evaluate and implement organic farming, as well as attitudinal differences in their propensity to consider organic conversion in the first place.

The *Evaluation and adaptation* stage can be considered as a key stage in the farmers' conversion process (as opposed to the farm conversion process) and represents an important period of learning, during which new knowledge and insights develop. Any external assistance should aim to support the farmer's learning process rather than aiming to provide a blueprint for the farm conversion; Vanclay (1997) argued that extension workers should not aim to become agents for change, which may be an important lesson for the development of new services such as those provided by Farming Connect in Wales.

Implementation

A review of the Standards and studies of the conversion process on livestock farms (Chapter 3) contributed the understanding that the *Implementation* stage that follows after the adoption-decision, labelled Adoption in the original adoption model, lasts for at least the minimum time period for conversion required in the Standards. The key distinction to the previous stages is that, a decision in favour of conversion having been made, this decision is now implemented, which is likely to have implications for farmers' information needs. The *Implementation* period that follows differs in a number of ways from an established organic system: farmers may experience additional declines in yields, output and income, and face additional investment costs, before the farm qualifies for price premiums (Dabbert, 1994; Padel and Lampkin, 1994b). On the case study farms, this Implementation period lasted between one and seven years after the decision to convert the whole farm had been taken, until an endpoint represented by full organic certification and financial stability (although it proved difficult to determine this) under the new management was reached (Dabbert, 1994). The impact of the conversion process on the case study farms is discussed in greater detail below.

Given that gradual conversion, including registration of the farm with a certification body, can already have been part of the previous stage of *Evaluation and adaptation*, it is difficult to distinguish clearly between the two, and the conversion process of the farm (as compared with the farmer) can stretch over both, whereby the element of *Evaluation* gradually declines and that of *Implementation* increases. As far as the impact of conversion on farms is concerned, the distinction between the two stages may not be strictly necessary and the beginning of conversion could be referred to as in the Standards. i.e. the date when the last non-permitted inputs were applied. Whether or not the farmer has decided to convert the rest of the farm is likely to be not so important for an individual field under study, as long as it is known since when it is 'in-conversion'. However, production-related and economic research on farms could also be affected by the early evaluation stage of the farmer's decision-making process, as this could have resulted in gradual extensification of fields or practices, e.g. the introduction of clover in leys or the reduced use of dry-cow therapy. On the case study farms, for example, the extent of the reduction in stocking rate levels and milk yield appeared to be influenced by the intensity before conversion. This implies caution in interpreting trend comparisons that use a pre-registration reference point, as discussed below. Researchers of change processes should therefore always aim to obtain some information about the historic development, and if possible more than one year's reference data to evaluate trends.

Conclusion

It can be concluded that the three-stage model provides a useful concept to study the organic conversion process, both in terms of the farmer's decision-making process and on the conversion of farms, and has wider application to environmental change processes on farms. A general information gathering stage is followed by an important stage of practical and theoretical evaluation on the specific farm, before full implementation of the new system follows. Personal, farm-specific and external variables influence the second stage, and farm-specific and personal variables are influenced by the second and third stage. For the organic conversion process in particular, the registration with a certification body does not characterise the endpoint of the farmer's decision-making process, but remains a useful reference point for the study of the impact of conversion on farms, provided that the historical context is considered.

An integrated approach to analysing the personal, social, production-related and financial implications of change processes on farms

The study was conducted using comparative case study research in the traditions of farming systems research, qualitative social inquiry and inductive research. This method was chosen because for organic conversion, as in the broader area of farmers' decision-making related to environmental issues, no single conceptual model had been identified in the literature and personal values and goals appeared to be very important.

When this research began, few dairy farms were engaged in organic conversion, limiting the number of farms that could be studied. Maxwell (1986) recommends, because of diminishing returns in the quality of the data, that comparative farm case-study programmes should be limited to approximately ten farms. Originally, this number was recruited, located in the most important regions for organic milk production at the time (south-west England and Wales), but unfortunately two farms left the study after three years of monitoring, leaving a full set of data from only eight farms to be evaluated.

In developing the specific approach for the study, reference was made to the tradition of Farming Systems Research (Gilbert, 1980; Bawden, 1995) and soft systems thinking (Checkland, 1999). Further methodological guidance regarding sampling, collection and analysis of unstructured data was drawn from standard works on fieldwork and data analysis for qualitative social research (e.g. Lofland and Lofland, 1984; Patton, 1990; Silverman, 2000, Creswell, 1998), case study research in general (e.g. Yin, 1994) and Maxwell's (1986) recommendations on using case studies in Farming Systems Research. The conversion process was investigated both in relation to the farmer (social characteristics, experiences, use of information sources) and to the farm (farm structure, impact on production, impact on income) through a combination of unstructured and structured data.

With the help of contacts in various organic organisations, farms were selected to represent typical dairy farms that began their registered conversion between 1988 and 1991. The farms varied pre-conversion in terms of type, size and intensity, so that further insights into driving factors and processes could be gained through these contrasts. On average, the sample was of similar intensity to the national dairy industry at the time with respect to stocking rate, milk production per cow and output per hectare (Franks, 1999), but of lower intensity than dairy farms monitored by Milkminder (Thomas and Perry, 1991). Differences existed with respect to herd size (average of 131 compared with 69 cows), cost structure, income situation and age (Franks, 1999).

The qualitative data were collected using intensive interviews with the farmers in 1995, which were fully transcribed and analysed with the help of a computer program for indexing and retrieval of unstructured data (OSR, 1995). The case study farmers had a range of farming and business-related goals that influenced their decision-making. Studying the farmers' motivations for conversion and their objectives proved to be an effective tool for gaining a better understanding of the objectives on each farm, particularly those that appeared to be important in shaping farm development.

The quantitative data originated mainly from farm accounts and dairy enterprise costings, and covered a range of physical and financial indicators from the last year before conversion to the 1997/98 financial year. The distinction between physical and financial indicators made it possible to differentiate the production-related effects of the conversion on land use, forage and milk production from the financial impacts of premium price marketing and production related impacts on costs. The analysis was mainly based on standard farm management analysis procedures, but included the analysis of trends over time. The data from each of the case study farms were compared against the pre-conversion situation of the farm itself and, in aiming to establish the hypothetical situation of production and income levels under uninterrupted conventional management, two sets of conventional comparisons.

The combination of data on the farmers' attitudes and experiences and the impact of conversion on the case study farms allowed for an assessment of the farmers' objectives, not only on the basis of their attitudes, but also on the basis of the outcome of the decision-making process. The farmers' behavioural changes were thus not only studied on the basis of attitudes, but through a variety of perspectives (Becker and Geer, 1970; Willock *et al.*, 1999) allowing for triangulation of the findings (Patton, 1990). A similar combination of data was also used in some farming styles research (e.g. van der Ploeg, 2000), but his study added the dimension of time, important for understanding change processes, by considering longitudinal data and development trends. A similar case study approach was used by Gafsi (1999) in a study of the change of farming practices in the area of water protection and in other studies of farmer decision-making (Sutherland *et al.*, 1995; Öhlmer *et al.,* 1999). The main advantages of a case study approach is that farmer decision-making can be studied in the context of both the person and the farm and that the method is suitable for studying the process of change itself.

However, the approach also has a number of shortcomings. Firstly, because of number of farms and the sampling procedure, the sample cannot be considered to be representative of organic milk producers, although when the study began, it covered approximately 50% of dairy farms converting to organic production at that time. Secondly, because qualitative data were only collected at one point, there was a need to rely on the farmers' memory regarding the pre- and early conversion phases, which could have been avoided by collection of data of farmers' attitudes at a very early stage of their conversion, although for several farms it would have been very uncertain at that time whether or not the farmer would have continued with conversion. Thirdly, the quantitative data collection procedure based mainly on an analysis of farm accounts and bank statements did not adequately cover some issues. It would have been desirable to carry out direct measurement of forage production over the whole conversion period, and the data for labour use (annual labour units) and net worth development were not reliable.

The method provided a qualitative understanding of a range of values and factors that have an impact on the organic conversion process on dairy farms. Herrero (1999) argued for a need to obtain such a broad understanding of the basic objectives of the decision-maker, the behaviour of and interrelation between different parts of the farming systems, and the agro-ecological context in order to develop a support system for holistic livestock management. The case study method proved suitable for studying the process of conversion of farmer and farm, and for uncovering how the process is influenced by attitudes, objectives and farm variables in a qualitative way, as well as what information requirements arose at various stages. It was also possible, at least to some degree, to explain the variation between farmers in terms of their choice of conversion strategies and approaches to organic milk production. The in-depth knowledge of each farm allowed for all results to be interpreted in the context of the whole farm system and thus – despite the lack of representativeness of the sample – also resulted in more information about the physical and financial impact of organic conversion on dairy farms.

It can be concluded that farm case study research is a suitable method for studying systems' change processes on farms, such as conversion to organic farming, by investigating the decision-making process of the farmer, the implementation process on the farm, and the interactions between the two in a qualitative way, and by drawing conclusions about the information requirements arising at various stages, whereby the farmers' perspectives of the change process can be considered. Such case study research cannot replace larger surveys, but supplements their results through in-depth knowledge and better understanding of important factors.

The farmers' perspectives of the conversion process and linkages with farm-specific variables

The literature review (Chapter 2) highlighted that conversion is influenced by (and in turn influences) a range of personal, farm-specific and external variables. When the research for this project began, the interactions between personal and other variables were poorly understood. Studies comparing conventional and organic producers showed that personal attitudes, such as concerns about the environment, attitudes to self-sufficiency and business, belief in the potential of organic farming and attitudes to challenge, may increase farmers' propensity for organic conversion (e.g. Durum, 1999). However, other research also showed that the motives for conversion vary considerably and that converting farmers vary in their strategies. There was a strong possibility that personal attitudes might not only influence whether or not conversion is likely, but also how it would be implemented. Methods of studying farmers' information requirements (through direct questioning and derivation from existing systems, David and Olson, 1985) also suggested that it is important to study the farmers' experiences with a particular system and problems they encounter with it.

As not all issues that might influence farmers' decision-making were clear when the research began, the use of open questioning was identified as most suitable for the subject, also because it permits a better understanding of farmers' subjective experiences of the change process (Albrecht, 1994; Skerrat and Midmore, 2000). A wide range of personal, social and managerial aspects of the conversion were discussed. The interview guide also included a number of closed questions regarding the farmers' use of information sources and their farm-specific objectives. The farmers were encouraged to report their experiences in areas of the conversion of livestock farms that had been identified from the literature, such as forage and animal production. These experiences were referred to in interpreting the data from the monitoring of farm production and financial indicators (see below).

Farmers' attitudes, motives and objectives

The motives of the case study farmers for their conversion varied, the range being similar to that found in other studies. Most farmers mentioned general environmental concerns, including doubts about the direction conventional agriculture was taking, and the majority also mentioned financial reasons, both likely premiums and reducing costs of production. Several farmers mentioned personal motives, but few mentioned technical motives for the conversion (one farmer was concerned about the health of his cattle), which had been mentioned frequently in previous studies (e.g. Vine and Bateman, 1981).

Overall, the motives of case study farmers appeared to be similar to those in 'later' studies (e.g. Maurer, 1997; Kallio, 1997), with a strong dominance of environmental and financial reasons, which may indicate that a shift in motives, at least among dairy producers, may indeed have happened much earlier than commonly acknowledged, related to the wider availability of organic premiums after the deregulation of the Milk Marketing Board. However, because of the small number of farms studied, it is not possible to draw firm conclusions. An alternative explanation may be the stronger farming orientation of the case study farmers compared with organic farmers in other surveys. For example a large proportion of the horticultural producers surveyed by Burton *et al.* (1999) came from other professions, whereas the majority of the case study farmers had some agricultural education and background.

All farmers had a variety of objectives in running their farms, including lifestyle and family-related goals, and further improvement of the financial situation remained an important objective to most farmers throughout their conversion. Other objectives important to the farmers were related to diversification, technical aspects of production and lifestyle (Bahner, 1995; Fairweather, 1990; Gasson, 1973; Willock *et al.*, 1999). Several of the objectives clearly had an impact on farmer decision-making, confirming its complexity, and the influence of a range of socio-economic and psychological variables (various authors quoted by Willock *et al.*, 1999). This makes the general assumption questionable that farmers decision-making is motivated primarily by the profit-maximisation objective.

Among the case study farmers it was possible to identify a range of goal-related variables that appear to influence most strongly the direction in which a farm developed during conversion. The two most important objectives on each farm were diversification (four farms), dedication to production (level, intensity and/or size, two farms), low-cost or low-input production (three farms), marketing (five farms) and lifestyle (two farms), which occurred in four different combinations. The goal orientations correspond with those found in other studies of organic farmers (Noe, 1999; Peters, 1997) and also with a number of farming styles identified among conventional producers (Fairweather, and Keating, 1990; van der Ploeg, 1994a,b; van der Ploeg, 2000). For example the low-cost orientation appears to be very similar to the 'economic' orientation, effectively referring to a way of farming with low costs and low external inputs, that van der Ploeg (2000) considered as deserving more attention for rural development. However, van der Ploeg saw this style as standing in contrast to alternatives, such as diversification and organic farming, whereas these results would suggest that a low-cost orientation is represented among organic producers and others with a similar orientation may well consider organic conversion. Other values that were found to influence farming styles of conventional farmers, such as 'flexibility' (Fairweather and Keating, 1990), 'cow breeding' and 'greed' (van der Ploeg, 1994 a and b) were not represented among the case study farmers.

The results also gave an indication that farmers' personal attitudes are influenced by the conversion experience. During the interviews, the farmers showed great concern for technical issues, whereas these had hardly been mentioned as reasons for conversion. To make organic farming work, while the Standards restrict the level of intervention possible, farmers have to learn to pay more attention to technical details in the first place, so that problems are avoided. The data also clearly show that the farmers learned from their experiences, for example feed shortages taught them to improve their swards or reduce stocking rate levels. It appears as if the farmers develop a more 'organic' attitude as a result of the conversion process. This change in attitude could possibly extend beyond husbandry to other areas, such as marketing, or belief in organic farming. Whether attitudinal differences found between organic and conventional producers in several studies (e.g. de Buck *et al.*, 2001; Fairweather, 1999, Midmore *et al.,* 2001) therefore represent a determining factor of adoption is questionable. To investigate this point in greater depth, it would be necessary to collect attitudinal data from farmers before and at several stages during their conversion process.

It can be concluded that farmers' motives for conversion vary and that their personal attitudes not only influence whether they will take up organic conversion, but also the direction that the farm takes. It appears likely that the whole conversion process influences the farmers' attitudes, so that the farmer him/herself may as a result become more 'organic'.

Choice of different conversion strategies

The literature showed that both 'staged' and 'single step' conversions were represented among converting farmers in the UK (Lampkin, 1993), but the reasons for the farmers' choice of conversion strategy were not fully understood. The staged approach, whereby fields could be converted starting with fertility-building crops was historically dominant, but recently, with the availability of financial support for conversion and strong market demand, single-step conversions have become more common, as indicated by the large proportion of land that began conversion in 1999 and was certified in 2001 (SA, 2001b). This contradicts Vartdal (1993), who concluded that later converting farmers are more likely to choose staged conversions.

Of the eight case study farms, four mixed and two specialist farms opted for a staged conversion, two specialist farms were converted in a single step. For specialist livestock farms under conditions of relatively high and secure organic premiums for milk, rapid conversion is financially more interesting as it offers the possibility of faster certification of the herd (Lampkin, 1999), although the implications for forage supply should be carefully assessed (see below). For mixed farms gradual conversion of the land starting with fertility-building crops is more appropriate, but this strategy makes it more difficult to identify accurately the earliest possible certification date for the dairy herd. To establish this date accurately well in advance is in the interests of both the farmer and potential milk buyers, so that a market for the milk can be secured (Bagenal, 1998, personal communication).

However, the results of two specialist dairy farms that opted for staged conversion illustrate that the choice is also influenced by other factors, such as the farmers' decision-making process. The specialist dairy farmers opted for staged conversion effectively to keep their options open. They wanted to evaluate the impact of organic farming on smaller parts of their farm before they were committed to convert the rest of the farm. This staged conversion had the added advantage that the risks, for example of feed shortage, could be reduced and for farms with arable cropping would allow fields to be entered into conversion with a fertility-building crop. However, once the decision to convert the farm was made, the remaining land was converted rapidly and most farmers wanted to "*get on with it*" and not want to have to manage two different systems any longer.

It can be concluded that choice of conversion strategy is related to farm type and the stage of the decision-making process of the farmer, whereby staged conversion can represent a form of on-farm evaluation of the organic farming system before the decision to convert fully is made. For specialist dairy farms an important reason for rapid conversion is earlier access to organic premiums, but staged conversions allow the risks to be spread and gradual gaining of confidence and experience.

Sources of support and information

In the early stages of decision-making and also during conversion, the farmers received social support from a range of personal contacts including members of the close family and friends, but also from other organic farmers, advisors and in one case the local vet. Several of the case study farmers had close links with the local agricultural community which they wanted to maintain throughout conversion. On the other hand, the farmers experienced resistance and scepticism towards conversion from the older generation on the farms, as well as from friends and advisors.

The stages of conversion provide a useful framework for identifying information needs. At first, during the *Information gathering* stage the information required is of a general nature, covering technical, financial and information about market and policy development. In the next stage of *Evaluation and adaptation*, information needs centre around the evaluation of organic farming with respect to the farm itself. This is followed by more detailed technical information needs, as well as needs related to finding markets and understanding the certification process. Similarly, there are varying preferences for information sources as in the phases of the adoption/diffusion model (Lionberger, 1961).

The case study farmers, like organic farmers in other studies (e.g. Gengenbach, 1996; Fersterer and Gruber, 1998; Luley, 1996), used a variety of information sources. Other organic farmers became more important as an information source as the conversion progressed (Wynen, 1990). During the later stages of the farm conversion (*Evaluation and adaptation, Implementation*), converting farmers clearly prefer more specialist organic information sources (including publications and other organic farmers) to sources widely used by farmers in general (such as farming media and consultants). This reflects the lack of consideration of the needs of organic farmers by mainstream information providers, and can also be explained by the organic farmers scepticism towards the agents and institutions of conventional agriculture (Gengenbach, 1996). The farmers, like the horticultural producers studied by Burton *et al.* (1999), continued to read general farming magazines, but did not find them useful as information sources. It is possible that farmers converting today would see this differently, because the coverage of organic farming issues and the attitude towards it has changed considerably in the UK farming media over the last ten years. This organic paradox, the scepticism towards the institutions of mainstream agriculture on the one hand *versus* the need for liaison (Michelsen *et al.*, 2001; Padel, 2001). There appears to be a clear gap of information sources in the early stages of *Information gathering* and *Evaluation,* when farmers are likely to turn to known and trusted information sources, such as their mainstream consultant. UK farmers at this stage currently qualify for free telephone support and, in most regions, limited on-farm advice under the government sponsored OCIS programme, used by several hundred dairy producers each year (Organic Conversion Information Service, (ADAS, 1997; ECOTEC, 2001; Little, 2001). An additional way to address this gap (and to publicise OCIS further) would be to offer basic awareness training on organic farming to various agricultural professionals, some of whom have significant misconceptions about its likely impact and potential, as the experiences of some case study farmers illustrated.

During the *Evaluation* and *Implementation* stages, all eight case study farmers had more or less regular contact with a specialist organic advisor, unlike organic farmers in other studies (Luley, 1996) and most other UK organic farmers (Measures, 1998, personal communication). This difference may be related to the role of the Organic Advisory Service (OAS) in identifying the study farms, or possibly may reflect the wider availability of organic advice in the region. Most case study farmers also carried out some form of conversion planning, either with the help of the OAS or by themselves, also a much higher proportion than in other studies (Vogtmann *et al.*, 1993; Loes, 1992). This stands in contrast, for example, to the large proportion of Austrian organic farmers who did not have access to any specialist advice and failed to understand basic principles and concepts of organic farming, resulting in a high proportion re-converting to conventional production once they could leave the organic support scheme without financial penalty (Fersterer and Gruber, 1998; Kirner *et al.,* 1999, a,b). It is possible that some entrants to the UK organic farming scheme will also behave in a similar way, particularly if premium markets do not materialise as anticipated.

Like farmers in Brandenburg, Germany (Hamm et al., 1996), the case study farms found this professional support very useful and conversion planning could also reduce the need for practical experimentation, helping farmers to avoid costly mistakes. It appears as if specialist organic advisors can, by discussing and interpreting the principles, concepts and the likely impact of organic farming in the context of the specific farm, support farmers in progressing to the next stage of *Implementation.* This issue becomes particularly important where conversion aid programmes provide financial incentives, but is not addressed by the UK OCIS programme, as farmers are only entitled to two visits that usually take place before the farm is converted. Advice during conversion could potentially reduce the number of farmers likely to re-convert, as well as reducing the risk of conversion. High costs of advice, however, as in a user-pays environment, would restrict the number of farms that take it up, as was made clear by the case study farmers and in reports on organic advice in European countries (Fersterer and Gruber, 1998, Lampkin *et al.*, 1999). The availability of detailed conversion planning advice as part of the new Farming Connect service in Wales (OCW, 2001) is an attempt to address this issue.

More experienced converting and organic producers could benefit from a regular check-up on the strengths and weaknesses of their systems, particularly in areas that are not of prime concern to them. This idea corresponds to the annual inspection by the certification bodies, but due to the almost complete separation between inspection and advice for a number of reasons; the main function of the inspection is currently to provide assurance to the consumer and is of limited value to the farmer in improving on weaknesses.

One limitation on the greater uptake of advice may be the number of qualified and experienced advisors. Most professional organic advisory services have difficulties in recruiting well-trained personnel (very few UK universities and colleges offer any training in organic farming) and their limited financial resources do not permit them to invest in extensive training of new recruits (Measures, 2000, personal communication). All case study farmers were keen to point out the two-way relationship with advisors and their role as farmers in contributing knowledge. This highlights a need to consider differently the role of organic farmers in the structure of information and advisory services and to move away from the expert-based approach to agricultural extension.

It can be concluded that information needs and preferences for sources of information change during the key stages of the conversion process, from the general to the specific, both in terms of the general nature of the needs and also in terms of the increasing preference for information tailored specifically to organic farming systems and to the specific farm. There is a need to support farmers in their learning process during and not just before conversion and to re-consider the position and role of farmers as equal partners in organic information and advisory services.

Impact of conversion on farm structure, forage and milk production, and the related information requirements

This objective of the research was addressed through a review of Standards, literature of organic and converting dairy and livestock farms, and the monitoring of case study farms. Based on this, conclusions about the likely information requirements of dairy farmers could be drawn.

Structural changes

According to the general principles of the EU Regulation on organic livestock production, organic stock farming is a land-based activity (EC, 1999, Annex 1 B, 1.4). It appeared likely that converting dairy farms would undergo some structural changes, such as increasing the temporary clover/grass leys in the rotation and adjusting stock numbers to the natural carrying capacity of the land. There was further some indication that mixed farms are more suitable for conversion, which should lead to greater diversification on specialist farms as conversion progresses.

The results show that during conversion increases in **farm size** were also observed on some case study farms, but there was no indication that farms bought or rented additional land to compensate for forage yield reductions during conversion, as had been suggested in other studies (Rantzau *et al.*, 1990; Schulze Pals, 1994). It appeared that the changes in farm size were not directly related to the conversion, apart from growing confidence in organic farming on some large estates resulting in more land being converted.

Pre-conversion there was a greater tendency towards specialisation on the smaller farms (50 to 85 ha), whereas most of the larger farms (200-450 ha) had more diverse enterprise structures; some were previously orientated towards arable production. Due to the introduction of cereals crops on some, but not all, specialist farms during conversion, the forage area as a proportion of UAA declined on those farms by 4%. However, the majority of the specialist farms converted without major changes to land use. Forage area increased by 14% on mixed farms, due to the introduction of clover/grass leys to increase fertility building in more arable-orientated rotations. As in recently published Danish studies (Halberg *et al.*, 1997; Kristensen *et al.*, 1998), the land use changes on these dairy farms during conversion were lower than would be expected from comparisons of average land use on organic and conventional farms across all farm types. It can therefore be concluded that changes in land use during conversion are related to the situation before conversion, which does not imply substantial land use changes, particularly on smaller and more specialised dairy farms.

The results confirm that organic conversion is likely to have an impact on **stocking rates**. Average values on the case study farms were reduced by approximately 15%, with initially higher reductions (of approx. 30%) on some farms, particularly those with higher intensity before conversion. Under organic management, stocking rate levels on the majority of farms (five) were close to the average value of 1.5 LU/ha. Values under organic management for the case study farms were lower than in earlier studies (1.6–2.0 LU/ha; Lampkin, 1993) and considerably lower than for clover-based conventional dairy systems in the UK (1.9 LU/ha; Leach, 1999) and the national average for conventional systems (1.7–2.3 LU/ha, Harper and Jones, 1997; Franks, 1999), which may partly be related to the fact that the sample contained four farms with a mixed enterprise structure and to the reduced use of concentrates on some case study farms. However, stocking rate values were higher than reported in recent German and Danish studies (0.8 LU/ha-1.2LU/ha, Kristensen *et al.*, 1998; Schuhmacher, 2000). Stocking rate development during conversion on the case study farms was influenced by the need for fertility building on arable land, by farmers' production preferences (farm stocked highly prior to conversion aiming to re-establish high values) as well as factors such as forage production levels and feed purchases. It can therefore be concluded that stocking rates are likely to decline during conversion. However, because of the interaction with purchased fees ('borrowed hectares') and their likely reduction during conversion, as well as in the influence of personal preferences of the farmer, they cannot be considered a valuable indicator of the development of forage production on farms during conversion.

Forage yield development

Based on the literature, forage yield levels were expected to decline during conversion, related to the withdrawal of nitrogen fertilisers and need to establish clover-based swards, but to return to levels comparable with conventional farms once a stable organic system has been established. However, in general terms organic producers are to a much lower degree able to influence yield levels through moderating inputs other than slurry/manure and P & K applications, and productivity levels depend much more on effective forage utilisation and grazing management.

The case study farmers had some initial problems with the requirements of the Standards, e.g. the need to separate 'organic' and 'in conversion' forage, particularly for clamp silage making on farms with staged conversions. They also experienced some technical problems with the establishment of legume-based forage crops (both undersowing and timing of open sawing), as well as their management, for example adjusting to the later growth pattern for grazing and silage making, problems which could possibly have been avoided with improved access to information. One farmer spoke about having to re-learn the rules for silage making in going for later cutting dates. This is reflected in recommendation by Sheldrick *et al.'s* (1995) that white clover-based swards should be cut for silage after pure perennial ryegrass swards, whereas red clover leys could be harvested at the same time as pure ryegrass swards.

In addition to stocking rates (see above), forage yield development on the case study farms was monitored through the calculated indicator of utilisable metabolisable energy (UME), which fell on average by 8% across all farms. Seven of the eight farms showed reductions of up to 18% in UME values during the first two to four years of conversion, but variation in UME values (up to 30% below average values) was also experienced in later years of conversion. UME development trends appeared on most farms to be related to annual rainfall, confirming climate as a very important factor for forage production under organic management (Newton, 1995; Jones *et al.*, 1996). However, some variation in UME values did not appear to be explained by rainfall, which suggests that other factors such as conversion are important.

Forage yield development had been directly measured by IGER using sampling of silage cuts and exclusion cages during the first three years of the project (1993 to 1995). However, because of the earlier start of the conversion on most farms, these years did not coincide exactly with the early conversion years. Combining data from all farms, Jones *et al.* (1996) reported 15% higher yields in the second year of conversion compared with the first year. This implies that an initial conversion-related forage yield decline exists. This was also predicted by Danish models to be in the range of 12–15 %, depending on soil type but independent of climatic influences (Halberg and Kristensen, 1997). Under organic management, forage yield levels may return to equivalent or slightly lower levels than conventional clover-based or pure grass swards which has been established in various studies (Newton, 1995; Bax and Brown, 1995; Jones *et al.*, 1996). Because forage yields had not been measured under conventional management or throughout the study period, it is not possible to reach any firm conclusions about the magnitude of a conversion-related forage yield decline. A yield decline early in conversion was found during the conversion of the experimental farm at IGER Ty Gwyn (Weller, 1999) and appears to have been also experienced by those case study farmers who converted a large proportion of their land it one step. It appears therefore almost certain that such an effect exists and should therefore be considered in the planning of forage supply during conversion.

The farmers also mentioned a number of pests that may have contributed to forage yield decline, such as slugs, eelworm and rabbits, with slugs considered a big problem on two farms. Further difficulties were experienced with dock control, but it is not possible to verify the effect of any of these factors on yield.

Milk production

The Standards recommend that livestock should be fed preferably using feeds from the holding, and that through good husbandry (housing, choice of breeds, feeding) the need for medical intervention with drugs could be reduced.

Based on the literature it was expected that converting farms, particularly those with intensive milk production and high levels of concentrate feeding, were more likely to face reductions in milk production levels both per cow and per hectare. This was confirmed by the results from the case study farms. Specialist milk producers with higher than average milk yields pre-conversion showed yield reductions, whereas farms with lower yields maintained a more or less continuous increase in milk yield per cow. The conversion process led to initial yield reductions, at a time when average yields on conventional farms were continuously increasing (Franks, 1999), even if average milk yield for all farms under organic management in 1997/98 was comparable to pre-conversion levels.

Milk production per forage hectare during conversion was reduced by 14%, from 9392 litres per forage hectare in Year 0 to approximately 8000 litres per ha in 1997/98; initially even greater reductions occurred. The differences between the case study and conventional farms in terms of milk production per forage hectare increased during conversion, from 10% in 1990/91 to 30% in 1996/97. Trends for milk production per hectare seem to correspond with UME production and the annual rainfall.

Increasing trends in the second data collection period on several farms indicate that improvements in the milk yield per cow also remain an important objective for organic dairy producers. However, the average yield level of the case study farms of approximately 5200 litres per cow in 1997/98 was 10% lower than the national average for conventional dairy farms in the UK (MAFF, 1999) and considerably lower than yield levels of 6451 litres per cow in the specialist dairy herds monitored by Axient (Harper and Jones, 1998), although farms participating in Axient monitoring are believed to be above average in terms of management. Yields levels on the case study farms are similar to those reported for organic farms from Germany (Nieberg, 1999; Redelberger, 1995), but lower than studies reported from the Netherlands (Lei-DLO cited in Offermann and Nieberg, 2000) and Denmark (Kristensen and Kristensen, 1998). Recent data by (Fowler *et al.*, 2001) confirm a continuously increasing trend also on organic dairy farms in the UK. The utilisation of high genetic merit cows within organic farming systems has been questioned on both nutritional and welfare grounds, but also that selection will continue to include milk yield (Pryce *et al.*, 2001). Haiger (2000) also considers breeding for higher performance per cow an effective way to save on feed, labour and housing expenses on organic farms, but suggests a physiological limit–related mainly to the cow's ability to eat sufficient quantities of forage–of approximately 8000 kg of annual production should be respected.

It can be concluded that initial reductions in milk yield are likely, depending on the yields before conversion, but that converting producers (as dairy producers in general) appear to aim for increases in milk production levels per cow.

Use of concentrates and milk production from forage and from the farm's resources

In line with the general principles of organic farming, it was expected that converting farmers would either reduce levels of concentrate feeding per cow, or use the allowances in the Standards for feeding purchased concentrates in order to maintain milk production levels. Unlike the situation with forage production, milk yields may be influenced by the level of concentrate inputs under organic management, both purchased and home-grown. In this context, concepts of factor/product optimisation derived from production economics may be applicable, particularly in terms of the level of concentrates fed, the least cost composition of the concentrate mix, and the optimal combination of forage and cereal production activities within a mixed farming system.

The results from the case study farms showed that, on average, feeding of concentrates was reduced by approximately 20% per cow or 25% per litre. The average reductions in concentrate use are in line with later studies of organic milk production (Kristensen and Kristensen, 1998; Krutzinna, 1996), where lower concentrate use was found, or a higher proportion of energy supplied by roughage in the diet of organic compared with conventional dairy cows. Average concentrate use under organic management ranged from 0.1 to 0.3 kg per litre.

However, the variation between farms in terms of concentrate use remains substantial; reductions in use varied from 15% to 60%, and on one farm the level of concentrate feeding was increased. The use of concentrates did not, however, appear to be directly correlated with milk yield. The two farms with the highest average concentrate use also had the lowest average milk yields; others using very low levels of concentrates were among those with the highest milk yields. The data gave some indication that levels of concentrate use are related to forage production and that some case study farmers increased concentrate feeding to compensate for reductions in forage yield. More detailed data on the cows' actual diets, milk quality, quantity and quality of all feeds would have been needed to establish the real cause of the differences.

The use of home-grown concentrates (introduced during conversion on five farms) increased on average by 160%, and accounted for between 7% and 75% of total concentrates fed under organic management. However, the average use of home-grown cereals under organic management was relatively low at 20%, but higher than on conventional farms, where on average less than 10% of concentrates were home-grown (Franks, 1999). Most of the case study farms made use of the allowances in the Standards to purchase concentrates, but no farmer experienced significant problems with the sourcing of purchased concentrates that fulfilled the Standards' requirements.

Milk production from forage per cow and per ha increased on average by 40%, but the variation between farms was considerable. Due to greater availability of forage increases were more marked on the mixed farms. Milk production from forage under organic management ranged from 2200 to over 4500 litres per cow. Milk from forage values corresponded closely with UME values and hence annual rainfall data, which illustrates the influence of external factors on the system.

Feed shortages during conversion

The experience of four case study farmers confirms that feed shortages can be a problem during conversion, as German studies had suggested (Rantzau *et al.*, 1990; Schulze Pals, 1994). Three of the farms that experienced feed shortages during conversion were among those with above average stocking rates before and during conversion, and two farmers admitted that they had ignored warnings about the need to reduce stocking rates early in conversion. As their personal preferences seemed to influence stocking rate levels, it is possible that the farmers themselves, in aiming to maintain high stocking rates, were contributing to the likelihood of feed shortages, which were exacerbated by forage yield declines related to conversion and/or low annual rainfall. Although it may appear tempting to maintain high stocking rates during conversion or when farming organically, this is a risky decision. Should forage production decline for whatever reason (conversion, rainfall or pests), the certified organic farmer has to purchase organic forage or concentrates at significant additional expense, if he of she does not want to encounter energy shortages in the diet with potentially negative impacts on milk production and/or fertility.

The experiences of the case study farms show that feed shortages can be a problem, not only early in conversion, but also later on. It appears that they are caused by one or a combination of the following factors:

- Forage yield decline (factors influencing this appear to be conversion, soil type, rainfall, choice of crops, clover establishment);
- Lack of knowledge about the later growth pattern of clover-based swards;
- High stocking rates;
- Reductions in the use of concentrates leading to higher energy demands from forage.

If not counterbalanced by additional purchases of forage or concentrates, feed shortages could lead to a situation of energy deficiencies in the ration, with negative impacts on milk production and/or the welfare of the cattle. It appears possible that problems of fertility related to low energy supply found in other studies (Baars and Buitink, 1995; Steinwidder, 2000) could also be explained by a shortage of forage, and not just low concentrate feeding. This is supported by the conclusion of Haiger and Sölkner (1995) who found no negative impacts on the fertility of higher yielding cows with low concentrate diets, in a situation where forage of sufficient quantity and quality was fed in abundance (Haiger and Sölkner, 1995).

Farm management indicators of on-farm forage production

Given the importance of forage yield decline and feed shortages for converting dairy farms and the fact that direct information about forage yields is commonly not available on farms, one aim of the research was to test the validity and suitability of two indirect indicators of on-farm forage production.

Forage production was assessed on the case study farms over the whole study period on the basis of stocking rate (GLU/forage ha) and utilisable metabolisable energy (UME) per hectare. The stocking rate indicator has the advantage that it is widely used and well known to most farmers. However, it is not only a function of the forage production on the farms, but also influenced by feed purchases or 'borrowed' hectares. As the Standards regulate the concentrate input (see UKROFS, 2001) and conversion frequently leads to reductions in concentrates fed (Kristensen and Kristensen, 1998l Lampkin, 1993; Schulze Pals, 1994), the stocking rate cannot be seen as a reliable indicator of forage production. The results further highlight that stocking rate is also influenced by the farmers' preferences, and the need for fertility building in arable-orientated rotations.

The validity of UME as an indicator of forage productivity on farms was confirmed by a significant correlation between UME values and the physical measurements of grazing yields from the IGER data (unpublished data by Jones *et al.*, 1992–1995). Nevertheless, UME values do not represent the true net energy supply on each farm, because of the use of estimates for purchased forages and energy contents (Thomas and Perry, 1991) and the lack of consideration of silage reserves.

It can be concluded that UME trends appear to be better suited than stocking rates to assessing changes in farm-level forage production during conversion. Such energy-based concepts also have the potential for use in forward budgeting of forage, so that the impact of reduced concentrate feeding on annual forage demand could adequately be considered. Further experiences with the use of UME and similar concepts as tools for practical advisory work are needed before they can safely and effectively be used.

Other aspects of production

A number of issues were raised by the farmers that were not monitored on the farms. Several farmers had problems at first with understanding the Standards (e.g. dietary requirements) and found conversion planning had helped with the timing and achievement of certification.

The move away from dry cow therapy towards greater emphasis on mastitis prevention was perceived a challenge by the case study farmers. However, contrary to the farmers' worries before hand, health problems of dairy cows and incidence of disease on the case study farms were found to be similar to those on conventional farms (Weller and Cooper, 1996) as was also found in other studies (Krutzinna and Boehncke, 1996; Roderick et al., 1996; Weller and Cooper, 1996; Weller and Davies, 1998). Hovi (1999) concluded that despite the ban on the preventive use of antibiotics, cows on organic farms do not face a greater risk of clinical mastitis than conventionally managed ones. However, organic farms had higher somatic cell counts and the incidence of mastitis was higher in the first lactation week and in the dry cow period (Hovi, 1999).

It appears that once organic, dairy farmers are reasonably successful in their treatment of most of the incidences of clinical mastitis, but animal health clearly was an important area of information requirement throughout the conversion process. This had also implications for the relationship with the local vet, whose role changed from an emphasis on the provision of treatment to diagnosis and advice. Current converting dairy farmers are faced with a similar challenge, but the UK Standards now require the development of health plans (UKROFS, 2001), setting out strategies for prevention and treatment, with the involvement of the veterinary surgeon. The growing number of veterinary surgeons with knowledge of alternative treatments could reduce the need for self-help approaches as had been used by most case study farmers, but alternative treatments, e.g. homoeopathy, have been the subject of very few scientific studies of efficacy (e.g. Leon et al., 1999) and the uncertainty remains substantial.

With the help of veterinarians specialising in this area, farmers develop their own strategies and knowledge networks, but more support, such as training courses on homoeopathic treatment aimed at farmers and veterinarians, would help those who are thinking about it or are converting their farms.

No specific problems with regard to animal housing were mentioned. Only one farmer changed the housing system in the course of the conversion. Several farmers highlighted that they had already carried out improvements, so further changes were not of a very high priority. This may, however, be related to the farmers' lack of perception of a problem in this area. The is a strong move towards farm assurance schemes, with the first compulsory scheme likely to be introduced for dairy farms (National Dairy Farm Assurance Scheme – NDFAS), and welfare certification in the conventional sector (e.g. RSPCA Freedom Foods), are likely to increase the attention paid to this by organic certification bodies in future.

Conclusions and implications for research and information needs

The data show that the case study farms realised a principal aim of organic farming–reducing the reliance on external inputs–by the complete cessation of using artificial nitrogen fertilisers, by reducing the feeding of concentrates, and by producing more milk from forage. The main benefits of reduced reliance on external inputs is increased self-reliance/self sufficiency, reduced non-renewable resource use and reduced pollution (Lampkin, 1997). The reduction of concentrate feeding is also likely to have direct health benefits to the cow (Boehncke, 1996; Boehncke, 1997) as well as ethical benefits of reducing the competition of cattle for cereals that humans can consume (Phillips and Sorensen, 1993).

Similarly, and also contributing to the aim of greater diversity of land use, the use of home-grown concentrates increased on most (but not all) case study farms, but did not on average account for more than 20% of total concentrates fed. Under organic management between 52% and 92 % of the total milk was produced from the farms' own resources, which represented an increase during conversion of approximately 30% on average.

Given that the research was concerned with the process of change from one system to another, it did not aim to address specifically the question of the optimal use of purchased concentrates and the allocation of land between forage and home-grown cereal production, with implications for stocking rates and total milk output. These questions could be addressed by considering the factor–product and product–product relationships of production economic theory. With the increasing availability of research from experimental sites (e.g. IGER, 1999) and from commercial farms (e.g. Fowler *et al.*, 2001; various reference cited above), as well as current research in progress at Aberystwyth (IGER/UWA) comparing different organic milk production strategies, the lack of data should no longer limit the use of theoretical concepts of optimisation to these questions.

For farms with a substantial proportion of arable crops in the rotation, the product-product relationship between the forage and cereals enterprises are likely to be complementary (Chapter 3), particularly given the fertility benefits transferred from the forage to the arable enterprises. However, on the mixed farms with more than 50% forage, and particularly the specialist farms in the study with more than 80% of the land used for forage crops, the relationship between the cereals and forage activities is likely to be competitive, as the proportion of forage is greater than needed to maintain satisfactory levels of nitrogen, organic matter and pest/disease suppression capacity for the cereals activity, so that the optimal level of the two activities is primarily related to the financial returns to each.

Similarly, the application of factor-product and factor–factor relationships could help to identify the least-cost combination of purchased concentrates and forage at given levels of output, within the limits of the Standards, and considering the potentially negative impacts of concentrates on the health of the cattle.

It is likely that converting and organic dairy producers would also benefit from more knowledge on how to maximise forage intake, and hence milk production from forage, for example through breeding for large rumen volume, allowing the cows continuous and easy access to forage of good quality, and feeding a variety of forages (Browne et al., 1995; Chamberlain and Wilkinson, 1996). Few case study farmers, for example, were growing other forages, such as whole crop silage, fodder beet and forage maize, which could play an important role as an additional supply of energy. Other factors that assist higher forage intake were 'automatically' achieved, such as the relatively high proportion of legumes in the forage leading to higher intake through increased digestibility (Sheldrick et al., 1995). Furthermore, reduced concentrate feeding will reduce the depression of forage intake (leading to greater intake but also demand for forage). A negative effect on forage intake was found above a daily intake of 3 kg of concentrates (Brown *et al.*, 1995).

Strategic reductions in concentrate feeding leading to increased demand for forage could contribute to the problems with feed shortages during conversion and under organic management associated with declining forage production and farmers' preferences for high stocking rates. The restrictions in the Standards on the use of conventional concentrates and the need to purchase organic forages leave organic dairy producers with fewer possibilities to compensate for feed shortages, making better planning of forage demand and supply very important.

The specific information requirements related to forage and milk production can be summarised as follows:

- Understanding the Standards' requirements and the certification process;
- Forecasting the forage and feed demand and supply to avoid unexpected feed shortages with potential negative impacts on cow fertility, milk production and finances;
- Optimal allocation of land between forage and cereals enterprises;
- Optimal levels of concentrate use and guidance on how to increase milk production from forage;
- Preventive management and alternative treatment for animal health problems.

The financial impact of conversion on the dairy enterprise and farm income

The objective of analysing the impact of conversion on the dairy enterprise gross margins and farm incomes on mixed and specialist farms and of identifying risk and profitability factors was achieved through a review of literature and analysis of the data from the case study farms.

Dairy cow gross margins

The literature review had shown that initial reductions in gross margin per cow during the early period of conversion are likely, but that cost savings and/or other income (e.g. quota leasing) could help to compensate for losses in productivity. Converting dairy farms did not qualify for organic price premiums for at least 27 months (now 24 months), depending on their conversion strategy, and were therefore expected to suffer an initial loss in income during conversion. The availability of specialist outlets for organic milk improved dramatically during the study period.

The dairy herds on the case study farms qualified for organic status between two and six years after conversion, and all case study farmers were able to sell all their milk with a substantial price premium at the end of the study period, although the situation has changed since then and currently a substantial proportion of milk produced organically in the UK cannot be sold at a premium. Several farms showed initial reductions of the dairy cow gross margin in the first years, but others were able to compensate for reductions in milk production with higher income from quota leasing and through reductions in variable costs. On average, the financial performance of the dairy enterprise improved throughout conversion.

The data from the case study farms confirmed the importance of a price premium for the financial success of the converting dairy farms (Padel and Lampkin, 1994). Other factors that contributed to variation in dairy enterprise gross margin between converting farms were yield, other dairy output and variable costs. The level of the organic price premium (in contrast to whether or not a farm obtained a price premium at all) was not found to be an explanatory factor for variation in dairy enterprise gross margins. Zerger (1995) also found sales price (incl. organic premiums) not to be an important factor in determining the financial success of organic grazing livestock producers.

A clear impact of conversion on the use of and costs of concentrates could be confirmed, but not on other categories of variable costs (e.g. vet. & med.). On some farms, almost one third of variable costs had been categorised as dairy sundries. It appeared that a high price premiums obtained in some cases were associated with very high dairy expenses, and future research should aim to improve the recording of miscellaneous enterprise costs, so that influencing factors can more clearly be identified.

Increased availability of outlets for organic milk is also likely to be the main reason for all but one of the case study farmers not pursuing direct marketing for milk, although this had been stated as a motive for conversion on several farms. The development of direct marketing had been seen as an essential part of organic farming (e.g. Geier, 1981) and a typical feature of many organic farms (Padel and Lampkin, 1994b). It appears that direct marketing of milk mainly develops out of necessity and that most farmers prefer to sell milk in bulk to an organic outlet if they can. One farmer in southwest England, who was not able to sell organically at the time of the interview, was still convinced that the conversion had been worthwhile for him, although he had delayed the application for a symbol for the dairy herd.

A cross-case comparison of gross margins under organic management identified milk yields per cow, use and costs of concentrates, UME production and low costs for dairy sundries as potentially important factors for financial success, but this did not include the level of organic price premium. A comparison of the all-farm average dairy gross margins under organic management with conventional data showed a similar dairy output per cow in most years, lower use and costs of concentrates, lower allocated costs for forage production (mainly savings in fertiliser costs) and higher dairy sundries, leading to comparable gross margins per cow in most years, apart from 1997/98 when price reductions in the conventional sector and increases for the case study farms improved the relative advantage of milk production on the case study farms. Average dairy gross margin per forage hectare on all case study farms was consistently lower than conventional, an indication of the lower intensity per hectare of the organic system on these farms.

Sampling procedures and sample size imply that the results cannot be considered representative for converting farms or for organic milk production in the UK. For this, monitoring of randomly selected and larger samples is needed. Because other farm resources that are also affected by conversion (e.g. labour) are not included, the trends in dairy enterprise gross margin development should not be taken in isolation but seen in the context of the whole farm income data discussed below. However, at the level of dairy cow gross margin, it was possible to analyse the financial impact of conversion on this specific enterprise, and to highlight key production-related and financial factors. Both the dairy gross margin per cow and the milk production from forage were identified as important profitability factors at a whole farm level.

It can be concluded that the financial success of milk production per cow was not strongly affected by the conversion. The farms were able to compensate for reduced output through costs savings and organic premiums. Margins per hectare, however, declined reflecting the lower stocking rates on most case study farms. However, the results also show that organic producers, like other dairy producers, need to consider the costs of production carefully, if they wish to improve their margins. Reducing the use of concentrates with higher milk production from forage appears to be one promising strategy in this context. It therefore appears as if some 'rules of thumb' for decision-making that the farmers may have referred to in the past (e.g. higher use of concentrate leading to increased milk production and better margins) may no longer apply. Different input and output relationships, both in physical and value terms, apply than before conversion and, because of the complexity of the system (in which biological, ecological and economic influence need be considered), further research should aim to clarify optimal strategies for organic milk production under various soil and climatic conditions in the UK and under different management objectives.

Labour

Increases in labour demand of 10–20% and higher labour costs are frequently associated with conversion to organic farming, although specific references regarding dairy farms were found to be contradictory (e.g. Jansen, 2000; Offermann and Nieberg, 2000). On the case study farms, labour requirements were found to be increasing during conversion, as previously found by Lampkin (1993) and Freyer *et al.* (1994). The estimated number of Annual Labour Units (ALU) increased by approximately 20% (ranging from 10% to 30%), resulting in labour cost increases of on average 53% (range from 10% to 90%), between the last year of conventional management and 1997/98. The comparison of the average labour cost trends of the case study farms with conventional data shows a higher rate of increase on the case study farms (53% compared with 35%; Franks, 1999), which confirms a conversion impact over and above general trends of rising wage costs.

In the interviews, the farmers gave some indication that preventive health management might be one reason for the higher labour demand, but the experiences (and values) varied considerably between farms. One other reason for increased labour demand could be a more diverse enterprise structure (Padel and Lampkin, 1994b). The high score that the farmers gave to the statement 'more time for the family' seems to indicate that increases in labour requirement did not only lead to greater employment of farm workers but also to a higher workload for the family.

It can be concluded that conversion is likely to lead to increases in labour requirements also on dairy farms, potential reasons being preventive health management and farm diversification, but further research would be needed to establish more clearly the reasons for and the extend of changes in labour requirements on mixed and specialist dairy farms during conversion. Conversion planning should consider increases in demand and costs for labour (over and above inflation wage increases) of approximately 20% on dairy farms.

Fixed costs

An average increase in fixed costs (including labour costs) on the case study farms of 25% over the study period confirmed a general trend in the literature towards higher fixed costs on organic farms (Offermann and Nieberg, 1999). Total input costs increased by 10%, compared with a 40% increased over the same period for dairy farms (Franks, 1999). Apart from the increases in labour costs (see above), general farming costs and other fixed costs also increased, which accounted for approximately 35% of total fixed costs in the 1997/98. Increases other than labour are likely to be mainly related to certification charges (Padel and Lampkin, 1994b) and costs for advice and information (Diers, 1993). A small decline of approximately 5% in machinery costs (maintenance and depreciation) on the case study farms in the study period compared with an increase of approximately 35% on conventional dairy farms (Franks, 1999), suggests that conversion could have a negative impact on machinery costs, which had been suggested as one reason for fixed cost *increases* by Padel and Lampkin (1994b). It appears that the expected replacement of external inputs through increased use of fixed resources during conversion (Zerger, 1995) resulted on the case study farms mainly in increased inputs of labour (not differentiated between manual and managerial tasks) rather than machinery. No significant correlation between fixed costs and NFI/ha could be established in this small sample. However, there importance had been highlighted in other research (Fowler *et al.*, 1999b; Zerger 1995), whereas high profitability of organic arable and horticulture farms was found to be associated with high labour and fixed costs.

It can be concluded that the general principle of replacing external inputs with more intensive use of farm-internal resources has economic implications during the conversion process. On dairy farms, this is likely to lead to increases in labour and general farming costs (which include certification charges and costs of information and advice), leading to fixed costs increases, whereas in real terms machinery costs may decline. Further research would be needed to investigate the impact of conversion on fixed costs and the relationship to overall profitability more accurately. Considerable variation between the case study farms suggests that conversion planning should consider carefully the individual farm resources and financial commitments.

Net Farm Income development

Lampkin (1993) showed that income development on farms during conversion to organic farming were not only influenced by the system change, but that external factors, for example the introduction of milk quotas, could also have a significant impact. Comparisons of the Net Farm Income (NFI) of each case study farm with average national trends were carried out representing the hypothetical income situation that might have occurred had the farms not been converted. These showed that most case study farms experienced an initial decline in incomes at a time when average incomes for mixed and dairy farms in England and Wales increased, whereas subsequent periods of income increases and declines corresponded with national trends, apart from the final year where a declining trend in the conventional dairy industry (caused by a significant fall in milk prices) was not experienced by the case study farmers who sold their milk at organic prices.

It was calculated that five of the eight case study farms incurred costs of conversion in the first three years (i.e. income forgone compared with continuous conventional management) ranging from £2 to £280 per hectare per year. Three farms showed no loss of income but gains in the range of £106 to £195 per hectare per year. Calculated over a five-year conversion period, costs of conversion were identified on only three farms, ranging from £70 to £195 per hectare per year. The all-farm average costs of conversion in this reduced sample (£13 per hectare and per year over a three year period)–using published NFI indices rather than matched clusters of conventional farms–were lower than the £50 per hectare per year calculated for the first two to three years of conversion for ten farms and one experimental farm in the first phase of this project (Haggar and Padel, 1996) and lower than the up to £100 per hectare and per year that were estimated by Lampkin (1993) for specialist dairy farms.

Where it occurred, the negative impact on income of conversion was mainly restricted to the early years of conversion and the decisions of the case study farmers represented an investment in improved income in the long term. This is confirmed by all but one farm improving business health during conversion, measured as Rent Equivalent (actual rent and interest charges) as a proportion of total output (RE-ratio). In the final study year, values on all the case study farms were below the 15–20% RE-ratio threshold that was suggested as a rule of thumb by Crabtree (1988). RE-ratio was not found to be significantly correlated to NFI per hectare in this small sample, indicating that tenure and interest, although clearly important for the decision-making of the individual farmer are potentially less important as a profitability factors.

The literature review had identified the possible negative impact of reduced stocking rates on farm income (Offermann and Nieberg, 2000), but the experience of the case study farms suggest that converting and organic farms with high stocking rates are also more likely to suffer feed shortages, resulting in higher costs for forage and concentrate purchases with negative impacts on income. No significant correlation between stocking rate and UME per hectare to NFI could be established, indicating that the importance of stocking rates in determining income levels per hectare might be exaggerated. As discussed above, optimal stocking rate levels are likely to be affected by the economic relationship between concentrate and forage utilisation, and it is therefore likely that under varying levels of forage productivity, costs of forage production and organic concentrate prices, and different optimal levels of concentrate use apply. Further research would be needed to investigate this in greater detail.

The analysis of the case study data also confirmed an impact of enterprises mix (i.e. the proportion of forage area) on Net Farm Income per hectare under organic management, which had been found to be an important factor in determining the average per hectare income of organic farms by Fowler *et al.* (1999b). However, contrary to what had been argued theoretically–that benefits arising from interactions between production enterprises would be better achieved in mixed rather than specialised systems–the results showed that the specialist case study farms appear to cope better financially with the conversion process than the mixed farms. This may be related to the financial advantage of milk production over arable production, with specialist dairy farmers have an oversupply of what Younie and Baars (1997) call the 'central bank' of organic farming, the clover-grass ley with its rotational benefits for soil fertility, weed, pest, disease and parasite control. As a result the specialist farms can benefit from economies of scale, without facing the same disadvantages that other organic systems operating in a relationship of complementarity between forage and cereal production would encounter. However, the specialist farms face potentially greater risk and uncertainty, such as drought affecting forage production or from falls in milk prices. Arguably, such specialist systems may also represent a greater risk to the environment in terms of oversupply of nitrogen, although mechanisms of biological regulation, such as reduced activity of *Rhizobia* in high nitrogen situations may counteract this. However, future research aimed at optimising organic milk production strategies needs to investigate these economic relationships in a more formal way (such as modelling) whilst considering the impact of various production systems on the environment, for example through nutrient budgeting.

On the case study farms the financial impact of the conversion-decision clearly continued beyond the statutory minimum period of 27 months for conversion of land and the dairy herd. The length of the farm conversion period –the time between registration with a sector body and a theoretical endpoint of a stable organic systems in the sense of Dabbert (1994)–lasted between three and seven years. However, on some farms it was difficult to identify a period of income stability during the study period, which would represent this theoretical endpoint of the conversion so that which this point was taken having been reached when either by the herd was certified and milk marketed with a premium, or when farm income remained positive or exceeded pre-converison levels, which ever date was reached later.

It can be concluded that the case study farm incomes were in most cases initially adversely affected by the conversion, but not only recovered – they exceeded pre-conversion levels. Conversion therefore represented an investment in the classic sense of the term. If the case study farms would have converted under current conditions and had been eligible for the Organic Farming Scheme, costs of conversion where they occurred (of £70 and £195 per hectare per year over five year period) would in most cases have been offset by the average payments of £90 per hectare and per year over a five year period (Lampkin and Measures, 2001).

Factors that appear to influence the level of the conversion costs are the structural changes, pre-conversion intensity and conversion strategy. As the considerable variation between case study farms illustrate, adverse effects can be substantially reduced or totally avoided. It appears that a short staged conversion strategy of converting the land in two to three years could combine the benefits of risk reduction of the staged approach, whilst still permitting relatively fast access to price premiums, which is the main advantage of rapid, single-step conversions.

This chapter has discussed the findings of the study in the context of the key objectives that were outlined in the introduction. The final chapters draws some key conclusions related to each of the objectives and present recommendations for dairy farmers interested or engaging in conversion, for providers of information on organic farming and future research requirements.

Conclusions and recommendations

Key conclusion

The aim of the research presented in this thesis was to investigate the process of conversion to organic milk production and its impact on production and incomes of farms, in order to identify converting farmers' information needs and to develop recommendations as to how these information requirements could best be met. This had been broken down in more detailed objectives that were discussed in the previous chapter. In this final chapter some key conclusions are drawn and the recommendations are presented.

In the absence of a clear theoretical framework change processes on farms there was need was identified to conceptualise the conversion process. It can be concluded that the conversion process itself can be characterised by three key stages of *Information gathering*, *Evaluation and adaptation* and *Implementation*. The first stage reflects the farmers' general need for information and has no impact on the farm. During the second stage, the farmer learns most intensely about the new practices, through a combination of a theoretical as well as a practical evaluation, leading to the adaptation of the new practices and growing confidence to continue. The impact of the changes on the farm begins in the second stage, but falls mainly in the third stage of implementation, until stability is achieved under the new system. Conversion to organic farming thus represents a complex and relatively long process that is influenced by personal, farm specific and external factors and has an impact on personal attitudes and the farm. The process or conversion to organic farming is clearly different both from the organic farming system to which it leads and the previous system that it replaces.

A further objective was to develop and apply an integrated approach to analysing personal and farm-specific changes on farms and explore linkages between variables in different categories. It can be concluded that the method of comparative case study research coming from the tradition of qualitative social inquiry represents a suitable method to study change complex changes processes on farms, such as conversion to organic farming. A combination of quantitative and qualitative data can be analysed, the farmers' objectives and experiences can be considered and a good understanding of important factors can be obtained. However, the combined analysis of different types of data remain explorative and needs further development. Farm case study research cannot replace but supplements surveys of larger samples by providing understanding of the complexity of farming as a human activity.

The research aimed to obtain a better understanding of farmers' perspectives of the conversion process. From this it can be concluded that personal attitudes not only influence whether they will take up organic conversion, but also the direction that the farm takes during the conversion process and it appears likely that the conversion process also influences farmers' attitudes. They choose a strategy for conversion both in relation to their enterprise mix and the stage of decision-making. Staged conversion can represent the *Evaluation and Adaptation* stage before the final decision to convert is made. Farmers' needs and preferences for sources of information change during the key stages of the conversion process, from the general to the specific. There is a need to support farmers in their learning process during and not just before conversion and to re-consider the position and role of farmers as equal partners in organic information and advisory services.

The research analysed the impact of the conversion on production and farm income on dairy farms in order to develop recommendations about the information needs of converting dairy farmers.

The result show that a conversion-related yield reduction of forage crops is likely but further research is needed to quantify this. The forward planning of forage demand and supply, considering intended strategic reduction in concentrate feeding, is important to avoid unexpected feed shortages with potential negative impacts on cow fertility, milk production and farm finances, but the availability of data remains limited.

From the results of the case study farms it can be concluded that farm incomes were in most cases initially adversely affected by the conversion process, but did not only recover but exceeded pre-conversion levels. Conversion therefore represented an investment in the classic sense of the term, and in most cases the costs of conversion would have been fully offset by the payment rates under the current organic aid scheme.

Recommendations

For dairy farmers considering or engaging in conversion

Dairy farms can be converted either in stages or all at once. The former allows gradual adjustment and for the risk to be spread, by converting only a proportion of land each year. The latter may provide more rapid access to premiums, but carries greater risk, for example of feed shortages. A short staged conversion of 2-3 years may reduce risk, but allows relatively fast access to organic premiums. If a dairy farm is converted the experience of the case study farms suggests that this is likely to lead to changes in the following areas, for which new converters should be prepared:

Land use: Key changes arise from the need to rely on clover for nitrogen fixation, but on most dairy farms no structural change may be required. How big the necessary changes are depends on the situation before conversion. Specialist dairy farms do not to need grow cereals to become organic, but there may be a need to de-intensify.

Stocking rate: Reductions are likely to be necessary on most farms, particularly if intensively stocked. The necessary level of reductions depends son the specific farm situation, reflecting the likely forage yield reductions and the emphasis on milk production from forage. Because of the impact of purchased concentrates (borrowed hectares) the stocking rate is not very a reliable indicator of farm forage supply. A target stocking rate of 1.5 to 1.6 LU/ha appears to be a reasonable guide for most milk producing farms that allows for buffers of forage to be maintained.

Forage supply: Forage yields under organic management depend on clover content, climate and soil conditions. Initial yield reductions in the range of 15% are likely (depending on soil type and swards condition), because of a need for the system to adjust, as well as the reseeding of leys and pastures to establish clover. Forage yields are likely to recover later, and higher yielding forage crops, e.g. red-clover leys, whole crop silage and careful planning could help to avoid problems. A later growth pattern and later date for turn out and for silage cutting date should be expected (white clover-based swards would be later than pure perennial ryegrass swards, whereas red clover leys can be cut at the same time). The feed value of legumes is greater than of pure grass, so that overall the impact on feed quality does not appear to be of great significance. Information about suppliers of seed mixtures and about the establishment and management of clover in leys and permanent pasture and of its handling can be obtained from organic farming organisations and advisors.

Milk yield: Initial reductions in yield per cow are likely, particularly if concentrate feeding is reduced. Depending on prices, leasing out quota can provide additional income, but this is likely to be less of an issue as quotas are phased out. Forage analysis and ration planning remain important tools for profitable organic milk production.

Health management: The restrictions on the use of veterinary medication make it necessary to move towards prevention. Feeding, breeding, housing and hygiene are key areas that should be addressed in health plans. Information about alternative treatments (publications and seminars) and contacts to experienced veterinarians are available from organic farming organisations.

Marketing: It is advisable to plan well ahead and to contact potential buyers for organic milk as early as possible. Direct marketing or on farm processing may provide alternatives for some farmers, but requires commitment in itself and should not just be seen as simple alternative.

Dairy cow gross margins: The combination of higher prices and reduced costs are likely to more than compensate for output reductions in the long-term. Margins may decline initially, before premiums become available. However, the financial success does not entirely depend on the premium, but also on the costs of production.

Labour and fixed costs: It is likely that conversion will lead to increases in labour demand and costs may rise by approximately 10-20%. Total fixed costs also should be expected to increase over and above inflation, due to additional labour costs, certification charges and costs for advice.

Income: Under the current Organic Farming Scheme and with some careful planning it should be possible for many dairy farms to convert without income penalties.

Farmers considering or beginning conversion can obtain information about organic farming from a variety of sources, such as publications (general farming press), specialist organic farming magazines and books. They can now also contact the free Organic Conversion Information Service. Farmers are also likely to benefit from visiting organic farms, preferably of similar type. A number of organisations maintain networks of demonstration farms and organise farm walks. Not all farms visited may be fully comparable to the farmer's own situation or reflect a similar approach to farming, but it is worth knowing that there is considerable variety also among organic producers.

In a next stage there is likely to be a need to evaluate the feasibility of an organic conversion for the specific farm. It is difficult to experiment with organic farming on a small scale, because it is the system that changes, not simply a new technology. However, experiments with important aspects are possible, for example with clover/grass leys on some fields, or by reducing the prophylactic use of dry-cow therapy, which will help assess the suitability for the farm. If such practical experiments are carried out, it is desirable for future reference to record procedures and experiences in some detail, e.g. sowing dates, mixtures techniques used etc.

The case study farmers' experience further demonstrate the benefits of **conversion planning**, which can help to assess the financial and technical feasibility and reduce the chance of costly mistakes, particularly feed shortages. Planning should assess the farm in its current situation, develop an organic target for it, and set out steps of the transition over the necessary number of years leading to certification including a cropping plan showing which fields are to be converted first.

Valuable information for this comes from the farm itself. Specialist publications (e.g. Organic Farm Management Handbook by Lampkin and Measures, 2001) and organic advisors are also now available to support the process. In Wales free conversion planing advice became available in 2001 as part of the new Farming Connect Service of the National Assembly for Wales.

For providers of information and advice on organic farmers

The research shows that the farmers' and the farms conversion process take place in three key stages:

1) Information gathering
2) Evaluation & adaptation
3) Implementation

The first stage refers to the farmers' decision-making, the conversion of the farm can begin in the second and mainly takes place in the third stage.

In all three stages information and knowledge are important for further progression, because organic farming is a knowledge rather than input-based form of agricultural production. However, the farmers' information requirements become more and more specific and the preference for information sources changes during the process.

In the *Information gathering* stage technical information (Standards' requirements and technical feasibility) is as important as information about the financial impact of organic farming, and about external circumstances (e.g. the future directly of agricultural policy, market intelligence). In this stage also personal contacts are very important, such as on farm walks, so such opportunities should be provided. Raising awareness about the impact of organic farming in the agricultural community as a whole would help to reduce existing misconceptions, for example by providing training for agricultural consultants, veterinarians and bank managers.

The *Evaluation & adaptation* stage is the key learning stage for the farmers. The information needs are related to **whether** and **how** organic farming can work on a specific farm. Farmers gain knowledge from their own experiments including gradual conversion, but also from external sources. External assistance is likely to be most effective when it can be specifically related to the farm situation and to the farmers' own experience, i.e. a move from information to advice. Support through conversion planning could help to reduce the need for practical experimentation, but will not replace it on most farms, as the farmer needs to gain confidence and learn how organic farming works on their farm.

External assistance should aim to **support the farmers' own learning** rather than provide a blueprint for the farm conversion, so that the farmer can confidently move on to the next stage. Regional networking may also provide a forum for social support and learning, but will not fully address technical information requirements that vary depending on the farm type and are highly specific.

In the final phase of *Implementation* the farmers have gained confidence, and are now mainly concerned with making organic farming work better in fulfilment of their own objectives. Apart from more detailed technical knowledge, farmers need further information about the certification process and marketing opportunities. At this stage information may be obtained from a variety of sources, such as other organic farmers, organic advisors and books, but also technical specialists with a mainly conventional background, e.g. dairy consultants. It is here that also the latest research findings become important and need to be conveyed to practitioners, who will (and should) also influence the future direction of research, based on their experience. There is clearly a need to reconsider the role of farmers as equal partners, both in research programmes and in information and advisory services.

Farmers are likely to seek information in fulfilment of their own specific objectives, but could also benefit advice in other areas in which they are not personally so interested. The annual organic certification process would provide an opportunity to assess the strengths and weaknesses of each farm, but currently provides only limited assistance to farmers on how to overcome the farm's weaknesses. This is caused by the almost complete separation between inspection and advice and it may be necessary to re-discover the benefits of the inspection to the farmer as well as the assurances to the consumer.

Recommendations for conversion planning

Advisors providing assistance with conversion planning must recognise that, as indicated by the case examples, on the majority of farms this exercise is undertaken during the early *Evaluation and adaptation* stage, before the farmer has finally decided on whether to convert the farm. It appears therefore highly questionable whether farmers will precisely follow plans drawn up at this stage.

The *Evaluation and adaptation* stage represents the most intensive phase of learning by the farmer, based on knowledge from experimentation on the farm (gradual extensification, block experiments and gradual conversion) as well as external information. A key function of conversion planning should be to encourage and support this learning, rather than the development of a blueprint for the change process *per se*. The farm-specific situation (including the farmers objectives and the current financial situation) clearly needs to be considered, but equally important is the farmer's full involvement in planning the changes. An expert plan, drawn up an advisor away from the farm and possibly by using sophisticated planning tools (e.g. optimisation techniques) may very well set out the most effective route for the farm conversion, but risks–as some observations on the case study farmers have illustrated–being either very quickly forgotten or completely ignored.

Those who offer support with conversion planning should see this as a **process**, which can benefit from external assistance and information, rather than a **product** to be provided. The incremental and evolutionary nature of the conversion process itself has to be reflected in conversion planning. The process needs to be flexible and requires continuous adjustment in line with growing knowledge and experience of the farmer. To begin with in support of the evaluation process the emphasis should be on outlining and testing different options; later on the emphasis gradual progresses towards the Implementation process. Regular check-ups should therefore be envisaged, whereby any set plan is compared against reality and adjusted to reflect new developments.

Given the difficult financial situation of many farms in 2001, existing financial incentives for conversion (price premiums and aid programmes) and the increased importance of financial motives, a financial feasibility check is essential to prevent unrealistic expectations of what conversion can do for a farm and should be a standard element of any conversion plan. This should be based as much as possible on the farm-specific resources and cost structures and the farmers' aspirations, making appropriate allowance for costs increases (e.g. labour) and - given uncertainties in future market development - include a sensitivity analysis for different levels of organic premiums.

On dairy farms, conversion and other planning should include budgeting of the demand and supply of forage, considering likely changes in forage yields, milk production levels, stock numbers, and concentrate feeding. An energy-based approach (similar to UME) using values for daily ration planning converted to an annual basis could provide a suitable way forward. Further research is, however, needed to obtain reliable data for conversion-related forage yield decline under UK conditions and for typical losses for conservation and grazing, as well as energy content of various forages.

Better tools to assist conversion planning also need to be developed, for example computer software that combines a range of technical and financial feasibility checks of conversion and in some areas further research is needed to improve the available planning data.

Future research requirements

The method of long-term case studies is valuable for the study of change processes on farms. In-depth research of small samples of converting or organic farms allows the researcher to gain a good understanding of the driving factors within a farming system, related both to the farmer and the farm, as well as providing rich longitudinal data on production and income. Case studies could therefore effectively supplement surveys of larger, representative samples of organic farm, but tools for the combined analysis of different types of data are need of further development.

The need for further research was identified in the following areas:

- On-going farm business monitoring of larger samples of organic farms to generate financial information, and comparison with appropriate data from conventionally managed farms to provide evaluative financial information about organic farming. Such information is clearly needed by farmers interested in organic farming, and to generate planning data for conversion and organic farming, for the benefit of farmers, advisors, policy-makers and researchers. Any monitoring of dairy farms should aim for a better breakdown of the category of miscellaneous costs and all surveys should differentiate different sales channels of organic products.
- Studies of the forage yield development during conversion under UK soil and climatic conditions, including various techniques for establishment, the impact on quality, losses due to conservation and grazing, and the energy content of various organic forages. Such research is needed so that conversion planning can effectively estimate the likely changes to net forage supply. There is also a need to identify solutions acceptable under organic Standards for special technical problems experienced by the case study farmers, such as the control of docks and slugs.
- Research should identify and evaluate practical on-farm indicators of forage production (such as UME) and tools for forage budgeting in conversion planning.
- Future research should aim to optimise strategies for organic milk production under various climatic and farm structural and economic conditions, such as the optimal allocation of land between forage and cereal activities, the optimal use of concentrates and forages in the diet and interaction with the stocking rate, using modelling techniques that allow aspects of the long-term impact on the environment (e.g. nutrient supply and demand) to be considered.
- Further research is needed to establish the extent of and reasons for changes in labour requirements and fixed costs during conversion to organic farming, including the costs of information gathering and certification.

Much has changed the since the study began: Then only 50 dairy producers were farming organically, and there was limited interest for conversion. In contrast, in December approximately 300 dairy farmers were registered as organic farmers and several hundred more are expressing an interest by contacting the OCIS help-line each year. However, the study has clearly identified key challenges and risks of the conversion process on dairy farms, from which conclusions about the information requirements were drawn and recommendations developed. It is the author's hope that these findings represent one step towards an improved understanding of how the challenge of greater sustainability of agricultural production can be met at the farm level.

References

ADAS (1997) *Organic Conversion Information Service Customer Satisfaction Survey.* Unpublished report to MAFF, ADAS Market Research Team. Bristol.

Agra-Europe (1990) Commission launches new environmental protection scheme. *Agra Europe* (27/7/92), E4-5.

Albrecht, H. (1974) Die Verbreitung von Neuerungen - Der Diffusionsprozess. *Der Förderungsdienst* 22 (2), 33-40.

Albrecht, H. (1980) Diffusion processes and social structure: Review of research within rural sociology. In: *Modelle fuer Ausbreitungsprozesse in sozialen Strukturen.* (H. J. Hummel and W. Sodeur). Verlang der Sozialwissenschaftlichen Kooperative; Bad Homberg, pp 39-51.

Altieri, M. A. (ed.) (1987) *Agroecology: the scientific basis of alternative agriculture.* Intermediate Technology Publications; London.

Anim, F. D. K. (1999) A note on the adoption of soil conservation measures in the Northern province of South Africa. *Agricultural Economics* 50 (2), 336-345.

Ashmole, A. (1993) *The organic values of agri-culture.* PhD -Thesis, University of Edinburgh.

Austin, E. J., J. Willock, I. J. Deary, G. J. Gibson, J. B. Dent, G. Edwards-Jones, O. Morgan, R. Grieve and A Sutherland (1998a) Emperical models of farmer behaviour using psychological, social and economic variables. Part I: linear modelling. *Agricultural Systems* 58 (2), 225-239.

Austin, E. J., J. Willock, I. J. Deary, G. J. Gibson, J. B. Dent, G. E. Jones, O. Morgan, R. Grieve and A. Sutherland (1998b) Empirical models of Farmer Behaviour using psychological, social and economic variables. Part II: Non-linear and Expert Modelling. *Agricultural Systems* 58 (2), 225-241.

Baars, T. and I. Buitink (1995) *Some Practical Aspects of Preventing Disease in Organic Husbandry, Health Promotion, Natural Behaviour Enhancement.* Luis Bolk Institut. Driebergen.

Baars, T. and M. v. Dongen (1997) The possibilites of introducing red clover into mixtures of grass and white clover on organic farms under grazing. *NENOF* (4), 2-3.

Baars, T. (1999) Review of grassland and fodder production. In: *ENOF White Book: Organic Farming Research in the EU towards the 21st Century.* (J. Isart and J. Llerena). ENOF European Network for Scientific Research Co-ordination in Organic farming; Barcelona, pp 77-83.

Bager, T. and J. Proost (1997) Voluntary regulation and farmers' environmental behaviour in Denmark and the Netherlands. *Sociologia Ruralis* 37 (1), 79-94.

Bahner, T. (1995) Landwirtschaftliche Betriebsgestaltung nach persönlichen Zielen. *Agrarwirtschaft* 44 (10), 343-350.

Balfour, E. B. (1976) *The Living Soil and the Haughley Experiment.* Universe Books; New York.

Bax, J. A. and I. Browne (1995) *The Use of Clover on Dairy Farms.* MDC and Scottish Agricultural College - Crichton Royal Farm; London and Ayr.

Beharrell, B. and A. Crockett (1992) New age food! New age consumers. *British Food Journal* 94 (7), 5-13.

Berg, E. (1989) *Entscheidungsverhalten und Beratungsbedarf von oekologisch wirtschaftenden Landwirten.* Diplomarbeit, Fachbereich Agrarwissenschaften, Justus-Liebig-Universitaet; Giessen.

Blobaum, R. (1983) Barriers to conversion to organic farming practices in the midwestern United States. In: *Environmentally Sound Agriculture. Proceedings of 4th IFOAM Scientific Conference Boston 1992.* (W. Lockeretz). Praeger; New York, pp 263-278.

Boehncke, E. (1996) Pansengesundheit. In: *Ökologisc he Landwirtschaft.* (I. Lünzer and H. Vogtman). Section 4.8 (7). Berlin, Heidelberg, New York; Springer-Verlag, pp 1-16.

Boehncke, E. (1997) Preventive strategies as a health resource for organic farming. In: *Resource Use in Organic Farming. Proceedings of the third ENOF workshop.* (J. Isart and J. J. Llerena). ENOF European Network for Scientific Research Co-ordination in Organic farming; Acona, pp 25-36.

Braun, J. (1994) Impacts of Widespread Conversion to Organic Agriculture in the State of Baden-Württemberg, Germany. In: *The Economics of Organic Farming.* (N. H. Lampkin and S. Padel). CAB International; Wallingford, pp 329-341.

Brighton, R. B., J. G. Cooke and J. C. Armitage (1988) *The production, distribution and marketing of organic produce.* A local collaborative project in the West Midlands, Worcestershire College of Agriculture; Hindlip.

Browne, I., D. Allen, R. Phipps and J. Sutton (1995) *Mixed Forage Diets for Dairy Cows.* MDC-Milk Development Council. London.

Brush, S. B. (ed.) (2000) *Genes in the field. On-farm conservation of crop biodiversity.* Lewis Publishers/IRDC/IPGRI; Boca Raton.

Burton, M., D. Rigby and T. Young (1997a) Sustainable agriculture technologies: A quantitative analysis of adoption. Paper presented at the 'Agricultural Economics Society Annual Conference', Edinburgh.

Burton, M., D. Rigby and T. Young (1997b) Why do UK organic horticultural producers adopt organic techniques? *NENOF* 1997 (6), 7-10.

Burton, M., D. Rigby and T. Young (1999) Analysis of the determinants of adoption of organic horticulture techniques in the UK. *Journal of Agricultural Economics* 50 (1), 48-63.

Buttel, F. H., O. Larson and G. W. Gillespie (1990) *The Sociologie of Agriculture.* Greenwood Press; Westport, Connecticut, USA.

Campbell, D. (1995) Dairy sector looks likely to mature. *New Farmer and Grower* 1995 (46), 20-21.

Chadwick, L. and M. McGregor (1991) Non-organic farmers' perceptions of and attitudes towards organic farming. In: *Organic Farming Centre Annual Report 1990.* Organic Farming Centre, School of Agriculture; Edinburgh, pp 104-112.

Chamberlain, A. T. and J. M. Wilkinson (1996) *Feeding the Dairy Cow.* Chalcombe Publications; Welton.

Chambers, R., A. Pacey and L. A. Thrupp (ed.) (1989) *Farmer First: Farmer Innovation and Agricultural Research.* Intermediate Technology Publications; London.

Clarke, R. (1991) *Farmers' attitudes to organic farming practices in Victoria.* Research Report Series, Department of Agriculture; Victoria.

Conacher, A. and J. Conacher (1982) *Organic Farming in Australia.* Occasional Paper of the Dept of Geography, Geowest No 18, University of Western Australia.

Dabbert, S. and J. Braun (1993a) *Betriebsvoranschlag und lineare Programmierung als Hilfsmittel fuer die Beratung alternativer landwirtschaftlicher Betriebe.* Institut der Betriebswirtschaft, Universität Hohenheim. Hohenheim.

Dabbert, S. and J. Braun (1993b) Auswirkungen des EG-Extensivierungsprogramms auf die Umstellung auf oekologischen Landbau in Baden-Wuerttemberg. *Agrarwirtschaft* 42 (2), 90-99.

Dabbert, S. (1994) Economics of conversion to organic farming: cross sectional analysis of survey data. In: *The Economics of Organic Farming: An international perspective.* (N. H. Lampkin and S. Padel). CAB-International; Wallingford, pp 285-293.

Datamonitor (1999) *Natural and organic food and drinks 1999.* Datamonitor Europe.; London.

Davies, O. D. (1996) The value of white clover in grass/clover silage when fed to dairy cows in early lactation. In: *Legumes in Sustainable Farming Systems.* (D. Younie). Occasional Symposium No. 30, British Grassland Society; Reading, pp 225-226.

de Buck, A. J., I. v. Rijn, N. G. Röling and G. A. A. Wossink (2001) Farmers' reasons for changing or not changing to more sustainable practices: an exploratory study of arable farmers in the Netherlands. *The Journal for Agricultural Extension and Education* 7 (3), 153-166.

Dettmer, J. (1986) *Motive und sozial-ökonomische Probleme der Umstellung auf ökologischen Landbau aus der Sicht von ökologisch wirtschaftenden Bauern.* Studien zur ländlichen Humanökologie, Institut für Rurale Entwicklung, Georg-August-Universität; Göttingen.

Diers, I. and C. Noell (1993) Anpassungs- und Lernkosten bei der Umstellung von konventioneller auf alternative Milchproduktion. *Betriebswirtschaftliche Mitteilungen der Landwirtschaftskammer Schleswig-Holstein* 459 (June 93), 3-15.

Duram, L. A. (1999) Factors in organic farmers' decision making: diversity, challenge, obstacles. *American Journal of Alternative Agriculture* 14 (1), 2-9.

Ebbesvik, M. and A. K. Loes (1994) Organic dairy production in Norway. Feeding, health, fodder production, nutrient balances and economy. Results from the 30 farm project, 1989-1992. Paper presented at the 'Nordiska jordbrugsforskares foerening seminar: Converting to organic agriculture', Mikkeli.

EC (1991) Council Regulation (EEC) No 2092/91 of 24 June 1991 on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs. *Official Journal of the European Communities* L198 (22.7.91), 1-15.

EC (1999) Council Regulation (EC) No 1804/1999 of 19 July 1999 supplementing Regulation (EEC) No. 2092/91 on organic crop production of agricultural products and indications referring thereto on agricultural products and foodstuffs to include livestock production. *Official Journal of the European Communities* L222 (24.8.1999), 1-28.

ECOTEC (2001) *Economic evaluation of free advice programmes on conservation, pollution abatement and organic conversion.* Report for the Ministry of Agriculture, Food and Fishery. London.

Eder, M. (1998) *Der biologische Landbau in Oestereich - Situationsdarstellung und Produktionsstrukturanalysen.* Universitaet fuer Bodenkultur.

Eurostat (2001) Thirty years of agriculture in Europe. Changes in agricultural employment. *Statistics in Focus: Agriculture and Fisheries* Theme 5 (14/2001), 1-7.

Fairweather, J. and N. Keating (1990) *Management styles of Canterbury farmers: a study of goals and successes from the farmers' point of view.* Research Report, 205, AERU Agrobusiness & Economics Research Unit, Lincoln University.

Fairweather, J. R. and H. Campbell (1996) *The Decision Making of Organic and Conventional Producers.* Research Report, 233, Agribusiness and Economics Research Unit. Lincoln, Canterbury.

Fairweather, J. R. (1999) Understanding how farmers choose between organic and conventional production: results from New Zealand and policy implications. *Agriculture and Human Values* 16 51-63.

FAO (1984) *Agricultural Extension Reference Manual.* Food and Agriculture Organisation of the United Nations; Rome.

Fersterer, S. and A. Gruber (1998) *Beratungsstrukturen für die biologische Landwirtschaft in Österreich im Vergleich mit ausgewählten europäischen Ländern.* MECCA-Environmental consulting. Wien.

Fischer, R. (1982) *Der andere Landbau: Hundert Bio-Bauern und Gaertner berichten ueber ihre Beweggruende, Arbeitsweisen und Erfahrungen.* Verlag Buchhandlung Madliger-Schwab; Zuerich.

Fisher, P. (1989) *Barriers to the adoption of organic farming in Canterbury.* MSc Thesis, Centre for Resource Management, Lincoln University; Lincoln, New Zealand.

Fowler, S., N. Lampkin and P. Midmore (2000) *Organic Farm Incomes in England and Wales, 1995/96 -1997/98.* Institute of Rural Studies, University of Wales, Aberystwyth.

Fowler, S., I. Wynne-Jones and N. Lampkin (2001) *Organic dairy farm incomes 2000/2001.* University of Wales Aberystwyth.

Fowler, S. M., N. Lampkin, H. McCalman and S. Padel (1999) *Organic Milk Production: post conversion phase, 1995/96 to 1997/98.* Unpublished report to MAFF, Project OF0113, Welsh Institute of Rural Studies, University of Wales. Aberystwyth.

Fragstein, P. v. (1985) Ökologische Zusammenhänge - Die Ökologie als Grundlage der Agrarproduktion. In: *Ökologischer Landbau: Lanwirtschaft mit Zukunft.* (H. Vogtmann). Pro Natur Verlag; Bad Soden, pp 13-30.

Franks, J. (1999) *Dairy Enterprise Costs Study: A review of the structure and economics of milk production 1987/88 to 1996/97.* Special Studies in Agricultural Economics, No. 45, Farm Business Unit, Manchester University. Manchester.

Freyer, B. (1994) Ausgewählte Prozesse in der Phase der Umstellung auf den ökologische Landbau amd Beispiel von 7 Fallstudien. *Berichte über Landwirtschaft* 72 366-390.

Freyer, B. (1991) *Ökologischer Landbau: Planung und Analyse von Betriebsumstellungen.* Ökologie und Landwirtschaft, Verlag Josef Margraf; Weikersheim, FRG.

Freyer, B., R. Rantzau and H. Vogtmann (1994) Case studies of farms converting to organic agriculture in Germany. In: *The economics of organic farming: An international perspective.* (N. H. Lampkin and S. Padel). CAB-International; Wallingford, pp 243-263.

Gafsi, M. (1999) A management approach to change on farms. *Agricultural Systems* 61 (1999), 179-189.

Gasson, R. (1973) Goals and values of farmers. *Journal for Agricultural Economics* 24 (3), 521-537.

Gasson, R. and A. Errington (1993) *The Farm Family Business.* CAB International; Wallingford.

Geier, B. (1981) *Absatzwege und Preisgestaltung von Produkten aus biologischem Anbau.* Gesamthochschule Kassel.

Gengenbach, H. (1996) Fachberatung biologisch-dynamischer Landbau in Hessen. *Lebendige Erde* 1996 (3), 237-243.

Gerber, A. and V. Hoffman (1998) The diffusion of eco-farming in Germany. In: *Facilitating Sustainable Agriculture.* (N. G. Röling and M. A. E. Wagemaker). Cambridge University Press; Cambridge, pp 134-150.

Gruber, L., R. Steinwender, T. Guggenberger, J. Häusler and A. Schauer (2000) Vergleich zwischen biologischer und konventioneller Wirtschaftsweise im Grünlandbetrieb. 2. Mitteilung: Futteraufnahme, Milchleistung, Gesundheit und Fruchtbarkeit. *Die Bodenkultur* (Cited after Steinwidder 2000),

Haggar, R. and S. Padel (ed.) (1996) *Conversion to organic milk production.* Technical Review No4, IGER; Aberystwyth.

Haiger, A. and J. Sölkner (1995) Der Einfluss verschiedener Futterniveaus auf die Lebensleistung kombinierter und milchbetonter Kühe. *Züchtungskunde* 67 (4), 263-273.

Haiger, A. (2000) Lifetime dairy performance as breeding aim. In: *Proceedings of the 13th International IFOAM Scientific Conference.* (T. Alföldi, W. Lockeretz and U. Niggli). IFOAM; Basel, pp 316-319.

Halberg, N. and I. S. Kristensen (1997) Expected crop yields loss when converting to organic dairy farming in Denmark. *Biological Agriculture and Horticulture* 14 (1), 25-42.

Hamm, U., A. Poehls and J. Schmidt (1996) *Analyse der Beratung von ökologisch wirtschaftenden Landwirten in Mecklenburg-Vorpommern.* Reihe A: Band 2, Fachhochschule Neubrandenburg, Fachbereich Agrarwirtschaft und Landespflege. Neubrandenburg.

Harper, T. and D. Jones (1998) *Axient Milk Minder - Summary of Results 1997-98.* No.4, Axient. Crewe.

Harris, C. K., S. E. Powers and F. H. Buttel (1980) Myth and reality in organic farming: a profile of conventional and organic farmers in Michigan. *Newsline* 8 (July), 33-44.

Haug, R. (1999) Some leading issues in international agricultural extension, a literature review. *The Journal for Agricultural Extension and Education* 5 (4), 263-274.

Heffernan, D. W. (1982) Assumptions of the Adoption/Diffusion Model and Soil Conservation. Paper presented at the 'RCA Symposium: Future Agricultural Technology and Resource Conservation', Washington D.C.

Henning, J., P. Thomassin and L. Baker (1991) *Organic Farmers in Quebec: Results of a Survey.* Department of Agricultural Economics, McGill University. Quebec.

Herrero, M., R. H. Fawcett and J. B. Dent (1999) Bio-economic evaluation of dairy farm management scenarios using integrated simulation and multiple-criteria models. *Agricultural Systems* 62 (1999), 169-188.

Henwood, K. L. and N. F. Pidgeon (1993) Qualitative research and psychological theorizing. In: *Social Research: Philosophy, Politics and Practice.* Sage Publications; London, pp 14-32.

Houghton, M. and A. H. Poole (1990) *Organic Milk Production.* Special Report, 70, Genus Management. Crewe.

Hovi, M. (1999) Mastitis in organic dairy herds - results of a two year survey*.* Paper presented at the 'Mastitis: the organic perspective conference', Stoneleigh.

Huus, A. (1992) *Oekoloegisk landbruk og oekonomi.* 10, Norsk Insitut for Landbruksoekonomien.

IFOAM (1998) *Basic standards for organic production and processing.* International Federation of Organic Agriculture Movements; Tholey-Theley.

Jacobsen, B. H. (1994) Research findings and implications. In: *Farmers decision making a descriptive approach.* (B. H. Jacobsen, D. E. Pedersen, J. Christensen and S. Rasmussen). Institute for Agricultural Economics; Agricultural University, Copenhagen, pp 11-14.

Jansen, K. (2000) Labour, livelihoods, and the quality of life in organic agriculture. *Biological Agriculture and Horticulture* 17 (3), 247-278.

Jarret, F. G. (1957) Resource productivities and production functions. *Review of Marketing and Agricultural Economics* 25 (1-2), 146-150.

Jones, E. I., P. J. Bowling and R. J. Haggar (1996) Forage yield and quality during conversion. In: *Conversion to Organic Milk Production.* (R. Haggar and S. Padel). IGER, Technical Review N. 4; Aberystwyth, pp 57-65.

Kallio, V. (1997) *Organic farming in the Finland.* Unpublished, Department of Economics and Management, University of Helsinki. Mikkeli.

Kirner, L. and W. Schneeberger (1999a) Vergleich der Struktur der Betriebe mit biologischer Wirtschaftsweise und Verzicht auf bestimmte erstragssteigernde Betriebsmittel im österreichischen Umweltprogramm. *Die Bodenkultur* 50 (2), 133-141.

Kirner, L. and W. Schneeberger (1999b) Hemmfaktoren einer Ausweitung des Biologischen Landbaus in Oesterreich. *Die Bodenkultur* 50 (4), 227-234.

Köpke, U. (1998) Why to use the term 'organic agriculture'? In: *The Future of the Organic Farming Systems, Proceedings of the 4th ENOF workshop, 25-26 June.* (J. Isart and J. J. Llerena). ENOF European Network for Scientific Research Co-ordination in Organic farming; Edingburgh, pp 7-12.

Kramer, D. (1984) *Problems facing Canadian farmers using organic agricultural methods.* Canadian Organic Growers; Willowdale, Ontario.

Kristensen, E. S., H. Högh-Jensen and I. S. Kristensen (1995) A simple model for estimation of atmospheric-derived nitrogen in grass clover systems. *Biological Agriculture and Horticulture* 12 (3), 263-276.

Kristensen, T., M. Vaarst and E. S. Kristensen (1994) Analysis of the production in Danish organic and conventional dairy herds*.* Paper presented at the '10th IFOAM conference', Lincoln, New Zealand.

Kristensen, T. and E. S. Kristensen (1998) Analysis and simulation modelling of the production in Danish organic and conventional dairy herds. *Livestock Production Science* 54 (1), 55-65.

Krutzinna, C. and E. Boehncke (1996) Organic milk production in Germany. *Biological Agriculture and Horticulture* 13 (4), 351-359.

Lampkin, N. (1997) Organic livestock production and agricultural sustainability. In: *Rescource Use In Organic Farming. Proceedings of the third ENOF Workshop 5-6 June.* (J. Isart and J. J. Llerena). ENOF European Network for Scientific Research Co-ordination in Organic farming; Ancona, pp 321-330.

Lampkin, N. (2001) *Eurodata for Organic Farming.* Institute of Rural Studies, University of Wales. Aberystwyth.

Lampkin, N. H. (1990) *Organic farming.* Farming Press; Ipswich.

Lampkin, N. H. (1993) *The economic implications of conversion from conventional to organic farming systems.* PhD-Thesis, Department of Economics and Agricultural Economics, University of Wales.

Lampkin, N. H. (1994a) Economics of organic farming in Britain. In: *The Economics of Organic Farming.* (N. H. Lampkin and S. Padel). CAB International; Wallingford, pp 71-87.

Lampkin, N. H. (1994b) Estimating the Impact of Widespread Conversion to Organic Farming on Land Use and Physical Output in the U.K. In: *The Economics of Organic Farming.* (N. H. Lampkin and S. Padel). CAB International; Wallingford, pp 343-358.

Lampkin, N. H. and M. Measures (ed.) (1994) *Organic Farm Management Handbook.* University of Wales, Aberystwyth and Elm Farm Research Centre; Aberystwyth and Newbury.

Lampkin, N. H. (1999) *Organic farming conversion models.* Final Report to MAFF/FRCA, Welsh Institute of Rural Studies, University of Wales. Aberystwyth.

Lampkin, N. H., C. Foster, S. Padel and P. Midmore (1999) *The policy and regulatory environment for organic farming in Europe.* Organic farming in Europe: economics and policy, 1. University of Hohenheim; Hohenheim.

Lampkin, N. H. and M. Measures (ed.) (2001) *2001 Organic Farm Management Handbook.* Institute of Rural Studies and Elm Farm Research Centre; Aberystwyth and Newbury.

Larson, K. L. and L. A. Duram (2000) Information dissemination in alternative agriculture: an analysis of researchers in the North-Central region. *American Journal of Alternative Agriculture* 15 (4), 171-180.

Leach, K. A., J. A. Bax, D. J. Roberts and C. Thomas (1999) *The establishment and performance of a dairy system based on perennial ryegrass/white clover swards compared with a system based on nitrogen fertilised grass.* Scottish Agricultural College, Auchincruive. Ayr.

Leon, L., H. Sommer and R. Anderson (1999) Intrazysternale Behandlung boviner subklinischer Mastitiden mit dem Homöopathicum Lachesis D8. In: *Beitrage zur 5. Wissenschaftstagung zum Ökologischen Landbau.* (H. Hoffmann and S. Müller). Verlag Dr. Köster; Berlin, pp 372-379.

Lionberger, H. F. (1960) *Adoption of New Ideas and Practices.* Iowa State University Press; Ames, Iowa.

Little, T. (2001) *A review of the Organic Conversion Information Service (OCIS) in Wales (1996–2001).* Report to the National Assembly for Wales, Organic Centre Wales, University of Wales. Aberystwyth.

Lockeretz, W. and P. Madden (1987) Midwestern organic farming: a ten-year follow-up. *American Journal of Alternative Agriculture* 2 (2), 57-63.

Lockeretz, W. (1990) Major issues confronting sustainable agriculture. In: *Sustainable Agriculture in Temperate Zones.* (C. A. Francis, C. Butler Flora and L. D. King). John Wiley; New York, pp 423-438.

Lockeretz, W. (1991) Information requirements of reduced chemical production methods. *American Journal of Alternative Agriculture* 6 (2), 97-103.

Lockeretz, W. (1997) Diversity of personal and farm characteristics among organic growers in the Northeastern United States. *Biological Agriculture and Horticulture* 14 (1), 13-24.

Lockeretz, W. (2000) Organic farming research, today and tomorrow. In: Proceedings of the 13th International IFOAM Scientific Conference. (T. Alföldi, W. Lockeretz and U. Niggli). International Federation of Organic Agricultural Movements; Basel, pp 718-720.

Løes, A. K. (1992) *Aktuelle Omleggningsproblemer - a Spørreundersøkelse (Actual conversion problems - a survey).* No 9, Norsk Senter for økologisk Landbruk. Tingvoll.

Loibl, E. (1999) Bewegründe Biobauer zu werden- Vorrausetzungen und Ursachen. *Der Förderungsdienst* 47 (10), 344-346.

Luley, H. (1996) *Information, Beratung und fachliche Weiterbildung in Zusammenschlüssen ökologisch wirtschaftender Erzeuger.* Markgraf Verlag; Weikersheim.

MacRae, R., S. B. Hill, J. Henning and G. R. Mehuys (1989a) Agricultural science and sustainable agriculture: a review of the existing scientific barriers to sustainable food production and potential solutions. *Biological Agriculture and Horticulture* 6 (3), 173-219.

MacRae, R. J., J. C. Henning and S. B. Hill (1989b) *Financing Sustainable Agriculture: Current Problems and New Strategies.* Ecological Agriculture Projects, McGill University; Quebec.

MacRae, R. J. (1990) *Strategies to overcome institutional barriers to the transition from conventional to sustainable agriculture in Canada: the role of government, research institutions and agribusiness.* PhD-Thesis, McGill University, Montreal.

MacRae, R. J., S. B. Hill, G. R. Mehuys and J. Henning (1990) Farm-scale agronomic and economic conversion from conventional to sustainable agriculture. *Advances in Agronomy* 43 155-198.

Malcolm, L. R. (1990) Fifty years of farm management in Australia: Survey and review. *Review of Marketing and Agricultural Economics* 58 (1), 24-55.

Marshall, A. (1999) *Conversion to Organic farming in Scotland and France.* MSc-Thesis, Edinburgh.

Maurer, J. (1997) Umstellung auf Biolandbau in der Schweiz- Motivation und Hemmnisse. In: *Beitrage zur 4. Wissenschaftstagung zum ökologischen Landbau, 3 - 4 March 1997, Bonn.* (U. Köpke and J. A. Eisele). Verlag Dr. Köster; Berlin, pp 523-529.

Maxwell, S. (1986) The role of case studies in farm systems research. *Agricultural Administration* 21 147-180.

McCann, E., S. Sullivan, D. Erickson and R. D. Young (1997) Environmental awareness, economic orientation, and farming practices: a comparison of organic and conventional farmers. *Environmental Management* 21 (5), 747-758.

Measures, M. (1990) Converting to organic farming. In: *Organic farming: an option for the nineties.* (T. Clunies-Ross and T. Weisselberg). British Organic Farmers/ Organic Growers Association; Bristol, pp 11-13.

Michelsen, J., U. Hamm, E. Wynen and E. Roth (1999) *The European market for organic products: growth and development.* Organic Farming in Europe: Economics and Policy, 7. University of Hohenheim; Hohenheim.

Michelsen, J., K. Lynggard, S. Padel and C. Foster (2001) *Organic Farming Development and Agricultural Institutions in Europe: A study of six countries.* Organic Farming in Europe: Economics and Policy, 9. University of Hohenheim; Hohenheim.

Midmore, P. (1994) Input-output Modelling of Organic Farming and the Rural Economy of England and Wales. In: *The Economics of Organic Farming.* (N. H. Lampkin and S. Padel). CAB International; Wallingford, pp 361-368.

Midmore, P., S. Padel, H. McCalman, N. H. Lampkin, S. Fowler and J. Isherwood (2001) *Attitude to Organic Production: a survey of producers.* Unpublished final report to MAFF, Institute of Rural Studies, University of Wales, Aberystwyth. Aberystwyth.

MINTEL (1991) *Organic Food.* Market Intelligence Unit; London.

MINTEL (2000) *Organic Food and Drink Retailing.* Market Intelligence Unit of the UK Economic Intelligence Unit. London.

Morgan, K. and J. Murdoch (1998) *Organic Versus Conventional Agriculture: knowledge, power and innovation in the food chain.* Papers in Environmental Planning Research, Department of City and Regional Planning, Cardiff University. Cardiff.

Muehlebach, J. and E. Naef (1990) *Die Wettbewerbsfaehigkeit des biologischen Landbaus: eine betriebs- und arbeitwirtschaftliche Analyse des biologischen Landbaus.* Schriftenreihe der FAT, 33. Eidg. Forschungsanstalt fuer Betriebswirtschaft und Landtechnik; Taenikon, Switzerland.

Murphy, M. (1992) *Organic farming as a business in Great Britain.* Agricultural Economics Unit, University of Cambridge; Cambridge.

NatWest (1992) *National Farm Survey.* National Westminster Bank; Coventry.

Neuerburg, W. and S. Padel (ed.) (1992) *Organisch-biologischer Landbau in der Praxis.* BLV-Verlag; Muenchen.

Newman, G. (1995) Dairy cow feeding in organic systems. *New Farmer and Grower* (46), 18-19.

Newton (1995) Herbage production from organic farms. *Journal of the RASE* 156, 24-34.

Nieberg, H. (1999) *Produktionstechnische und wirtschaftliche Folgen der Umstellung auf ökologischen Landbau- Ergebnisse der Langzeitanalyse.* FAL Arbeitsbericht. Braunschweig.

Noe, E. (1999) Who are the organic farmers in Denmark of today? Paper presented at the 'XVII Congress of Rural Sociology', Lund, Sweden.

Norgaard, R. B. (1991) Sustainability: the paradigmatic challenge to agricultural economics*.* Paper presented at the 'International Association of Agricultural Economists Conference', Tokyo.

Nowak, P. J. (1982) Adoption and Diffusion of Soil and Water Conservation Practices*.* Paper presented at the 'RCA Symposium: Future Agricultural Technology and Resource Conservation', Washington DC.

OCIS (1997) *Organic Conversion information service.* MAFF, Ministry of Agriculture Fisheries and Food; London.

OCW (2001) *Fact Sheet No 1.* Organic Centre Wales, University of Wales; Aberystwyth.

Offermann, F. and H. Nieberg (2000) *Economic performance of organic farms in Europe.* Organic farming in Europe: Economics and Policy, Vol. 5. University of Hohenheim; Hohenheim.

Ogini, Y. O., P. Stonehouse and E. A. Clark (1999) Comparison of organic and conventional dairy farms in Ontario. *American Journal of Alternative Agriculture* 14 (3), 122-127.

Öhlmer, B., K. Olson and B. Brehmer (1998) Understanding farmers' decision-making process and improving managerial assistance. *Agricultural Economics* 18 (1998), 273-290.

Østergaard, E. (1996) *Kunnskap some refleksjon og dialog.* Unpublished discussion paper, Norwegian Agricultural University; Aas.

Padel, S. (1988) Umstellungsplanung: Risikoabschätzung für zukünftige Bio-Bauern. *Bioland* 88 (3), 16-19.

Padel, S. and N. H. Lampkin (1994a) Farm-level performance of organic farming systems: an overwiew. In: *The Economics of Organic Farming.* (N. H. Lampkin and S. Padel). CAB-International; Wallingford, pp 210-219.

Padel, S. and N. H. Lampkin (1994b) Conversion to organic farming: an overview. In: *The Economics of Organic Farming.* (N. Lampkin and S. Padel). CAB-International; Wallingford, pp 295-313.

Padel, S. (1996) Financial implications of conversion to organic milk production. *Ecology and Farming* (13), 26-29.

Padel, S., N. Lampkin and C. Foster (1999) Influence of policy support on the development of organic farming in the European Union. *International Planning Studies* 4 (3), 303-315.

Padel, S. (2001) Conversion to organic farming: a typical example of the diffusion of an innovation. *Sociologia Ruralis* 41 (1), 49-61.

Padel, S., N. H. Lampkin, S. Dabbert and C. Foster (2002) Organic farming policy in the European Union. In: *Advances in the Economics of Environmental Resources.* (D. Hall). 4. pp 169–194.

Pampel, F. and J. C. van Es (1977) Environmental quality issues of adoption research. *Rural Sociology* 42 (1), 57-71.

Peters, E. (1997) Strategien der Biobauern gegenüber Veränderungen im Marktegeschehen. *Ökologie und Landbau* 25 (1), 21-26.

Peters, S. E. (1994) Conversion to low-input farming systems in Pennsylvania, US: an evaluation of the Rodale Farming Systems Trial and related economic studies. In: *Economics of Organic Farming.* (N. Lampkin and S. Padel). CAB International; Wallingford, pp 265-284.

Phillips, C. J. C. and J. T. Sorensen (1993) Sustainability in cattle production systems. *Journal of Agricultural and Environmental Ethics* 6 (1), 66-73.

Pretty, J. (1998) *The Living Land: agriculture, food and community regeneration in rural Europe.* Earthscan; London.

Pretty, J. N. (1994) Alternative systems of inquiry for a sustainable agriculture.

Pryce, J., E. E. Wall, A. B. Lawrence and G. Simm (2001) Breeding strategies for organic dairy cows. In: *Breeding and Feeding for Animal Health and Welfare in Organic Livestock Systems. Proceedings of the fourth NAHWOA workshop in Wageningen.* (M. Hovi and T. Baars). VEERU, University of Reading; Reading, pp 23-34.

Ragin, C. C. (1987) *The comparative model: moving beyond qualitative and quantitative strategies.* University of California Press; Berkeley.

Ramsden, S. and B. Rodgers (1999) Attitudes of organic producers to different marketing outlets. *Farm Management* 10 (7), 392-402.

Rantzau, R., B. Freyer and H. Vogtmann (1990) *Umstellung auf oekologischen Landbau.* Angewandte Wissenschaft, 389. Landwirtschaftsverlag; Muenster-Hiltrup, FRG.

Redelberger, H. (1995) Wirtschaftlichkeit der Milcherzeugung im oekologischen Landbau. *Oekologie und Landbau* 1995 (4), 30-33.

Redman, M. (1991) Organic dairy costings: update. *New Farmer and Grower* 33 (Winter), 20-21.

Reksen, O., A. Tverdal and E. Ropstad (1999) A comparative study of reproductive performance in organic and conventional dairy husbandry. *Journal of Dairy Science* 82 (1999), 2605-2610.

Richter, F. (1990) *Du merkst aufeinmal, dass es nicht nur ein Traum ist.* Diplom-Thesis, Gesamthochschule Kassel, Fachbereich Landwirtschaft, Witzenhausen.

Rigby, D. and T. Young (2000) *Why some agricultural producers abandon organic production systems? An exploration of UK data.* The University of Manchester. Manchester.

Roderick, S., N. Short and M. Hovi (1996) *Organic Livestock Production: animal health and welfare; research priorities.* VEERU, University of Reading. Reading.

Rogers, E. M. and F. F. Shoemaker (1971) *Communication of Innovations: a cross-cultural approach.* Free Press; New York.

Rogers, E. M. (1983) *Diffusion of Innovation.* The Free Press; New York.

Röling, N. G. and F. de Jong (1998) Learning: Shifting paradigms in education and extension studies. *The Journal for Agricultural Extension and Education* 5 (3), 143-161.

Röling, N. G. and J. Jiggins (1998) The ecological knowledge system. In: *Facilitating Sustainable Agriculture.* (N. G. Röling and M. A. E. Wagemakers). Cambridge University Press; Cambridge, pp 283-311.

Russel, D. B., R. L. Isone, D. R. Gamble and R. K. Williams (1989) *A Critical Review of Rural Extension- Theory and Practice.* Faculty of Agriculture and Rural Development, University of Sydney, Social Ecology Centre and Australian Wool Corporation.

Ryan, B. and N. C. Gross (1943) The diffusion of hybrid seed corn in two Iowa communities. *Rural Sociology* 8 (1),

SA (1992) *Standards for Organic Agriculture.* Soil Association; Bristol.

SA (1999) *The Organic Food and Farming Report 1999.* Soil Association; Bristol.

SA (2001a) *The Organic Food and Farming Report 2000.* Soil Association. Bristol.

SA (2001b) *The Organic Food and Farming Report 2001.* Soil Association; Bristol.

Schmid, O. (1987) Besonderheiten bei der Umstellung auf Biolandbau: Konsequenzen fuer die Planung. In: Kursunterlagen zum Bioberaterseminar 15.9.87, Forschungsinstitut fuer Biologischen Landbau; Oberwil, Switzerland, pp

Schneeberger, W., M. Eder and A. Posch (1997) Strukturanalyse der Biobetriebe in Österreich. *Der Förderungsdienst- Spezial* 45 1-12.

Schuhmacher, U. (2000) Rahmenbedingungen, Kennzahlen und Entwicklungsmerkmale der Milchviehhaltung im ökologischen Landbau. *Tierärtzliche Praxis* 28 (G), 96-102.

Schulze Pals, L. (1993) *Regional und betriebliche differenzierte Untersuchung ueber Akzeptanz, Motivation und wirtschaftliche Folgen einer Umstellung auf oekologischen Landbau im Rahmen des Extensivierungsprogramms.* Arbeitsbericht, 2/93, Bundesforschunganstalt fuer Landwirtschaft, Institut fuer Betriebswirtschaft.

Schulze Pals, L. (1994) *Oekonomiche Analyse der Umstellung auf ökologischen Landbau.* Schriftenreihe des BEMLF, Landwirtschaftsverlag; Münster Hiltrup.

Schulze Pals, L., J. Braun and S. Dabbert (1994) Financial assistance to organic farming in Germany as part of the EC extensification programme. In: *Economics of Organic Farming.* (N. H. Lampkin and S. Padel). CAB International; Wallingford, pp 411-436.

Scoones, I. and J. Thompson (ed.) (1994) *Beyond farmer first.* Intermediate Technology Publications; London.

Sheldrick, R. D., D. J. Thomson and G. Newman (1995) *Legumes for Milk and Meat.* Chalcombe Publications; Marlow.

Sholubi, Y. O., P. D. Stonehouse and A. E. Clark (1997) Profile of organic dairy farming in Ontario. *Amercial Journal of Alternative Agriculture* 12 (3), 133-138.

Skerrat, S. and B. Dent (1996) The challenge of agri-environmental subsidies: the case of the Breadalbane ESA, Scotland. *Scottish Geographical Magazine* 112 (2), 92-100.

Snijders, P. J. M. and T. Baars (1995) Organic dairy farming, present situation and quesions for research. Paper presented at the 'Applied research for sustainable dairy farming, 31 May - 2 June',

Steinhäuser, H., C. Langbehn and U. Peters (1978) *Einfuehrung in die landwirtschaftliche Betriebslehre.* Eugen Ulmer; Stuttgart.

Steinwidder, A. (2000) Aspekte der Milchviehfütterung im biologischen Betrieb. Paper presented at the '27. Viehwirtschaftliche Fachtagung: Management von Hochleistungskühen, Grünlandwirtschaft und Milchproduktion, Biologische Wirtschaftsweise 6-8 June', Irdning.

Stolze, M., A. Piorr, A. Häring and S. Dabbert (2000) *The Environmental Impacts of Organic Farming.* Organic farming in Europe: economics and policy, 6. University of Hohenheim; Hohenheim.

Sutherland, A. J., M. McGregor, B. Dent, J. Willock, I. Deary, G. Gibson, R. Grieve and O. Morgan (1995) Edinburgh Farmer Decision Making Study: elements important to the farmer. Paper presented at the 'EAAE- Conference',

Svensson, I. (1991) *Statligt stoed till alternativ odling 1989.* Alternativ odling, 7. Research Committee for Alternative Agriculture; Uppsala.

Taylor, D. L. and W. L. Miller (1978) The adoption process of environmental innovations: a case study of a government project. *Rural Sociology* 43 (4), 634-648.

Thomas, C., A. Reeve and G. E. J. Fisher (1991) *Milk from Grass.* British Grasland Society; Reading.

Thomas, D. and A. Perry (1991) *Genus Milkminder, Annual Report.* Genus Management; Wrexham.

Tovey, H. (1997) Food, environmentalism and rural sociology: on the organic farming movement in Ireland. *Sociologia Ruralis* 37 (1), 22-37.

UKROFS (1993) *Standards for Organic Food Production.* UK Register of Organic Food Standards, Food From Britain; London.

UKROFS (2001) *Standards for Organic Food Production.* UK Register of Organic Food Standards; London.

Upton, M. (1976) *Agricultural production economics and resource use.* Oxford University Press; Oxford.

van der Ploeg, J. D. (1994a) Animal production as a socio economic system: heterogenity, producers and perspectives. Paper presented at the 'Biological basis of sustainable animal production', Wageningen, Netherlands.

van der Ploeg, J. D. (1994b) Styles of farming: an introductory note on concepts and methodology. In: *Born from Within.* (J. D. van der Ploeg and A. Long). Van Gorcum; Assen, pp 7-30.

van der Ploeg, J. D. (2000) Revitalising agriculture: farming economically as starting ground for rural development. *Sociologia Ruralis* 40 (4), 497-511.

Vanclay, F. and G. Lawrence (1994) Farmer rationality and the adoption of environmentally sound practices: a critique of the assumptions of traditional agricultural extension. *European Journal for Agricultural Education and Extension* 1 (1), 59-90.

Vanclay, F. (1997) The social basis of environmental management in agriculture: a background for understanding Landcare. In: *Critical landcare.* (S. Lockie and F. Vanclay). Centre for Rural Social Research, Charles Stuart University; Wagga Wagga, pp 9-27.

Vanclay, F. and P. Howden (1997) Working the grain: farming styles amongst Australian broad-acre croppers. Paper presented at the ' XVII Congress of the European Society for Rural Sociology', Chania, Crete.

Vartdal, B. (1993) *Motivatsjon og meistring av omlegging til oekologisk jordbruk.* 3/93, Sentre for bygedforskning and NORSOEK. Trondheim.

Veauthier, G. and C. Krutzinna (1992) Grundfutterqualitaet im oekologischen Landbau. *Lebendige Erde* 1992 (3), 156-160.

Vine, A. and D. Bateman (1981) *Organic farming systems in England and Wales: practice, performance and implications.* University College of Wales.

Vittersø, H. (1995) *Foretaksøkonomiske tilpasninger i økoloisk melkeproduksjon.* 1998:8, NILF Norsk Institutt for Landbruksøkonomiske Forskning. Oslo.

Vogel, S. (1994) Austrian Farmers' attitudes and behaviour patterns with respect to environmental problems. In: *Farmer decision-making: a descriptive approach.* (B. Jacobsen and e. al). Institute of Agricultural Economics and Royal Veterinary and Agricultural University; Copenhagen, pp

Vogtmann, H., B. Freyer and R. Rantzau (1993) Conversion to low external input farming: a survey of 63 mixed farms in West Germany. Paper presented at the 'Agroecology and Conservation issues in temperate and tropical regions', Padua.

Weber, E. U. (1994) Behavioural decision theory: insights and applications. In: *Farmers' Decision Making - a descriptive approach.* (B. H. Jacobsen, D. E. Pedersen, J. Christensen and S. Rasmussen). Institute for Agricultural Economics and The Royal Veterinary and Agricultural University; Copenhagen, pp 13-25.

Weber, S. (1993) Umtersuchungen zur Umstellung auf oekologische Milcherzeugung- Versuchsbeschreibung, Milchleistung, Kenngroessen der Energiebilanz, Milchqualitaet und betreibswirtschaftliche Auswertung. *Betriebswirtschaftliche Mitteilungen der Landwirtschaftskamer S.H.* 459 (June 1993), 17-24.

Webster, P. (1999) The challenge of sustainability at the farm level: presidential address. *Journal for Agricultural Economics* 50 (3), 371-387.

Weller, R. and A. Cooper (1996) Animal health. In: *Conversion to Organic Milk Production.* (R. Hagger and S. Padel). IGER Technical Review No.4; Aberystwyth, pp 96-110.

Weller, R. and D. W. R. Davies (1998) Somatic cell count and incidence of clinical mastitis in organic milk production. *Veterinary Record* 143 (13), 365-366.

Weller, R. F. (1999) The management and development of Ty Gwyn. In: *Organic Milk Production: post conversion phase, Report to MAFF (OF0113).* Institute of Grassland and Environmental Research; Aberystwyth, pp 54-64.

Wernick, S. and W. Lockeretz (1977) Motivations and practices of organic farmers. *Compost Science* 77 (6), 20-24.

Willock, J. (1994) Decision-making on family farms. In: *Farmers' Decision Making- a descriptive approach.* (B. H. Jacobsen, D. E. Pedersen, J. Christensen and S. Rasmussen). Institute for Agricultural Economics and Royal Veterinary and Agricultural University; Copenhagen, pp 63-76.

Willock, J., I. A. Deary, G. Edwards-Jones, G. J. Gibson, M. J. McGregor, A. Sutherland, J. B. Dent, O. Morgan and R. Grieve (1999) The role of attitudes and objectives in farmer decision making: Business and environmentally-oriented behaviour in Scotland. *Agricultural Economics* 50 (2), 286-303.

Winter, R. (1991) Economic questions of dairy production in ecological agriculture in northern Germany. In: *Alternatives in Animal Husbandry.* (E. Boehncke and V. Molkenthin). Proc. International Conference, July 1991, University of Kassel; Witzenhausen, pp 329-334.

Woodhill, J. and N. G. Röling (1998) The second wing of the eagle: the human dimension in learning our way to more sustainable futures. In: *Facilitating sustainable agriculture.* (N. G. Röling and M. A. E. Wagemakers). Cambridge University Press; Cambridge, pp 46-70.

Wynen, E. (1990) *Sustainable and Conventional Agriculture in South-Eastern Australia: a comparison.* Economics Research Reports, 90.1. School of Economics and Commerce, La Trobe University; Victoria.

Wynen, E. (1992) Conversion from conventional to organic agriculture in Australia. Paper presented at the 'Annual Conference of the Australian Agricultural Economics Society', Canberra.

Yin, R. K. (1994) *Case study research: design and methods,.* Applied Social Research Method Series Vol. 5, London; Sage Publications.

Younie, D. and T. Baars (1997) Resource use in Organic Grassland: the central bank and the art gallery of organic farming. In: *3 ENOF workshop Rsource Use in Organic Farming.* (J. Isart and J. J. Llerena). ENOF European Network for Scientific Research Co-ordination in Organic farming; Ancona, pp 43-60.

Zanoli, R., D. Gambelli and D. Vairo (ed.) (2000) *Organic farming in Europe by 2010: scenarios for the future.* Organic farming in Europe: economics and policy, 8. University of Hohenheim; Stuttgart.

Zerger, U. (1995) *Der Betriebsvergleich als Mittel zur Analyse betriebswirtschaftlicher Fragestellungen im ökologischen Landbau.* Verlag Dr. Kovac; Hamburg.

Appendix