MINISTRY OF AGRICULTURE, FISHERIES AND FOOD

Research and Development

Final Project Report

(Not to be used for LINK projects)

Date project completed: 09/01/1999

Section 1: Identification sheet

1. (a) MAFF Project Code: OF 0155

(b) Project Title: Factors affecting the profitability of organic farms

(c) MAFF Project Officer: Peter Costigan

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(e) Contractor's Project Officer

(f) Project start date: 9/10/98 END DATE 28/2/99

(g) Final year costs:

(h) Total project costs / total staf

(i) Date report sent to MAFF

(j) Is there any Intellectual Prop

*staff years of direct science eff

Section 2: Scientific objectives / Milestones

2. Please list the scientific objectives as set out in CSG 7 (ROAME B). If necessary these can be expressed in an abbreviated form. Indicate where amendments have been agreed with the MAFF Project Officer, giving the date of amendment.

Objective 1
Provide an overview of the state of the art in the UK and Europe and identify a preliminary set of factors affecting the profitability of organic farms in time for the MAFF review of organic research on 14/15th May 1998. [Delays in receipt of the contract meant that this target date had passed.]
Objective 2
Analyse the 1995/96 and 1996/97 data using appropriate statistical techniques including regression and principal components analysis.
Objective 3
Use case studies and modelling to deepen the understanding of factors identified in Objective 2.
Objective 4
Produce a report of the factors identified and outline implications for research priority setting, including a presentation/discussion of results to MAFF in London at the end of the project.

3. List the primary milestones for the final year.

It is the responsibility of the contractor to check fully that ALL primary milestones have been met and to provide a detailed explanation if this has not proved possible

Section 3 : Declaration

4. I declare that the information I have given in this report is correct to the best of my knowledge and belief. I understand that the information contained in this form may be held on a computer system.

Signature [signature] Date 11/02/2000

Name Nicolas Lampkin

Position in Organistation Senior Lecturer/Project Manager

Section 4 : Executive summary

2.1.2 Financial factors

The importance of price premiums for profitability has been clearly established for cropping farms. The lack of availability of price premiums for livestock products means that the importance of price premiums in livestock systems to overall financial success has not been established.

There is some indication that the success of organic farms is likely to depend on the successful management of internal resources; the diversity of the farming business might aid this, but no studies have established any clear indicators or relationships. The total variable costs might give some indication and would be expected to be low where the internal utilisation of non-marketable goods, such as fertility, nutrients and forage, is efficient.

There is evidence that organic farms of a particular type (cropping, mixed and horticultural units) require more labour than comparable conventional farms and that the inclusion of labour intensive enterprises might lead to higher labour requirements, particularly during conversion. Organic farmers appear more likely to employ labour, and it can therefore be concluded that labour requirements, as well as the use of paid labour, are likely to represent an important profit factor on organic farms.

There is some indication that organic farms also have higher other fixed costs than conventional farms but few studies examine this in detail. The issue of fixed costs is likely to be of greater importance for the profitability of organic farms as more emphasis is placed on the management of internal resources than of purchased inputs.

It is likely that organic farms, in line with all farming activities, benefit from economies of scale. Questions remain whether the importance of diversity applies differently to farms of different size, with large farms benefiting more from labour diversification, but smaller farms benefiting from economies of specialisation. There is no clear assessment in the literature with regards to the risk associated with organic production.

2.1.3 Managerial factors

Organic producers have a variety of financial and non-financial objectives, which are likely to contribute to their managerial decisions and hence to the profitability of their farms.

In some studies the time under organic management has been identified as having an influence on farm success that might be attributed to greater level of experience as well as soil biological conditions.

In addition, their managerial ability and experience, farm workers' motivation and the marketing ability, are likely to contribute towards the success of the farm but none of these issues has been studied on organic farms.

It is, however, likely that organic farmers vary in their personal and business related objectives and in management ability, and that this variation is an important factor of success.

2.1.4 Farm profitability measures

To analyse the factors influencing profitability on any farm it is important to select measures of profitably that reflect the financial situation of the farm and are representative of the influences on the farmers' decision-making process. Profit, in this report, is used as an economic term, although other potential meanings are acknowledged.

Arguably, cash income reflects best the financial decision-making as influenced by liquidity and bank statements. However, depreciation is recognised as a real cost to most farmers aiming to maintain their investment. Despite the value of increased comparability between farms of different tenure and indebtedness in standard FBS income measures (NFI and MII), the inclusion of the notional charges for labour and rent implies that farms are associated with expenses that will have no bearing on their financial decision-making. As the analysis is based on data of organic farms in the FBS format, ONI was selected as the most appropriate measure of farm profitability for much of the analysis, but NFI and cash income have been included for the factor analysis.

Despite the limitations of gross margins in general (designed for the comparison of enterprises with similar resource requirements) and for organic farms in particular (replacement of external inputs through management of internal resources) they often represent the only available data on physical and production aspects of organic farms. Gross margin data are therefore used in this study to illustrate the effect of price, variable costs and yield factors on the outputs for arable crops and milk.

3. Farm data analysis

Farm income data generated under MAFF contract OF0125 (*Economics of organic farming* (Fowler *et al*, 1998 and 1999) from different organic farm types are analysed in this section investigate the impact of factors previously identified. The sections contain three different approaches:

- Analysis of whole farm data across and within farm types including correlations of variables against ONI per ha with the aim to investigate the impact of factors previously identified;
- an enterprises gross margin analysis, where elements of the gross margins are correlated against the gross margin as well as against ONI, with the aim to particularly investigate issues physical and production related issues;
- factor analysis with the aim of isolating some underlying factors from the large number of variables identified.

This study was based on a set of traditional financial accounts for a range of organic farming types over two fiscal years (1995/96 and 1996/97). Data from thirty-five farms (thirty six in 1996/97) were recorded as part of MAFF project OF0125. Some data from 1997/98 are used in later sections of this report, in particular gross margin analysis, but were not available for much of the work. Four different MAFF-funded projects contributed data to project OF 0125 (Fowler *et al*, 1999). Three of the studies were based around the conversion of farms of different types to organic agriculture; most of the conversions took place in the early 1990s.

Although the data collection procedures were different, the methods of data analysis, to FBS guidelines, were consistent among the different sources. The methods of farm selection for the different projects were not the same. The farms for the three conversion studies could not be randomly selected as there were insufficient numbers of farms converting at that time; farms for the fourth study were randomly selected, but a high proportion of selected farms (64%) were unwilling or unable to participate.

The dataset did not constitute a representative sample of all organic farms but this did not affect its use for the purpose of the study, which was concerned with the variability between farms, and to build a qualitative picture to direct further research into the technical and financial aspects of organic farming.

3.1.1 Farm data analysis

The comparisons of organic farms with their conventional cluster farms in 1996/97 indicated the different relative performances among different farm types. The organic samples were small, but within the sample the mixed group performed better than their conventional equivalents. However even the best lowland cattle and sheep farmers achieved only 17% higher ONI per hectare than the matched conventional group, and the majority had poorer performance. It is probable that the yield limitations on organic livestock farms, through limitations on stocking rate, combined with lower, and harder to achieve premium prices for organic meat, mean that it is more difficult to achieve increased profitability through organic farming for livestock farms (excluding dairy). Cropping and dairy farms, with relatively high premium prices, can compensate for yield reductions, and increase profitability more easily. In these two categories, farms that performed better or worse within their respective organic groups in terms of ONI per hectare, also performed better or worse than their matched conventional groups.

Care must be taken in the use of relationships identified across all farm types. In terms of £/ha, organic horticultural holdings had a higher average ONI than dairy farms, followed by mixed, then cropping farms followed by cattle and sheep farms which had, on average, a very low ONI. By their nature, horticultural and dairy farms will make more intensive use of land, and tend to have both higher outputs and higher inputs which are part of the higher ONI. Fowler *et al.* (1999) found that outputs per hectare were highest on horticultural holdings (£4,972/ha) followed by dairy farms (£1,918/ha), and lowland cattle and sheep, mixed and cropping farms had similar outputs (£953/ha, £922/ha and £819/ha respectively). The levels of inputs followed the same order, but lowland cattle and sheep inputs were sufficiently high to result in a barely positive ONI.

General conclusions from the above analysis across all farm types are therefore limited, and the overall significant correlation found across farm types, between ONI and Whole Farm Gross Margin (WFGM), total outputs and total inputs, in both years, is to be expected.

Correlating total cropping output to ONI resulted in positive trends for all farm types in 1996/97, but negative trends with dairy farms in 1995/96, and the positive correlation was only significant for horticultural holdings in the first year. It appears that where there are cropping enterprises on the farm, the cropping outputs are key to the profitability of the farms, but livestock output is of key importance only on predominantly livestock farms. Among mixed farms there is some indication of the importance of high value crops in the rotation, although this was not confirmed by statistical analysis across all farm types.

Across all farm types total inputs per hectare were extremely strongly correlated with ONI in 1995/96 ($r = 0.99$, $p=0.01$), but less so in 1996/97 ($r=0.73$, $p=0.01$). Total variable costs were also positively correlated ($p=0.01$) with ONI for both years.
Within the individual farm types, cropping, horticulture and sda cattle and sheep had consistent trends between variable costs and ONI in both years; trends were not significant but positive for the cropping and horticulture farms and negative for sda cattle and sheep farms. Other farm types had negative trends between variable costs and ONI in 1995/96 but positive trends in the next year.

Both running costs excluding labour and labour expenditure were significantly correlated ($p=0.01$) with ONI across all farms in both years, but the trends were not the same across all farm types. Unlike with variable costs, however, trends were consistent between years for all farm types except for dairy running costs excluding labour. Cropping and horticultural holdings had positive correlations between running costs excluding labour and ONI, and mixed and both types of cattle and sheep farms had negative correlations. The only significant correlation with running costs excluding labour ($p=0.05$) was on dairy farms in 1995/96 ($r = -0.92$, $p=0.05$), yet the trend was slightly positive in 1996/97 on dairy farms. Paid labour was negatively correlated with ONI on both years on cropping

The aim of the work was to investigate data collected under project OF0125 (Economics of Organic Farming) to identify factors affecting the profitability of organic farms, between and within farm types. Additionally, issues affecting profitability which would benefit from research input were to be identified.

Literature review

European studies were reviewed to find key profitability factors for organic farms. Three main managerial influences were identified: personal and business goals, time under organic management, skills and management ability. Personal goals affect the management of all farms, and influenced the decision to convert to organic methods.

Farm data analysis

Whole farm data of 26 farms (95/96 and 96/97) and some enterprise gross margin data (including some 97/98 data) for organic farms of six different types were analysed. The small sample size of some farm types limited statistical significance, but important trends were identified and discussed.

Occupiers Net Income per hectare (ONI/ha) was used as a measure of profitability, as it offered the best compromise between the true financial position of the farms, and comparability between farms.

The income variation between organic farm types per hectare showed a similar trend to conventional farms (horticulture > dairy > mixed, cereal and general cand sheep) and clearly highlights the difference between farm types in income levels per hectare.

Correlations of output and input variables with ONI/ha were strongly affected by farm type, and often reflected the intensity of the enterprises. Significant positive correlations between cropping output and ONI/ha across all farm types indicated the importance of crop output for a wide range of organic farm types.

Factor analysis was used across all the farm types to reduce the large number of variables into underlying synthetic factors. Factors of scale, intensity, experience, integration and diversity were responsible for some income variation.

Case studies

Case studies and modelling were used to confirm the findings from the data analysis and explore the importance of other profitability factors.

Farms selected for the case studies (two dairy, one mixed, one beef and sheep) were those that were financially successful in 1996/97 relative to other organic farmers. All farmers felt that husbandry skills, technical aspects of organic management, and attention to detail were important to their success. Knowledge had been gained through experience and/or training and the use of consultants. The farmers ranked the improvement of crop and animal production as their most important objectives. In each case, appropriate rotations and farming systems were working well. Marketing efforts made by the cattle and sheep and mixed farmers contributed to their success.

Technical issues, which would benefit from research, were identified: these included parasite control for sheep, potato blight, weed control (particularly in spring cereals), seed predation by birds, and dry cow mastitis.

Modelling

Comparison of the model's 1995 and 1997 predictions with survey data confirmed their validity, and highlighted the importance of premium prices, the enterprise mix and potential economic advantages of more specialised systems.

The potential impact of technical improvements on overall profitability of organic farms was investigated by changing the yield assumptions. The benefit of an assumed 10% increase in yield is greater for livestock farms (25-33% increase in whole farm GM) than for cropping farms (13-21% improvement).

Conclusions

A summary table of the research recommendations is presented in the final section, this includes the following areas:

- the importance of productivity as a profit factor on organic farms. The need for research effort contributing to the improved yield, quality and efficiency of production for crops, forage crops and livestock, and targeting of inputs, is highlighted,
- technical knowledge and management ability were obvious in the best performing farms. This highlights the need for investment in training and dissemination of technical information,
- the importance of premiums for the financial success of some farm types and the need for better data on the labour and cost implications of realising the premium through various marketing channels,
- the importance of enterprise mix and the potential role that high value crops might have in increasing profitability, but technical details and resource implications need to be investigated,
- the need for further research in the area of labour requirements and employment implications of organic management for different enterprises and farm types,
- the need for clearer information on the efficiency of input use and investments, and the need for a better understanding of the economic benefits of enterprise diversity and integration versus the benefits from economies of scale and specialisation, including an assessment of risk and uncertainty issues and the implications of policy changes on this dynamic.

1. Background to the study

The MAFF Research and Development programme includes a policy objective, to: '*improve the agronomic efficiency and profitability of organic farming, including the enhancement of economic performance by existing producers, so as to encourage conversion*' (Chief Scientists Group, 1998). Recent work under MAFF contract OF0125 (Economics of organic farming) at the University of Wales, Aberystwyth, as well as previous and on-going MAFF funded work on conversion to organic arable, dairy, hill beef and sheep, and vegetable production has shown great variability in the profitability of organic farms, both within and across farm types.

In line with the above, the objective of this study was to identify relevant profitability factors and to analyse financial data from organic farms to provide a base from which to set priorities. In this way, the means to improve profitability can be highlighted and research work focused to improve economic viability, thus removing a barrier to conversion.

As the first step the research team met for a brainstorming to identity possible profitability factors based on their knowledge of the organic industry and specific farms in the UK. The results of this brainstorming, guided the following review and data analysis. However, due to the largely financial nature of the data, the scope of this study to examine some of the factors in detail was limited.

The team then used a variety of methods to achieve the above stated objectives, which are documented in the following sections.

2. **Literature review**: British and other European literature on the economics of organic farms is reviewed and key profitability factors highlighted.
3. **Analysis of farm income data from organic farms**: Farm income data generated under MAFF contract OF0125 (*Economics of organic farming* (Fowler *et al*, 1998 and 1999) from different organic farm types are analysed using three approaches. These are; the analysis of farm data across and within farm types including correlations of variables against ONI per ha, gross margin analysis, and factor analysis which identifies underlying factors from the large number of variables.
4. **Case studies**: The results of four cases studies are presented, through which other factors that might have had an impact on profitability, including the motivation and objectives of farmers, were explored in more detail.
5. **Modelling**: The results of modelling are presented, where, with the help of farm type specific models, the effects of changes in some of the factors identified, such as impact of yield and changes in premiums prices on profitability, are explored.

In the two final section the findings of the different methods are discussed and conclusions with implications for the setting of research priorities are drawn.

2. Assessing the profitability of organic farms

Financial monitoring in several European countries has shown that, compared to conventional farms, organic farms achieved similar profits, but the differences between countries and farm types were considerable. For cropping enterprises yield reductions in the range of 30-40% and high premiums, in combination with substantially lower variable costs, allowed for similar margins to be achieved. In livestock enterprises, reductions in the level of production are lower, but premiums are less widely available and there are less reductions in variable costs. Changes to the overall enterprise mix as a result of the organic management may result in comparatively lower farm incomes compared to conventional farm data. The literature review confirms three broad areas that affect the overall profitability on organic farms: production factors, financial factors and managerial issues.

2.1.1 Production related profitability factors

The productivity of cash and forage crops is influenced by similar factors as on conventional farms, but the degree of influence might be different (Offermann and Nieberg, 1999). These include soil and climatic conditions as well as the proportion of crops in the crop rotation and stocking rate and, unique to the organic system, time under organic management.

In grazing livestock systems stocking rate is clearly an important factor influencing farm profits, indicating the natural carrying capacity of the land as well as the intensity of the system. Milk yield has been identified as a major factor of success of organic dairy farms in Germany, but research into the factors that might influence animal production is limited and no other clear relationship between profitability and other factors of animal production have been established.

farms, and positively correlated on horticultural holdings and mixed farms on both years, although only significant at the p=0.05 level in 1995/96 (r = 0.9 horticulture, r = 0.99 mixed farms). Total labour input and ONI were not significant, but positive for all farm types and both years except on mixed farms on both years, and lowland cattle and sheep farms in 1996/97. Machinery depreciation, used as a measure of investment and correlated with ONI, showed positive trends in cropping and horticulture holdings and inconsistent results for other farm types, which may be expected as other farm types are less dependant on machinery.

The negative correlation between ONI and land managed organically on cropping farms probably results from the increase in land not in cash-cropping due to conversion. The correlations between the proportion of land in cash crops and ONI was positive (but not significant) in both years, and proportion of land in grassland or setaside and ONI was negative (n.s.) in both years.
Correlations of the elements of some crop gross margins with each other and with ONI confirm the importance of crop yields and premium prices.

The analysis of dairy gross margins confirmed a strong relationship between milk yield, stocking rate and gross margin per hectare and highlights the importance of forage yield and utilisation (UME) for financial success.

3.1.2 Factor analysis

The aim of the factor analysis was to explore whether, with the help of a multivariant statistical method, the large number of possible explanatory variables could be reduced to a smaller number of factors contributing to better understanding of the variability of profit measures in the dataset. The data were analysed across all farm types for two separate years, as well as in a pooled dataset, and in a separate analysis of arable farms.

Using the principal component factor extraction method across all farm types three broad factors were identified, although the coefficients for the factors varied between the different analyses.

- Factor *Intensity* with negative coefficients for total output and fixed costs.
- Factor *Scale* with positive coefficient for labour costs and fixed costs and a negative coefficient for land area.
- Factor *Integration* representing the integrating forces between enterprises, with influence of coefficients for diversity and variables costs.

The linear regression of the factors with three income measures in the dataset when the two years are pooled suggests that, across all farm types, the factors involving *scale,* and *intensity* have a negative influence on farming incomes per hectare, with *intensity* providing a substantially greater negative effect than *scale*. The factor *integration* has the strongest, and positive, influence on incomes. The analysis of the pooled dataset confirmed the possibility of significant structural changes in the sector between the two years.

The analysis of the data for arable farms used additional variables and different factors emerged. The factor *intensity* showed the additional influence of variable costs within one particular farm types. In addition three other factors associated with *experience*, enterprise *diversity* and *agri-environmental* payments were identified. Farm incomes were, as before, negative correlated to *intensity*, whereas the factor *experience* appeared to be positive correlated with income.

The further analysis of the data on the basis of total income rather than income measures per hectare did not lead to any additional insight but suggests that smaller farms are predominantly run for reasons other than profit maximisation.

Across all farm types underlying factors associated with intensity, integration, scale, diversity and experience may explain some income variability. However, the main problem with this type of statistical analysis is small overall size of the sample. Despite exclusion of extreme cases, a significant variation in the dataset remained as a result of farms belonging to a range of different farm types.

The factor analysis confirmed the likelihood that underlying factors associated with scale, intensity, experience and integration and diversity are responsible for some variation in the profitability of organic farms. However, overall the number of farms of each individual farm type was too small for statistical confirmation of the effect of these factors.

4. Case Studies

Organic farmers are farmers who have agreed to follow a set of rules governing their farming practices; these rules are known as organic standards and are now covered by EC law (EC, 1991). These standards mean that the organic farmer has a limited range of tools available, encouraging a different approach to farming, more reliant on careful husbandry, especially of the soil. This element of the project aimed to identify approaches, attitudes and techniques, which contributed to the relative success of some of the farmers.

Data analysis gave a preliminary quantitative understanding of the economic performance of organic farms, but is a snapshot approach, depending on the circumstances of the particular years surveyed. To investigate the historic background of conversion and the development of financial and agronomic performance, the analysis was supplemented by in-depth interviews with four of the farmers studied.

The aim of the case studies was to identify the most successful farmers in income terms (ONI/ha) of four farm types to explore the

factors contributing to their success. As the horticultural holdings in the survey were very small in size and income, and the sample of sda cattle and sheep farms was too small, the aim was to focus on the other four farm types, but it was not possible to recruit a suitable cropping farmer. Two dairy farmers were therefore studied: one specialist dairy farm (over 70% of output from dairy output) that achieved the highest ONI of six dairy farms in 1996/97, (third out of six in 1995/96), and a mixed dairy farmer who achieved consistently high livestock gross margin results (dairy cows and sheep), but was fourth (1995/96) and fifth (1996/97) of the [redacted] dairy farms in terms of ONI/ha. All, but one, were long term established organic units.

The interviews with the selected farmers were semi-structured, and taped (for a review of the methodology, see (Patton, 1990)). The technique adopted allowed the interviewer to phrase questions flexibly, enabling conversational flow and discussion of topics in depth where required.

Both dairy farms were on long established organic holdings, but maintained professional advisory input, one for technical input, the other largely to discuss plans and have feedback.

The mixed dairy farmer attributed his success to a well-planned and balanced rotation, careful day to day planning and management, and attention to detail. Despite considerable experience he still used advisory services to update his technical knowledge.

The specialist dairy farmer grew some cereals and a variety of forages for stock feed. He had achieved the highest gross margin per cow in 1995/96, and third highest in 1996/97, but had scored only 3 (mildly interested) when asked about his aim to improve livestock or crop production. He scored 5 (very interested) for his desire to reduce veterinary inputs, relating to on-going problems with dry cow mastitis, but his over-riding interest was in technical improvement of the whole system in terms of sustainability. Financial burdens had been increased due to investments made to improve nutrient retention, in the knowledge that the investment was unlikely to pay off in economic terms. The success of this farm appears to relate to an established, balanced rotation and extremely well run system.

The lowland cattle and sheep farmer interviewed achieved the highest ONI/ha in this group in 1995/96 (£207/ha), and improved this to £218/ha in 1996/97. He achieved the second highest gross margin for sheep and the highest gross margin for beef in 1996/97. The financial results in terms of gross margins are clear indicators of technical expertise and attention to detail, but the interview also revealed tight financial control operating on the farm and a great deal of effort and time spent on marketing.

The farm selected from the mixed group achieved the highest ONI/ha with cropping and cattle and sheep enterprises and was outperforming other farms that had potentially more favourable enterprises such as cropping or dairy. However, this farm did not perform particularly well in terms of livestock gross margins; information on crop gross margins was not available. The interview revealed a long period of development of the farm, from a cereals and livestock farm, to including field vegetables, gradually re-investing profit into machinery, and increasing the labour force to a regular group of full time employees. The farmer attributed his success to his dedication to the farm, attention to detail, and the knowledge he had built up over ten years.

Table 4 gives an overview of reasons for poor and good levels of ONI for five farm types. Some reasons for good performance were revealed by the case studies; reasons for poor performance largely came from financial analysis and knowledge of the farms in question by the research team.

Table 4 Reasons for performance level of farms within different farm types

	Low ONI	*High ONI*	*Other comments*
Cereals and general cropping	High paid-labour costs. On-going conversions.	Large areas in field vegetables.	Three farms in this category with non-organic areas.
Horticulture	Socially motivated under-pricing.	Area under polytunnels	Small market garden operations.
Dairy	High land-related expenses. Drought. Mixed system. Slug damage.	Varies. Experience and established rotations. Good grass growing areas.	
Lowland cattle and sheep	Recent converters. High paid labour/ consultants. Conservation motivation.	Husbandry effort. Experience. Dairy enterprise.	Wide ONI variation across farms.
Mixed	Lifestyle emphasis	Vegetable enterprises.	Very diverse group.

Points separated by full stops in most cases apply to different farms.

Production: Technical aspects of production were felt to be important to the success of the farm and many sought to improve this by the use of advice and training and developing methods to suit their own situation

Financial: The drive to increase income was less pronounced than the motivation to improve production or biodiversity. The development of the organic system on the farm centred more on marketing or technical improvement than in a direct goal of increased profitability, although recently increasing premiums will have contributed significantly to better financial performance.
Manage High value is placed on good trained and motivated staff and importance attached to their management; from the financial data this investment is rewarded in terms of profitability. Management of the resources was recognised as key, it was felt that the organic system took a while to reach optimum performance, but others felt that it should be open to continual review and refinement.

5. Organic farming models

In 1995 Lampkin, in conjunction with ADAS, FRCA and the Organic Advisory Service developed models of seven different organic farm types to compare the profitability of organic and conventional farming systems, and to analyse the costs of conversion to organic farming under different levels of mainstream, organic and other agri-environmental policy support (Kenworthy *et al.*, 1996). They have been used as the basis for MAFF's organic conversion literature as well as the review of payment rates under the organic aid scheme.

The original 1995 models have been revised on two occasions, in 1997 and 1999 (Lampkin, 1999b), to take account of changes in policy support and prices. Through this, it is now possible to evaluate the effects of changes in individual components of profitability on overall performance, particularly changing levels of yields and premiums that are difficult to assess through statistical analysis of the farm data. The use of the models for the analysis of profitability factors of organic farming systems of different farm types, forms the basis of this section.

The models are based on standard farm planning data derived from various editions (and interim revisions) of the Organic Farm Management Handbook (Lampkin and Measures, 199x) and similar publications for conventional farming (ABC, 199x; Nix, 199x; SAC, 199x). Gross margin data from these sources for conventional and organic farming were standardised to ensure comparability. Certain variables, including mainstream policy support, organic premium prices, organic and other agri-environmental policy support, and quota transactions were isolated from basic gross margins in order to analyse changes in these variables separately. In addition, certain fixed costs that were expected to change as a result of conversion to organic farming were identified and estimates for their likely changes included. These include notional interest charges on capital invested in livestock and buildings, organic certification charges and information costs (seminars, advice etc.). It was not possible to include any changes in labour requirements in the models because of the lack of suitable data.

For each farm type, a typical conventional and organic system was defined and various strategies for the transition from one system to the other were analysed. However, as the issue of conversion strategies is not a focus for this report this will not be considered further here. The focus of the analysis is on certain key variables that have a significant influence on the profitability of organic farms:

- changes in prices and changes in policy support payments over time,
- variations in yield and stocking rate assumptions,
- variations in enterprise mix assumptions.

An attempt was made to model the impacts of labour costs on whole farm net margin, but the results based on average values per hectare or animal, derived from conventional systems, did not provide any useful information. More data on actual labour use in organic farming systems is needed for a realistic analysis of this type to be completed.

Through a comparison of the revisions, together with some further changes in their assumptions, the models give some insight into the impact of some profitability factors that had been identified in the literature review but could not be confirmed through the farm data analysis because of a lack of appropriate variables in the dataset.

In general terms, the results of the models were found to compare well with the farm survey data (Fowler *et al*, 1999), both in terms of absolute values and trends over time, which confirms the models as a suitable research tool and gives a degree of confidence in the model's 1999 predictions. The comparison also highlighted the importance of the enterprise mix and potential economic advantage of more specialised systems.

The overall results of the models show that organic premium prices are a very important factor in the relative profitability of organic systems. Due to more stable prices, organic whole farm gross margins have declined to a much lesser extent than for conventional, which has led to an increasingly better relative performance of the organic models. The results of the adverse 1999 scenario indicate that with reduced organic price premiums and improved conventional prices, some of this advantage would be lost. However, the relative profitability of the organic system varies between farm types. Most organic livestock systems (apart from the hill livestock system) appear less sensitive to organic premium changes than arable and cropping systems.

This is confirmed by the more detailed documentation of the influence of various elements of the whole farm gross margins, which shows that although no organic system would perform as well as the conventional system without any organic price premium, the impact of changes in price premiums on the overall farm results appears to be higher on stockless and mainly arable systems than on the dairy and livestock systems.

There are no great differences between the organic and conventional models in terms of subsidy utilisation, apart from the lowland livestock category, where it appears that lowland livestock farmers in practice may not fully utilise the beef extensification payments that appear to correspond well with commonly lower stocking rates of the organic system.

The yield assumption of the models was changed to investigate the potential impact of technical improvements on overall profitability of organic farms, assuming that yield improvements can be achieved without cost penalties. The results clearly indicate the potential benefit of such improvements. Livestock farms would benefit more than cropping farms and the improvement on livestock farms is less price sensitive than for cropping farms.

Changes in the enterprise mix assumptions for the cropping models clearly support the potential contribution that high value crops can make to the overall profitability of arable and cropping systems, but labour and fixed costs implication could not be investigated. Changes in the enterprise mix of the dairy models in terms of increased dairy cow numbers and reduction of cereals clearly confirm the economic advantages of increased specialisation of organic dairy farms, even though implications for composition and costs of the dairy ration need further attention.

Changes in the enterprise mix assumptions for the livestock models show that only in the case of hill farms did an increase in sheep numbers by 20% with associated reductions in beef lead to a significant gross margin advantage, which might be attributable to the relatively high level of subsidies for hill sheep production. However, the potential adverse effects of such changes (e.g. increased parasite problems in mainly sheep-based systems) have to be considered.

6. Discussion

The aim of the study was to identify factors likely to affect profitability and examine their potential influence by statistical analysis of income data of organic farms (correlations and factor analysis), intensive interviews with selected case study farmers, and modelling. The aim of this section is to draw together the results of the various approaches and discuss them in the light of the findings from the literature review.

Profit in this report is used as an economic term, but the term can be associated with wider welfare benefits.
Most of the previous work on the profitability of organic farms comes from other European countries, and apart from some economic monitoring, only limited studies have been conducted in the UK. In broad terms, organic compared to conventional agriculture is characterised by lower yields, lower variable costs and higher prices. Labour requirements and labour costs may be higher than on conventional farms, whereas other fixed costs are assumed to be similar, apart from particular investment needs and learning costs.

The profit factors identified can be grouped in three broad categories, physical or production related, financial and managerial but there is considerable overlap and interaction between the categories. .

The farm data showed that, across most farm types, average incomes are lower than for the average of comparable conventional farms (Fowler *et al.*, 1999). When individual organic farms are compared with matched groups of conventional farms, the farm types showed different trends. The literature also suggests that there is wide variation between organic farms of different types and that organic systems are likely to be more diverse than conventional.

Based on the review of farm income measures, Occupiers Net Income (ONI) per hectare was selected as the main measure for farm data analysis; it reflects the actual income level most closely, without losing comparability between farms. However, in the factor analysis, where comparability between the farms appeared more important, Net Farm Income (NFI) and Cash Income were also used. Due to the small sample and great variability between and within farm types, statistical analysis of the data was largely inconclusive, but some trends were identified, confirming the importance of physical yields and fixed costs including labour, on profitability.

6.1 Physical factors

Generally, the review of European literature confirmed lower productivity of organic farms compared to conventional. Lower crop yields (up to 40% reduction), some reduction in forage production (no clear figures available), and slightly reduced production of grazing livestock (in the range of 0-20%), were identified. There are few data on the production potential of intensive livestock.

6.1.1 Cash crop yields

The literature review suggests that crop yields are influenced by similar factors as in conventional agriculture, but to varying degrees, such as soil and climate, rotation (including root crops, legumes, stocking rate), P&K availability particularly for forage crops and time under organic management. As there were no uniform indicators of crop yields in the farm dataset (based on standard FBS data) their influence on profitability could not directly be investigated. Nevertheless, correlations between crop output per hectare and ONI across all farm types and particularly for cropping farms confirmed the importance of the physical factors as well as premium prices. Correlations in the gross margin analysis confirmed the importance of crops yields on crop gross margin through significant positive correlations in five of eight cases. Some correlations between yield and ONI confirmed the importance of crop productivity for financial success.

The models confirmed the positive effect that yield increases would have on the overall profitability of organic cropping enterprises, using the assumption that yield improvements could be achieved without associated costs implications.
The case studies highlighted the importance of technical aspects of production for success of the farms.

6.1.2 Animal production

There is less research into animal production and factors influencing it, but two factors, stocking rate and milk yield, were identified in the literature. These were confirmed as financial success factors of livestock farms, but not for the cropping based farming systems. There is evidence in the literature of the influence of concentrate use and forage quality, but this could not be investigated in this study. Few studies focus on the production of intensive livestock enterprises such as pigs and poultry, and the dataset did not allow for investigation of this.

Because of a lack of appropriate uniform variables of animal productivity in the dataset, total livestock output was used. In the statistical analysis of the farm data, no clear relationship across all farm types could be established, but positive trends showed an influence of livestock output on the income of livestock farms, although this trend was less strong than was cropping output for cropping farms.

The analysis of dairy gross margins confirmed a strong relationship between milk yield, stocking rate and gross margin per hectare, and the analysis also highlighted the importance of forage yield and utilisation (UME) for financial success.
The models confirm the importance of productivity particularly for livestock systems, where 10% increases in stocking rate and animal productivity led to 25-32% increases in whole farm GM, depending on the farm type.

6.1.3 Farm types, enterprise mix and size

The literature suggests income differences between farm types that were clearly confirmed by the farm data. The survey data also show the wide variety within farm types, suggesting there is scope for improvement in some cases. The small sample size within each farm type, however, prevented statistical analysis of the underlying factors. The farm data analysis also confirmed that profitability factors vary between farm types.

The literature also suggested that not only distinct farm types, but also the mix of enterprises within farm types might influence farm income, such as the proportion of high value or root crops. Due to the small sample size within each farm type these could not be confirmed by the statistical analysis of the farm data. However, output from cropping enterprises was significantly correlated with ONI across all farm types, which confirmed the importance of cropping output for the profitability of all organic farms. It appears that, where there are cropping enterprises present on the farm, these are key to the profitability of the farms, but livestock output is of key importance only on predominantly livestock farms.

The model results and their comparison with actual farm data highlights clearly the importance of the enterprise mix, such as the potential income contribution of high value crops (neglecting, however, the fixed resource implications) and the potential economic advantage of more specialised organic systems, such as specialised dairy or stockless systems.

The literature suggests that economy of scale is also important for organic farms. The analysis of the farm data did not confirm this with negative trends between farm size and income per ha, but the effects of farm type and enterprise mix might have overshadowed the size effect. Factor analysis, where combinations of variables were considered, confirmed scale and intensity as profitability factors, with implications for output and total fixed costs.

Because of the lack of information on appropriate physical performance variables, whole farm gross margin was included as a variable in the farm data analysis and the model calculations.

The positive relationship between ONI and WFGM is explained (at least in part) by effects of farm type, intensity and size and the element of variable cost in the gross margin figures. However, significant correlations of WFGM with ONI were also established within most farm types, confirming the importance of physical performance for the financial success or failure of organic farms.
Through factor analysis, a factor called *integration*, influenced by diversity and the level of variable costs, was identified.
All four case study farmers related their success to well balanced, established rotations, taking the particular soil and marketing potential into account (site appropriate enterprises and rotations).

6.2 Financial factors

6.2.1 Subsidies

The literature review highlighted the increasing importance of subsidies for organic farms through conversion payments, and through the introduction of other agri-environmental measures as well as mainstream CAP-measures available to organic farmers.

Very few farms in the sample were eligible for organic aid so the overall contribution to farm income in this dataset was insignificant.

The statistical analysis of the farm data showed a high variability in the importance of subsidies between farm types, broadly reflecting general trends in the agricultural industry. Subsidies were very important for cattle and sheep producers (particularly in severely disadvantaged areas) and arable producers, but made a low contribution to output and income in dairy and horticulture farms. Other agri-environmental subsidies (excluding the organic aid scheme) were important in the marginal livestock producing [redacted]. They contributed 6% of output of severely disadvantaged areas, and 3% of lowland cattle and sheep farm output, but less than 0.5% of output of other farm types.

A negative trend between subsidies and ONI across all farm types appears to contradict the importance of subsidies as a profit factor at first, but highlights the fact that more profitable farms are less dependent on subsidies, and farms with the lowest income levels are more likely to receive significant amount of subsidies.

Comparison between the lowland cattle and sheep model, and survey farms shows that lowland livestock farmers may not make full use of higher payments under the beef extensification scheme.

6.2.2 Premium over conventional prices

The effect of premium prices, particularly for crops, is well documented in the literature. Due to the nature of the farm survey data, it was not possible to investigate the effect of premium prices through the statistical analysis of the whole farm data, but the gross margin analysis confirmed some influence of crop premiums on gross margin.

The results of the modelling confirm that no organic system would perform as well as the conventional system without any organic premium, but the results vary according to farm type. For cropping and dairy farms, premium prices make a significant contribution to their overall profitability.

The literature suggests some influence of marketing channels on premiums, but there was not enough detailed information available in the farm survey dataset, particularly on the cost implications of specialist sales channels, such as box schemes, to cover this aspect in the farm data analysis.

However, interviews with the most successful farmers in the mixed, and lowland cattle and sheep category, highlight the importance of marketing efforts for their success.

6.2.3 Influence of variable costs

The literature suggests that organic farms that are effective in utilising farm derived resources are more likely to be profitable than those that rely on external resources. On the other hand, it is a common perception that strictly following organic principles will make farms less profitable. The literature further suggests that because of the lower importance of external resources, variable costs are less important as a profit factor on organic farms, compared with conventional farms.

Total variable costs were used as a measure of the use of external resources. This measure would be expected to be low when the internal utilisation of non-marketable goods, such as fertility, nutrients and forage is effective. The statistical analysis of the farm data across all farm types showed, on the contrary, a positive relationship between ONI and variable costs. It is likely that this is partly the result of farm type and intensity, rather than a general principle of organic farming. This is confirmed by the very few significant negative correlations found within some farm types (e.g. second year lowland cattle and sheep) and negative or conflicting trends in others. Stronger positive trends for cropping and horticulture farms may indicate that the use of variable costs is more important for specialised cropping systems, whereas a negative trend for sda cattle and sheep farms clearly confirms the cost saving potential.

The greater importance of variable costs for cropping systems is also confirmed by the positive correlation of cropping inputs across all, and positive trends within some farm types in both years, whereas livestock inputs were not significantly correlated to ONI across all farms or produced strong consistent trends. However, crop variable costs are clearly influenced by enterprise mix as there are considerably different variable costs for root and combinable crops.

This is contrasted by the gross margin analysis, where there was often a negative trend between variable costs and crop gross margins.

6.2.4 Farm resources and fixed costs

In the literature it was concluded that fixed costs are also likely to be important for the success of organic farms. This includes labour, where generally higher requirements on organic compared to conventional farms are confirmed, although studies differ on suggested reasons for this increased labour and point to the influence of farm type and enterprise mix. Two recent review studies come to the conclusion that further work on the impact of labour as well as other fixed costs, is clearly needed.

Two main categories of fixed costs were included in the analysis, running costs (excluding labour, as a joint category for machinery and general farming costs) and total labour costs.

For the running costs, a similar picture to the variable costs emerged, farmers with higher running costs appeared more profitable, as there was a significant positive correlation across all farm types between running costs (excluding labour) and ONI. This may confirm

suggestions that expenditure on running costs on organic farms replaces variable costs and hence contribute to profitability. However, within farms types, only the cropping and horticulture farms showed positive relationships to the running costs, suggesting that successful cropping and horticulture farms have higher costs and overheads. Again, the picture is not as clear for the mixed livestock systems, though a negative trend for mixed farms and sda farms in both years indicates the potential of cost saving measures particularly in these groups.

The influence of labour as a profitability factor is confirmed across all farm types, as paid and total labour were significantly positively correlated with ONI in both years. On farms where more labour was employed/paid, more income was generated, so there was, on average, a tangible benefit from investment in labour. A strong positive trend between paid labour and ONI within horticulture and mixed farms indicates the potential that more labour intensive/high value crops might have a positive impact on income.

The case study farmers expressed a preference for permanent staff rather than casual labour and confirmed the importance of this investment in human resources. However, negative trends on mixed farms (total labour and ONI) and cropping farms (paid labour and ONI) in both years highlighted the danger that increased labour may not always lead to increased returns.

The need for investment, at least for some farm types, was also confirmed by a significant positive correlation between machinery depreciation and tenant type capital and ONI across all farm types and within the horticulture farms, and confirms a suggestion that some horticulture and cropping holdings may be undercapitalised. However, a strong negative trend in the mixed group and the lack of any clear trend in all other farm types contradicts this and prevents any general conclusion from being drawn.
The analysis did not establish any clear relationship between land charges and profitability in the sample, which contained a large proportion of owner occupied farms.

The significant positive correlation between rent equivalent (RE) and ONI across all farm types, and strong trends within some groups, confirms RE as a uniform but simple success measure of business health. As the farms in this sample are mainly owner occupied, this measure is strongly dominated by the interest element of the RE.

6.3 Management factors

The importance of managerial factors was established through the literature review, particularly in the area of the management of internal resources and labour as well as premiums and marketing ability. As there are no clear indicators of managerial ability in the financial farm survey data, it's influence could not be directly investigated.

Organic producers have a variety of non-financial and financial objectives, similar to conventional producers, that are likely to contribute to their managerial decisions. The importance of non profit-oriented goals and the diversity of management styles among farmers in general is clearly identified by various studies of organic farmers. This was confirmed by the case studies (selected because of their financial success within specific farm types), where the farmers rated good husbandry as a more important goal than increased profitability. However, this may not have been the case in the past, and may indicate their achievement of security and current satisfaction with their farming system and lifestyle.

All case study farmers were keen to move away from intensification and were interested in the environment.

The case studies confirmed the importance of experience and detailed technical knowledge and recognised the optimal management of the farm's resources as a key factor for success. All the case study farmers appear to show some characteristics of *"dedicated producers"* (Fairweather and Keating, 1990), but no formal farming- style classification was carried out.

The case study farmers also placed high value on trained and motivated staff and issues of staff management, it appears that this investment is rewarded in terms of profitability.

6.4 Summary

The profitability factors discussed are summarised in Table 6.1. The results of the study suggest that the profitability of organic farms develops between the opposing factors of the benefits of integration of enterprises on the one hand and the factors of economy of scale with benefits of specialisation on the other. The case studies suggest strongly that it depends on the managerial ability of the farmer to mediate these opposing forces, consider their resource implications and establish the optimal structure for the farm.

Summary of profitability factors identified

Factors	*Literature*	*Farm data*	*Case studies*	*Models*
Section	*2*	*3*	*4*	*5*
Physical factors				
Cash crop yield	x	x	x	x
Forage crop yield	x	x		x
Soil quality	x		x	
Climate	x		x	
P&K status	x			
Time under organic management	x	x	x	
Rotation (legumes, cereals)	x	x	x	
Animal production	x	x		x
Milk yield	x	x		
Stocking rate	x	(x)		
Forage utilisation and quality	x	(x)		
Concentrate use	x			
Farm type	x	x		x
Enterprise mix (e.g. high value crops)	x	x	x	x
Size (ha UAA)	x			
Intensity	x	x		
Economy of scale	x	x		
Financial factors				
Whole Farm Gross Margin		x		x
Premium of cash crops	x			x
Premium of livestock products	x			x
Total output per ha		x		
Crop output		x		
Livestock output		(x)		
Misc. output		(x)		
Total subsidies		(x)		x
Total input		x		
Crop var. inputs	x	x		
Livestock var. inputs	x	?		
Running costs (excl.labour)		x		
Labour costs	x	x		
Labour use	x			
Total fixed costs	x			
Tenant capital per ha	x	(x)	(x)	
Rent equivalent	x	x		

Table 6.1 (cont.) Summary of profitability factors identified

Factors	*Literature*	*Farm data*	*Case studies*	*Models*
Section	*2*	*3*	*4*	*5*
Managerial factors				
Farming goals	x		x	
Personal goals	x		x	
Staff management			x	
Management ability	x			
Experience	x	x		
Technical knowledge			x	
Marketing ability			x	
Financial budgets			(x)	
Management of internal resources	x		x	
Diversity	x	x	x	

(x) does not apply to all farm types

7. Conclusions and recommendations

7.1 Physical factors

The study highlights the importance of physical productivity on profit. Production level is more likely to have a direct impact on organic farm incomes, as the influence of variable costs in organic systems is lower than in conventional systems. Yield improvement for crops could, for example, be achieved through choice of better suited varieties, improved weed control and improved nutrient flows.

Similarly, in animal systems, improvements in productivity and increased farm income could be achieved through: improved forage yields, forage utilisation, forage supplementation through farm based and purchased concentrates, the suitability of breeds and breeding objectives, and better health management.

All research aiming to improve of the productivity of organic systems needs to consider resource implications (including crop and animal health and fertility) and costs (fixed as well as variable costs).

Interactions between quality and yield are important for both crops and livestock and may have marketing implications, but this issue could not be highlighted in the study.

Generally, there appears to be a lack of monitoring data on yields, quality and organic price premiums on commercial organic farms, which is not sufficiently achieved through the current economic monitoring that is based on the FBS format. However, any increase in documentation has implications in terms of workload for the farmer.

7.2 Financial factors

7.2.1 Farm type

Due to the small sample size and the high variability between farm types, the scope of the statistical analysis was limited. Larger samples for each main farm type would be needed to enable any future similar economic monitoring and analysis of profit factors to be more effective.

The study confirms the high variability of income data between farm types, but also within farm types.

Subsidies

The importance of mainstream CAP and agro-environmental subsidies as an income factor appears to be similar to the conventional sector (important for cattle and sheep and arable producers, not important for dairy and horticulture producers).

However, the contribution of the organic aid and new organic farming scheme should be monitored. The current sample of organic survey farms contained too few eligible, converting farms.

7.2.2 Premium prices and markets

The study clearly confirms the importance of price premiums for organic farms and it can therefore be concluded that access to specialist markets is important for their financial success. This issue is of particular importance for the product group where a UK based market for organic produce is only just developing, such as beef and sheep, and for farms that do not traditionally produce finished stock (e.g. hill cattle and sheep production).

The study also highlights a lack of clear data on actual costs incurred in achieving the premium in the various marketing channels, as well as the importance and cost implications of specialist marketing channels (e.g. box schemes).

Under current economic conditions, organic arable and dairy systems react more sensitively to premium price changes, whereas the livestock systems are less price-sensitive.

7.2.3 Variable costs

The study confirms in broad terms the lower importance of variable costs for the success of organic systems, but clearly highlights the difference between enterprises and farm types.

For cropping and horticulture systems, and particularly for high value crops (root crops and vegetables), there is a need to better understand the efficiency of input use, such as purchased versus home-grown transplants and their yield implications, degree of mechanisation and casual labour.

7.2.4 Labour

The study confirms that farms with higher labour costs appear to also achieve a higher income. However, both the literature review and the lack of sufficient detail in the current monitoring highlight the need to investigate labour issues and labour requirements in more detail, particularly in relation to the implications of enterprise mix and farm type, and the use of casual labour and contractors.

The study gives some indication of a need for sufficient levels of investment to be maintained, particularly for horticulture and cropping holdings, but highlights also the danger of overspending, particularly for cattle and sheep systems. It is not clear how to differe[redacted]e effective from non-effective investment.

Research effort in this area should lead to better availability of data on resource implications for organic advisors and farmers.

7.3 Managerial factors

The study clearly highlights the importance of high technical knowledge (rotation design and implementation, attention to detail) for the financial success of organic farms.

The study confirms a tension between the aim to increase stability of the systems through enterprise diversification on the one hand and benefits from economy of scale on the other hand, which might imply penalties of specialisation in terms of crop and animal health and fertility. Managerial ability is therefore important for financial success.

7.4 Recommendations for research and policy support

It was the aim of this study to give recommendations on how, through research, the profitability of organic systems could be improved. Table 7.1 draws out the most important issues, gives reference to their discussion within this report, and highlights the research issue or current status. The table needs to be seen in the context of the previous section (Table 6.1) where the evidence for issues affecting profitability was presented.
In addition to research areas identified by this study, some other important research issues have also been listed that were raised during the discussions of the research team or by the case study farmers.

7.4.1 Production issues

Crop and forage yields are affected by management, and such physical factors as the climate and soil. It has to be kept in mind that the majority of organic production in UK originates from farming systems with grazing livestock. It is not possible to alter some factors such as location or climate, but others could potentially be improved, examples for possible improvements are listed below.

Crop production

Research issues relating to the improvement of crop production are:

- seed predation by birds
- weeding
- row spacings, seed rates and placing
- variety choice and suitability
- rotation plan and fertility requirements
- yield/quality trade-off
- efficacy of investment in marketing (eg box schemes, farm shops)
- problems with potato blight when standards change and copper is no longer permitted
- field vegetable quality issues relating to use of machinery
- new crop opportunities for organic farms

Forage production

Issues relating to improvement of forage production and use are:

- forage quality and its effect on livestock production
- nutrient status and its effect on yield and quality
- utilisation efficiency
- species and variety choice
- vulnerability of red clover to nematodes

Livestock production

Issues relating to improvement of livestock production are:

Dairy

- forage quality and utilisation,
- concentrate use
- stocking rate

Cattle and sheep

- livestock production data
- quality
- access to markets
- calf and store enterprises, including store trading opportunities
- sheep parasite issues in upland situations, incl. breeding
- balance of livestock numbers and implications for pests

Table 7.1 Summary research recommendations

	Enterprise /Farm type	*Section*	*Research issues*	*Priority*
Yield	Crops Forage Cattle and sheep Dairy	2.1.1 3.3 5.4	Yield improvements Resource implications Influence of rotation/ enterprise interactions Farm data	O N N N
Quality	Crops Forage Cattle & sheep Dairy		Quality improvement Yield-quality interactions Quality-price interactions	N N N
High value crops (field scale vegetables)	All	3.2.3 4.2.4 5.4	Resource implications, production efficiency	N N,O
Premium prices	All	2.1.2 3.3 5.4	Access to markets Cost implications of access	N N
Input levels	All Horticulture Cropping	2.1.2 3.2.3	Efficiency of use	N,O
Running costs	All	2.1.2 2.2.1 3.2	Efficiency of investment Importance for different farm types	N N
Labour	All High value crops Marketing	2.1.2 3.2 3.4 4.2.3	Requirement and costs Role of contractors Role of casual labour Implications for rural employment	N N N N
Economic	All	3.2 3.4	Larger samples Marketing and physical data Assessment of risk and uncertainty	N N N
Diversity/ specialisation	Dairy Hill livestock Cropping Mixed farming Horticulture	3.4 4.2.3 5.4	Implications for health and fertility of crops and livestock, Economy of scale Cost and labour implications	O O,N O,N N N

* N = Research needed, O = Research ongoing

7.4.2 Financial issues

- appropriate use of labour
- running costs (of varying importance to different farm types)
- price premiums (of varying importance to different farm types)

It should be considered whether information collected through the certification process could be more effectively utilised as a data source for research.

7.4.3 Managerial issues

- Trade-off between specialisation and diversity
- Economies of scale, especially in relation to the above

7.4.4 Policy issues

The following issues have been highlighted as relevant to policy decisions and organic farming:

- issues of training and advice relating to the benefits of experience and knowledge, marketing and use of management accounts
- vulnerability of hill livestock farmers to subsidy changes
- incentive to increase sheep numbers (at the expense of cattle numbers) due to subsidy benefits, contrary to the benefits of mixed grazing systems
- lack of available markets for calves and store cattle
- targeting of specific enterprises to maintain a balance of production types (arable, horticulture including fruit, and pigs).

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