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WELSH INSTITUTE *of* RURAL STUDIES

ORGANIC POULTRY PRODUCTION

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Final report to MAFF

Contract ref.: CSA 3699

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Acknowledgements

Our thanks go to first to the many producers, packers, processors, feed company representatives, supermarket buyers and others who helped us with information for this project and provided feedback on early drafts of the report. Given the lack of published information on organic poultry production in the UK, this study would not have succeeded without their willingness to impart information.

We are also grateful to the Organic Advisory Service at Elm Farm Research Centre for allowing us to make use of some of the information which they have assembled on organic poultry production.

This project was funded by the Ministry of Agriculture, Fisheries and Food.

Preface

Important - please read this!

This work for this report was completed in March 1997. The data and facts presented were, to the best of our ability, correct at that time and represent the situation as we found it in 1996. Since 1996, the organic market has developed further, so that some of the market size and price data will already be out of date.

In addition, in May 1997, a new draft of the EU organic livestock regulation prepared by the Dutch Presidency was circulated for discussion. The European Parliament has also proposed several amendments to the original Commission document which features significantly in this report.

Key changes proposed in the Presidency document include permission to use synthetic amino acids and fishmeal as ingredients in poultry rations, which removes some of the most significant constraints identified in Section 3.4 of this report, and reduce some of the likely financial implications discussed in Section 5. However, the proposed stocking rate limits effectively remain, although this can be ameliorated through the formation of partnerships between organic poultry producers and other organic (arable/horticultural) producers to redistribute manures. The Parliament's response places strong emphasis on prohibition of GMO-derived feeds, thus reducing the suitability of conventionally produced soya and maize for organic production.

The regulation is still very much in the consultation phase and further significant changes are likely. Those made so far could also be reversed. Interested parties are therefore urged to maintain contact with UKROFS (see Section 7.1.1 for address) for updates on the Regulation and implications for UKROFS and other UK standards.

Readers' attention is also drawn to the recent Farm Animal Welfare Council July 1997 report on the 'Welfare of Laying Hens'. This addresses some of the key issues raised in this report and is likely to have a significant influence on the future development of barn and free-range egg production in the UK. The report is available from FAWC, Government Buildings, Hook Rise South, Tolworth, Surbiton, Surrey, KT6 7NF.

While we have done our utmost to ensure that errors in this report have been kept to a minimum, it is inevitable given the nature of this study that there will still be some, for which we take full responsibility and would welcome any feedback.

Nic Lampkin

Aberystwyth, September 1997

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Aims and objectives

Organic poultry production in the UK is under-developed compared with other organic sectors. Of 820 certified organic producers in the UK in 1996, less than 50 had any poultry enterprises, and only 10 of these were of a significant scale. Organic production in 1996 was unlikely to be greater than 20,000 layers producing 0.5 million dozen eggs with a retail sales value of £1.0 million, and 85,000 table birds with a retail sales value of £0.85 million annually.

The aim of this study is to provide an assessment of the potential for organic poultry production in England and Wales and, in particular, to identify likely technical, financial and market constraints on the development of organic chicken egg and table meat production enterprises.

The focus of this study is on businesses that might choose to adopt organic poultry production. This includes existing organic producers entering poultry production, as well as free-range producers who might wish to convert to full organic standards. It is assumed that organic poultry production systems are unlikely to result from the conversion of intensive conventional poultry units

Production standards and legislation

Organic poultry producers are subject to a wide range of regulations and codes of practice, covering organic production, poultry marketing, health and hygiene, welfare, killing and processing, making this one of the most regulated agricultural sectors. This section of the study focuses on a comparative analysis of current UK organic standards (UKROFS and Soil Association), the proposed EU organic livestock regulation, EU free-range poultry meat and egg production regulations, and the RSPCA Freedom Food Standards as the most prominent of the alternative animal welfare standards.

The current UK organic poultry standards do not appear to impose any special constraint on the future development of the organic poultry industry. However, the EU proposals may have significant implications, particularly for table bird production. The major issues are discussed in conjunction with the analysis of production systems and key management issues below.

In general, organic production standards are more comprehensive and restrictive than most ‘intermediate’ standards. Some aspects of the RSPCA Freedom Food standards are more specific than current organic standards and could be considered for inclusion in organic production standards.

Production systems and key management issues

On the basis of a review of the literature, discussions with and visits to existing organic poultry producers, and consultations with poultry specialists, the following significant production issues were identified:

1. Breeds, sourcing and rearing of stock

- Breed suitability, particularly in the case of table bird production, is a major cause for concern - management and/or alternative breed solutions will be required.
- The sourcing of stock from conventional hatcheries, and the concept of converting conventional pullets, appears to be less than ideal in an organic farming context. While it is likely that conventional hatcheries will continue to be needed for the foreseeable future, there is a case for pullets to be reared organically for egg production.

2. Housing and outside access

- Animal welfare and behavioural considerations are important in the design and choice of housing for organic production. Enriched housing with nest boxes, facilities for dust-bathing and appropriate shelter and vegetation in the range area are desirable.
- The choice between mobile and static housing will depend on scale of production, but mobile housing offers greater opportunities for the integration of poultry into a diversified organic farming system.
- Outside access to land covered by vegetation and rested regularly to allow vegetation regrowth and parasite control is essential. Stocking rates should be at least equivalent to existing free range requirements and serious consideration should be given to the benefits as well as the disadvantages of the proposed EU overall stocking limit as a means of encouraging the concept of organic poultry production as a land-based enterprise.

3. Nutrition

- The sourcing of sufficient organically-produced ingredients and conventional ingredients acceptable under current and proposed organic standards is a significant issue. The acceptability or otherwise of synthetic amino acids and fishmeal to supplement the protein requirements of poultry causes most concern.
- The contribution of vegetation and animal proteins obtained at range to the diet of poultry is currently undervalued and should receive more recognition in organic standards and in ration formulation for poultry. For example, mulching of vegetation to encourage earthworms could significantly reduce the need for animal protein and amino acid supplements, but its potential contribution has not been adequately assessed.

4. Animal health

- Feather pecking and cannibalism is identified as a significant potential problem in organic as in other free-range systems, where careful management is required to avoid the need for beak trimming.
- Coccidiosis is seen as the number one health problem. The development and use of vaccines such as Paracox appear to provide a suitable alternative to the use of coccidio-stats in feeds and is a recommended as more appropriate in an organic farming context.
- Potential problems from external parasites should be reduced through the provision of dust-bathing facilities.

5. Slaughter and processing facilities

- The reliance of organic poultry producers on specialist markets means that most have had to develop their own packing and slaughtering/processing facilities. This has particular implications in terms of production and marketing costs, as well as the regulations which organic producers have to adhere to. Future expansion of the industry is likely to be constrained until more centralised facilities can be developed.

Market development

The market for both organic eggs and table birds currently indicates a significant excess of demand over supply, leading to premiums of 50% over free-range prices being obtained. However, the production base is very small, and significant expansion by one producer or a new entrant can lead to price volatility while the market stabilises. The market for organic eggs is almost entirely reliant on the multiples, while the organic table bird market is currently almost entirely through specialist retail outlets, with one notable exception. There would appear to be significant scope for expansion through the multiples if supplies could be increased.

Financial appraisal

The prices currently obtainable for organic egg and table bird production generate better gross margins per bird than free range or conventional production, despite the high costs for organic cereals and approved conventional ration components. Most small producers, however, are operating at too small a scale to generate a positive return over fixed costs, and it is likely that the only viable expansion of organic poultry production will occur on larger units (1,000 table birds/week or 5,000 layers). The impact of the draft EU regulation on feed prices and the requirement for longer finishing periods for table birds could seriously affect the financial outlook for table bird producers in the absence of higher prices.

Future potential and key constraints

There is clearly demand for organic poultry products and the potential to increase output. Whether this can be achieved will depend on:

- the development of larger production units so that fixed costs, in particular for labour, can be reduced through increased automation
- the development of centralised packing, killing and processing facilities, together with the development of outlets (such as baby foods) for downgrades
- greater market opportunities and certainty to provide confidence to expand, including the development of appropriate working relations with the multiples
- the availability of poultry feed of an appropriate quality to maintain productivity and at an acceptable price
- the supply of product at a price acceptable to the consumer
- the removal of uncertainty concerning future organic livestock standards and regulations

Research requirements

Many of the husbandry issues identified can be resolved on the basis of existing scientific knowledge and practical experience. A limited number of specific research requirements have been identified:

- Determine the contribution of vegetation and animal protein obtained at range to the nutritional requirements of poultry
- Identify appropriate breeds which meet slow growth requirements and are acceptable to the consumer
- Examine the relationship between growth potential and productivity, finishing periods and food conversion efficiency under free-range and organic conditions (the lack of predictability in organic systems is potentially a major concern)

Policy requirements

The main policy requirements emerging from these conclusions are:

- Continue efforts to ensure that the requirements of the EU organic livestock regulation are appropriate to the continued development of the organic poultry sector in accordance with the overall objectives of organic farming
- Provide opportunities within future national and regional marketing and processing grant schemes for the development of centralised packing and processing facilities
- Consider the option of a capital investment grant within the Organic Aid Scheme to assist the more intensive poultry producers in adapting to the housing and stocking rate requirements of organic standards.

1 Introduction

The aim of this report is to provide an assessment of the potential for organic poultry production in England and Wales and, in particular, to identify likely constraints on the development of organic poultry production enterprises, including physical, financial and market factors.

1.1 Background

In recent years, organic farming in western Europe has developed rapidly, with the organically managed land area expanding to over 1.3 million ha on 60,000 farms by 1996. In the Scandinavian and German-speaking countries, organic farming has moved from a marginal position of less than half of one percent of agricultural land use to become a significant part (2 to 10%) of the agricultural sector, bringing the overall EU average close to one percent. Within this overall context, organic production has traditionally focused on cereals, pulses and fresh produce for which ready markets exist. Ruminant livestock also play an important role because of their ability to utilise effectively the fertility-building clover/grass phase of organic rotations. In Germany, for example, nearly 8% of the total suckler cow herd is managed organically, compared with only 2% of the agricultural land area, despite the relatively low level of development of the market for organic meat. More recently, the demand for organic milk has increased substantially, leading to significant price premiums in several European countries.

By contrast, organic pig and poultry production are hardly developed at all. At the end of April, 1996, our estimates suggest that there were 10-15 organic poultry meat producers and 25-40 egg producers in the UK, out of a total of 820 certified organic farms, the majority producing on a very small scale (e.g. less than 25 layers). Larger scale commercial organic producers could be counted in single figures for both meat and eggs, but even here the size of operations, with one or two significant exceptions, were typically in the range of 200-1,000 table birds/week and 500-5,000 layers. Such operations are much smaller than would be expected in conventional poultry production, including free-range. The size of the organic poultry sector in 1996 is unlikely to be greater than 20,000 layers producing 0.5 million dozen eggs with a retail sales value of £1.0 million, and 85,000 table birds with a retail sales value of £0.85 million annually.

This situation is not unique to the UK - similar circumstances are found in the Scandinavian and German-speaking countries where otherwise organic farming is much further developed. The reasons why organic poultry production remains such an undeveloped sector, and steps which may be taken to address this problem, are the focus of this study.

1.2 Problem description

Published information on organic poultry production in the UK is scarce. Lampkin (1990) describes free-range and perchery approaches to organic egg production, while a brief overview of the UK organic poultry industry and provisional costings for organic egg production have recently been published (Lampkin and Measures, 1995; Weisselberg, 1995; Steele, 1996). Organic production standards (SA, 1996; UKROFS, 1996) specify a range of conditions with respect to poultry production. Some more detailed information is contained in German language publications (e.g. Neuerburg and Padel, 1992; Fölsch *et al.*, 1992; Zollitsch *et al.*, 1995).

Key issues (and potential constraints) identified in these publications with regard to the design and management of organic poultry systems include:

- breed suitability, origin and rearing of stock;
- housing, behaviour and welfare;

- types and sources of acceptable feedstuffs to provide suitable rations at reasonable cost;
- animal health and treatment, in particular coccidiosis, salmonella and feather pecking;
- stocking densities, access to range and manure handling/utilisation;
- market demand and marketing channels, including availability of processing facilities; and
- financial costs and returns of poultry enterprises.

1.3 Objectives of the study

Arising from the key issues identified above, this report has three main objectives:

1. To describe alternative organic poultry production systems and to define their physical parameters, with a particular emphasis on free-range systems and their respective input requirements and output potential.
2. To investigate the market opportunities for organic poultry meat and egg production in England and Wales, through an examination of the existing market structure; an appraisal of existing and potential marketing strategies; and an assessment of likely demand conditions.
3. To illustrate the relative profitability of alternative systems of organic poultry production through the formulation of appropriate farm business plans, including the projection of cash flows under given assumptions, and the application of sensitivity analyses to key variables influencing profitability.

The focus of this study is on businesses that might choose to adopt organic poultry production. This includes both existing organic producers entering poultry production, as well as free-range producers who might wish to convert to full organic standards. Organic poultry production systems are unlikely to result from the conversion of intensive conventional poultry units, so this option is not considered further.

The consideration of poultry is restricted to chickens, although other types (turkeys, geese, ducks) are also produced to organic standards and in some cases indicate significant potential.

2 Definitions, production standards and legislation

2.1 Definition of organic farming and implications for poultry production

Organic farming can be defined as an approach to agriculture where the aim is to create integrated, humane, environmentally and economically sustainable agricultural production systems producing acceptable levels of crop, livestock and human nutrition, protection from pests and diseases, and an appropriate return to the human and other resources employed. Maximum reliance is placed on locally or farm-derived, renewable resources and the management of self-regulating ecological and biological processes and interactions. Reliance on external inputs, whether chemical or organic, is reduced as far as possible. In many European countries, organic agriculture is known as ecological agriculture, reflecting this reliance on ecosystem management rather than external inputs.

In order to achieve the animal welfare, environmental, resource-use sustainability and other objectives, certain key principles are adhered to. Those relevant to poultry production include:

- management of livestock as land-based systems (i.e. excluding feedlots and intensively-housed pig and poultry units) so that stock numbers are related to the carrying capacity of the land and not inflated by reliance on 'purchased' hectares from outside the farm system, thus avoiding the potential for nutrient concentration, excess manure production and pollution;
- reliance on farm- or locally-derived renewable resources, such as biologically-fixed atmospheric nitrogen and home-grown livestock feeds, thereby reducing the need for non-renewable resources as direct inputs or for transport;
- reliance on feed sources produced organically, which are suited to the animal's evolutionary adaptations (including restrictions on use of animal proteins) and which minimise competition for food suitable for human consumption;
- maintenance of health through preventive management and good husbandry in preference to preventive treatment, thereby reducing the potential for the development of resistance to therapeutic medicines as well as contamination of workers, food products and the environment;
- use of housing systems which allow natural behaviour patterns to be followed and which give high priority to animal welfare considerations, with the emphasis on free-range systems for poultry;
- use of breeds and rearing systems suited to the production systems employed, in terms of disease resistance, productivity, hardiness, and suitability for ranging.

2.2 Production standards and the legislative context

Production standards and related legislation provide the opportunity for the sustainability and animal welfare objectives of free-range and organic production systems to be clearly identified, so that consumer preferences with respect to these objectives can be reflected in the market place. The higher prices which producers can achieve when meeting these standards are clearly important, but standards and legislation remain a means to an end rather than an end in themselves. It should be noted that production standards and legislation are evolving measures subject to continual amendment, so that the analysis presented in the following pages represents only the situation prevailing at the time of the study in 1996.

2.2.1 Legislative context

Several pieces of European and national legislation are of significance with respect to organic poultry production. These either underpin or are additional to the production standards used in practice. The differing terminology relating to alternative production systems for eggs and poultry as outlined below should be noted.

2.2.1.1 EU organic farming regulations

EC Reg. 2092/91 (EC, 1991a) and subsequent amendments (e.g. EC, 1995, see also MAFF, 1995b) defines organic crop production and the means by which organically produced crops may be certified and legally sold within the European Union. At present this regulation does not cover organic livestock production, although it does provide for the extension of the legislation in this respect. Draft legislation has been circulated for consultation (EC, 1996) and this draft is included in this review.

2.2.1.2 EU egg production regulations

EC Reg. 1943/85 (EC, 1985) originally defined alternative egg production systems (specifically: free-range, semi-intensive, deep-litter, and perchery/barn) for the purposes of labelling small egg packs only. This regulation has been superseded by EC Reg. 1907/90 (EC, 1990b), which defines marketing standards for eggs with respect to freshness, grading and appearance, and EC Reg. 1274/91 (EC, 1991b) which amends EC Reg. 1907/90 with regard to quality grades and freshness, including the description of production systems used (free-range, semi-intensive, deep litter and perchery (barn) eggs - see Tables 2.1-2.3 for details). EC Regs 786/95 (EC, 1995b) and 1511/96 (EC, 1996b) amend Regs. 1907/90 and 1274/91, in particular through the introduction of new egg sizes (see Table 4.9). These criteria are currently under review and will be subject to further amending legislation.

2.2.1.3 EU poultry (meat) production regulations

EC Reg. 1906/90 (EC, 1990a) (as amended by EC Regs. 317/93 and 3204/93) defines processing and marketing standards for poultry, including the optional use of indications concerning the type of farming (specifically: extensive indoor (barn-reared), free-range, traditional free-range and free-range: total freedom). The detailed rules for farming types are introduced in EC Reg. 1538/91 (EC, 1991c) which amends 1906/90. This latter regulation, which has itself been amended on several occasions (in particular by EC Regs. 2891/93 and 3239/94), covers terminology for different poultry species, part of birds, degree of evisceration, classification as Class A or B, conditions for freezing, chilling, pre-packing, water content and monitoring, as well as methods of production (see Tables 2.1-2.3). MAFF (1996) gives an unofficial consolidated version of these changes.

2.2.1.4 Poultry breeding and hatching

The Poultry Breeding Flocks and Hatcheries Order 1993 (MAFF, 1993b) specifies that hatcheries with capacities for over 1,000 eggs/year or breeding flocks over 250 birds must be registered with MAFF and have testing for salmonella. This order implements EC Council Directive 92/117 (EC, 1993) and replaces earlier UK legislation which required salmonella testing by egg producers. The production and marketing of eggs for hatching and farmyard poultry chicks are also covered by a number of EU Council and Commission regulations. As these enterprises are not considered further in this report, full details are not given here.

2.2.1.5 Hygiene and safety

In addition to the egg production regulations identified above, the Egg Products Directive, implemented in the UK by Statutory Instrument 1993 No. 1520, includes special hygiene regulations relating to the use of cracked eggs.

For table birds, the Poultry Meat, Farmed Game Bird Meat and Rabbit Meat (Hygiene and Inspection) Regulations 1995 apply to producers slaughtering and marketing more than 10,000 birds in a year. This implements EC Directive 71/118 as amended and updated by Directive 92/116, which requires all slaughterhouses with a throughput of 10,000 birds or more per year to be licensed through the Meat Hygiene Service and to comply with the requirements of the regulations. Additional rules apply to throughputs above 150,000 birds per year, but these do not appear to be applicable to the current scale of the organic sector. For producers exempt from the above regulations (i.e. those slaughtering and marketing less than 10,000 bird per year), a Code of Practice is issued jointly by the National Farmers' Union of England and Wales, the British Poultry Federation and the Environmental Health Officers' Association. At the time of writing this report, a new Code of Practice was in draft. There are restrictions on the locality of sales and the type of sales permitted under this exemption (wholesale and mail-order sales are not allowed), and the slaughter premises must be registered with the local Food Authority. All exempt slaughterhouses must be registered with the Food Authority and must comply with the Food Safety (General Food Hygiene) Regulations 1995. Slaughtering is also covered by the Welfare of Animals (Slaughter or Killing) Regulations 1995. Producers/processors should be aware of the general provisions of the Food Safety Act 1990, for which the main defence to a charge is 'reasonable precautions' and 'due diligence'. Food businesses must also apply to the local authority under regulation 2 (2) (b) of the Food Premises (Registration) Regulations 1991.

2.2.1.6 Animal welfare

Agriculture (Miscellaneous Provisions) Act 1968 provides the basis for codes of recommendations for the welfare of livestock, including poultry. These have from time to time been supplemented by recommendations from the Farm Animal Welfare Council, including the FAWC's Charter which includes the 'five freedoms' on which the RSPCA's Freedom Food standards (RSPCA, 1995) are based.

2.2.2 Production standards

In reviewing the requirements of production standards currently in use, we have identified the following organic and 'intermediate' approaches which are likely to be relevant either to producers or to consumers who might be interested in organic poultry. The 'intermediate' approaches are considered to be relevant because a) consumers may prefer the combination of lower prices with less restrictive standards, or may not be aware of differences between the various standards and choose solely on price grounds; and b) producers currently meeting 'intermediate' standards may be willing to consider full conversion to organic standards.

2.2.2.1 Organic standards (UKROFS, Soil Association (SAOMCo), IFOAM, draft EU regulation)

Organic poultry production in the UK is at the moment guided/regulated by several sets of standards. All UK producers who want to have their products labelled as organic must in effect comply with the UKROFS standards (UKROFS, 1996). Although they do not have legal status yet, the UKROFS livestock standards represent a nationally agreed definition which Trading Standards officers can use in cases of fraud, even though, as one producer pointed out, this is difficult to enforce. The UKROFS standards do not give much detail with respect to poultry production. Producers wishing to register with any specific organic sector body must comply with that body's set of standards, which in some instances, such as the Soil Association's (SA, 1996), are more detailed and restrictive than the UKROFS standards.

In an international context, the IFOAM standards for organic livestock production (IFOAM, 1996) underpin most national organic livestock standards which are not otherwise covered by legislation, and these standards have had some impact on the drafting of international trade agreements such as

the FAO Codex Alimentarius definitions. The IFOAM standards do not specify much detail relating to poultry production, but deal more with general principles. At present the Soil Association is the only UK certifier accredited by IFOAM.

The draft EU regulation for organic livestock production (EC, 1996) has also been included in this analysis. If implemented, it will have significant implications on the development of the UKROFS standards, and on the viability of organic poultry production in the UK.

2.2.2.2 Intermediate standards (Free-range, barn, perchery, RSPCA Freedom Food, Conservation Grade, Traditional, Heritage)

Production systems terminology for eggs (free range, semi-intensive, deep litter, perchery (barn), caged (battery)) and for meat (free-range, traditional free-range, free-range: total freedom, and extensive indoor (barn-reared)) are covered by the EC regulations identified above. In some cases, different standards apply to table birds and layers, even though similar terms are used, such as free-range and barn - the distinctions should be carefully noted. The terms refer primarily to housing and not to other aspects of poultry management although grazing and some feed aspects are covered for poultry meat. The RSPCA's Freedom Food standards (RSPCA, 1995) impose additional animal welfare requirements, and are being increasingly adopted by multiple retailers such as Safeway and Tesco to reinforce existing barn and free-range labelling. As such these labels may have a significant impact on the development of the organic sector. In the past, Conservation Grade poultry production has also featured, but at present no producers are certified as meeting these standards so they are not considered further in this review. In addition to these standards, there are a wide range of company-specific standards, such as 'traditional' and 'heritage', which are not monitored by independent third parties and where details of the production standards underpinning the labels are not easily available. In practice, these latter standards tend to reflect age/maturity at slaughter and length of hanging rather than specific housing, animal welfare, health-care or nutritional requirements.

A general, critical review of the relationship between these 'intermediate' and organic standards and the role of multiples in their promotion is provided by Cottee (1996). However, a more considered review of some of these standards with respect to poultry is necessary. The following analysis focuses on aspects of the EU 'farming type' regulations and the Freedom Food standards in particular, as they appear most relevant to the future development of organic production in the UK.

2.3 Comparison of production standards

The different organic, RSPCA and EU poultry standards are summarised in tabular form in this section. The tables are not exhaustive, but serve to provide a quick comparison between certain areas of the various standards. The 'recommended' figures from the Soil Association standards are used, although there is a further category of 'permitted' which is shown in brackets that requires specific permission from the Soil Association Standards Committee. The permitted levels are often used in practice as the basis for organic management. The EU types listed correspond to the terminology defined by the various regulations discussed in Section 2.2.1 above. The EU classification of 'free-range: total freedom' for poultry meat conforms to all restrictions for traditional free-range, and additionally, specifies that the birds must have continuous day-time access to open-air runs of unlimited area.

2.3.1 Stock origin and conversion periods

Most organic standards recommend the use of suitable breeds for an organic regime. Ideally these would be organically reared, but there are derogations until organically reared animals are available in sufficient numbers which allow conventionally reared stocks subject to certain limits. All UK

organic standards specify that stock for egg production may be brought in up to 16 weeks of age and then a conversion period of 6 weeks applies. The draft EU regulation allows pullets to be brought-in up to 18 weeks but, where the holding is in conversion, a conversion period of 10 weeks is required (birds may start to lay at around 20 weeks). Poultry for meat production can only be purchased at one day old and have to be managed according to organic standards for their whole lifetime. The draft EU organic livestock regulation requires breeds for meat production to be of a strain known to be slow growing, which may be purchased from conventional sources up to 3 days old. Where a holding is in conversion, the proposed conversion period (during which stock need to be managed to organic standards) is six months – far in excess of the normal life of a table bird.

2.3.2 Housing

According to the current UKROFS standards all housing must, at minimum, follow the appropriate MAFF codes with respect to animal welfare. The stocking density inside the building is not covered by the regulations. The draft EU organic livestock regulation specifies a stocking density in housing of 7 laying hens/m^2. This is lower than the current SA maximum of 10 birds/m^2. Most standards for table birds have a limit of 12 birds/m^2 (RSPCA: 30 kg/m^2). The draft EU regulation is based upon semi-intensive, deep litter standards (EC Reg. 1274/91). It does not include perchery housing systems, where higher stocking densities can be accommodated without infringing upon the welfare of the hen. For example, the RSPCA standard for layers allows 7 birds/m^2 on floor area, but up to 15.5 hens/m^2 in multiple-tiered houses. The commercial Swiss systems that have been developed to replace battery cages on all farms house up to 20 birds/m^2 in groups of 900-2000 birds. Lower intensity aviary systems are likely to support stocking densities of up to 10 hens/m^2 (Fölsch, 1991).

At present, only the Soil Association standards specify group sizes for layers and table birds, although a forthcoming review of the RSPCA standards will bring in limits for flock and colony sizes for layers. The concept of a restricted group size could be beneficial to minimise the housing-related stress for the animals. However, there is no evidence to suggest that the Soil Association's chosen maximum size of about 500 birds per group corresponds with the birds' ability to recognise others, which has been specified as being in the range of 50 individuals (Fölsch, 1996, personal communication). The draft EU regulation requires group size to be appropriate for the animals behavioural needs, which would clearly need interpretation. It is probable that a group size of 500 birds or less would restrict the development of larger units for egg production and may explain the preference of larger producers for certification by UKROFS the Organic Food Federation or Organic Farmers and Growers Ltd rather than the Soil Association.

The UKROFS standards do not specify any requirements for lighting, whereas the SA and RSPCA standards and the draft EU organic livestock regulation require adequate natural lighting and ventilation for all stock and specify that the lighting period for poultry should not exceed 16 hours a day. The UKROFS standards also provide less detail about other aspects of housing than other standards, where requirements such as the number of nest boxes per bird, the use of non toxic building materials, the size of the pop-holes, access to dust bathing facilities, and a minimum littered area are specified. The most detailed standards in these regards are those of the RSPCA.

Table 2.1a Comparison of organic production standards for poultry (stock origin and housing)

	UKROFS	*Soil Association*	*IFOAM*	*EU organic livestock proposal*
Stock origin				
Breed				table birds to be of strain recognised to be slow growing
Source of pullets				organic origin desired
Age of chicks (table birds)	1 day	1 day	1 or 2 days	less than 3 days
Max. age (weeks) of conventional pullets	16	16		18
Conversion period (weeks)	6	6	under review	layers: 10 table birds: 6 months
Housing				
General		permanent housing prohibited, all wire or slatted floors prohibited	to allow behavioural needs	sufficient ventilation, dry rest area of sufficient size. Table birds: total usable area of poultry houses at one site not more than 1600 m^2
Stocking density per m^2 (layers)	7 hens or 17 kg - more with perches	7-10 hens or 15 kg		7 hens
Stocking density (table birds)	spacious, 34 kg/m^2	12 birds or up to 25 kg/m^2		12 birds up to 25 kg/m^2
Littered area (layers)	required	required, to be kept dry and friable	natural materials required	1/3 of floor space
Littered area (table birds)	75%, 25% slats allowed	75% of floor space to be dry and friable	natural materials required	1/3 of floor space
Collection of droppings		recommended on 25% of floor space		sufficiently large area
Dust bath				
Perches (cm/hen)	optional	20 (15)		required
Nest boxes		1 per 5 (8) hens		
Group size	stable groups	layers: 100(500) table birds: 200(500)		group size dependent on behavioural needs. 4800 birds max/house
Building material		non toxic		non toxic
Disinfection		between batches, methods listed		list of approved substances
Lighting (max. hours)		16 incl. natural daylight	as per local certifier	16 incl. natural daylight

Sources: UKROFS (1996), SA (1996), IFOAM (1996), EC (1996a)

Table 2.1b Comparison of intermediate production standards for poultry (stock origin and housing)

	RSPCA Freedom Food	*EU free-range eggs and free-range or traditional free-range table birds*	*EU semi-intensive, deep litter, perchery (barn) eggs and barn-reared table birds*
Stock origin			
Breed	undesirable traits to be avoided; table bird chicks only from salmonella-free breeding flocks	traditional free-range to be of a strain recognised to be slow growing	
Source of pullets	reared in similar system		
Age of chicks (table birds)			
Max. age (weeks) of conventional pullets			
Conversion period (weeks)			
Housing			
General	fresh air without aerial contaminants, access to littered or well-drained areas; table birds should be not be more than 3 metres from food or water when housed	traditional free-range: total usable area of poultry houses at one site must not exceed 1,600 m^2	
Stocking density per m^2 (layers)	7 on floor or up to 15 hens in multi-tier systems	deep litter: 7 hens perchery: 25 hens	deep litter: 7 hens perchery: 25 hens
Stocking density (table birds)	max. 30 kg/m^2 (environmental enrichment must be provided for indoor chickens)	free-range: 13 birds up to 27.5 kg/m^2, trad. free-range: 12 birds up to 25 kg/m^2 *	12 birds up to 25 kg/m^2 *
Littered area (layers)	1/3 of floor space	deep litter: 1/3 of floor space	deep litter: 1/3 of floor space
Littered area (table birds)	whole floor to be dry and friable		
Collection of droppings		deep litter: sufficiently large area	deep litter: sufficiently large area
Dust bath	access at least 4 hours daily		
Perches (cm/hen)	15 x 40 mm	perchery: 15	perchery: 15
Nest boxes	1 per 5 hens		
Group size	under review	trad. free-range: 4800 max. per poultry house	
Building material	non toxic		
Disinfection	required between batches		
Lighting (max. hours)	18 (min. 10 lux faded gradually) & natural daylight		

Sources: RSPCA (1995), EC (1990a), EC (1991b), EC (1991c), MAFF (1996)

* mobile houses with less than 150 m^2 floor area and open at night: max 20 birds, 40 kg/m^2.

2.3.3 Outside access

The UKROFS standards specify that poultry must have continuous and easy access to outside ranges, covered with suitable vegetation. This excludes barn systems which have a small littered outside area, and other similar systems, from organic production, although some of these are currently allowed under the organic standards in some countries e.g. in Germany. The Soil Association standards specify a stocking rate for set stocking (618 birds/ha) below the EU requirements for free-range egg production (1000 birds/ha), but for rotational stocking their position is not clear. The EU draft regulation for organic livestock permits higher stocking rates (4,000/ha based on semi-intensive standards), but specifies that a rotational system for the range area should be implemented, and that the outside area should provide access to feeding points and water. Apart from the increase in stocking rates, the only likely change to current UK practices is the requirement for a resting period between batches in the outside area for rearing poultry. The RSPCA standards for layers specify grassland must be available, with provisions for disease control, such as rotation, and specify the minimum amount of that rotation that must be available at all times. The RSPCA does not require table bird producers to operate a free-range system.

The draft EU regulation views organic animal production as a land-based activity and assumes a close relationship with land use. Whether that implies that all crop and livestock enterprises on the holding should be managed organically, or whether just enough land should be part of the unit so that the effluent can be disposed of, is not entirely clear. However, rules are proposed that the holding should not exceed a stocking density of 2 LU/ha (1 laying hen = 0.014; pullets (1 week old to point of lay) = 0.03; broilers = 0.0017; other table chickens = 0.004 LU). Potentially this can have implications for poultry production in the UK, where no such direct relationship to land use is regulated at the moment. In particular, existing organic poultry producers with no other organic enterprises will not have sufficient land converted to maintain organic status (see Section 5.4.4).

2.3.4 Welfare

In addition to welfare requirements with respect to housing, the UKROFS standards refer to the MAFF Welfare Codes with respect to beak trimming and wing clipping. The SA standards only permit the clipping of flight feathers for individual birds and prohibit beak clipping together with all other types of mutilation. A similar view is expressed in the draft EU regulation, even though they state that certain exemptions can be granted by sector bodies and mutilation must be carried out by qualified personnel. The RSPCA standards prohibit mutilations, but permit tipping of the hook of the upper mandible of layers in individual cases.

2.3.5 Feeding

Diet is the major point of divergence between 'intermediate' and organic standards, as the intermediate standards have very little to say about feed type or quality. All organic standards state that ideally 100% of the diet should be organic, but give some allowance for some non-organic components of the diet under the current situation. The UKROFS standards allow non-ruminants up to 30% (calculated on a daily basis) from non-organic sources. At least 50% of the diet must be fully organic, and the remaining 20% can come from sources that are in conversion to organic production. The draft EU regulation is proposing stricter rules by reducing the percentage of non-organic origin for the derogation period to 20% and requiring 60% fully organic (in line with current Soil Association standards following IFOAM accreditation). In addition, the EU draft regulation specifies that holdings should 'normally produce their animal feed themselves' and require special approval to buy in feeds.

The standards also regulate the permitted protein sources that can be used in poultry rations. UKROFS excludes all materials from intensive and unknown origins and specifies that the use of solvent extracted feedstuffs is prohibited. Like the EU draft regulation, the SA standards specify

allowed components for the non-organic part of the diet, which include cereals and cereal by-products, a wide range of legumes, waste products from the brewing and sugar industries, expelled oilseed residues, dairy products and fish meal. The EU draft excludes all animal protein other than milk and milk products for feeding, which would exclude fish meal which is currently quite widely used in UK organic poultry rations. The RSPCA standards also exclude the feeding of animal proteins.

The question of synthetic amino acids is controversial in the organic movement in Europe at the moment. They are permitted under some standards, but either restricted or prohibited under others. IFOAM is intending to revise the standards to prohibit the use of synthetic amino acids in organic rations and the IFOAM EU Group has made similar recommendations to be included in the EU proposal. In the draft EU regulation for organic livestock, synthetic/pure amino acids are not mentioned and hence prohibited since only listed conventional feed components are approved.

In addition to the standards mentioned in the tables, two others are worth mentioning with particular reference to feeding restrictions. Corn-fed table birds may be fed a ration containing a minimum of 65% cereals, a maximum of 15% cereal by-products, a maximum of 5% pulses or green vegetables and a maximum of 5% dairy products (EC, 1991b). If specific cereals are named, they must comprise at least 35% of the ration, 50% in the case of maize. Additive-free systems (e.g. Graig Farm) restrict the use of growth promoters and coccidiostats, essentially following free-range and in some cases organic standards, but without the requirement for organic feed or the costs of independent certification.

2.3.6 Health and medication

The aim of organic systems is to optimise breeding, rearing, feeding, housing and general management in order to achieve stability and balance in the farming system, maximise the health of the animal and minimise disease pressure and stress. In organic standards preventive treatment is restricted to the restrained use of vaccination and homoeopathic nosodes for known farm problems. Growth promoters, hormones and the routine (prophylactic) use of antibiotics are not allowed.

All organic standards emphasise the prevention of disease by enhancing the welfare of the animal and prohibit the use of prophylactic treatment with chemotherapy. However, UKROFS gives exemptions with respect to the use of anthelmintics, but require that they should be accompanied by the employment of management practices to reduce the problem. Whether or not this includes the use of coccidiostats in poultry starter rations remains unclear, whereas they are specifically mentioned as allowed under the current SA standards and are widely used in the currently available rations of that type.

Where possible, treatment of ailments is approached by aiding the animal's own resistance and the use of complementary therapies such as homoeopathy. Conventional treatment should be used in all cases where it is necessary to prevent prolonged illness or suffering, but longer withdrawal periods are imposed under organic production standards for controlled drugs and prescription/pharmacy only medicines and veterinary products. The draft EU organic livestock regulation allows a maximum of two courses of treatment in an annual production cycle, or lifetime if that is less than one year, above this they will lose their organic status for that year.

The RSPCA standards and EU free-range and barn regulations give no restrictions on medications, growth promoters, vaccinations or the use of hormones, although the RSPCA is bringing in a more detailed veterinary plan which will be subject to annual review.

Table 2.2a Comparison of organic production standards for poultry (outside access, welfare and feeding)

	UKROFS	*Soil Association*	*IFOAM*	*EU organic livestock proposal*
Outside access				
General	access to suitable shelter	access to suitable shelter		protection available, layers: continuous daytime access, table birds: access from 6 weeks - 2m²/bird
Pop-holes	continuous and easy access to runs	continuous and easy access to runs	continuous and easy access to runs	4m per 100m² of house
Pasture	suitable vegetation	rested one year in 3 if set-stocked		vegetation with rest period
Stocking density (birds/ha allocated)		618 if set-stocked		4,000 for hens, 5,000 for table birds
Welfare				
General	MAFF codes	MAFF codes	behavioural needs must be provided for	
Beak trimming	MAFF codes	not permitted	not permitted	not permitted, exemption possible
Wing clipping	MAFF codes	individual birds	not permitted	not permitted, exemption possible
Feeding				
General (All specify that feed should satisfy the livestock's nutritional requirements)	table birds: careful control required to prevent welfare problems from too rapid growth rates	aim is for own farm produced organic feedstuffs	over 50% must be produced on the farm or from organic farms in the region (exemption possible)	normally produced on holding, feed for fattening to be 70% cereals
Feed origin	mainly organic: 50% organic 30% conventional	60% organic 20% conventional	max. 20% conventional (average)	all organic except where derogation 60% org., 20% conv.
Animal protein	no 'intensive' additions	dairy products, fishmeal	local certifier to specify	dairy products
Pure amino acids	restricted	restricted	local certifier to specify	not mentioned, so prohibited
Other	non solvent extracted; more than 25 mm feeding trough space per bird.	yolk colorants, in feed medication or other additives prohibited	local certifier to specify	list of approved components, synthetic substances to aid reproduction prohibited
Growth promoters	no	no	no	No

Sources: UKROFS (1996), SA (1996), IFOAM (1996), EC (1996a)

Table 2.2b Comparison of intermediate production standards for poultry (outside access, welfare and feeding)

	RSPCA Freedom Food	*EU free-range eggs and free-range or traditional free-range table birds*	*EU semi-intensive, deep litter, perchery (barn) eggs and barn-reared table birds*
Outside access			
General	layers: < 350 m to range, shelter and overhead cover available table birds: access not compulsory, but if free-range, access for 8 hours or daylight hours if less	layers: continuous daytime access to open-air runs; table birds: free-range - for half lifetime cont. daytime access (> 1m²/bird), trad. free-range - cont. access from 6 weeks (>2m²/bird)	semi-intensive layers: continuous daytime access to open-air runs
Pop-holes	sufficient to ensure ready access to range, min. size 450mm x 2m wide, min. one pop-hole /600 birds	4 m per 100m^2 of house floor area	
Pasture	layers: grassland with disease control measures - if rotation, $^1/_6$ must be available at any one time	ground must be mainly covered by vegetation	semi-intensive layers: ground must be mainly covered by vegetation
Stocking density (birds/ha allocated)	1000	free-range eggs: 1000 table birds: free-range 10000 trad. free-range: 5000	semi-intensive layers: 4000
Welfare			
General	written veterinary health and welfare impact plans, no induced moulting by withholding water or feed, must provide abrasion for claws		
Beak trimming	layers: tipping tolerated only 5-15 days old; table birds: no mutilation		
Wing clipping			
Feeding			
General	fresh, wholesome and appropriate	feed for fattening to be at least 70% cereals	
Feed origin			
Animal protein	not permitted		
Pure amino acids			
Other			
Growth promoters			

Sources: RSPCA (1995), EC (1990a), EC (1991b), EC (1991c), MAFF (1996)

Table 2.3a Comparison of organic production standards for poultry (health and medication, transport and slaughter)

	UKROFS	*Soil Association*	*IFOAM*	*EU organic livestock proposal*
Health and medication				
General	positive welfare	disease prevention	maximise resistance and prevention	disease prevention
Restrictions	double withdrawal period	extended withdrawal period, vaccinations	double withdrawal period	double withdrawal period, vaccinations, max. 2 doses of medication in a year/lifecycle
Prohibited	preventive chemotherapy, no 'intensive' additions	prophylactic treatment, feed additives	prophylactic treatment, growth promoters	prophylactic treatment
Transport and slaughter				
Transport	stand without restriction, protected from fluctuating temperatures, sheltered	stand without restriction, no tranquilisers, sheltered	must not result in physical injury, no chemically-synthesised tranquilisers	unnecessary stress avoided
Journey time	max. 10 hours inclusive	max. 8 hours inclusive	max. 8 hours to slaughterhouse	
Minimum age				81 days
Slaughter		licensed abattoirs		

Sources: UKROFS (1996), SA (1996), IFOAM (1996), EC (1996a)

2.3.7 Transport and slaughter

The producers consulted for this report were all under the impression that the standards specify a minimum slaughter age of 10 weeks, however, this is not included in either the UKROFS or SA standards and communication with both these bodies failed to identify the origin of this belief. However, the minimum slaughter ages for barn-reared and free-range poultry (56 days = 8 weeks) and traditional free-range (81 days =11.5 weeks) apply and the latter is proposed in the draft EU regulation.

SA, UKROFS and RSPCA standards specify minimum travel conditions and maximum transport times of 8 hours (RSPCA 6 hours for table birds). The RSPCA give more detailed requirements for transport unloading and holding conditions, and slaughter processes. The draft EU regulation does not specify limits.

Table 2.3b Comparison of intermediate production standards for poultry (health and medication, transport and slaughter)

	RSPCA Freedom Food	*EU free-range eggs and free-range or traditional free-range table birds*	*EU semi-intensive, deep litter, perchery (barn) eggs and barn-reared table birds*
Health and medication			
General	veterinary plan, vaccination, table birds: inspect 3x daily, salmonella tests in all houses where birds < 25 days old		
Restrictions	in-feed antibiotics only for therapeutic reasons under direction of vet.		
Prohibited			
Transport and slaughter			
Transport	considerate handling, noise to be minimised, no unfit birds		
Journey time	layers: max. 8 hours incl. unloading, table birds: 6 hours		
Minimum age (days)	as per relevant EU farming type	free-range: 56 trad. free-range: 81	56
Slaughter	as close to point of rearing as possible, max. suspension time of 1.5 minutes, electrical stunning		

Sources: RSPCA (1995), EC (1990a), EC (1991b), EC (1991c), MAFF (1996)

2.4 Conclusions

The current UK organic poultry standards do not appear to impose a special constraint on the future development of the organic poultry industry. However, under current standards it is unlikely that any large-scale, intensive conventional poultry producers would convert to organic production, given the costs of changing housing systems, providing access to pasture and the cost of organic feedstuffs, without a guaranteed premium market.

Conversion to organic production might be an interesting proposition for those smaller producers who are already producing a special quality product, such as free-range or additive-free eggs or table birds, and for existing organic producers looking to expand into a new enterprise.

A number of the larger-scale poultry producers commented that they found the Soil Association's higher standards with respect to group size and minimum organic feed requirement too restrictive compared with other standards based on the UKROFS minimum requirements.

There would appear to be some scope for the tightening of standards with respect to the use of anti-coccidial agents in feeds (see Section 3).

In general, organic production standards are more comprehensive and restrictive than most 'intermediate' standards. Some aspects of the RSPCA Freedom Food standards are more specific than current organic standards and could be considered for inclusion in organic production standards. As 'intermediate' producers become more familiar with complying with production regulations, standards, and inspection bodies, a move to organic standards will be less daunting than at present. Consumers also, through supermarket use of the RSPCA standards, are becoming more aware of, and have a greater confidence in, production standards, and may become increasingly prepared to pay more for extra reassurance.

The draft EU organic livestock regulation, if unchanged, could have a significant impact because organic poultry will need to be produced on an organic farm with stocking rates limited to 2.0 LU (e.g. 140 hens) per farm hectare, and because the tightening of the non-organic feed allowances may make it more difficult to produce suitable rations at an acceptable cost.

The focus of the draft EU organic livestock regulation on 'traditional free-range' requirements as a basis for organic table bird production is likely to cause particular problems for existing organic table bird producers, in particular:

- the requirement for a strain of bird to be used which is recognised to be slow growing
- the minimum slaughter age of 81 days
- the requirement that food used in the finishing stage should contain at least 70% cereals, combined with restrictions on organic origin, protein and amino acid sources.

Conversely, the focus on semi-intensive rather than free-range standards for egg production is likely to result in a relaxation of standards which may not be acceptable to UK consumers who would expect free-range as a minimum.

A requirement to grow the majority of the feed on the farm might restrict marketing opportunities for cereals from holdings in conversion and thereby act as a general barrier to the conversion of more arable-oriented farms. There could, however, be scope for partnerships between poultry producers and arable farmers to overcome this.

These issues are discussed in more detail in Section 3. It is likely that reliance on the basic 'free-range' definition for both layers and table birds, supplemented by tighter stocking rate restrictions, would be preferable to the current EU proposals. This would allow organic producers to compete on a more equal basis with other free-range producers, to use birds which are readily available in the UK, and to slaughter earlier at a size and shape more acceptable to the consumer.

3 Organic production systems and key management issues

3.1 Introduction

Detailed descriptions of poultry management, and in particular free-range poultry management, are contained in a number of standard texts (e.g. ATL, 1995; Dennett, 1996; MAFF, 1973; Roberts and Roberts, 1988; Thear, 1990). The aim of this section is to describe in more detail aspects of organic poultry production systems as currently practised, and to identify key management issues arising from current practices and research. The description of production systems and the identification of relevant management issues in this section are based on interviews with existing organic poultry producers in England and Wales, a review of the European literature, and research in progress on organic and free-range poultry production. Specialist advice has been provided by Richard Wells, Head of the National Institute of Poultry Husbandry at Harper Adams Agricultural College, Shropshire.

3.2 Breeds, sourcing and rearing of stock

3.2.1 Sourcing

At present, most organic producers in the UK use commercial hatcheries and rearers for reasons of availability and price. There are three main problems with this for the smaller producer: availability of appropriate breeds, transport costs, and the minimum quantities of birds that the large producers will supply.

Purchasing from commercial hatcheries means that eggs and chicks will have undergone precautionary hygiene treatments needed in large-scale hatcheries. This may include formaldehyde treatments of eggs, and if chicks hatch soon after treatment there may be some implications for later respiratory problems (*Poultry World*, June 1996).

Table birds have to be bought in as day-old chicks and will probably have received a mist vaccine against Newcastle disease (fowl pest). Prices vary with the size of the batch, sex and transport costs; typically, prices paid were between 25p and 45p each for as-hatched birds, 50p or more for males only, plus transport. Organic producers tend to be comparably small buyers, especially if they work with multi-age sites in order to achieve a continuous supply to the market. In some cases this means buying through a wholesaler rather than direct from a hatchery, so that organic producers are likely to be subject to higher prices than conventional producers.

Producers also found problems with suffocation losses using carriers. One producer found it worthwhile to use taxis for their weekly batches, which cost 2p/bird, and another producer personally collected birds from the local hatchery in cardboard containers.

3.2.2 Breeds

This section focuses on factors affecting breed choice in terms of the objectives of organic production systems. The physical productivity of different breeds is reviewed in Section 3.7.

3.2.2.1 Layers

Most organic producers use intensively-bred brown hybrids for laying, because of the lack of any suitable alternatives, even though they might not be ideally suited to the organic management system. Some of the smaller-scale producers used specialist breeds such as Marans, in part because the birds and speckled eggs are attractive to consumers. Experiments with pure breeds in Germany show that they are not sufficiently productive for commercial egg production (Lange, 1995). More recently, mainstream breeders have started to develop lines specifically for free-range

production, such as the Hisex Ranger, with performance comparable to that of other brown hybrids (see below). A Czech company (Dominant) has also started to market a range of layers specifically for organic production.

3.2.2.2 Table birds

The use of modern hybrid birds for table bird production is seen as a matter of concern by some producers. This is due to their fast growth rate relative to leg strength, leading to welfare problems with joint weaknesses and misshapen legs, and because of the increasing incidence of ascites in intensive broiler systems. Some organic producers successfully use hybrid birds by reducing the quality of the ration in the early stages so that growth rates are reduced, and claim that leg weakness problems can be overcome in this way. Early access to range was also believed to contribute to stronger legs. It is not possible to make clear recommendations between modern hybrids at this stage, although the Ross male is believed by some organic producers to be more likely than the Cobb to have leg problems as it is arguably faster growing. The linkage of modern hybrids to higher mortality due to 'flip-overs', ascites and leg problems is recognised by breeders and some emphasis is now put on selection for ascites, better leg quality and disease resistance (*Cobb News* 12/1, 1997; *Hybro Newsletter*, 1996).

The use of alternative breeds for table birds is highly dependent on consumer preferences and willingness to pay a considerably higher price for a different quality (Deerberg, 1995). Slower growing breeds such as the ISA Shaver Redbro are available, and are successfully used in Germany, Austria and France in traditional and total free-range systems involving 11-12 week growing periods to enhance flavour and lengthen the period out on range.

A comparison of Ross and ISA birds produced to traditional free-range (Label Rouge) standards (Lewis *et al.*, 1997) found that the Ross birds had higher growth rates, feed intakes and feed conversion efficiency, even when fed a Label Rouge diet (cereals based, 20-25% less protein) (Table 3.1). However, deaths and culling rates (primarily due to leg problems and ascites) were significantly higher in the Ross groups.

Table 3.1 Performance of Ross and ISA birds managed to traditional free-range (Label Rouge) diets and standards, and slaughtered at 83 days

Breed	*Food availability*	*Body weight (g)*	*Food intake (g)*	*Food conversion*	*Mortality (%)*
ISA	Ad-lib	2785	8257	3.01	0.0
Ross	Ad-lib	4571	13166	2.91	2.4
Ross	Restricted	2826	7259	2.61	6.0

Source: Lewis *et al.* (1997)

UK consumers reportedly do not like the reduced breast size on these breeds and they are no longer hatched in the UK. Several organic producers have tried the Redbro and report poor consumer acceptance, despite Tesco's apparent success with imported Label Rouge birds. The Lewis *et al.* (1997) study found that the ISA birds, when managed under similar conditions, had less breast and total meat yields, larger drumsticks and more meat on the wing, as well as a larger percentage of wing and total bone. Ross birds fed *ad libitum* had more leaf and gizzard fat, but this was not found when diets were restricted.

In addition, importing them would be difficult and costly due to quarantine regulations. The EU draft organic livestock regulation specifies the use of such breeds, and could have a very severe impact on UK organic table bird production. The reduced-intensity/restricted feed route (see Section 3.4) may represent a partial solution to the welfare and other problems of the fast-growing hybrids. Alternatively dedicated hatcheries could be encouraged to work with earlier lines of Cobb/Ross birds which are still maintained by the breeders.

3.2.3 Rearing

3.2.3.1 Layers

At present, there are no organic pullet-rearing enterprises to supply layers for organic egg production, other than those who breed their own stock requirements. Under Soil Association standards, layers may be bought in from conventional sources up to 16 weeks of age and undergo a six week conversion period - the preferred option for larger-scale producers. Some smaller-scale egg producers did rear their own replacements and in some cases also incubated the eggs.

As it is currently not possible to purchase organically reared pullets, purchase of pullets that have been reared under similar housing conditions (free-range systems) is the best option available in the short term. Range-reared birds are more likely to utilise the full range of facilities in and outside the house, a point emphasised strongly by one producer who would only buy in pullets range-reared from 5 weeks. In practice, the cost of pullets is likely to be in the same range as for free-range producers, depending on age, batch size and whether or not pullets are purchased from any specific rearer where free-range facilities are utilised.

A requirement that pullets be reared organically from day-old chicks would add to the cost of replacement layers, but would ensure that the birds are range-reared, and thus better-suited to free-range systems. This would place egg production on a similar basis to other organic livestock enterprises, with no requirement for a conversion period.

In principle, there is no reason why pullets could not be reared organically as the requirements for this are little different to the requirements for table bird production in terms of housing and access to range. The main management recommendation for rearing own replacements is to manage lighting so that the pullets do not experience a 'spring' situation, which triggers laying too early and would lead to too small egg sizes and increased losses from prolapse of the oviduct (which, in turn, predisposes to cannibalism). This is achieved by preventing an increase in day-length during rearing to simulate autumn conditions with short day lengths (8 hours or decreasing rapidly to 8 hours from 22 hours), subsequently increased in steps to 15-16 hours at the start of the laying period. For pullets reared on range in the spring, supplementing with light at a higher level to maintain constant day length can also achieve the desired effect.

The use of routine medications and other practices not accepted in organic systems could be avoided, although there would need to be some discussion about whether standard vaccination programmes for pullets could still be followed. Typically, pullets will have received vaccinations for Newcastle disease (fowl pest), infectious bronchitis and Marek's disease. Some rearers will also vaccinate against ILT (infectious laryngotracheitis) at 11-16 weeks of age. ILT can be spread by vaccine, so in any case producers should ensure that they do not buy vaccinated birds if they do not have the infection on their unit.

Given the possibility that appropriately-reared pullets will feature in the EU organic livestock regulation after an initial derogation period, and the specific needs of free-range production, a pullet rearing enterprise is included in the detailed financial assessments in Section 5.

3.2.3.2 Table birds

As table birds have to be purchased as day-old chicks, the young chicks need to be kept under brooders for the first 4-5 weeks in purpose-built housing. Gas brooders were preferred to electric red light heaters by producers on grounds of reliability and flexibility due to the risk of power cuts and bulbs blowing, and increased mobility. Some producers have also found smothering to be less of a problem with gas brooders. The main requirement to reduce smothering is a diffuse heat source to avoid huddling, with a temperature of 30^{o}C under the heater and 25^{o}C elsewhere. This should be reduced progressively to 20^{o}C by the end of the brooding period. Rounding off corners using circular partitions also helps to avoid huddling in corners. Accommodation should be well insulated,

with uniformity of light intensity, heat and ventilation to encourage use of the whole floor area. Regular observation is also important.

After this stage, they are normally moved to other buildings with access to range for growing/ finishing. One producer was considering the use of contract rearers for the first phase, as this does not require any land or other parts of the holding to be managed organically.

3.3 Housing

This section outlines the main issues concerning design and management of housing for poultry which fulfil the requirements of organic standards and allow for an efficient, but nevertheless welfare-oriented, management of the animals.

The current UKROFS standards specify that all poultry must have easy access to an outside grazing area. Systems that do not fulfil this requirement, such as barn egg and barn-reared table bird production systems, are not considered. However, such systems are currently covered by the organic standards in some other countries, e.g. Germany, where larger egg producers provide a small covered outside area for the birds. This gives some access to fresh air, dust-bathing facilities and an area for scratching, and hence presents a compromise to enhance the welfare of the animals without the associated difficulties with managing grassed outside runs for larger flocks. It is likely that the draft EU organic livestock regulation's focus on semi-intensive egg production is intended to accommodate such systems.

Organic standards aim to provide an environment for poultry in which all normal behaviour patterns can occur as this will minimise the stress to the birds. Low stress levels are likely to have a positive effect upon both the health and production capacity of the flock. The majority of producers shut their poultry in at night to protect them from predators and therefore the design of the housing system must take the behavioural needs that arise during this period of confinement into account.

The focus here is on two approaches to housing used by organic producers: mobile systems with houses that can be moved, for example to utilise the grass/clover ley in an arable rotation, and static housing systems, where the birds have access to an outside area covered with vegetation.

3.3.1 Behavioural considerations

General issues in relation to poultry behaviour and welfare are reviewed in Appleby *et al.* (1992) and Sainsbury (1992). In this section, emphasis is placed on issues with particular relevance to the organic management of poultry.

As with most farm animals, chickens have a strong pecking order. The birds can recognise each other on the basis of their head form and they can remember approximately 50-60 other individuals (Fölsch, 1996, personal communication). Excessive numbers give a socially unstable group and the risk of serious pecking problems. Within such a flock subgroups are formed. In the wild these normally consist of about 4-6 hens with one cock. 4-6 has also been found to be the approximate size of subgroups of hens in aviary systems (Keppler *et al.*, 1996). In farmed systems, the presence of cocks is not strictly necessary, even though some people have argued that the presence of approximately one cock for every 30 hens can have a calming effect (Fölsch, 1986). One organic producer argued that even 1 cock to 200 hens could be beneficial.

Finding food is an important social activity for hens. They usually feed at the same time with the acoustic signals of pecking and scratching acting as a stimulant for other hens. Similarly the noise of the feeding implements (chains etc.) can stimulate their feeding behaviour. The structure and colour of the food influences feeding but their sense of taste is not very well developed. Pecking and scratching are part of the normal feeding behaviour, and the housing system needs to provide

appropriate space for these activities. This is possible both on bedded floors within the housing system and in outside areas.

To rest, the birds prefer to perch on the lower branches of trees. The housing system should allow for this behaviour to be mimicked and also provide sufficient space for fluttering and flying. The lighting system must allow adequate rest periods.

Attractive nests reduce the number of ground and mislaid eggs and therefore the number of dirty eggs and the time needed to collect the eggs. Nests should be in a quiet corner of the barn, preferably away from light and pop-holes, but not too far away from the other facilities (Bauer *et al.*, 1994). Work by Appleby (1984) has shown a preference for nests with an enclosing framework. Presumably this is associated with nesting undercover in the wild. Experiments in an aviary system show a clear preference for corner nests - dividing screens in the perch area in front of the nests can have the same effect (Bauer, 1995). The use of curtains can help to reduce light intensity and increase attractiveness, but on the other hand nests that already contain eggs are preferred. In addition, littered nests (oat husk seems to be most preferred) are more attractive, but can create problems with automatic egg collection, even though such systems are available (Bauer *et al.*, 1994).

The comfort behaviour of the hens includes sand, dust and sun-bathing. More specifically, sand and dust-bathing are important for the maintenance of hygiene and help to reduce the number of ectoparasites considerably. Areas for these activities are needed either inside the housing system or in the outside area.

Whilst outside the hens also look for shelter from predators (e.g. birds of prey). If the shed is too far away or not easily accessible, other shelter needs to be provided. Complementary grazing by sheep can be beneficial, particularly with controlling early spring growth.

3.3.2 Mobile housing

The main advantage of mobile housing is that the birds can be moved to fresh grass areas so that the risk of soil-borne parasites in the outside area can be kept low. However, this does not eliminate the risk that stock may be re-infected by pathogens from their own droppings if these are retained in the houses. The main restriction is imposed by the size of the huts in order that they remain moveable. Commonly, units for 200-300 birds are found, although some designs can accommodate 500 birds. The system appears to be well-suited to producers who are wanting to build up a small additional enterprise of layers to supplement existing organic production, have a fresh product for the shop etc.

The disadvantage of mobile housing is that all other production factors needed (feed, straw or other litter material and water) need to be transported to and from the houses, which increases the labour requirements considerably. Water can be provided via overground plastic piping rather than being transported manually. However, this carries the risk of freezing in cold weather. Electricity supply to the housing will have the disadvantage (and danger, unless low voltage equipment is used) of trailing cables unless the time and expense of digging them in is taken. Overall, the costs of mobile housing per bird are likely to be higher than for fixed systems.

For layers it is advisable to use well-designed equipment inside, with the collection of droppings, nests and perches separate from feeding and drinking facilities. These can also be offered in the range area. Egg collection needs to be carried out manually. Other aspects of the housing design are similar to table birds (see below). A house for 200 layers typically costs £700-800, depreciated over 5-7 years.

In the case of table birds, the total flock size can be larger, because no daily collection of eggs is required, even though the issue of transporting feed and water remains. Most of the producers using

mobile housing for table birds used designs suited to 200 bird units, in line with the Soil Association recommendations, usually self-designed and built.

The designs can be simple: for example a 2 m x 5 m insulated shelter, 1.5 m high at the apex, with sloping roof and half-curtained sides for ventilation. Insulation is important to maintain feed conversion rates in winter. The insulation consists of a polypropylene liner filled with 'crownwool' insulation.

Painting with camouflage paint contributes significantly to water-proofing and durability but is a significant additional cost, representing ca. 12 % of the total cost. Within the house is a grit dispenser, feed troughs and automatic water nipples, with flexible water supply piping to allow for movement of the house. Doors are provided at each end with ventilation through the top half of each door (the rear door can be blanked off to reduce through drafts). Curtains which can be drawn internally can assist with the management of temperature and ventilation. Skids with metal linings on the base assist movement. Housing of this type costs around £500 per unit (£300 for materials and £200 for labour).

At one day old, the birds are restricted within this shelter with a low circular partition and a heater lamp (see Section 3.2.3.2). The partition can be removed at around 2 weeks and the birds can be allowed access to a fenced area outside for feeding which prevents older birds getting access to the feed. At 2 kg liveweight, an additional house will be needed to meet maximum stocking density limits (e.g. Soil Association: 25 kg/m^2). Straw bedding (one third of a 1.2m bale per house per day) is advisable for scratching and to maintain litter in a dry, friable condition and can help to avoid breast bone blistering.

Other designs used involved a building consisting of corrugated tin, insulated board and wood, with two large flaps at the base which could be opened in the morning and shut at night, and the conversion of lorry refrigerated units to arks. In Sweden, prototypes of a wheeled 'hen wagon' have been designed for much smaller numbers of hens (Ciszuk, 1996, personal communication), but these are unlikely to be economic for commercial production.

Between batches, it is necessary to rest houses for about a week, to clean them thoroughly and to disinfect them with iodoform, steam or blow torch, or lime depending on the construction of the house. Cleaning is essential, given the potential of litter to harbour salmonella. An internal liner provides a smooth, washable surface which assists hygiene control.

The movement of houses within and between fields also needs careful consideration to obtain most benefit from a mobile system. One system used in practice involves 12 houses, on a 12 week growing cycle. The houses are on a 2 ha field, spaced about 15 metres apart. The birds rarely stray more than 9 metres from their own house. Each batch is moved a total of three times during the production cycle. Another system involved 10 houses on a 10-12 week growing cycle, with the houses dragged weekly to new grass in a 12 ha field.

Table birds need encouragement to exercise and use range, and this can be achieved by supplying some or all water and feed requirements outside during daytime. Outdoor feeders are available which restrict the access of wild birds to feed by requiring poultry to perch on a weighted rod to lift the lid. Welfare issues relating to the ranging of table birds are due to feature in revisions to the RSPCA Freedom Food standards.

Figure 3.1 Mobile housing examples

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3.3.3 Static housing

The main advantage of static housing is that it is easier to find automatic or semi-automatic solutions for the provision of feedstuffs, water and for the collection of eggs and droppings. The costs per bird are also likely to be lower than for mobile systems.

One disadvantage of static housing systems is the management of the outside area, where some rotational grazing needs to be implemented to reduce the risk of soil-borne parasites and diseases and to maintain vegetation cover. The total number of animals that can be housed in one building will depend upon the maximum distance that the animals can be expected to range, which is likely to be smaller for table birds than for layers. (The RSPCA Freedom Food standards specify that the distance from range to shelter or overhead cover should be less than 350 m.) This is not particularly difficult to meet, as a 30 x 350 m block would provide one ha of land, sufficient for 600 to 1000 hens depending on which production standards are used.

There is some suggestion that shrubs, larger vegetation and other shelter in the outside area encourages the birds to utilise a wider area to range and might also offer additional uses for the grazing area (Fölsch, 1996, personal communication). It has also been suggested that a rain-covered outside area, a so-called bad weather range, should be part of any free-range poultry system, because it allows for sand and dust-bathing and some access to light and air, even if the weather does not permit access to the pasture (STS, 1994).

Whichever approach is adopted, the area around the house will be most intensively used by the birds. Unless some form of management for this area is adopted, for example putting straw down or a bad weather range, it is likely that in wet weather mud will be carried into the house and may contaminate eggs and fittings.

There are two main types of systems for interior design of static houses for layers, the floor-based systems and aviary systems, where the environment of the hen is structured in several levels. Floor based systems are more commonly found among free-range producers in the UK whereas the aviary systems are more commonly used abroad, e.g. in Switzerland where welfare legislation is making the use of battery cages for hens virtually impossible (STS, 1994). The stocking density can be considerably higher when more levels are introduced, even though it is arguable that stocking rates similar to that achieved by battery cages of up to 20 hens/m^2 are too high for organic systems. Where perches are used, nesting boxes should be lower than perches to discourage roosting in the nests.

Aviaries utilise the whole space with raised equipment. In semi-intensive systems with up to 12 hens/m^2 perches are situated above a mesh covered area where droppings are collected. For table birds, the use of perchery housing is less appropriate, because of the problems with weight relative to leg strength. This is also a potential problem with the use of outside feeders referred to above.

Reducing the contact of the birds with their droppings by covering the litter area reduces the risk of infection (see below). In more intensive systems the droppings are automatically collected, usually by conveyor belts under the perches. Regular removal of droppings also helps to improve air quality in larger houses (Hauser and Fölsch, 1995).

About 25-33% of the floor area should be available for scratching. The litter material can consist of straw, soft wood shavings, compost and sand, or a combination of these. It should be kept dry and friable to minimise infection, but not too dry to avoid excessive dust in the air. Humidity should be kept below 70%. The layer of bedding should not be too thick so that the claws can wear off. Sand and dust bathing facilities can be offered additionally if not available in the outside area.

For the design of nests and feeding and drinking equipment there are no specific recommendations for organic production, other than the Soil Association/RSPCA requirement for one nest box per five hens. The Farm Animal Welfare Council recommends one metre of nesting space per 80 birds,

but this is under review and may be reduced to 1 metre per 120 birds. Feeding and drinking equipment needs to be situated where it is not contaminated by excrement. In larger systems automatic feeding and drinking equipment and also automatic collection of eggs is useful to limit the time needed otherwise for those activities (see also Section 3.3.1).

Static housing used by existing organic producers varies widely. One table bird producer uses timber buildings measuring 24 m x 7.5 m for 250-300 birds with pop-holes allowing outside access, although usage of range was light. The larger-scale egg producers who were willing to comment either used conventional housing or insulated barns holding up to 1,000 birds, mostly slatted floors, but some with part slats and part litter (shavings or straw). One producer argued that it was not necessary to clear out the sheds after every batch: the old litter was covered with wood shavings and brown paper. Microbial activity in the litter can have a positive effect on hygiene (Matter, 1989), and composted litter, which has reached high temperatures during composting, is sometimes re-used in the United States (Wells, personal communication).

A static system using small houses for layers is illustrated in Lampkin (1990) – see page 27, where access to two separate grazing areas is controlled by fencing, allowing rotation between the two areas. Ideally stock should be rotated at six week intervals to prevent parasite build-up. The Soil Association's standards also require that land is rested from poultry production one year in three if set-stocked.

When deciding between the static housing options described above, several questions need to be addressed:

- Can any existing buildings be used?
- If not, what type of new building is envisaged – e.g. polytunnel or more permanent solution?
- How many birds are to be housed per unit area and what type of internal equipment is wanted?
- How can access to the range area be provided?

On a conventional farm, it is unlikely that many of the buildings would be suitable for organic production. Except in the case of free-range producers, it is likely that the individual buildings are too big, being built for many thousands of birds. On a multi-building site, it is likely that these buildings are sited too close together, restricting the amount of land available for ranging and foraging. Housing design may also be unsuitable, particularly in the case of battery cages. Converting other farm buildings may also not be suitable because of inappropriate location.

Planning permission will almost certainly be required for any new Class 3 buildings for organic poultry, unless the gross floor area is small (< 465 m^2) *and* other criteria for exemptions such as distance from roads and other buildings are also fulfilled. The issue of planning permission should not be under-estimated. Mobile houses may be the only option to avoid a requirement for planning permission, but in some areas rules such as resting the land for one month each year may be imposed.

Temporary building is another approach. These do not have foundations and some may be treated in different ways to Class 3 buildings depending on the planning authority. One option is the use of polytunnels which would cost about £1,000 for a 150 m^2 unit suitable for housing about 1,000 layers or 1,500 table birds. Another example is the Cherwell Engineering Porkquee Tent System. Although designed for outdoor pigs, the building could be adapted. The system is based on bay length units of 2.5 m, which can be supplied in widths of 5 m, 7.5 m and any length in increments of 2.5 m. The portal frame is totally self-supporting and side panels or big bales can be used. (Traditionally, straw bales have been used to provide temporary shelter for poultry with a suitable roof cover). The cost for a 7.5 x 20 m (150 m^2) tent is about £4,000.

Figure 3.2 Static housing examples

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3.3.4 Lighting

Organic standards specify that natural lighting must be available. However, natural light (direct sunlight in particular) is considered to increase the potential for feather pecking and cannibalism. Careful design of the windows is therefore required, so that equal distribution of the daylight can be achieved. For this purpose the use of windows in the roof can be beneficial. However, because of the above mentioned risk direct sunlight should be avoided, either by placing extended roofs in front of the windows or by covering the glass with white paint.

Artificial lighting can be used to extend the lighting period to a maximum period of 16 hours of light, whereby the day length should be extended in the morning rather than in the evening. In this way the majority of hens will have laid before they go out, so that the chances of dirt contamination of the eggs are reduced.

3.3.5 Fencing

It is not strictly necessary to have fencing around the range areas as birds will not move far from their houses and they are normally shut up at night. However, if predators are a problem or there is a need to protect other crops this should be considered. The most effective form of fencing is electric netting connected either to batteries or to the mains, although the losses to predators might be greater than with a fixed fence. Stands of electrified wire at 10 cm intervals can be used as an alternative to netting. If a permanent non-electrified fence is used, it should be 2 m high, with a portion buried horizontally to the outside and an electric wire 30 cm away from the fence and above the ground to deter digging by foxes.

3.4 Nutrition

3.4.1 Principles

Organic production standards specify that only a limited range of purchased feedstuffs may be used, that 70-80% of the ration should be certified organic or in conversion, and that ideally poultry should have access to vegetation (green fodder). Ideally, a high proportion of the feedstuffs supplied should be grown on the farm itself. This reduces the pollution problems associated with imports of large quantities of nutrients and their disposal as livestock wastes on relatively small areas of land. If all feedstuffs would be grown on the farm, one hectare of farmland could support approximately 100 layers (Hörning, 1995). These requirements have implications for ration formulation to meet production targets, in particular protein balance, as well as cost since organic cereals attract a significant premium. Additives such as the antibiotic Avoparcin, likely to be prohibited in the European Union due to fears of transmission of antibiotic resistance to bacteria infecting humans, are not permitted, although coccidiostats are currently permitted on a restricted basis under UK standards.

Searching for food and feeding have an important social function for the hens, and the presence of other feeding hens stimulates feeding behaviour. Additionally structure and colour of the food encourage (or discourage) the hens to feed. Larger particles are more easily recognised than fine dust, bright colours are preferred. Hens have a muscular stomach but no teeth. Eating of sand or small stones helps the digestive system. Feeding some whole grain as scratch feed in the litter or outside areas allows the hens to exercise their natural behaviour, but should be restricted so that the hens still consume enough feed with higher protein and energy content. If whole grain is fed, access to fine stones (e.g. insoluble flint or granite grit, not limestone) should be given. One German producer advocates soaking some of the grain prior to feeding in order to increase food intake (as the hens show a preference for moistened grain) and to increase the time occupied by feeding.

Because of the relatively short digestive system, high concentration and digestibility of nutrients is required. Essential amino acids are normally supplied with the feed, although, in principle, the requirements for trace elements, vitamins and amino acids should be reduced where birds range effectively and can ingest soil, herbage and animal proteins. It is difficult to find reliable estimates of the contribution to the diet that can be obtained from these sources. Researchers in Sweden are currently examining the potential of mulching grass in windrows to encourage earthworms as a protein feed source for chickens. This would appear to be a topic deserving further investigation.

Given the lack of information about the contribution to the diet obtained from ranging, the use of choice feeding (i.e. allowing the hen to select her own ration from a range of feeds) may be appropriate in organic production. Research published in the British Journal of Nutrition (Vol 34: 363-373, cited indirectly in Lampkin (1990)) indicates the potential for better feed conversion and the reduction of milling costs as one feed choice can be whole grain. A protein concentrate with mineral and vitamin supplements can be fed separately. Calcium sources (soluble grit) should be fed separately as a third food choice to avoid overeating of protein at times of high calcium requirement.

3.4.2 Ration formulation

Ration formulation for poultry is influenced by the very specific amino acid, mineral and vitamin requirements and the limited availability of appropriate feedstuffs to meet these. Standard requirements for poultry nutrition are set out in Leeson and Summers (1991) and Bolton and Blair (1974).

Many UK organic producers rely on home mixes of organic cereals (primarily wheat) and pulses (primarily field beans), supplemented in some cases by full fat soya, grass meal and maize gluten (prairie meal). This is not incompatible with the cereals-based diets proposed in the draft EU organic livestock regulation with respect to traditional free-range table bird production. The larger-scale producers use complete diets supplied by specialist processors, which attempt fully to meet nutrient requirements subject to the current 30% conventional ingredients constraint. However, the supply of such feeds is not stable due to the difficulty in obtaining suitable organic protein sources. The prohibition of fishmeal, and the restriction of the conventionally-produced components to 20% (as per current Soil Association standards and in line with EU proposals) can cause significant problems for diet formulation (see below, also Kjaer, 1996; Zöllitsch, 1996, personal communication). This will be exacerbated if the use of synthetic amino acids, in particular methionine and lysine, is also prohibited as proposed in the draft EU organic livestock regulation. Alternative amino acid sources include maize gluten, skim milk powder, yeast and expelled oilseeds, but the latter may increase the fat content of rations and reduce its keeping quality, and most are not produced organically. The availability of maize gluten and other maize products is also in question following the introduction of genetically modified maize and its prohibition under organic standards.

The other major issue in ration formulation is price. In the last year, conventional feed costs have increased significantly as a result of the BSE-related restrictions on the use of animal proteins in livestock feeds - 1996 prices were 15-20% higher than 1995 prices. To some extent, the shift to soya as a protein source in conventional rations reflects existing organic practice and has contributed to a small reduction in relative costs. However, the cost of organic feeds has increased even more rapidly, because of strengthening demand for organic cereals, which has seen prices increase by 20% or more to over £200/t since 1995. Towards the end of 1996, prices for organic feed cereals fell back to £180-190/t, relieving but not eliminating the pressure. Prices for commercially-available poultry feeds meeting organic standards currently range from £250 to £350/t, compared with £150 to £220/t for conventional feeds. The cost of organic feed is clearly a key factor influencing the financial performance of organic poultry enterprises and the possibilities to reduce feed costs need to be explored fully.

The following comparisons therefore include our own least-cost formulations for two scenarios:

1. Current organic standards (UKROFS), with 30% conventional allowance and permitted use of fish meal and synthetic amino acids, but no ready availability of organic maize and soya.
2. Proposed EU organic livestock standards, with 20% conventional allowance, no permitted use of fish meal and synthetic amino acids, but organic soya and maize (not genetically modified) available from US or EU imports. Finishing rations for table birds should also contain a minimum of 70% cereals - it has been assumed that this includes maize and maize/cereal by-products.

The results of these two scenarios are shown in each of the following tables and the consequences discussed in the conclusion to this section. In some cases, the consequences of restricting synthetic amino acids has been shown separately.

3.4.2.1 Commercially available layer rations

The genetic potential of hybrid stocks is about 300 eggs per year per bird, although 270-280 eggs is more typical in free-range systems. To achieve this, enough nutrients and minerals have to be eaten. With increasing egg production and decreasing live weight the requirements on feed quality increase. Layer rations need to have: sufficient calcium, phosphorus and vitamin D to maintain shell quality; sufficient material such as maize products, grass or lucerne meal to promote good egg colour in the absence of added yolk colourants; optimum protein to energy ratios for production and persistency of lay; appropriate levels (up to 3%) of linoleic acid for egg size; and appropriate energy levels to meet the higher energy requirements of free-range systems in cold weather and lower requirements in hot weather. Very large egg sizes are not ideal from an animal welfare perspective, and are not welcomed by all consumers, so very high nutrient density feeds and high linoleic acid levels may not be necessary.

Some 18% protein layer rations developed for organic systems using local ingredients are illustrated in Deerberg (1989, 1995), Elwinger (1996), Lampkin (1990) and Züllig (1988). Typically these contain 50% home grown cereals, 10% maize gluten, 25% field beans/fodder peas; 5% dried grass, 8% calcium sources and 2% other minerals/vitamins.

Typical production systems for pullet rearing involve the use of a chick starter for 8-10 weeks followed by a grower diet up to 10 days before start of lay. For about the first 40 weeks of lay, a high protein (18%) ration can be fed , followed by a lower protein ration (16%) for the next 40 weeks. The ration examples shown in Tables 3.2 to 3.5 cover each of these four types.

Typical feed requirements for layers are given as 115 g/bird/day in cage and 130 g/bird/day in free-range systems. In a study of Danish commercial farms, feed consumption varied between 119 and 160 g/hen per day, which was related to the low temperatures, specially on the holding with the highest feed requirements (Tersbøl and Kristensen, 1996). Although no data was obtained from UK organic producers, it is likely that feed consumption by organic layers will be of the order of 130 g/hen/day. This may increase to 150 g/day for low energy diets in cold weather, as hens tend to eat in relation to their energy requirement and the energy concentration of the ration. If low energy content is combined with high protein levels and high intakes, this can lead to excessive/wasteful use of protein, so that cold weather rations require higher energy concentrations than the rations illustrated here. In practice, the energy content can also be altered by varying the proportion of scratch feeds with a fixed level of protein supplement.

Table 3.2 Example nutrient contents and rations for intensive and organic layer production in UK - chick starter

	Outsider's Guide (ATL, 1995)	*Isabrown* (Breeder literature)	*Harper Adams* (Wells, 1996 pers. comm.)	*Least cost organic ration formulations* (own calculations)		
				UKROFS	*EU incl. amino acid*	*EU excl. amino acid*
Ingredients (%)						
Cereals			74	**40.0**	**37.3**	**22.8**
Wheatfeed				**10.0**	**10.0**	**10.0**
Brewers/distillers grains				0.0	0.4	0.0
Maize				0.0	0.0	0.0
Maize gluten (60%)				0.0	0.0	0.0
Peas/beans				**15.0**	**15.0**	**10.6**
Soyabeans			17.5	17.8	**16.7**[$]	**31.7**
Oilseeds			2.5	0.0	5.0	12.4
Dried grass/lucerne				**5.0**	**5.0**	**5.0**
Dairy by-products				0.0	0.0	0.0
Fishmeal			2.5*	1.5	0.0	0.0
Vegetable oil			0.5	0.3	0.1	0.0
Molasses				0.0	0.0	0.0
Yeast				3.9	3.6	1.8
Calcium/phosphate sources			1.7	3.0	3.3	2.7
Salt				2.9	3.0	2.8
Mineral/vitamin supplement			1.3	0.3	0.3	0.3
Amino acids				0.2	0.3	0.0
Nutritional value (%)						
Crude protein	18	19	18.2	21.1	20.1	25.0
Metabolisable energy (MJ)	11.7	11.9	11.8	11.5	11.5	11.5
Methionine	0.38	0.45	0.32	0.6	0.6	0.5
Lysine	0.90	1.05	0.89	1.3	1.3	1.6
Linoleic acid	1.0	1.25		1.7	1.8	2.2
Calcium	0.90	1.0	1.2	1.2	1.2	1.2
Available phosphorus	0.45	0.45	0.65 total	0.5	0.5	0.5
Performance						
Quantity (g)	2000					
Period (weeks)	0-8					
Raw material cost[~] (£/t)				226	257	318

NB figures shown in bold relate to organically produced ingredients

* meat and bone meal pre 1996 BSE-related prohibition

[$] of which 12.7 organic

[~] add £20-25 for processing and £12-15 for bags

Table 3.3 Example nutrient contents and rations for intensive and organic layer production in UK - pullet grower

	Outsider's Guide (ATL, 1995)	*Isabrown* (Breeder literature)	*Harper Adams* (Wells, 1996 pers. comm.)	*Least cost organic ration formulations (own calculations)* *UKROFS*	*EU prop.*
Ingredients (%)					
Cereals			80.6	**28.2**	**29.9**
Wheatfeed				**30.0**	**30.0**
Brewers/distillers grains				12.6	0.5
Maize				0.0	0.0
Maize gluten (60%)				0.0	0.0
Peas/beans				**1.8**	**10.1**
Soyabeans			7.5	0.0	0.0
Oilseeds			7.5	10.0	10.0
Dried grass/lucerne				**10.0**	**10.0**
Dairy by-products				0.0	0.0
Fishmeal			1.25*	0.0	0.0
Vegetable oil			2.5	3.0	2.8
Molasses				0.0	0.0
Yeast				0.3	1.5
Calcium/phosphate sources			1.6	1.6	1.9
Salt				2.3	3.1
Mineral/vitamin supplement			1.3	0.2	0.2
Amino acids				0.0	0.0
Nutritional value (%)					
Crude protein	15.5	15.5	15.1	17.6	15.0
Metabolisable energy (MJ)	11.3	11.3	11.3	11.0	11.0
Methionine	0.28	0.3	0.24	0.3	0.3
Lysine	0.65	0.68	0.63	0.7	0.8
Linoleic acid	0.85	1.0		2.9	2.9
Calcium	0.80	1.1	1.1	0.8	0.8
Available phosphorus	0.35	0.35	0.5 total	0.5	0.5
Performance					
Quantity (g)	5000				
Period (weeks)	9-18				
Raw material cost˜ (£/t)				171	184

NB figures shown in bold relate to organically produced ingredients

* meat and bone meal pre 1996 BSE-related prohibition

˜ add £20-25 for processing and £12-15 for bags

Table 3.4 Example nutrient contents and rations for intensive and organic layer production in UK - layer high protein

	Outsider's Guide free-range (ATL, 1995)	*Isabrown* (Breeder literature)	*Harper Adams* (Wells, 1996 pers. comm.)	*Least cost organic ration formulations (own calculations)* *UKROFS*	*EU prop.*
Ingredients (%)					
Cereals			57.5	**4.0**	**37.8**
Wheatfeed				**46.0**	**13.1**
Brewers/distillers grains				5.4	0.6
Maize/maize germ meal			8.75	0.0	0.0
Maize gluten (60%)			3.75	0.0	0.0
Peas/beans				**15.0**	**15.0**
Soyabeans			13.75	0.0	**9.1**
Oilseeds				0.0	0.0
Dried grass/lucerne				**5.0**	**5.0**
Dairy by-products				0.0	0.0
Fishmeal			5*	3.0	0.0
Vegetable oil			0.7	7.4	1.4
Molasses				0.0	0.0
Yeast				3.1	5.0
Calcium/phosphate sources			9.25	8.4	9.5
Salt				2.5	3.1
Mineral/vitamin supplement			1.24	0.2	0.3
Amino acids			0.01	0.0	0.0
Nutritional value (%)					
Crude protein	17.5	17	18.2	18.0	18.0
Metabolisable energy (MJ)	11.3	11.7	11.5	11.0	11.0
Methionine	0.37	0.38	0.42	0.3	0.3
Lysine	0.77	0.78	0.82	0.9	1.0
Linoleic acid	1.25	2.0		4.9	1.8
Calcium	4.0	4.0	4.35	3.5	3.5
Available phosphorus	0.35	0.33	0.52 total	0.5	0.5
Performance					
Quantity (g)	130 per day				
Period (weeks)	19-44				
Raw material cost˜ (£/t)				199	242

NB figures shown in bold relate to organically produced ingredients

* meat and bone meal pre 1996 BSE-related prohibition

˜ add £20-25 for processing and £12-15 for bags

Table 3.5 Example nutrient contents and rations for intensive and organic layer production in UK - layer, medium protein

	Outsider's Guide free-range (ATL, 1995)	*Isabrown* (Breeder literature)	*Harper Adams* (Wells, 1996 pers. comm.)	*Least cost organic ration formulations (own calculations)* *UKROFS*	*EU incl. amino acid*	*EU excl. amino acid*
Ingredients (%)						
Cereals			57.75	**20.2**	**30.3**	**23.7**
Wheatfeed				**30.0**	**29.7**	**30.0**
Brewers/distillers grains				6.3	0.6	0.0
Maize/maize germ meal			14	0.0	0.0	0.0
Maize gluten (60%)			2.5	0.0	0.0	0.0
Peas/beans				**14.8**	**15.0**	**15.0**
Soyabeans			9	0.0	0.0	**6.3**
Oilseeds			12.5	0.0	0.0	0.0
Dried grass/lucerne				**5.0**	**5.0**	**5.0**
Dairy by-products				0.0	0.0	0.0
Fishmeal			5*	0.0	0.0	0.0
Vegetable oil				7.7	3.4	3.6
Molasses				0.0	0.0	0.0
Yeast				3.6	5.0	4.5
Calcium/phosphate sources			9.25	9.2	8.2	8.7
Salt				2.9	2.5	2.9
Mineral/vitamin supplement			1.22	0.3	0.2	0.2
Amino acids			0.03	0.1	0.1	0.0
Nutritional value (%)						
Crude protein	15.5[#]	16	16.1	16.0	16.0	17.0
Metabolisable energy (MJ)	12.0[#]	11.5	11.2	11.0	11.0	11.0
Methionine	0.3	0.37	0.4	0.3	0.3	0.3
Lysine	0.64	0.76	0.7	0.8	0.8	1.0
Linoleic acid	1.0	1.4		4.9	2.7	3.1
Calcium	4.2	4.4	4.34	3.5	3.5	3.5
Available phosphorus	0.25	0.3	0.52 total	0.5	0.5	0.5
Performance						
Quantity (g)	130 per day					
Period (weeks)	45-72					
Raw material cost[~] (£/t)				198	224	235

NB figures shown in bold relate to organically produced ingredients

* meat and bone meal pre 1996 BSE-related prohibition

[~] add £20-25 for processing and £12-15 for bags

[#] the protein and energy concentrations shown here are better suited to winter rations

3.4.2.2 Commercially available table bird rations

The main objective in formulating rations for organic table bird production is to slow down growth in the early stages so that a) leg and other problems associated with intensively managed hybrids can be avoided, and b) that weights at 56 or 81 days are appropriate to consumer demands. This means that protein levels are reduced, while protein/energy ratios may be increased to meet the additional requirements of birds at range.

One organic producer uses a starter ration with 20-22% crude protein for the first 4 weeks, followed by a finishing ration with 18% protein to finish at 10-12 weeks, giving an overall feed conversion factor of 3.5-4. In the last couple of weeks, some wheat is added to the rations to get a thin layer of fat to improve flavour. Another producer uses an 18% protein starter and a 16% protein finisher to finish at about the same time, with a feed conversion factor of 2.5 at 10 weeks in a barn-reared system. As an alternative to prepared compounds, one producer purchased organic wheat at £215/t and a 36% protein concentrate at £360/t which was fed in a 60:40 ratio (20.6% average protein) for the first 3 weeks and then a 70:30 ratio (18.1% average protein) to slaughter.

In the least cost formulations illustrated below (Tables 3.6-3.8), protein and amino acid requirements are reduced by 10% compared with standard recommendations for conventional production, giving crude protein levels of 21%, 19% and 17% for starter, grower and finisher rations respectively. Recommended energy levels have been reduced to 12.0 MJ/kg, which still gives higher energy/protein ratios than for intensive production. This contrasts with even lower protein levels for the Label Rouge diets tested by Lewis *et al.* (1997) which are also illustrated in Tables 3.6-3.8.

Table bird diets contain a lot of fat and do not store very well, the fat or oil becoming oxidised in a relatively short time. For small producers this adds to cost as the quantities they can use and therefore the availability of quantity discounts are reduced. This problem may be exacerbated by the use of oilseeds to maintain amino acid levels.

For free-range and traditional free-range table birds, the food used in the fattening/finishing stage must include at least 70% cereals. Where barley is used for table birds, an enzyme additive is recommended.

Poultry meat may also be marketed with reference to the grains fed. According to EC Reg. 1906/90 (EC, 1991b), reference on labels to the following particular diet ingredients is permitted:

- cereals, providing they account for at least 65% by weight of ration during the rearing period, may include up to 15% of cereal by-products;
- one specific cereal, minimum inclusion 35%;
- maize, minimum inclusion 50% (i.e. corn-fed);
- pulses and green vegetables, minimum inclusion 5%
- dairy products, minimum inclusion 5% during the finishing stage.

The draft EU organic livestock regulation specifies that rations for table birds should consist of 80% organic/in conversion ingredients, no fish meal and no synthetic amino acids. For finishing, the 70% cereals requirement also applies. As the least cost ration examples in the following tables (Tables 3.6-3.8) indicate, it is difficult to meet the no synthetic amino acid requirement and the other constraints simultaneously, without forcing up both the cost and the protein/amino acid content of the ration significantly. This directly counteracts the need for reduced protein rations to minimise welfare and consumer acceptability problems if the birds grow too fast or too heavy, unless methionine and lysine availability targets are further reduced. A deficiency in only *one* essential amino acid will restrict growth.

Table 3.6 Example nutrient recommendations and rations for intensive and free-range/organic table bird production - starter

	Breeder recommended (Breeders literature)	*Harper Adams* (Wells, 1996, pers. comm.)	*Additive free* (Kennard, 1996, pers. comm.)	*Label Rouge* (Lewis *et al*., 1997)	*Current organic* (Feed company labels)	*Least cost organic ration formulations* (own calculations) *UKROFS*	*EU incl. amino acid*	*EU excl. amino acid*
Ingredients (%)								
Cereals		62.5	62	22	organic	**45.0**	**39.9**	**31.2**
Wheatfeed			15	7	organic	**10.0**	**10.0**	**10.0**
Brewers/distillers grains						2.4	0.0	0.0
Maize/maize germ meal				40		0.0	0.0	0.0
Maize gluten (60%)					conv.	0.0	0.0	0.0
Peas/beans			10		organic	**10.0**	**10.0**	**10.0**
Soyabeans		27	1	28	full fat	10.7	**23.0**[$]	**23.8**
Oilseeds					conv.	0.0	0.0	10.8
Dried grass/lucerne						**5.0**	**5.0**	**5.0**
Dairy by-products						0.0	0.0	0.0
Fishmeal		5	8		conv.	6.4	0.0	0.0
Vegetable oil		3				3.2	1.6	0.0
Molasses						0.0	0.0	0.0
Yeast						3.5	3.9	3.3
Calcium/phosphate sources		0.4		1.7		1.3	3.0	2.5
Salt		0.1		0.22		2.2	3.3	3.1
Mineral/vitamin suppl.		1.92	4	1.27	conv.	0.3	0.3	0.3
Amino acids		0.08		0.1		0.1	0.2	0.0
Coccidiostats			no	Yes	optional	optional	no	no
Nutritional value (%)								
Crude protein	23	22.9	18	20.2	20.5	20.7	20.7	23.8
Metabolisable energy (MJ)	13.0	12.7		12.1		12.0	12.0	12.0
Methionine	0.5-0.65	0.55		0.33	0.53	0.5	0.5	0.4
Lysine	1.25-1.4	1.3		1.06		1.3	1.3	1.4
Linoleic acid						2.9	2.5	1.9
Calcium	1	0.94		0.90		1.0	1.0	1.0
Available phosphorus	0.45	0.74 total		0.45		0.5	0.5	0.5
Performance								
Quantity (g)	400							
Period (weeks)	0-2	0-2		1-4				
Liveweight (g)	350							
Raw material cost[~] (£/t)						237	272	297
Cost (ex. mill, incl. bags)	160		220		280-340			

NB figures shown in bold relate to organically produced ingredients

[$] of which 15.10 organic

[~] add £20-25 for processing and £12-15 for bags

Table 3.7 Example nutrient recommendations and rations for intensive and free-range/organic table bird production - grower

	Breeder recommended (Breeders literature)	*Harper Adams* (Wells, 1996, pers. comm.)	*Label Rouge* (Lewis *et al*., 1997)	*Current organic* (Feed company labels)	*Least cost organic ration formulations* (own calculations)		
					UKROFS	*EU incl. amino acid*	*EU excl. amino acid*
Ingredients (%)							
Cereals		63	25	organic	**25.0**	**23.6**	**14.3**
Wheatfeed			11	organic	**30.0**	**30.0**	**30.0**
Brewers/distillers grains					0.0	0.0	0.0
Maize/maize germ meal			40		0.0	0.0	0.0
Maize gluten (60%)				conv.	0.0	0.0	0.0
Peas/beans				organic	**10.0**	**10.0**	**3.7**
Soyabeans		26	21	full fat	13.7	**16.6**[$]	**27.0**
Oilseeds					0.7	0.0	9.8
Dried grass/lucerne					**5.0**	**5.0**	**5.0**
Dairy by-products					0.0	0.0	0.0
Fishmeal		2.5		conv.	1.6	0.0	0.0
Vegetable oil		3+2.5 fat			5.0	4.9	2.8
Molasses					0.0	0.0	0.0
Yeast					3.3	3.5	1.9
Calcium/phosphate sources		0.7	1.7		2.3	2.8	2.3
Salt		0.1	0.21		3.0	3.3	3.0
Mineral/vitamin supplement		2.0	1.27	conv.	0.2	0.2	0.2
Amino acids		0.2	0.1		0.2	0.2	0.0
Nutritional value (%)							
Crude protein	21-22	21	17.8	19	18.9	18.9	22.0
Metabolisable energy (MJ)	13.4	12.9	12.2		12.0	12.0	12.0
Methionine	0.5-0.6	0.52	0.29	0.47	0.5	0.5	0.4
Lysine	1.20	1.23	0.88		1.1	1.1	1.4
Linoleic acid					4.1	4.1	3.7
Calcium	0.9	0.89	0.89		1.0	1.0	1.0
Available phosphorus	0.45	0.72 total	0.44		0.5	0.5	0.5
Performance							
Quantity (g)	2000						
Period (weeks)	3-5	3-4	5-10	3-8			
Liveweight (g)	1500						
Raw material cost[~] (£/t)					218	253	296
Cost (ex. mill, incl. bags)	155			270-310			

NB figures shown in bold relate to organically produced ingredients

[$] of which 11.4 organic

[~] add £20-25 for processing and £12-15 for bags

Table 3.8 Example nutrient recommendations and rations for intensive and free-range/organic table bird production - finisher

	Breeder recommended (Breeders literature)	*Harper Adams* (Wells, 1996, pers. comm.)	*Additive free* (Kennard, 1996, pers. comm.)	*Label Rouge* (Lewis *et al*., 1997)	*Current organic* (Feed company labels)	*Least cost organic ration formulations* (own calculations)		
						UKROFS	*EU incl. amino acid*	*EU excl. amino acid*
Ingredients (%)								
Cereals		62	73	30	organic	**55.0**	**62.7**	**61.2**
Wheatfeed			15	12	organic	0.0	0.0	0.0
Brewers/distillers grains						0.5	0.0	0.0
Maize/maize germ meal				40		0.0	7.3	0.2
Maize gluten (60%)						0.0	0.0	8.5
Peas/beans						**10.0**	**2.0**	0.0
Soyabeans		25		15	full fat	15.3	**16.4**[$]	**17.5**
Oilseeds						1.4	0.4	9.1
Dried grass/lucerne						**5.0**	**0.5**	**1.3**
Dairy by-products						0.0	0.0	0.0
Fishmeal		1.3	7		conv.	0.0	0.0	0.0
Vegetable oil		3.5+ 5 fat	2 fat			2.9	1.3	0.3
Molasses						0.0	0.0	0.0
Yeast						3.7	5.0	5.0
Calcium/phosphate sources		1.0		1.7		2.9	2.9	2.9
Salt		0.1		0.21		2.7	1.1	2.7
Mineral/vitamin suppl.		2.05	3	1.27	conv.	0.3	0.2	0.4
Amino acids		0.05		0.0		0.1	0.1	0.0
Nutritional value (%)								
Crude protein	19-21	19.6	16	15.6	16.5-18	17.1	17.1	20.53
Metabolisable energy (MJ)	13.5	13.2		12.3		12.0	12.0	12.0
Methionine	0.45-0.57	0.44		0.26		0.4	0.4	0.34
Lysine	1.13	1.06		0.72		1.1	1.0	1.0
Linoleic acid						2.9	2.5	1.8
Calcium	0.80	0.96		0.88		1.0	1.0	1.0
Available phosphorus	0.35	0.69 total		0.44		0.5	0.5	0.5
Performance								
Quantity (g)	1500							
Period (weeks)	6-7	5-7	5-10	11-12	8-12			
Liveweight (g)	2500		3500 (trial)					
Raw material cost[~] (£/t)						229	281	305
Cost (ex. mill, incl. bags)			210		280-300			

NB figures shown in bold relate to organically produced ingredients

[$] of which 14.7 organic

[~] add £20-25 for processing and £12-15 for bags

3.5 Animal health

Most of the organic producers surveyed reported very few or no health problems, emphasising the need for good management and meticulous care with respect to hygiene and cleanliness, including disinfection between batches. However, there currently appear to be some health problems in organic poultry production for which specific solutions in the spirit of the organic standards have not been found. For other health issues, such as virus diseases, it is assumed that satisfactory solutions can be achieved with prevention through management and/or permitted methods of treatment/vaccination. Day-old chicks and pullets purchased from conventional hatcheries and rearers will be routinely vaccinated against a number of diseases in any case. In practice, few (if any) organic producers used vaccines once the birds had arrived on the holding.

For table bird production multi-age sites which are necessary for continuous production can represent a greater problem in terms of health management than all in, all out systems, even though this view is not shared by all producers.

3.5.1 Feather pecking and cannibalism

Feather pecking and cannibalism currently appear to be a big problem for larger-scale organic egg producers on the continent. We were not able to confirm whether this is a problem in the UK as the few existing larger egg producers were not willing to talk to us in detail about their production systems. Cannibalism is a problem in many conventional free-range systems, sometimes, but not always associated with feather pecking which is only one of several pre-disposing factors (along with group size and light intensity). Losses due to cannibalism are not as high in littered systems as in battery cages (Matter, 1989). Hens in conventional systems, whether free-range, deep litter or battery cages, are therefore usually beak trimmed, and it is likely that some UKROFS producers also use hens that are beak trimmed. This practice is not permitted under Soil Association standards and might not be permitted if the EU organic livestock proposals are implemented, so alternative solutions need to be found.

Feather pecking alone might not necessarily represent a serious problem, even though it leads to a partial loss of feathers and can represent a visual problem. However, feather pecking often is followed by cannibalism, where hens inflict injuries mainly to the cloacal region of other hens, which can lead to further health problems because of infection and also has negative impacts on production. Producers therefore try to reduce feather pecking in the first instance in order to avoid the problem of cannibalism.

A variety of factors have been suggested as causes for feather pecking including exposure to sunlight, insufficient protein supply, excessive egg sizes, excessive group size, stress and boredom (Ekstrand, 1996; Fölsch *et al.*, 1992; Bauer and Keppler, 1996).

MAFF (1973) attributed feather pecking to boredom, but also to sudden stress, dietary deficiencies, overcrowding and lack of trough space. Boredom can be combated by supplying food in mash form, as opposed to pellets, thus extending the time taken by the hen to eat its daily requirement. Scratch feed can also be used so that the behavioural pattern to search for food can be better satisfied (Bauer and Keppler, 1996; Baum, 1994).

A study in Germany (Baum, 1994) which involved detailed observation of layers receiving the same diets under different housing conditions came to the conclusion that feather pecking is clearly a behaviour problem, related to an unsatisfied behavioural pattern of searching for food, that can almost be seen as an indicator of welfare quality in certain housing systems. Because of the concentrated form in which whole feeds are offered, the pattern of searching for food is not fully satisfied and gets directed towards other objects in the area, i.e. fellow hens. In the trials feather pecking only occurred in floor systems on netting and did not occur in the free-range comparison.

Dennett (1996) implicates large (2 m) pop-holes and over-exposure to sunlight as a cause of feather pecking and MAFF (1973) recommended reduced light intensity to avoid problems. Swiss experiences point to the importance of equal distribution of day light on the floor area by using windows in the roof (STS, 1994) and Bauer and Keppler (1996) recommend the use of light bulbs rather than strip lights.

Dennett (1996) argues that excessive egg size is the biggest cause of feather loss in modern free-range layers. He recommends that producers should aim to avoid stress by getting a better balance between feeding and production and by avoiding, for example, the feeding of high levels of linoleic acid and high energy feeds where birds do not require it (i.e. do not range widely). The diet (lack of essential amino acids) is also implicated by Holle (1996, personal communication) as a cause of feather loss.

Bauer and Keppler (1996) argue that feather pecking starts during rearing: feather pecking incidence is higher among chicks reared on flat plastic surfaces than on sand-covered or slatted floors, and a covering with short straw as play material on top of wood shavings seem to give best results. Unfortunately, once the animal has learned feather pecking, the behaviour recurs, even when transferred into a more enriched housing system (Baum, 1994). This further supports the suggestion that pullets should be reared appropriately so that problems with cannibalism later can be avoided.

Kjær (1996) recommends that attention should also be focused on breeds. He claims that a tendency to engage in feather pecking is partly inherited and it appears that most modern lines of hybrids selected under intensive conditions have similar problems when housed in free-range systems.

Cannibalism can also be related to parasite problems and infections in the ovaries and cloacal region of the layers. Birds already infected might draw the attention of other hens, and the wounds resulting from cannibalism can be the cause of further infection.

It is clear that a wide range of factors are potentially involved, and that producers need to pay attention to all of these if they are to avoid cannibalism problems in free-range systems without the use of beak clipping. In summary they should pay attention to the rearing of pullets, enriched housing systems, offering a variety of feed sources (including scratch feed) in a balanced ration, equal distribution of light (including daylight) and regular checks of climate and general health of the flock (Bauer and Keppler, 1996).

3.5.2 Coccidiosis

A major health issue that was identified in conjunction with table bird production, but would apply similarly to a pullet rearing enterprise, is that of coccidiosis. The problem is less serious for layers as adult birds can rely more on natural immunity.

Birds become infected through the ingestion of sporulated oocysts in the environment. A single sporulated oocyst may produce up to 8 million oocysts in the gut, causing significant damage to the intestinal walls, where the formation of scar tissue results in reduced nutrient uptake. Unsporulated oocysts are passed in the faeces. Sporulation requires warmth (25^{o}C), moisture and oxygen to complete the cycle.

Coccidiosis is the most frequently recorded poultry disease in conventional production, to the extent that the development of intensive conventional poultry production would not have been possible without the development of anti-coccidial drugs. Despite the availability of drugs, the problem is still widespread, due in part to the development of resistance to anti-coccidial agents. Sweden is now considering prohibiting the use of coccidiostats in all poultry feeds (Anon, 1996).

Considerable problems in organic table bird production were reported from Austria, where the use of coccidiostats is not permitted under the standards (Zollitsch *et al.*, 1995). Prevention with in-feed coccidiostats and treatment with Amprolium in water supplies is currently tolerated/permitted under UK organic standards, but can not be regarded as a long term solution, especially because problems of resistance force changes in medication on a frequent basis.

Despite treatment one UK organic table bird producer reported losses of up to 30% during the first two weeks, others claim to have no problems at all (with or without added coccidiostats) and report mortality rates in the range of 2.5-3%. This suggests the importance of husbandry and management, especially the restriction of contact with the droppings, in the prevention of coccidiosis. Several producers pointed to the importance of dry litter with sufficient straw bedding and general stock hygiene, as well as encouraging the development of immunity in the young stock.

The increasing problems with resistance to anticoccidial agents have led to the development of new approaches in conventional systems, involving natural exposure to generate an immune response with close monitoring and early therapeutic treatment, particularly for those species which do not induce a good immune response (Ross Tech, 1995). Litter should be replaced between crops and kept in good condition throughout the life of the flock. Moist litter in humid environments can lead to excessive sporulation and result in very high challenge - humidity should be kept below 70%. However, litter which is too dry may result in too low a level of sporulation to trigger an immune response. With good management and monitoring, natural exposure can result in good control of coccidiosis, which would appear to correspond with experience of at least some organic producers. There is a risk that growth rates in table birds might be reduced using this strategy, but this might even be an advantage when finishing at 10-12 weeks.

In addition, there is a large amount of published research relating to numerous aspects of coccidia infection and immunity, including comparisons of immune responses between different inbred lines of chickens (Bumstead *et al.*, 1995) and investigation of maternal antibody transfer (Smith *et al.*, 1994a & 1994b).

The development of vaccines is an area in which progress has occurred, with Immucox and Paracox vaccine available for use by table bird and layer breeders and not requiring routine post-vaccinal treatment with an anti-coccidial agent. Vaccination involves uniformly low doses of sporulated oocysts applied to feed or via drinking water up to 9 days old to facilitate the development of a broad immunity to coccidiosis, and is therefore more reliable than the natural exposure approach. It can be administered earlier than natural infection might occur, with less effect on weight gain. The attenuated vaccine Paracox is considered to give better control of the full range of problem species and to avoid the risk of the vaccine itself leading to clinical disease (Bushel, 1997). Lasting immunity to coccidiosis is maintained by periodic reinfection from sporulated oocysts in the litter. The vaccines are generally considered to be too expensive for use by table bird growers (ca. 15p/bird), but work on the production of a vaccine more suited to the needs of the commercial table bird grower is in progress (Anon., 1996).

There only seems to be very limited success with the use of alternative remedies acceptable under organic standards (Zollitsch, 1996, personal communication). For organic producers, the identification of lines or breeds of chickens with higher natural immunity to the numerous coccidia strains may be the preferable option, as there is continued debate about the use of vaccines. However, if the implementation of better management practice alone does not lead to reduced losses, the vaccination route may well be preferable to the continued use of coccidiostats, despite its expense, given the problems of resistance and the withdrawal period required before the meat is suitable for human consumption.

3.5.3 Salmonella

Salmonella has not been identified as a major problem from the producers we had contact with in the UK, but was mentioned as a problem area in Germany. The most likely source of contamination of a flock is through contaminated young stock. In the case of table birds, chicks can be tested and if necessary treated with antibiotics. With pullets, tests should be provided by the rearing enterprise.

General recommendations regarding hygiene (collection of droppings in the case of layers, sufficient bedding, cleaning out between batches, regular veterinary control, hygiene in the feed supply) are also important and should help to reduce the likelihood of infection. Feedstuffs may need to be heat treated (75° C) to avoid the risk of any salmonella infection. Problems can arise even when maintaining units as 'closed' as practicable since, when birds have access to range, they come into contact with wild birds. A vaccine for salmonella is available but expensive.

Procedures for Salmonella control in breeding flocks and hatcheries and in commercial egg laying flocks are set out in MAFF Codes of Practice (MAFF, 1993a and 1995a). Regulatory control of salmonella has shifted from farms to hatcheries (MAFF, 1993b), so that the requirements for testing in commercial flocks introduced in 1989 no longer exist.

3.5.4 Ascites

Ascites has developed to be a major factor in conventional table bird mortality, particularly at high altitudes, ranging from 3-20%. It was mentioned as a problem by only one organic producer, although others referred to problems with suffocation, smothering and unattributed mortality which may be ascites linked. The major cause of ascites is hypoxia (too little oxygen). The problem affects young, fast growing table birds, as high growth rates increase oxygen demand. Carbon dioxide levels in incubation, chick delivery, brooding and throughout the key growth stage are critical, but physiology, genetics, nutrition, management and ventilation all play a part. In particular, high growth rate diets and high fat contents increase oxygen demand, and pelleted feeds are associated with greater problems than mashed. Reduced protein feeds (17%) can be used to combat ascites where it is a problem. In addition, the use of live vaccines and lung diseases may also affect the lungs ability to absorb oxygen. In general, it may be expected that the reduced intensity of feeding organic poultry should reduce the risk of ascites.

3.6 Slaughter and processing facilities

Most of the organic table bird producers we contacted have their own slaughter and processing facilities on the farm, which were either classified as low throughput slaughter houses (200-3000 birds per week) or small on-farm facilities (less than 200 birds per week with local marketing only). Many also emphasised hanging for periods ranging from 2 to 8 days prior to evisceration in order to improve flavour.

In the low throughput slaughter house category, one producer used a semi-automatic killing machine and wet plucking machine (bowl plucker: the birds are dipped in a hot tank (temperature critical to +/- 0.25^{o}C and time critical to 25 seconds), then into a bowl containing 5 birds) which plucks them. Two people can slaughter 200 birds in 4 hours using this approach. However, this specialist equipment was only in use for a limited period every week, representing wasted capacity. Evisceration and processing (packing and portioning) required three people working for two-thirds of a day.

Another producer used to slaughter on farm, but Environmental Health officials were not happy with this so that birds now go to be slaughtered 35 miles away, where they are killed (85p/bird) and dressed (50p/bird for delayed evisceration) and then returned to the farm. A team of butchers is employed to cut and pack the batches.

The main reasons mentioned for the building of own facilities were:

- the distance to the nearest organically approved slaughterhouse and the associated transport costs and welfare concerns;
- the need to hang before evisceration and additional charges that were made by abattoirs for this;
- the difficulties with getting small batch sizes processed in abattoirs; and
- the scattered nature of the industry which prevents effective co-operation between farms.

The reported investment in on-farm facilities ranged from £10,000-£50,000. The facilities required include a stunner (£200), a plucker (£1,500-£2,000), a dipper (£3,000-£4,000) and a bleeding carousel (£200) in an adequate hygienic building. On a larger unit, the carousel cost £8,000 alone, and refrigeration costs of £2000 each for 2 container fridges (each holding 3-400 long-legged, eviscerated birds) were also incurred. (1,000 birds on trolleys require 25 m^2 refrigerated area). Separate rooms are needed for slaughtering, hanging and evisceration. Subsequent processing may be carried out on or off the farm.

The level of investment required depends upon whether or not the slaughter facilities are aiming for registration with the health and food safety authority as low throughput or as farm-based facilities. This will depend upon the size of the throughput, the likely trading area and whether or not they want to sell to wholesalers.

Whichever approach is adopted, producer slaughter-facilities also need to meet the Welfare of Animals (Slaughter or Killing) Regulations 1995 and to follow the Code of Practice for On-farm Slaughter and Marketing of Poultry (Section 2.2.1). Veterinary charges for registration as a low-throughput unit are currently £56/month.

There are producers with excess processing capacity, who would benefit from other producers nearby using this capacity, and in some cases have encouraged nearby producers to get involved in organic poultry production on a contract basis. This has the particular advantage for new producers that they do not necessarily need to invest in their own facilities.

Mobile slaughtering may be appropriate as an alternative to farm-based processing facilities and larger abattoirs. These travel to individual farms, or a central point for a group of farms, thus minimising transport for the animals to be slaughtered. To date, mobile facilities have been developed primarily for slaughtering larger animals (Michaud, 1996), and the operators indicate that a dedicated vehicle would be required for poultry slaughtering. Producers would still need to identify farm-based or processor-based facilities for hanging and evisceration.

3.7 Production systems and physical performance

3.7.1 Egg production

Stock is usually purchased at about 12-14 weeks of age and then requires a conversion period of 6 weeks. Laying commences at about 20 weeks, which is slightly later than in conventional systems, but is likely to be beneficial for the production of larger egg sizes. Peak production (95% lay) is at about 28 weeks falling to 60-65% at 72 weeks. Maximum production in terms of egg size and number is likely to occur in weeks 36-40, depending upon the breed used. Specific data with respect to egg size and production levels is supplied by breeders (Table 3.9). There has been a marked improvement in productivity of hens in recent years, with egg yield per layer up by 30% (from 220 to 300 eggs/hen) since 1970.

The standard production period is 52 weeks in lay after which the birds are slaughtered. Most organic egg producers use this approach. If this period is extended, the eggs will be larger, but shell quality deteriorates. An alternative is to allow the birds to moult and use them for a second

production period. This avoids the cost of pullets, but housing may not be fully utilised due to first year mortality. Natural moulting can result in birds out of production for up to 3 months. The alternative is to induce moult at about 60 weeks of age (ATL, 1995) by restricting feed and cutting day length to 6-8 hours (in a windowless house) for 2-3 weeks. Lighting and feed can then be gradually restored to bring birds back in lay by 8 weeks (MAFF, 1973), followed by a second production period of about 35 weeks (ATL, 1995). Forced moulting by withdrawing feed is not permitted under the RSPCA Freedom Food standards. However, the quality of feed can be reduced by using whole grains (e.g. barley), rather than a concentrated diet, for four weeks and returning to a medium protein ration subsequently.

Table 3.9 Physical performance data for layer breeds under caged and free-range conditions

	ISA Brown	*Hisex Brown*	*Hisex White*	*Hyline Brown*	*Hisex Ranger*	*Free-range*	*Organic (estimated)*
Rearing period (weeks)	18	17	17	17	17	17	20
Mortality %	3	3	4	3	3		3
Bodyweight (kg)	1.5	1.41	1.13	1.48	1.5		1.5
Feed cons. (kg/bird)	6.9	5.7	5.2	6.0	6.34		9.6
Laying period (to 72 weeks)							
Egg production per hen housed	307	297	302	304	292	285	270
Age at 50% production (days)		145	147	150	150		155
Av. egg weight (g)	62.6	62.8	60.4	63.7	63.2	63.1	63.0
Av. seconds (%)						6.5	7.0
Egg mass (kg)	19.5	18.7	18.3	19.7	18.5	18.0	17.0
Feed cons. (g/bird/day)	118	116	108	115	120-130	130	130
Feed per egg (g)	134	141	129	144	144	176	185
Feed conversion ratio	2.14	2.21	2.09	2.20	2.24	2.78	2.95
Mortality %	7.0	5.2	6.6	5.0	5.2	7.0	7.0
End of lay bodyweight (kg)	2.0-2.1	2.09	1.68	2.25	2.10	1.9	2.0

Sources: Breeders literature and own calculations

According to the breeder's literature, the Hisex Ranger pullet is a special selection from a Freedom Food approved hatchery, beak-trimmed, perch-trained on a slow step-down lighting programme targeted to be at 1.5 kg in 17 weeks. This combination is designed to give slightly later maturity, over 200 eggs in the top three egg sizes, persistency in lay and robustness on range, including initial bodyweight and strength to cope with the outdoor environment. The literature also mentions that 'breeding isn't the whole solution - the pullet needs to be reared carefully to prepare it for the outdoor life', which confirms the desirability of range and perch-training as part of the pullet rearing programme.

There is likely to be a reduction in production levels under organic management. The level of production achieved will depend upon the feed ration and other management factors of the holding, for example, the housing system. The one medium-sized UK organic egg producer who was willing to supply information is currently achieving about 220 eggs per hen per year in a free-range mobile housing system with a flock size of about 500 birds. However, this system involves moulting and is not comparable with the systems used by other organic poultry producers.

Data from Austria from more intensive aviary systems with balanced rations suggested a production of 275 eggs (Zollitsch, 1996, personal communication). A model calculation from Germany (Hörning, 1995) assumed egg production of 220-250 eggs per hen per year for different free-range systems and up to 270 eggs per hen per year in aviary systems. Holle (1996, personal communication) stated that a production level of 75% could be sustained over a longer period of time, which equals a similar production of about 275 eggs per hen annually. A Danish study of four

commercial organic egg producers showed annual production of between 207 and 277 eggs (between 56 and 81 %). The farm with the lowest production had big problems with *Pasteurella* infection and subsequent high mortality rates (23%) in the year of study (Tersbøl and Kristensen, 1996).

3.7.2 Table bird production

In conventional production, growth rates for table birds have increased substantially, with birds of 2-2.4 kg liveweight slaughtered at 6 weeks now compared with 10 weeks in 1958 (Table 3.10). These trends to very early slaughter are not acceptable for free-range systems under EU regulations which specify slaughter at 8 weeks for free-range and 11.5 weeks for traditional free-range (see Section 2). The organic producers we had contact with kill at between 9 and 12 weeks of age. One producer works on an 11 week cycle, buying day-old chicks as-hatched every two weeks, and makes use of differing periods to maturity for males and females to achieve weekly slaughter. There is some uncertainty amongst the producers as to whether or not organic production standards define a minimum slaughter age, with a figure of 10 weeks often being cited. However, there is no reference to a minimum age in either the Soil Association or UKROFS standards.

Table 3.10 Physical performance data for table bird breeds (as-hatched) and systems

	Ross 308 intensive	*Cobb 500 intensive*	*Free-range*	*Label Rouge*	*Organic - current*	*Organic - EU prop.*
Age (days)	56	56	56	83	70	81
Liveweight (kg)	2.82	3.16	2.3	2.79	2.5	2.75
FCR uncorrected	2.12	2.10	2.5	3.01	3.5	4.5
Feed (kg)	6.0	6.6	5.75	8.3	8.75	12.4
Mortality (%)	4.77	4.6	10	-	10	10
% eviscerated weight	69-72	73-74	72	n/a	72	72

Source: Breeders' literature, Lewis *et al*. (1997) and own calculations

3.8 Conclusions

There do not appear to be any insurmountable technical constraints as far as organic poultry production is concerned. There are, however, some areas of potential difficulty where attention to detail and good management is required, or where further development may be desirable:

- the suitability of breeds, in particular for table bird production, needs further consideration;
- the rearing of pullets organically from day-old chicks should be considered in preference to converting conventional pullets;
- longer-term, the possibility of organic hatcheries should be investigated, particularly if less common breeds are advocated;
- housing design, bedding and access to range should be appropriate to the bird's behavioural requirements - modifications to standards in line with Freedom Food recommendations could be considered;
- flock size, stocking rates etc. need to correspond to a number of objectives, including stress minimisation, integrating poultry in more diverse farming systems, and treating poultry as a land-based activity - there needs to be a debate as to the best way to achieve this under organic production standards;
- more emphasis will need to be placed on domestically produced livestock feeds in the foreseeable future, with significant implications for the protein and amino acid composition of the

ration - proposed changes to the EU regulation could result in substantial feed cost increases, especially if combined with longer finishing periods;

- more emphasis should be given to evaluating the contribution of vegetation, soil fauna and minerals as part of the contribution to poultry rations, as well as the potential of management practices to enhance soil fauna populations (e.g. earthworms in mulched vegetation);
- major animal health problems are restricted to two issues: cannibalism and coccidiosis - cannibalism can be tackled using a combination of several management practices, while the emphasis on coccidiosis should shift from the permitted use of coccidiostats to management practices and the use of vaccines;
- physical production performance is likely to be lower than for free-range poultry because of the wide range of management constraints imposed under current and proposed organic standards.

4 Marketing: current situation and development potential

This section describes the development of the UK poultry industry, and the relevance of organic, free-range and other alternative systems within this context. The market for organic poultry, defined in terms of chicken meat and eggs, is analysed to establish its shape and size, and turnover measured in terms of volume and value. Factors influencing market share, pricing and the potential for future development are discussed on the basis of:

- desk research, including a review of trade journals, recent poultry sector business reports and telephone contacts with researchers and buyers in the subject area.
- primary research in the form of face-to-face interviews involving key producers and processors within the organic and free-range poultry sector.

4.1 Market background

4.1.1 Historical context

The development of the organic poultry sector is quite recent, with early signs only becoming evident in the 1980s. The impetus for its development comes from an increase in consumer awareness and concern for animal welfare, human health and related issues. The modern poultry industry, however, is over 100 years old (Table 4.1).

Table 4.1 Historical development of the poultry meat and egg industry

Year	*Event*
1890s	First serious attempts at breeding poultry for performance
1920s	Colleges formulate improved rations for all types of poultry
1930s	First battery cages since Roman times
1950s	De-rationing of feed and discovery of several new vitamins for fortifying feeds enabled introduction of the table bird chicken
	Breeding companies become highly organised and international
	Benefits of lighting in indoor housing became well understood making it even more popular
1960s	Arrival of hybrids for specialised meat or egg production, mainly from the USA
	Windowless indoor systems introduced with complete control over light intensity and daylength
	Insulation and controlled environment with fan-assisted ventilation became universal for new and converted buildings
1970s	World fuel and feed crisis creates pressure to keep costs down on all aspects of production. This stimulates the use of high house temperatures and greater efficiencies are sought through tighter technical management
1980s	Market-led development of free-range and barn eggs causes swing back to non-cage systems of egg production
1990s	Egg and poultry meat sector face increasing pressures on issues concerning bird welfare, product hygiene and quality
	The high incidence of bovine spongiform encephalopathy (BSE) in dairy herds shocks UK and EU consumers, and leads to fresh concerns on animal health and poultry feed based on animal remains
	Organic production of poultry for meat and eggs commences on a commercial scale during 1990-91

Source: Adapted from Farrant (1995).

4.1.2 Product definition

The consumers of organic food define the core product in terms of benefits received: health, diet, nutrition, animal welfare considerations, environmental concerns, and quality (Table 4.2).

Table 4.2 Definition of poultry meat and eggs in terms of consumer perception

CORE PRODUCT			
Cage	*Barn*	*Free-range*	*Organic*
Diet	Diet	Diet	Health
Nutrition	Nutrition	Nutrition	Diet
	Animal welfare?	Animal welfare	Nutrition
		Quality	Animal welfare
			Environmental impact
			Quality

ACTUAL PRODUCT	
Eggs	*Poultry Meat*
Cage, barn/perchery, free-range and/or organic.	Table bird, barn-reared, (traditional) free-range and/or organic)
Available as whole shell, bulk liquid, frozen, extended shelf life or in powdered form (organic eggs are only available as whole shell)	Available as whole or in portions, and processed. (organic variety only available as whole or in portions)

AUGMENTED PRODUCT	
Eggs	
Colour	Available as white, brown or speckled
Size	Four grades (new sizes) XL, L, M, S
Packaging	Packed in egg boxes of 6, 12, 24 and trays of 12 and 24
	Bulk liquid in polythene bottles, or bulk tankers
	Powdered form in 25 kg sacks
Poultry Meat	
Colour	Slightly yellow e.g. corn fed, to white-pink/red
Size	Typically 1.5-2.5 kg
Packaging	vacuum packed on polythene trays in plastic bags

Source: own analysis

Both eggs and poultry meat have a short shelf life and a high turnover, so planned production and marketing are essential. Flavour and nutritional value deteriorate rapidly, which makes processing, cold storage and location of production units near markets necessary. Consumers prefer fresh, clean, brown eggs with a good flavour and smell. Some organic consumers will accept eggs which are multi-coloured and not necessarily of a uniform size. The customer requirement for grading need not always be the same as the industry regulations.

4.1.3 Conventional market trends

Market prices within the EU closely reflect the supply and demand position for eggs and poultry meat. The mechanisms of the Common Agricultural Policy in terms of intervention, livestock support premium schemes or minimum pricing do not apply, but import tariffs and export refunds can give indirect support to the sector. However, the poultry market is highly regulated, with regulations covering the quality of poultry produce, animal welfare and health (see Section 2).

During the last 25 years important shifts in all stages of the supply chain have helped to expand the poultry industry. Significant amongst these are the development of large scale and rapid breeding

techniques, and the ability of big processors and packers to meet the logistics and strict quality standard of the supermarkets.

During this period, poultry meat has continued to grow to about 38% of the UK meat market despite overall decline in the meat sector (Table 4.3). Annual consumption has increased from 15 kg in 1984 to 20 kg in 1994. This increase may be due to the perceived health benefits and the ease of cooking. The production of poultry meat has remained stable over the last four years at 590 million birds slaughtered. The broiler industry through further processing and added value has improved sales volume, but consumers are not eating any more. The consumption of other meats has consistently fallen over this ten year period.

In contrast, egg consumption declined to about 97 eggs/person/year in 1994 from 164 eggs eaten in 1985, although there has been a recent increase in both shell (700 million dozen) and processed egg (111 million dozen) consumption. The fall has been attributed to several reasons but mainly to the trend away from eating cooked breakfasts in the home. However, this has in part been counter-balanced by increased egg usage in manufactured and convenience foods and in meals eaten out. The processed egg market as a proportion of total consumption has increased over the last ten years from 5% to 15%, in line with the general trend towards increase in demand for processed and convenience foods. Only 2 of the 3.5 eggs consumed per person per week are shell eggs.

Table 4.3 Development of demand for poultry and substitute products

	1985	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*
Production										
Eggs (£ million)[a]	470	404	451	405	408	467	440	405	469	486
Poultry (£ million)[a]	709	762	803	821	844	901	900	934	994	1000
Eggs (million dozen)	906	880	878	869	763	804	816	806	803	811
Poultry (million birds)	502	521	554	588	540	567	591	589	589	586
Consumption (per person per week)										
Eggs (no.)	3.15	3.01	2.88	2.67	2.29	2.20	2.25	2.08	1.92	1.86
Poultry (g)	196	207	231	229	220	226	216	231	238	229
Beef and veal (g)	185	187	192	180	171	149	152	141	133	131
Mutton and lamb (g)	93	86	75	78	85	83	86	71	66	54
Pork (g)	98	103	90	94	89	84	82	72	80	77
Bacon and ham (g)	137	136	132	131	130	118	118	110	112	115

[a]1994 prices

Source: *Abstract of Statistics, 1996*

4.1.4 Market structure

Improved production management, breeding, nutrition and health care have combined to make poultry an affordable every day food. The number of egg production units in the industry has fallen substantially, with a concentration of larger production units. This is reflected in the changing production and market shares of different production systems (Table 4.4).

Table 4.4 Percentage of the national egg production flock (and market share) in different systems

Year	*Cage*	*Barn/perchery*	*Free-range*
1951	8	12	80
1965	53	37	10
1980	95	4	1
1995	84 (86)	4 (3)	12 (11)

Source: *Poultry World*, Sept. 1995 (market shares: *NFU Egg Production Bulletin*, July 1996)

Although there has been a recent reduction in cage egg production and an increase in barn and free-range output, the market is still dominated by cage production.

The broiler production industry is dominated by contract-producer arrangements. There is still a small free market in broiler production, but large multiple retailers generally sell their own brands, which are produced on contract. This is becoming an increasing feature in the egg industry. The contract buyer supplies the birds, feed, medication and technical advice. The producer supplies the labour, buildings, water and power. A guaranteed price is set and bonuses are received for pre-determined quality and quantity standards.

While there are still opportunities for egg producers to select their market independently, it would seem likely that if the large multiple stores expanded the stock of organic eggs and poultry, then they would buy on contract. This may or may not encourage small producers to expand their output.

4.2 Characteristics of the organic poultry industry

4.2.1 The market for organic meat

According to Mintel, the retail value of organic meat sold in the UK increased from £9 million in 1992 to £12 million in 1994, an increase of 33% (Mintel, 1995). This represents around 0.1 % of total meat sales. Other estimates have put the organic meat market at nearer £20 million (unknown source, cited in MLC, 1995) while estimates based on a survey of the number of animals sold as organic suggest that the market may be as small as 0.02% of the total meat market (MLC, 1995). The organic meat sector is also relatively small (less than 10 %) compared with the total organic food market (Mintel, 1995). Both these reports are already somewhat out of date given the significant changes in the organic market in 1996 in the wake of the BSE crisis and other factors.

Even before the recent changes, the MLC survey (MLC, 1995) showed that the producers are confident that they can increase their production significantly (Table 4.5). The high proportion of pigs and poultry produced and sold organically (relative to beef and sheep) is a reflection of the fact that the additional production costs are so high that production is rarely undertaken without an assured market. The current study has confirmed this, and production, although at a low base, may well double each year in the short term. Continued expansion of both supply and demand, with new entrants joining at the supplier and retailer end are expected.

Table 4.5 Current organic output and sales through organic outlets

	Current output	*Current output sold through organic outlets*	*Potential output*	*Potential output as a % of current output*
Beef	1992	867	3021	+ 60
Lambs	12301	4463	16391	+ 60
Pigs	2273	2243	2343	+ 3
Poultry	18780	18780	27880	+ 48

Source: MLC (1995)

The general trend toward reduced meat consumption and processed foods has implications for organic producers at both farm gate and retail level, although it may be argued that conventional market trends have no connection with the organic market as the product is different. If the fall in meat consumption is due to health reasons, then this may affect the potential market for all meat produce. If the reason is consumer resistance due to farming methods and animal welfare then there may well be an increase in the demand for organic produce.

4.2.2 Production

4.2.2.1 Egg producers

We identified three distinct groups of egg producers:

- the small producer with 50 birds or fewer, using specialist breeds, mainly supplying local consumers directly at the farm-gate or through box schemes, as a supplement to more significant enterprises but typically in a small-holding context.
- the medium-sized producer with 100-1000 layers: using mainstream breeds and mobile housing fully integrated with other organic enterprises on larger farms.
- larger-scale, commercial producers with 1,000 to 5,000 or more layers: often existing conventional free-range producers who have converted barn systems with outside access or free-range systems to organic production, using commercial breeds and buying in complete diets from organic feed suppliers. They market through conventional marketing channels and are reluctant to divulge any information that they feel is commercially sensitive. Such operations are typically isolated from other organic enterprises, but are smaller than would be expected in conventional poultry production.

Our estimates of the significance of these three groups are set out in Table 4.6. These estimates should be seen as provisional, as we were not able to identify all organic egg producers, nor to get detailed information from some of the most significant ones. As many organic egg producers by-pass conventional marketing channels by direct marketing, volume and value are difficult to estimate.

Table 4.6 Provisional estimates of the size of the organic egg production sector

	Small units	*Medium units*	*Large units*	*Total*
No. of flocks	25	10	5	40
No. of layers/flock	25	200	3500	
No. of layers - total	500	2000	17500	20000
No. of eggs/hen/year	200	220	270	
No. of eggs - total doz.	10,000	40,000	400,000	450,000
Retail value - £/doz.	2.00	2.25	2.50	
Retail value - £ total	20,000	90,000	1,000,000	1,110,000

Source: own estimates

Our estimates suggest that there were up to 40 egg producers in the UK in 1996, out of a total of 820 certified organic farms. We estimate total organic egg production to consist of a maximum of 20,000 layers producing 0.5 million dozen eggs with a retail sales value of a little over £1.0 million. This represents 0.13% of total UK egg production.

4.2.2.2 Poultry meat producers

This sector has a distinct grouping of small producers supplying a seasonal demand and a wider range of fowls. The larger producers concentrate on fewer product lines although they process more (Table 4.7). Most producers use bought-in commercial chicks and organic feed. In nearly all cases, housing is low-cost, home-designed, and producers mostly use small-scale farm slaughtering facilities. They direct-market their produce and are suspicious of selling to large multiples. The market price is acceptable, but they feel the price must reflect, in addition to the extra costs of production, the added costs of packaging, labelling and certification. Again the problem of sourcing both stock, feed and market outlets are the main problems affecting business and market growth. Distribution and the diversity of the market outlets are seen to be a problem.

Table 4.7 Provisional estimates of the size of the organic meat production sector

	Small units	*Large units*	*Total*
No. of units	10	5	15
No. of birds/unit/week	less than 100	200-1000	
No. of birds - total	10,000	75,000	85,000
Retail value - £/kg	4.00	5.00	
Retail value - total	80,000	750,000	830,000

Source: own estimates

In very broad terms, we estimate that current organic table bird production is less than 100,000 table birds with a retail sales value of £1.0 million annually. This represents less than 0.02% of the total UK broiler production. Our estimates are higher than those of the MLC (1995) study, as the MLC only identified production in Wales and south-west England, and failed to capture significant producers in central and eastern England.

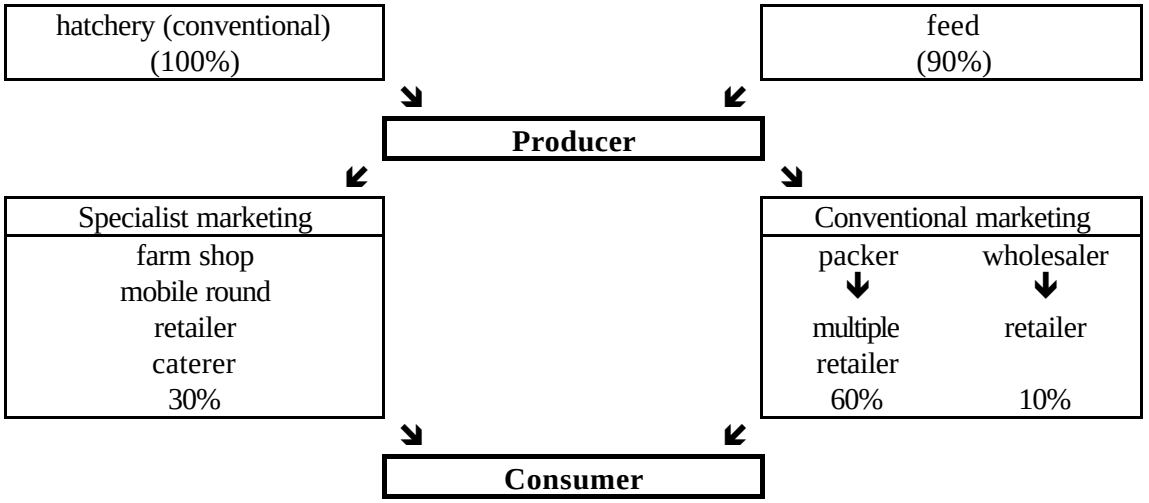
4.2.3 Marketing channels

4.2.3.1 Eggs

The conventional marketing channel for eggs is producer > packer > retailer. The packers are independent and set their own prices and standards although they generally follow the same trends. Large multiples buy from the four main packers and a few independent producers, as they demand guaranteed volumes and consistent quality. There is a move by one of the multiples to increase the proportion of barn eggs at the expense of cage eggs by reducing the price. Multiples can easily have a de-stabilising effect on the market for minority products.

The main marketing channels for organic eggs are illustrated in Figure 4.1.

Figure 4.1 Current marketing channels for organic eggs (% of sales volume)



Source: own data

In practice, the production and marketing of organic eggs is dominated by two packers: Stonegate and Thames Valley Eggs, working on a contract-producer basis. These packers market their eggs through a small number of multiples (mainly Tesco and Sainsbury (120 of 365 stores)) and between them account for 50% of our estimate of total production. Stonegate supply complete diet feed to producers, pack and collect the eggs, grade and test them, pack, shrink wrap, and deliver to the multiples. Their producers are independent, buy feed at cost from Stonegate (£245/t organic, £160/t conventional), and supply eggs back at £1.30/dozen. (Compared with the feed prices charged by the

main organic feed suppliers, this represents a reduction of £50/t worth 11p/doz. eggs. The eggs are then sold on to the multiples at a smaller margin which is seen as acceptable in the context of developing new markets and innovative products.

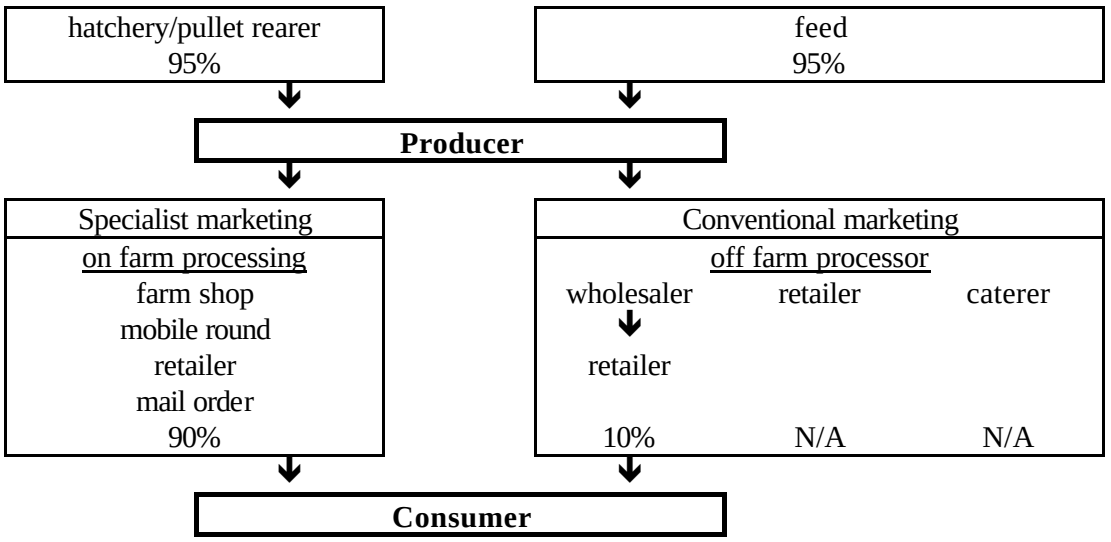
One of the larger independent producers operates his own processing, testing, grading and packing plant, selling to various retailers and wholesalers.

The smaller producers retail primarily through their own farm shops and to meat customers, frequently involving the customers packing their own eggs from trays into reused boxes. Some of these smaller producers are not keen to expand as this would involve developing new marketing approaches which is not seen as worthwhile.

4.2.3.2 Table birds

Most organic producers by-pass conventional marketing channels and rely instead on direct marketing through specialist marketing outlets, making a full picture of the throughput of each marketing channel difficult (Figure 4.2). The major wholesalers include Eastbrook Farm Organic Meats and Pure Suffolk Foods, as well as Peter Mitchell, all of which focus sales primarily on independent retailers and butchers in the London/south-east England market. There is some trade between organic producers, where a producer acts as a central distributor. Usually most producers act independently. In addition to supplying the wholesalers, producers also rely strongly on local butchers/retailers and farm-gate/shop sales. In some cases, market stalls/retail shops are managed as extensions to the farming operations. Outlets also include specialist organic supermarkets such as Out of This World in Nottingham, Bristol and Newcastle and Planet Organic in London.

Figure 4.2 Current marketing channels for organic table birds (% of sales volume)



Source: own data

At present, only one supermarket (Sainsbury) is testing organic poultry meat (chickens in eight and turkeys in 30 stores). Chicken sells 'amazingly well' at £5.00/kg, a 50% premium over the equivalent free-range products. The turkeys have only just been introduced for the Christmas market. Sainsbury comment that they have not received any enquiries from consumers indicating confusion between organic and free-range products, possibly due to the information that is supplied on the label.

4.3 Pricing

4.3.1 Organic meat premiums

The MLC survey (MLC, 1995) found that premiums for pigs and poultry were higher than for cattle and sheep (Table 4.8), and that a higher proportion of pig and poultry producers (but not all) were obtaining premium prices. In general, organic premiums were higher across the board at the end of 1996. Not surprisingly, satisfaction with the premium received was directly related to its size. In general, premiums of 10% and above were considered adequate, while in only one case was a premium of less than 5% considered adequate. Views were mixed on premiums of between 5 and 10%.

Table 4.8 Average premium on organic sales

		Size of premium		*Sellers not receiving a premium*	*Sellers satisfied with premium*
		Range %	Average %	%	%
Beef,	stores	0-10	3.6	56	50
Beef,	finished	0-75	10.5	18	54
Lamb,	stores	0-5	1.0	80	
Lamb,	finished	0-25	10.2	20	65
Pigs		0-40	19.2	17	100
Poultry		0-20	20.0	20	80

Source: MLC, 1995.

4.3.2 Eggs

Our evidence suggests that organic egg producers were able to obtain an ex-farm premium of up to 100% over cage eggs, and 35-50% over free-range eggs in 1996. Retail prices to consumers were 60% higher than cage and 35% higher than free-range.

Egg prices vary according to the production system, outlet and size (Table 4.9). There is a free market for conventional eggs, where individual producers negotiate contracts with packers. Bonuses are received for meeting quality and quantity conditions, therefore individual producer returns may vary. Producers can receive a bonus of two pence per dozen if they follow the Freedom Food standards. In general the price of eggs falls during the summer months, but the organic prices are relatively constant throughout the year.

There is a small price differential for barn eggs over cage, but this is expected to fall (Table 4.10). One multiple retailer is now selling barn eggs at the same price as premium cage eggs. The free-range differential over cage is more marked at around 30 to 40 pence, but again this is expected to narrow. The biggest difference is between cage and organic eggs where there is a price differential of between 70 and 100 pence per dozen. Notably the price differential at farm gate level is only 50 to 65 pence. It can be seen that it is at the retail end where the highest mark-ups occur.

The differential between organic and free-range is lower, at between 45 and 80 pence. The retail sector again manages the highest mark up, although at the farm-gate the differential is halved. If the organic sale price is linked to free-range prices (for which there is only limited evidence), any decline in free-range prices may result in reduced producer margins.

The proportion of the organic premium paid by the consumer which accrues to the producer depends on the level of marketing, distribution, wastage and other overhead costs, as well as the mark-up policy of the retailer. In the case of eggs, although there appears to be an additional retailer mark-up for eggs from barn, free-range and organic systems, the relative size of this is smaller for

organic eggs. This may reflect the higher end price to the consumer, with the retailer aiming for the same absolute rather than relative mark-up compared with other premium eggs.

Table 4.9 Egg prices (pence per dozen)

Old sizes (g)	*0 (>75)*	*1(70-75)*	*2(65-70)*	*3(60-65)*	*4(55-60)*	*5(50-55)*	*6(45-50)*
New sizes (g) (EC, 1996b)	*XL-very large(>73)*	*L-large (63-73)*		*M-medium (53-63)*		*S-small (<53)*	
Farm to packer							
Cage	68	65	57	51	45	34	26
Barn	70-85	65-85	60-75	50-65	40-50	25-40	N/A
Free-range	90-110	85-105	80-95	60-85	40-50	25-35	25-30
Organic	N/A	140	135	N/A	N/A	N/A	N/A
Farm to retailer							
Cage	85-100	80-95	75-85	70 -80	60-70	60-65	55-60
Barn	115-130	110-115	105-115	105-115	90-100	60-70	N/A
Free-range	130-170	130-155	115-135	100-125	80-115	60-80	N/A
Organic	N/A	190	170	160	N/A	N/A	N/A
Farm gate to consumer							
Cage	115-130	110-120	100-110	90-100	80-90	70-80	70
Free-range	150-210	145-190	125-155	115-145	100-125	65-95	N/A
Organic	N/A	180-200	166-180	153-166	133	105	N/A
Retailer to consumer							
Cage	180-200	160-185	135-165	130-150	120-140	90-120	80
Barn	N/A	190	190	160-170	160-170	N/A	N/A
Free-range	190-210	180-220	180-200	160-190	120-170	80-130	N/A
Organic	N/A	270-275	260-280	230-240	220-230	N/A	N/A

Sources: *NFU National Weekly Egg Market Intelligence Report*, 12/7/96 and own data (organic)

Table 4.10 Egg price differentials (pence per dozen)

	Farm> retailer	*Farm gate> consumer*	*Farm> packer*	*Retailer> consumer*
Barn over cage	25-45	N/A	10	30-35
Free-range over cage	30-35	35-40	30	40-50
Organic over cage	90-100	50-65	75	85-100
Organic over free-range	70-80	25-30	40-45	45-50
Organic over free-range (%)	35	20	40	30

Source: derived from data in Table 4.9

4.3.3 Table bird price range

The market supplied by organic producers is primarily for premium quality (hung), fresh chickens in the 1.5 to 2.5 kg weight range. Ex-farm prices have gone down in the last year, from £3.50 to £3.10/kg, as a consequence of new entrants, and are expected to fall even further, possibly to £2.75/kg. Although declining, there is still a differential over conventional products, with the prices at wholesale and retail level variable. Organic retailers would expect to add on a 35-40 % mark-up, which may be slightly higher than usual, but these help to cover the lower volume sales and higher wastage (Table 4.11).

The differential of organic over conventional poultry meat is very high, with organic poultry more than twice the price. The price differential is not so great between organic and free-range, but still

relatively high at 50%. It is difficult to establish a true picture as there is less information than for eggs. Also, the product range varies in type, quality and size.

Table 4.11 Whole table bird prices by outlet - fresh (p/kg eviscerated)

	Farm to packer	*Farm/ packer/ wholesaler to retailer*	*Farm to customer*	*Retailer to customer*	*Mail order*
Organic	285-310	290-400	400-500	460-560	840
Total freedom				350-380	
Free-range		230-400	up to 400	310-370	570
Barn reared		200			
Conventional	57-65 (liveweight)	130-155		special offers: 150-225 normal: 248-285	
Conv. (frozen)				119-221	

Sources: *Weekend Telegraph* (11/5/96), *NFU Broiler Bulletin* (July 1996), own data (July 1996)

Table 4.12 Comparative retail prices for fresh chicken portions (p/kg)

	Whole	*Half*	*Breast fillet*	*Drum stick*	*Wings*	*Breast quarter*	*Leg quarter*
Organic	400-550	450	1060-1700	415-550	220-310	460-790	430-640
Free-range	250-400	355-390	780-1400	275-350	120-270	460-580	345-420
Conventional	150-285	N/A	740-1080	130-200	110-150	610-750	190-200

Sources: farm/packer price lists, own data

Table 4.13 Price differentials for table birds (p/kg)

	Whole	*Breast*	*Drum stick*	*Differential*
Free-range over conventional	100	100-300	150	50%
Organic over conventional	250	300-600	300	100%
Organic over free-range	150	200-300	150	50%

Source: own calculations based on Table 4.12

Customers are mainly based in the south-east and London, although there are regional centres in Wales and a wider spread of mail order customers. A small number of restaurants and hotels and direct sale from farm shops make up the total customer base. A small percentage, say 10%, will buy organic at any price. About 50+% will buy either for a fixed sum of money, e.g. £10 worth of meat at a time, or one chicken at regular intervals, and 20+% will buy only if the price is below a certain level, and this is variable based on the region or part of London. Prices in Wales, for example, are generally 20 % lower than in the south-east England. Price elasticity effects indicate an acceptable figure is in the region of £4.00 to £5.00/kg meat.

The small scale of organic product sales may result in higher marketing and distribution costs. However, it is questionable whether the practice of adding a fixed percentage to trade prices at retail level is always justifiable, as there is no real difference in the level of service offered by the retailer with respect to meat from different production systems. The practice may simply increase costs to the consumer unnecessarily and act as a constraint to further development of the market.

4.4 Promotion

None of the businesses contacted spent significant amounts on marketing and promotion, other than the production of price lists and information leaflets. The main investment was in terms of time - developing good relationships with retailers and customers. As with other parts of the organic sector, organic poultry producers benefit from considerable positive media coverage, most recently with respect to BSE, but also with respect to *Salmonella* and anti-biotic resistance issues. Some

producers expressed frustration that more was not done by organic sector bodies to assist with generic promotion of organic produce.

4.5 Institutional factors

A number of institutional factors, such as regulations and the availability of financial support and information, have a potential, if unquantified, impact on organic poultry production. The aim here is simply to highlight issues which may be relevant.

4.5.1 Market regulations

Organic poultry producers are subject to a wide range of regulations in addition to those related specifically to organic production. These are reviewed in section 2 of this report. Regulations influencing all poultry producers, whether conventional or organic, are taken as given as there seems to be little scope for influencing these with organic producers specifically in mind and no issues have been identified where organic producers might wish to seek a derogation. The simplification of *Salmonella* control regulations since 1993 would appear to have dealt with the most important potential conflict area.

As far as organic certification is concerned, producers raised two issues: the costs of certification and the restrictions which particular sector bodies imposed. Certification costs are a matter for individual sector bodies. The variation in restrictions imposed by individual sector bodies is likely to be eliminated if the EU draft organic livestock regulations are imposed in their current form, but this will have significant adverse implications for the development of organic poultry meat production in particular, as identified elsewhere in this report.

4.5.2 Market support

Unlike for cattle and sheep, there is no direct financial support for poultry production, whether conventional or organic. Poultry producers are eligible for support with marketing and processing projects and feasibility studies, although no EU grants can be made in the poultry sector that increase capacity, unless there are compensating reductions elsewhere. Projects which would benefit the organic poultry sector could include shared slaughtering, hanging and processing facilities, as well as facilities for utilising outgrades, including the preparation of liquid egg and the utilisation of layer carcasses for organic babyfood, bakery and ready meal products. With the entrance of larger producers and packers into organic egg production, there is significant potential to meet the requirement of food processors, not only in the UK but abroad.

Of particular relevance is the Processing and Marketing Grants Scheme, which included organic products as a criterion for the shortlisting of projects. Although this has been discontinued in England, it is still available in Scotland, Wales and Northern Ireland. Applications may be made for investments over £70,000 with the maximum grant available in most cases of £1.2 million. Eligible costs include new buildings, refurbishment of old premises, installation of new equipment and consultants' and architects' fees up to 12% of the total grant. The level of grant available is 30% of eligible costs, with 25% from the EU and 5% from other Government sources. Applicants may seek assistance from other sources but must find at least 45% of the eligible project costs from their own resources.

The Marketing Development Scheme is also relevant. It aims to help farmers, growers and processors to develop efficient marketing structures and commercial expertise. Grant aid is provided at 50% of authorised costs subject to an overall maximum of £150,000. Eligible costs include feasibility studies and market research, costs of establishment, expansion or merger of producer groups (legal, recruitment and redundancy), salaries of the key staff including recruitment, salary and travel costs, production and dissemination of promotional material and events, director and management training and outside directors' expenses.

In addition, a range of business start-up, factory space and development grants are available from regional development agencies such as the Rural Development Commission, Highlands and Islands Enterprise, the Welsh Development Agency and the Development Board for Rural Wales. The EU-funded Objective 5b and LEADER programmes may also be relevant.

4.5.3 Market information and advice

Although organic poultry producers are registered with organic sector bodies for certification, they receive little direct help from them with respect to either market information or advice on production techniques. Many of the larger producers feel that no-one would be qualified to give advice anyway. Improved technical and market information could assist both producers converting from conventional free-range systems and existing organic producers seeking to establish new enterprises.

4.6 Future market development: opportunities and threats

4.6.1 Market potential

It was not a specific part of this study to conduct a detailed consumer survey or make specific future demand estimates for the organic poultry sector, as the sector is still very small and subject to significant price volatility when new producers and retailers enter the market. In this section, we have focussed primarily on buyers' views concerning the short to medium term prospects for the sector.

4.6.1.1 Eggs

In general the larger-scale producers are satisfied with existing arrangements, are willing and able to step up production in response to demand, but are not keen to see competitors moving into their territory.

Buyers for the multiples have suggested that there is potential to double the present market for organic eggs and seem keen to keep the organic market developing. Sales of organic eggs are predominantly in south-east England where a small but limited increase in demand is likely. The multiples are currently re-appraising whether there is growth in demand elsewhere in the country. Tesco reports that organic egg sales have increased significantly over the last few months and they see a growth from one to three percent of egg sales. They expect both free-range and organic egg sales to grow, but are experiencing a limit in both the quality and availability of supplies. They see a need for increased UK supplies as customers prefer to buy British. Sainsbury is considering an own label product due to the success of branded organic eggs.

4.6.1.2 Meat

Producers supplying specialist wholesalers and retail outlets were confident that the market could absorb increased production, although there was strong evidence that the entry of new producers had led to increased competition and a fall in prices. Producers are cautious about working with supermarkets because of a perceived lack of reliability and concern about their weight and other specifications. However, the supermarkets are likely to be a major source of future growth.

Sainsbury considers availability as the only constraint to growth and are taking a pro-active approach, but have not found an approved organic producer who can meet their required standards and volumes. The company expects that the target market may grow as a result of the stronger economy, as the sales of most luxury goods grow. Sales may also increase due to the heightened awareness about animal welfare. Others, such as Waitrose, have indicated significant interest in entering the market. The involvement of these supermarkets could increase demand from the existing 1,500-2,000 birds per week to 3-5,000 birds per week almost overnight.

Other supermarkets record that there is customer resistance to the higher prices for organic and that the range of competitive products also acts to confuse the customer and affects their choice (see below). They believe that the customer is satisfied with something less than organic. Tesco say that their free-range poultry is regarded by their customers as organic. Free-range represents 3% of their sales and they state that they would not sell free-range and organic together, as the customer would not perceive there to be a difference between these products, and the customer would not pay the differential price. An additional potential constraint is that supermarket buyers and micro-biologists are unfamiliar with hung meat and may need some persuasion. Tesco says that if it were to sell organic poultry, then it would only sell in stores in affluent areas of the country, such as Sandhurst, Covent Garden or Oxford Street.

The smaller retailers suggest that supply and demand is in balance, although they see some expansion in poultry meat if they can get local supplies. The high cost of transporting chilled meat is seen as a constraint to expansion. A larger and better chain of distribution is required, although parts of the organic movement would rather see local suppliers producing for local customers as the preferred development.

As most of the existing producers kill and process on their own premises, any expansion may require capital expenditure to comply with the regulations covering slaughtering and processing. At least one producer has spare slaughtering and processing capacity and would prefer to recruit other local producers (to minimise transport distances and costs) rather than expand his own capacity. An increase in the use of contract suppliers could provide a way of expanding output and managing the cost of slaughter, processing and marketing.

As part of an attempt to develop the marketing of organic meat in general, an organic livestock marketing co-operative has been established with a marketing grant from MAFF following the feasibility study by the Meat and Livestock Commission (MLC, 1995). The co-operative is now operational. To use the co-operative, producers need to purchase shares. It is too early to assess the contribution that the co-operative might have in relation to organic poultry meat - most existing processors feel that they can continue to operate independently. It is possible that the co-operative could have a role to play in the longer term, particularly with the development of processing facilities for local groups of producers.

4.6.2 Threats

4.6.2.1 Competition between existing organic producers

The organic poultry sector is dominated by only a few main players. There is room for more and scope for the current group to expand further. In the case of eggs, most of the larger producers had well established markets and there was little evidence of significant competition between them. In the case of poultry meat, most of the major players are in regular contact with each other, mainly to trade at a wholesale level. Competitors generally keep to their patch, and they also maintain discipline by refraining from poaching each others customers. However, this does not always hold as they do admit to competing with each other when supplies are high, particularly as a consequence of new entrants.

4.6.2.2 New entrants

The larger egg producers were very wary about the competitive threat from new entrants and were unwilling to reveal much about their operations. However, a move to own-label eggs by one of the supermarkets, or the entrance of another supermarket into the market, could require an increase in production beyond the level which can be met by current producers. In contrast, the poultry meat suppliers and wholesalers are not unduly concerned about the possibility of new players coming into the sector. Generally, their view is that the market needs to grow and that in order to compete with

the established broiler market the sector needs to be substantially bigger than currently, even if this entails a reduction in the price paid to producers.

4.6.2.3 Substitute products

Both egg and meat producers were concerned about consumer lack of understanding of what is meant by organic livestock production. The main concern is that competing products are only serious contenders because the market is confused about their true identity. The biggest threat is from free-range and 'additive-free' poultry which is often mistaken for being organic. Consumers also confuse organic with vegetarian. In addition, the development of barn-reared systems promoted as affordable animal welfare at prices close to conventional represents a potential threat. It was also alleged that rogue wholesalers/butchers were selling conventional broilers as organic poultry meat and benefiting from the higher prices charged.

In practice, many of the organic producers supply both organic and free-range/additive-free birds with organic prices 30-50% higher than free-range in the same outlet. This indicates that there is a group of consumers willing to pay more specifically for the organic product, although it is questionable whether consumer understanding of, and demand for, fully organic birds will develop as fast as it might if only the fully organic bird were available. In many cases organic producers have also differentiated their product by hanging the birds before evisceration to enhance flavour, and this has resulted in positive consumer and trade response.

4.7 Conclusions

There is the potential for the organic poultry sector to grow, both for meat and eggs, provided that:

- new producers secure a market before commencing production and that improved market opportunities increase confidence to enter/expand, for example through contracting;
- new markets are developed in regions outside south-east England;
- increased scale and consistency of supply and quality can encourage multiples to become involved, particularly given the general decline in the number of independent outlets, and the limited role of specialist organic retail, catering and mail-order outlets;
- shared processing and packing facilities can be developed in appropriate locations to minimise transport distances and costs;
- processing markets for outgrades (over/under-sized eggs, cracked eggs, layers, damaged table birds) can be developed, particularly to handle product not acceptable to multiples, but also as a reflection of the general shift to more processed foods such as ready meals and baby foods;
- pricing strategies do not discourage new customers from trying organic products;
- improved consumer information and generic marketing of organic products helps to differentiate organic and alternative products such as free-range and barn-reared;
- costs of labelling and certification are appropriate;
- changes in production standards/legislation do not excessively add to production costs or technical feasibility of poultry production (see earlier sections).

5 Business performance

5.1 Introduction

The viability of any livestock venture must ultimately be measured in terms of its business performance. This section illustrates the performance of organic poultry production, contrasting alternative systems for producing organic poultry and comparing them with conventional free-range and barn production systems. The aim is to provide a guide to the existing organic producer considering the establishment of a poultry enterprise and/or for the free range poultry producer contemplating a switch to an organic production system, assuming significant growth in the market for organic poultry products.

The main focus is on the likely business results in terms of gross and net margins for egg, meat and pullet production in an established organic system. Costs for the establishment of a new enterprise, or conversion of an existing conventional enterprise, have not been analysed in detail, as these costs are likely to vary considerably depending on the individual circumstances of the farm. However, some indication is given of likely investment costs which may be incurred. Detailed cash flow forecasts have not been included in the analysis, as it is not anticipated that there would be significant variation in inputs and outputs over time once an enterprise is established.

Relevant statutory requirements and technical issues have been highlighted in Sections 2 and 3 of this report, while details of the industry context, organic market, and pricing and marketing strategies are detailed in Section 4.

The prices, costs and input/output assumptions contained in this section are based on performance levels that might reasonably be expected from a typical unit. Actual costs vary significantly from producer to producer depending on the scale of operation, supply of inputs and payment terms. The figures presented may not apply to a specific producer or production system and, in reality, with the different management and production systems available are highly unlikely to do so. The results should therefore only be interpreted as indicative of potential performance.

5.2 Financial and physical performance assumptions

5.2.1 Outputs and inputs

For the purposes of this report, the assumptions detailed in Tables 5.1 and 5.2 have been made. These correspond with data presented in Sections 3 and 4 of this report. Sensitivity analysis tables (Sections 7.2-7.4) indicate the impact of variations in these assumptions. It has been assumed that the market can cope with the levels of production indicated. This may not be the case without significant reductions in market prices assumed.

The results based on these assumptions can provide only general guidance for a particular producer situation. Small variations in performance, cost of inputs, overheads, market prices and condition of buildings and equipment will have a significant effect on the bottom line.

5.2.2 Capital

Capital investment is required in buildings for housing and, where applicable, processing, packing and storage. Housing options are considered in detail in Section 3.3 and slaughtering/processing facilities in Section 3.6. The levels of investment required for these items are considered in more detail in Section 5.3 below, as are the depreciation costs associated with different housing types.

Table 5.1 Output quantity and price assumptions

	Price	*Quantity*	*Downgrades*	*Note*
Layers	£1.05/doz	22.5 doz./year	10%	1
Table birds (liveweight)	£1.70/kg	2.5 kg/bird	Negligible	2
Pullet rearing	£4.33	20 weeks	N/A	3

1. The egg price assumption is based on the following distribution by size class and prices achievable:

Size	0	1	2	3	4	5-7	Seconds	Average
Distribution (%)	3	10	20	27	20	10	10	
Price	150	140	130	120	100	50	20	104

   N.B. Old size classes have been used as price data for the new EU classes (see Table 4.9) were not available. Initial feedback on the new sizes indicated that medium eggs (equivalent to old sizes 3 and 4) are more popular.
2. Price assumed is prior to killing and processing. The equivalent deadweight price for killed and processed birds wholesale is £2.90/kg (see Section 5.3.1). Prices to contract growers may be significantly lower than this. Due to the nature of the market, including greater tolerance for blemishes and opportunities for portioning, sales income has not been reduced to reflect any potential down-grading. Larger producers selling to the multiple retailers will inevitably suffer from down-grading which may be in the region of 5-10% of birds produced.
3. Price reflects the costs of rearing organic pullets (see Section 5.3.3). Pullet rearers are continually under pressure to minimise prices and find it extremely difficult, in the conventional market, to pass on input price rises to the purchaser, and therefore rearing costs may be higher than the market price.

Source: own data and estimates

In order to obtain and keep wholesale contracts producers need to ensure continuity of supply. Table bird producers require sufficient buildings to enable enough 'crops' to be harvested to fulfil contractual arrangements. Generally, where packers have a number of suppliers, egg wholesalers are more tolerant of down periods during restocking and thus one house may be sufficient. In order to maintain a constant cash flow producers should ideally have at least three laying houses (flocks) at different stages of production.

Interest on working capital and capital invested in production buildings and equipment is costed at 8.5% in the whole system profitability analyses (Tables 5.7 and 5.10).

Other capital investment costs associated with purchasing/establishing a poultry unit e.g. building (non-production) costs, professional fees, mortgage costs for land etc. are not considered in this analysis.

5.2.3 Labour

Poultry workers fall under the Agricultural Wages Act 1948, being workers employed in agriculture. Wage rates are set and amended annually by the Agricultural Wages Order, and thus producers are bound by these rates.

Efficient use of labour is essential for profitable organic poultry production (eggs or table birds). As is clear from the financial results presented in Section 5.3, spreading labour costs over a larger number of birds is essential. Producers are, and will continue to remain, under pressure to increase output per labour unit. Labour requirements for both egg and table bird production vary significantly depending upon availability, degree of automation, and the level of unsalaried (farm-family) labour involved on a day to day basis. In many cases the actual labour involved in the production will be the farmer's own labour. Even in these cases casual labour, for catching, re-stocking and cleaning may be required. The costs of employing any labour-saving devices must be spread over a larger number of sales. The size of the business is therefore the major determinant of labour efficiency.

Table 5.2 Input quantity and cost assumptions

	Quantity	*Price*	*Range*	*Comments*
Layers				
Pullet cost (20 wk)		£4.33		Organic status, range-reared
Feed	47.5 kg	£270/t	£250-300	Pre-mixed and bagged
Grading/packing	per doz.	26p	15-30p	Excl. storage/marketing costs
Transportation	150 miles	31p/m		Stock collection, round trip
	60 miles	31p/m		Egg deliveries, round trip
Labour	Variable	£15,000	N/A	Full time stockman (gross cost)
Table birds				
Chick cost	Day old	40p	23-70p	As-hatched
Feed: Starter	0.5 kg	£300/t	£280-350	Pre-mixed and bagged
grower	2.5 kg	£290/t	£270-350	Pre-mixed and bagged
Finisher	5.75 kg	£300/t	£280-350	Pre-mixed and bagged
Transportation	150 miles	31p/m	N/A	Stock collection, round trip
	150 miles	51p/m	N/A	Table bird deliveries, round trip
Slaughtering	2.5 kg lw	75p/bird	65-125p	Throughput dependent
Evisceration	2.5 kg lw	50p/bird	27-70p	Delayed for 3 days
Labour	Variable	£15,000	N/A	Full time stockman (gross cost)
Pullet Rearing				
Chick cost	Day old	50p	23-70p	Females
Feed: chickmeal	2 kg	£300	£280-360	Pre-mixed and bagged
grower	6 kg	£230	£220-350	Pre-mixed and bagged
pre-lay	1.6 kg	£250	£250-300	Pre-mixed and bagged
Transportation	150 miles	31p/m		Stock collection. round trip
	150 miles	51p/m		Pullet deliveries, round trip

Sources: Chicks – producer survey, Pullets – own calculations, Labour – Nix, 1996, Transport – Automobile Association, Feed – based on commercially available organic feeds and least cost ration examples reflecting current UK and proposed EU organic standards (see Section 3.4)

Skilled organic poultry labour is not easily found. Proprietor/employee training may be necessary to raise skill levels. No courses specialising in organic poultry production are currently available, although conventional poultry production courses are available from a number of local agricultural colleges. Alternatively, existing producers may offer help and guidance on a consultancy basis.

5.2.4 Other costs

Other costs which have been considered include organic certification costs at ca. £300 per annum. This will depend on the certification body used and may be more expensive in the case of the Soil Association which charges on the basis of turnover, given the high turnover per unit land area of poultry enterprises. Certification costs have been treated as fixed costs in this report, because they do not vary in proportion to the size of the enterprise, although they should strictly be seen as part of the cost of obtaining organic premium prices. Office administration costs have been included based on standard data sources.

5.2.5 Costs not considered

Poultry production systems are subject to further costs not included in this analysis. These costs, which vary considerably from unit to unit, include:

- land management: mowing, fertilising, weed control and reseeding - where organic poultry production is integrated into an organic rotation, many of these costs would be rotational costs carried by the farm as a whole;
- house moving and cleandown: removal of equipment and manure, washing down periods and re-assembly - labour for these activities are included in the overall labour requirements;
- pest/predator control: fencing costs, fence movement and other measures;
- land rental equivalent: landlords/tenants charges, rent, insurance, drainage maintenance, interest charges and other ownership costs;
- training and inspection costs for the Meat Hygiene Service, medical certificates for personnel employed.

5.3 Financial results

5.3.1 Table birds

The financial performance of organic table bird production is critically dependent on feed prices and quantities (Table 5.3). While organic table bird production is currently profitable relative to conventional alternatives such as free-range and barn-reared, the increased feed prices and finishing periods which might result from the proposed EU organic livestock regulation could result in a significant loss. To avoid this, prices would need to increase from the £1.70/kg liveweight assumed to more than £2.00/kg.

The gross margin sensitivity analysis presented in Section 7.2 illustrates the key aspects regarding technical performance and profitability, assuming all other costs remain constant. The key variables analysed include table bird price and liveweight, feed quantity and price, and liveweight value and feed cost. Once the bird price falls below £1.50/kg liveweight the necessity for a heavier bird (subject to market requirements) increases in order to maintain a positive gross margin. Similarly as liveweight falls below 2.1 kg, losses are likely to occur unless the price receivable increases. The sensitivity analysis also shows that if feed prices fell below £250/t profitability would increase substantially. Feed prices of £350/t or above mean that total feed fed must remain below 9 kg/bird to remain profitable.

The total feed cost, representing the combination of feed conversion efficiency, finishing age and price, and the table bird value, combining liveweight and price, are the primary determinants of profitability. A reduction in table bird value to £3.25, or an increase in feed cost to £3.25/bird, would eliminate any gross margin.

It is assumed in Table 5.3 that the birds are sold live to a processor/packer. In practice, organic table birds are normally killed and processed by the producer. The organic liveweight price used is based on a deadweight price of £2.90/kg, adjusted for killing and processing costs of 50p/kg. This corresponds to contract killing and processing charges of ca. £1.25/bird, or on-farm killing and processing costs using low-throughput slaughter houses as illustrated in Table 5.4. Second hand equipment is required to maintain capital costs at acceptable levels for the smallest scale producers.

Table 5.3 Gross and net margins for current UK and proposed EU organic table bird production compared with alternative conventional systems

Details (per bird unless indicated)	*Organic UK current*	*Organic EU prop.*	*Conv. Free-range*	*Conv. Barn-reared*	*Conv. Standard*
Assumptions					
Housing (kg/m2)	25	25	27.5	25	34
Killing weight (kg)	2.5	2.75	2.3	2.3	2.3
Dressed weight (kg)	1.8	2	1.66	1.66	1.66
Dressed weight (lbs.)	4.0	4.4	3.7	3.7	3.7
Age (days)	70	81	56	45	45
Mortality and rejects (%)	10	12	10	8	8
Price (£/kg lw)	1.7	1.7	0.9	0.7	0.62
Feed conversion ratio	3.5	4.5	2.5	2	2
Feed (kg) Starter	0.5	0.5	0.5	0.4	0.4
Grower	2.5	2.5	2.5	2	2
Finisher	5.8	9.4	2.8	2.2	2.2
Total	8.8	12.4	5.75	4.6	4.6
Feed price (£/t average)	300	350	190	190	190
Daily liveweight gain (g)	36	34	41	51	51
Output (£)					
Broiler value	4.25	4.68	2.07	1.61	1.43
Less:					
Day old chicks	0.40	0.40	0.25	0.25	0.23
Mortality	0.10	0.12	0.06	0.04	0.04
Total output	3.75	4.16	1.76	1.32	1.16
Variable costs *(£)*					
Feed	2.63	4.33	1.09	0.87	0.87
Energy	0.15	0.20	0.10	0.06	0.04
Vaccines, vet. and med.	0.10	0.25	0.10	0.05	0.05
Other costs (litter, transport etc.)	0.15	0.20	0.12	0.10	0.08
Total variable costs	3.03	4.98	1.41	1.08	1.04
Gross margin (£)	0.73	-0.83	0.35	0.24	0.11
Allocatable fixed costs (£)					
Labour and management	0.10	0.12	0.06	0.05	0.04
Depreciation	0.08	0.10	0.06	0.05	0.03
Total fixed costs	0.18	0.22	0.12	0.10	0.07
Net margin (£)	0.55	-1.05	0.23	0.14	0.04

Sources: Organic - own estimates and producer feedback. Conventional - *NFU Broiler Bulletin*, April and July 1996, SAC (1996), Nix (1996), own estimates

See Section 7.2 for gross margin sensitivity analysis

Table 5.4 Killing and processing costs for on-farm, low-throughput slaughter houses of varying weekly throughput capacities

Weekly batch size		*200*	*500*	*1000*	*2000*	*3000*
Capital investment (£)		10000	15000	25000	30000	35000
Labour (hours/batch)		30	75	150	300	400
Killing and processing costs (£/batch)						
Labour	Killing	90	225	450	900	1200
	Evisceration	135	340	675	1350	1800
Energy		20	50	100	200	300
Vet. inspection		14	14	14	14	14
Capital	Full process	20	30	50	60	70
Total cost		279	659	1289	2524	3384
Cost per bird (£)		1.40	1.32	1.29	1.26	1.13

Sources: own estimates, producer feedback
See Section 3.6 for further information on slaughter and processing facilities

The overall profitability of organic table bird production (Table 5.7) is highly dependent on scale in order to spread fixed costs, in particular for housing (Tables 5.5 and 5.6). The extension of the finishing period from 70 to 81 days, which would be required to meet the current EU proposals, reduces the number of batches which can be finished each year in an individual house from 5 to 4, resulting in a 20% increase in housing costs. Although mobile housing entails much lower capital investments than static housing, the costs per bird finished are higher.

The results presented in Table 5.7 suggest that small-scale organic table bird production is not particularly profitable unless:

- greater efficiencies than those indicated above can be realised;
- lower input costs and/or higher output prices can be achieved due to location and/or bulk buying/ supplying;
- own and/or family labour can be utilised;
- on-site processing can be carried out in order to obtain a better selling price for dressed birds.

For weekly outputs of 500 or less, the returns indicated above are too low to manage a business if poultry is the main enterprise. Insufficient funds will be available for capital reinvestment/ repayments, taxation or personal drawings.

Table 5.5 Table bird housing costs for different housing types and sizes

Housing type	*Size (m2)*	*Cost (£/house)*	*Capacity (birds/batch)*	*Cost (£/place)*	*Life (years)*
Mobile	10	500	120	4.17	7
Mobile	20	800	240	3.33	7
Polytunnel	50	1000	500	2.00	5
Polytunnel	100	1500	1000	1.50	5
Tent	100	3000	1000	3.00	10
Pole barn, with cladding	100	8000	1000	8.00	20
Rearing house, barn-reared/ free-range	400	45000	4800	9.38	25
Rearing house, standard	1000	100000	20000	5.00	25

Sources: own estimates, producer feedback, pole barn: Nix (1996), rearing houses: SAC (1996)
See Section 3.3 for further information on housing types and requirements

Table 5.6 Cost of housing (£ per finished bird) by housing type and number of batches per year (finishing age)

Housing type	*Size (m2)*	*Number of batches per year* 8	6	5	4
Mobile	10	0.07	0.10	0.12	0.15
Mobile	20	0.06	0.08	0.10	0.12
Polytunnel	50	0.05	0.07	0.08	0.10
Polytunnel	100	0.04	0.05	0.06	0.08
Tent	100	0.04	0.05	0.06	0.08
Pole barn, with cladding	100	0.05	0.07	0.08	0.10
Rearing house, barn-reared/ free-range	400	0.05	0.06	0.08	0.09
Rearing house, standard	1000	0.03	0.03	0.04	0.05

Source: own estimates based on Table 5.5

Table 5.7 Profitability of organic table bird production units of different sizes

	Birds per weekly batch 200	500	1000
Annual production	10000	25000	50000
Labour (FTE)	0.3	0.45	0.6
Building type	Mobile	Polytunnel	Barn
Capital invested	9000	11000	90000
Gross margin (£/year)	9000	22500	45000
Fixed costs (£/year)			
Labour	4500	6750	9000
Depreciation and repairs	1200	2500	5000
Interest on capital at 8.5%	765	935	7650
Certification	300	300	300
Other (office etc.)	800	1000	1200
Total fixed costs	7565	11485	23150
Profit (£/year)	1435	11015	21850

Source: own estimates

5.3.2 Layers

Table 5.8 illustrates the precarious nature of conventional barn-reared and cage production systems, where large-scale production is required to make profits from very low margins. The higher price for organic egg production allows higher margins to be achieved than free-range, despite the higher feed costs.

The gross margin sensitivity analysis in Section 7.3 illustrates the key aspects regarding technical performance and profitability of organic egg production. Both the price received and quantity of eggs produced per year can fall substantially yet the enterprise still produces a positive gross margin. A fall in price to the current free-range egg level of 70p/doz. would however result in a negative margin, as would a (less likely) reduction in egg production to 17 doz./hen. Given current premium prices, possible feed price increases resulting from the stricter EU proposals could be absorbed more easily than in the table bird production case. Changes in the value of egg sales

(£/hen) have a much greater impact on gross margin than changes in total feed costs, with a reduction in sales from £24 to £18/bird resulting in a negative gross margin.

Table 5.8 Gross and net margins for organic egg production and alternative conventional systems

	Organic	*Free-range*	*Barn-reared*	*Cage*
Assumptions				
Unit size (birds)	1000	5000	5000	10000
Mortality (%)	8	8	8	5
Production (eggs/bird)	270	276	282	290
Packer/producer price (p/doz.)	105	70	60	47
Feed/bird (kg)	47.5	47.3	45.9	43
Av. feed price (£/t)	270	170	165	164
End of lay carcass weight (kg)	2	2	2	2
Financial data (£/bird)				
Output				
Eggs	23.63	16.10	14.10	11.36
Cull stock	0.35	0.35	0.35	0.35
Less:				
Pullet (20 weeks)	4.33	2.73	2.73	2.72
Mortality	0.35	0.22	0.22	0.14
Total output	19.30	13.50	11.50	8.85
Variable costs				
Feed	12.83	8.04	7.57	7.05
Heat and electricity	0.30	0.30	0.32	0.35
Vet & med.	0.20	0.20	0.20	0.20
Other costs	0.32	0.32	0.33	0.36
Total variable costs	13.64	8.86	8.42	7.96
Gross margin	5.66	4.64	3.08	0.89
Allocatable fixed costs				
Labour	3.00	2.55	1.70	1.02
Deadstock depreciation	1.20	1.20	1.20	1.06
Total fixed costs	4.20	3.75	2.90	2.08
Net margin	1.46	0.89	0.18	-1.19
Farmer to shop sales				
Additional price (p/doz.)	40	40	40	36
Grading/packing/marketing	26	26	26	26
Net additional price (p/doz.)	14	14	14	10
Gross margin (£/bird)	8.81	7.86	6.37	3.31

Source: organic - own estimates, others - *NFU Quarterly Egg Production Bulletin*, July 1996
Other costs have been excluded from the above calculations as detailed in Section 5.2
See Section 7.3 for gross margin sensitivity analysis

Given the low margins per bird, housing costs (Table 5.9) can be a significant factor determining overall profitability. Despite relatively low investment costs per bird place, the shorter life span of mobile and polytunnel housing results in higher annual depreciation costs per bird. The impact of flock size, housing type and market outlet on the profitability of organic egg production units is illustrated in Table 5.10.

Table 5.9 Housing costs for poultry by flock size and housing type

Housing type	*Size (m2)*	*Cost (£/house)*	*Capacity (layers)*	*Cost (£/bird)*	*Life (years)*	*Ann. depr. (£/bird)*
Mobile	40	1500	280	5.36	7	0.77
Polytunnel	70	1500	500	3.00	5	0.60
Free-range	150	12000	1000	12.00	20	0.60
Perchery	200	60000	5000	12.00	25	0.48
Deep litter	700	75000	5000	15.00	25	0.60
Cages	350	120000	10000	12.00	25	0.48

Sources: Mobile, polytunnel, free-range – own estimates, others - Nix (1996)
See Section 3.3 for further information on housing types and requirements

Table 5.10 Profitability of organic egg production units of different flock sizes

	Flock size (layers)			
	200	*500*	*1000*	*5000*
Assumptions				
Annual production (dozen)	4500	11250	22500	112500
Labour (FTE)	0.3	0.35	0.4	0.7
Market outlet	Retail	Retail	Retail	Packer
Building type	Mobile	Polytunnel	Free-range	Perchery
Capital invested	2500	4000	17500	85000
Financial data (£/unit/year)				
Gross margin	1762	4404	8808	28288
Fixed costs				
Labour	4500	5250	6000	10500
Depreciation and repairs	200	400	800	3000
Interest on capital @ 8.5%	300	340	1488	7225
Certification	300	300	300	300
Other (office etc.)	100	150	250	1000
Total fixed costs	5400	6440	8838	22025
Profit	-3638	-2036	-30	6263

Source: own estimates

The results presented in Tables 5.8 to 5.10 suggest that small-scale egg production is not profitable. Larger-scale production can be profitable provided that the market is not undermined by the scale of the production proposed. Small scale production may be profitable if:

- greater efficiencies than those indicated above can be realised;
- lower input costs can be achieved due to location and/or bulk buying;
- higher output prices can be obtained, in particular for small eggs and downgrades;
- own/family labour can be utilised.

The return indicated above for the larger unit is likely to be sufficient in the short term for business purposes where organic poultry production is not the sole enterprise. In the long term, higher profits would be necessary for substantial capital (re)investment in the business.

5.3.3 Pullet rearing

Demand for organic stock clearly exists although any price premium must be comparable with purchasing conventionally reared chicks and undergoing a conversion period. As detailed in section 3.2.3, pullets reared organically are not available in the market. Hence the focus in Table 5.11 is on pullet-rearing costs, assuming they are reared on the same holding as the layer enterprise. With prices for conventionally-reared pullets below published rearing costs (typically £2.50 compared with rearing costs of £2.75 at 16 weeks), pullet rearing does not appear to be profitable, and the higher costs of rearing organic pullets can only be justified in the context of organic egg production. (The additional costs for converted, conventionally-reared pullets shown in Table 5.11 relate to the feeding of organic rations from week 17 and the loss of organic premium in weeks 21 and 22 to complete the full 6 week conversion period.)

Table 5.11 Rearing costs for organic and converted conventional pullets

	Organic, range-reared	*Converted, range-reared*	*Converted, conventional*
Assumptions			
Flock size	1000	5000	5000
Age at transfer (weeks)	20	16	16
Feed consumption (15% extra for range-rearing)			
Starter (0-8 wks)	2.0	2.0	1.9
Grower (9-16 wks)	4.6	4.6	4.0
Grower (17-18 wks)	1.4	1.4	1.4
Pre-lay (19-20 wks)	1.6	1.6	1.6
Mortality (%)	5	5	3
Financial data (£/pullet)			
Livestock costs			
Day old chicks	0.50	0.50	0.50
Chick mortality	0.03	0.03	0.02
Egg premium penalty (21-22 wks)	0.00	0.24	0.24
Total livestock costs	0.53	0.77	0.76
Variable costs			
Feed 0-16 weeks	1.62	1.02	0.92
Feed 17-20 weeks	0.72	0.72	0.72
Heat and electricity	0.21	0.21	0.09
Vaccines	0.15	0.15	0.15
Transportation	0.10	0.10	0.10
Other costs	0.25	0.25	0.23
Total variable costs	3.05	2.45	2.21
Allocatable fixed costs			
Labour	0.35	0.35	0.27
Deadstock depreciation	0.40	0.40	0.33
Total fixed costs	0.75	0.75	0.60
Total rearing costs to 20 weeks	4.33	3.97	3.57

Source: own estimates, *NFU Egg Production Bulletin* (October 1996)
All stock (organic and conventional) receives organic rations from week 17
See Section 7.4 for gross margin sensitivity analysis

According to the gross margin sensitivity analysis (Section 7.4), organically reared pullets would need to achieve a sales price of over £4.50/bird to yield a positive gross margin. Profitability at lower prices can only be achieved if feed prices fall substantially from those detailed in Table 5.12. However, neither of these improvements is likely to provide sufficient margin to cover overheads and proprietors returns, when operating on a small-scale, unless a rearer group arrangement exists or, the rearing is run in conjunction with a laying enterprise and thus overhead costs are spread.

5.4 Discussion

5.4.1 Profitability

The levels of profitability for all the areas of organic poultry production examined are low or non-existent for small-scale production, and only reach reasonable levels of income for large-scale production. Where poultry production is the main or sole enterprise, profits of less than £20,000 will make business development and personal drawing levels very marginal for most businesses.

The main reason for this position, across all areas, is relatively high unit labour and capital costs for small units, as gross margins per bird are generally favourable for organic systems. In addition, the costs of day-old chicks and pullets, transport, feedstuffs and processing, packing and marketing are likely to be higher for small producers because of the small quantities involved.

At the gross margin level, the primary determinants of profitability of all systems analysed are total feed costs (reflecting price, feed conversion efficiency and finishing age), and sales value.

Table bird production in particular, whilst attracting a premium price nearly three times that of intensively reared table birds, faces total feed costs up to five times as high due to higher prices and longer finishing periods. Where total feed costs are kept to reasonable levels, the resulting gross margin per bird is significantly better than conventional, but this can quickly change to a significant loss.

As indicated, feed prices have a major effect on production costs and ultimately the returns necessary from the market place to compensate. A reduction in average feed price of £50/t would raise the profitability of the units detailed by £4,500 (200 birds/week), £11,000 (500 birds/week), and £22,000 (1,000 birds/week), assuming sales values do not fall correspondingly. Conversely, an increase of £50/t in feed costs resulting from the implementation of the EU organic livestock proposals would result in equivalent reductions in profitability. These losses would be compounded by higher costs associated with the longer finishing periods and would make organic table bird production a non-viable option without a corresponding increase in sale price.

Feed consumption is directly related to the quality of the rearing environment, including housing insulation and time spent on range in cold weather. The feed price payable by the producer will depend upon many factors including order quantities, bulk or bagged, analysis, raw material prices, contract and payment terms. Since feed is the single most important economic factor in table bird production, the rate at which it is converted into meat is equally important. The relationship between feed cost per kilogram and feed fed per kilogram of meat produced need careful monitoring to ensure maximum returns. The optimum marketing point for table birds is a combination of many factors including, market requirements, price, feed costs and overhead costs.

Sale price is to a certain degree pegged by alternative product prices, although some organic producers attempt to set prices to reflect production costs. An 18 % increase (to £2.00/kg liveweight) would raise returns by over £7,500 on the 200 bird/week unit and by as much as £37,500 on the 1000 bird/week unit. As production expands and larger-scale outlets (e.g. multiples) are required, the general trend will be for wholesale prices to decline, at least in the longer term. Such increases are therefore most likely to be achieved through direct sales to consumers and to retail outlets, with correspondingly higher marketing costs.

As with table bird production, egg production offers a reasonable profit for the producer provided the scale of the enterprise is large enough. Feed costs make up over 90% of total variable costs and are 80% higher than cage and 60% higher than free range systems. Prices received for eggs, feed costs and pullet price are the three major determinants in egg profitability at the gross margin level. An increase of 10 p/doz. would raise profit levels by £450, £1125, £2250 and £11250 for the 200, 500, 1000 and 5000 layer units respectively. A reduction in feed prices of £50/t would yield similar gains, and would reduce pullet rearing costs by 48 p/bird in the organic case, and by 15 p/bird where conventionally reared pullets are converted. The saving for organically reared pullets would represent an additional £4800 on a 1000 bird unit. An increase of £50/t in feed costs resulting from the implementation of the EU organic livestock proposals would result in equivalent losses, but other costs would not be significantly affected, unlike the table bird case, because fewer changes to current production standards are involved.

5.4.2 Management

Attention to detail is crucial to the profitability and success of any livestock unit and poultry production is no exception. Mortality on many organic units does not appear to be a significant problem. This is most likely a reflection of the small scale and quality of management (attention to detail). Hen mortality results in both a direct monetary loss from the value of the bird but also a consequential loss from the lack of margin/profit that would have been derived from the bird. Lack of bird replacement increases the cost allocation to the remainder of the flock due to the reduction in any economies of scale. Young birds lay at a higher rate and produce shells of a better quality than older hens. Rate of lay and feed consumption, however, deteriorate with age. Cull value varies little between one and two year old hens and, in order to spread depreciation and replacement costs, birds can be kept longer.

Hens that have gone through moult will produce a higher rate of eggs than at the end of the previous production cycle. They do not peak as well as young pullets, and the decline in production after the peak is more rapid than in the first year of production. The economic decision to go for a forced moult is a combination of matching the lower depreciation and replacement costs and larger egg sizes with a deterioration in the egg quality and quantity and higher feed requirements. Some producers, conventional and organic, have established that by use of a forced moult followed by a second laying cycle these costs are optimised and it becomes more profitable to replace layers when they are approaching two years old.

Eggs per bird per year is also a vital measure for layer success. The hen housed average (HHA) is the number of eggs produced over a 52 week laying period and based on the number of birds in the flock housed at point of lay. The number of top quality eggs produced has a major influence on the profitability of egg production systems. Poor management and deterioration in welfare and environment will have a detrimental impact on egg production. Free-range and perchery/barn producers are continually increasing the HHA, becoming ever closer to more conventional cage production targets. Further improvements in this area are likely, but it is not the primary reason for low profitability.

5.4.3 Capital Investment

Profitable organic poultry is dictated by a combination of stock quality, environmental factors, management and marketing and selling performance. When considering the desirability of an investment in a poultry enterprise however, we must further consider both the value of the investment, the opportunity cost and the proprietor's time/management involved before evaluating the success or otherwise of the project. Whatever the solution any investment or development must be in a gradual planned manner rather than a reactionary instinct.

Conventional poultry production reveals a direct relationship between size and efficiency of production, so much in fact that it is difficult to establish if the law of diminishing returns is applicable. The primary problem faced by most organic poultry producers is how big to become or whether to expand at all. Small-scale, family-operated businesses, taking advantage of on-site, exempted slaughtering facilities and realising premium local prices are faced with the difficult decision of whether to remain content (static) for ever, or to expand substantially. Expansion brings with it the associated risks of employing full-time labour, tying up considerable quantities of working capital and investing substantial amounts of capital in processing facilities. This expansion and investment is in the hope, or expectation, that some premium will remain over and above competitor products and sufficient to compensate for the higher investment and risk. Once the expansion route has been taken, automation, and therefore additional capital investment, becomes more essential to optimise labour input. Automation reduces time required for feeding, watering, cleaning and other management tasks. Expansion, through other economies of scale, has the impact of reducing these costs.

Throughout all the units examined the larger units were consistently more profitable due to the ability to spread overheads. The buildings and equipment recommended do not tie up vast quantities of capital. They do however require maintenance and ultimately replacement.

Automation to reduce labour costs in small scale table bird production systems is expensive and unlikely to be recouped. In view of the philosophy of organic farming the possibilities for mechanisation are often limited resulting in very labour intensive operations. This is particularly relevant with reference to processing. Supplying small quantities of birds to a local processor is expensive. On-site processing or co-operation in the operation of slaughtering facilities may be the only viable alternative.

Generally, expansion in the egg rather than table bird market is perceived as easier and less risky by producers. Expansion does require similar increases in land area or area devoted to the enterprise. Land prices and opportunity costs from other enterprises often prohibit expansion. Producers considering expansion, particularly into the wholesale or processing markets, must be aware of the associated risks. Good producers are not necessarily good buyers, processors or retailers. The adage of having all eggs in one basket may appear a deliberate pun. However, producers holding the basket with both hands may well find themselves in a safer position than those juggling two or three baskets.

5.4.4 Conversion

Prior to any assessment of either an existing organic poultry enterprise, a new enterprise or conversion to organic production, the proprietor's aims and objectives for the business must be clearly stated. The purpose of a business is to make more profit. The purpose of the proprietor being in business however may not be so clear cut. Many organic producers trade because they passionately believe in the product, the system or the philosophy. Others, because it is an expansion of a hobby, satisfies income requirements or simply because they gain a great deal of personal satisfaction from producing and selling direct to customers. However, for a significant proportion of producers it is their livelihood and thus needs to be assessed accordingly. Before any investment is committed, it must be clear what the goals are.

Based on current estimates of supply and demand the market for organic poultry looks promising. The potential lack of customer loyalty to organic poultry products as compared to other 'welfare friendly' systems is a real threat to profitability and future success, although recent trends in the development of the organic food market indicate increased consumer understanding of and loyalty to organic meat products. With the exception of traditional Christmas markets, the underlying success and future development potential for organic poultry may be fragile in the short term, although the organic market as a whole is currently one of the fastest growing sectors in terms of

retail sales. Prior to any establishment, development or diversification producers must undertake a comprehensive market analysis and must always secure a market, pre-production.

Tables 5.3 and 5.5 indicate the potential for increased profitability where free-range and barn-producers with outside access convert to organic production, assuming that current organic prices 50% higher than free-range (for both meat and eggs) are maintained, and that feed prices do not increase further. Existing free-range producers converting are at an advantage compared to organic producers diversifying into poultry production, given their existing investments in stock, housing and expertise. However, they face two significant disadvantages: the need to convert rangeland to organic status (with the necessary two year delay), and the availability of organic cereals. The latter problem is most easily solved where organic cereals are produced on the same holding, illustrating the advantages of integrating organic poultry production with other enterprises in a diversified organic farming system. While production costs for home-grown organic cereals are very low (ca. £20/t), the opportunity costs of not selling these into the open market should be included in any financial assessment.

The proposal in the EU organic livestock standards for a stocking rate limit of 2.0 LU per farm ha implies that a 5,000 layer unit would require 35 ha of organically managed land present on the holding and not utilised by other livestock. The amount required for ranging would only be 5 ha (8 ha in the case of Soil Association standards). A 50,000 bird/year table bird unit with 12,500 birds present at any one time (4 batches per house on 12-13 week cycle) would require 25 ha organically managed land and only 1.2 ha minimum rangeland (based on 2 m^2/bird for 6 weeks = 6,000 birds at any one time). In practice, the rangeland requirement will be higher than this to allow for resting for vegetation regrowth and parasite control. This requirement for additional organic land is likely to represent a significant constraint for some of the existing larger egg and poultry meat producers, as well as those considering conversion.

The attractiveness of conversion for conventional producers will also depend on the success of alternative 'welfare friendly' systems in improving financial returns. The market for RSPCA Freedom Food eggs and meat continues to expand rapidly and many producers see this as a more realistic way forward. Currently, organic poultry products are succeeding to maintain a significant price differential over alternative products, but this is only through offering additional quality characteristics (freshness, flavour, environmental benefits) in addition to potential animal welfare benefits. These aspects of quality will continue to need attention if organic poultry is to be seen as a premium quality product once 'welfare-friendly' products have captured a significant share, perhaps even the majority, of the conventional market.

In the intensive sector a degree of the financial risk has been reduced by vertical integration and, coupled with the trend towards larger units, has resulted in producers still being able to return some sort of profit, via large volumes, in spite of very narrow margins. This vertical integration and expansion is only partly available to organic producers, but is becoming more common, particularly for egg production. For table bird production, investment in on-site processing and packaging and producer to retailer marketing represents a form of vertical integration, but requires substantial investments and compliance with health and hygiene standards. Co-operation with other producers can enable economies of scale and expansion (via wholesale/co-operative type arrangements) to spread risk.

5.5 Conclusions

An analysis based on current premium prices and feed costs indicates that both organic meat and egg production can achieve better gross margins per bird than any of the alternative production systems evaluated. However, the likely increases in feed prices which would result from the stricter EU organic livestock proposals could lead to significant negative gross margins unless prices received by producers increase correspondingly.

Premium prices are essential to achieve these performance levels and can not be obtained if a market is not identified in advance.

The financial performance figures presented indicate standard/expected performance. Actual performance can be better or worse that these figures. The degree of variability and risk of an adverse outcome are hard to assess on the basis of current data.

A narrowing of price differentials between free-range and organic poultry, or continuing organic feed shortages/price increases could reduce the advantage which organic poultry production currently displays. This may arise if new entrants cause (possibly short-term) disruption to existing markets.

To maintain prices, all quality characteristics of organic poultry will need to be emphasised - being 'organic' will not be sufficient on its own. Consumer education to differentiate organic from alternative welfare-friendly standards may be required.

The analysis indicates the problems of small-scale units in providing an adequate level of return to investment. Smaller units require less capital investment, but housing and labour costs per bird are generally higher than in the case of larger units where economies of scale may be significant.

Economies of scale will need to be sought through capital investment, automation and collaboration between producers, particularly in the area of packing, processing and slaughtering.

There may be benefits to be gained from vertical and horizontal integration, between producers and feed compounders and processors, and possibly through integrating meat and egg production on individual units.

The need for larger units to maintain an acceptable level of profitability represents a challenge to the desire for smaller units to meet welfare, land use, and integration objectives highlighted in Sections 2 and 3. Proposals to limit group/flock sizes, and stocking rates, will require particularly careful consideration in this regard.

In general, several of the changes proposed in the draft EU organic livestock regulation could have significant adverse consequences on the financial performance of existing organic poultry producers. In addition, the uncertainty about possible changes to organic standards in line with these proposals could act as a deterrent to conversion.

Although some specialist poultry producers are currently involved in organic poultry production, it may be that the only long-term future for organic poultry is as part of a diversified organic farming system, for financial and technical reasons as well as the need to meet the proposed EU standards.

Successful organic egg and meat production is ultimately dependent upon productivity and cost of stock; scale of production, quality of housing/environment, management, feed quality and cost, and marketing success.

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7 Appendices

7.1 Organisations and addresses

7.1.1 Certification bodies

UKROFS: c/o Ministry of Agriculture, Fisheries and Food, Room 320c Nobel House, 17 Smith Square, London SW1P 3JR. Tel: 0171 238 5781

Soil Association: 86 Colston Street, Bristol BS1 5BB. Tel: 0117 929 0661

Organic Farmers and Growers Ltd: 50 High Street, Soham, Ely, Cambs. CB7 5HP Tel: 01353 720250

Organic Food Federation: The Tithe House, Peaseland Green, Elsing, East Dereham, Norfolk, NR20 3DY. Tel: 01362 637314

RSPCA/Freedom Foods (not organic): The Causeway, Horsham, West Sussex, RH12 1HG

7.1.2 Information sources

British Free-Range Egg Producers Association: Cheviot House, 71 Castle Street, Salisbury, Wiltshire

NFU Poultry: Agriculture House, Willie Snaith Road, Newmarket, Suffolk, CB8 7SN

Organic Advisory Service, Elm Farm Research Centre, Hamstead Marshall, Newbury, Berks. RG20 0HR. Tel: 01488 658 298

Organic Conversion Information Service Helpline: 0117 922 7707

7.1.3 Marketing agents

Thames Valley Eggs: Membury, Lambourn Woodlands, Hungerford, berks. RG17 7TX

Stonegate Farmers Feed Mills, Westover Trading Estate, Langport, Somerset, England, TA10 9RB. Tel: 01227 709666

Eastbrook Farm: Bishopstone, Swindon, Wiltshire SN6 8PW

Graig Farm: Dolau, Llandrindod Wells, Powys LD1 5TL. Tel: 01597 851655

Organic Livestock Marketing Co-operative, c/o Mary Weston, Carpenters House, Tur Langton, Kibworth,.Leics. LE8 0PJ. Tel: 01858 545564

Organic Farmers and Growers Ltd, c/o Bill Allen, 6 Haconby Lane, Morton, Bourne, Lincs. PE10 0NP. Tel: 01778 570629

7.1.4 Organic poultry feed compounders

Batchley Mill: John and Mary Wakefield Jones, Batchley, Bromyard, Herefordshire HR7 4TH Tel: 01885 483377

Chapman Vitrition Ltd: Ryhall Road, Stanford, Lincolnshire PE9 1TZ Tel: 01780 55651

H & I Glasser Ltd.: Wilstone, nr Tring, Hertfordshire HP23 4NU

Hi-Peak Feeds: 12 Ashbourne Road, Derby DE22 3AA

Other companies may be willing to compound feed to meet customer requirements.

7.2 Sensitivity analysis - table bird production

The following tables illustrate the sensitivity of gross margin values (£/bird) to changes in the variables indicated with all other factors held constant. The boxed value(s) represents the central gross margin assumption used in Section 5 of this report.

7.2.1 Broiler price and liveweight

	Price (p/kg)														
Weight (kg)	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240
2.00	-1.53	-1.33	-1.13	-0.93	-0.73	-0.53	-0.33	-0.13	0.08	0.28	0.48	0.68	0.88	1.08	1.28
2.10	-1.43	-1.22	-1.01	-0.79	-0.59	-0.38	-0.17	0.04	0.26	0.47	0.68	0.89	1.10	1.31	1.52
2.20	-1.33	-1.11	-0.89	-0.67	-0.45	-0.23	-0.00	0.22	0.44	0.66	0.88	1.10	1.32	1.54	1.76
2.30	-1.23	-0.99	-0.77	-0.53	-0.31	-0.07	0.16	0.39	0.62	0.85	1.08	1.31	1.54	1.77	2.00
2.40	-1.13	-0.88	-0.65	-0.40	-0.17	0.08	0.32	0.56	0.80	1.04	1.28	1.52	1.76	2.00	2.24
2.50	-1.03	-0.77	-0.52	-0.27	-0.02	0.23	0.48	**0.73**	0.98	1.23	1.48	1.73	1.98	2.23	2.48
2.60	-0.92	-0.66	-0.40	-0.14	0.12	0.38	0.64	0.90	1.16	1.42	1.68	1.94	2.20	2.46	2.72
2.70	-0.82	-0.55	-0.28	-0.01	0.26	0.53	0.80	1.07	1.34	1.61	1.88	2.15	2.42	2.69	2.96
2.80	-0.72	-0.44	-0.16	0.12	0.40	0.68	0.96	1.24	1.52	1.80	2.08	2.36	2.64	2.92	3.20

7.2.2 Feed quantity and price

	Price (£/t)														
Quantity (kg)	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
5	2.30	2.25	2.20	2.15	2.10	2.05	2.00	1.95	1.90	1.85	1.80	1.75	1.70	1.65	1.60
6	2.09	2.03	1.97	1.91	1.85	1.79	1.73	1.67	1.61	1.55	1.49	1.43	1.37	1.31	1.25
7	1.88	1.81	1.74	1.67	1.60	1.53	1.46	1.39	1.32	1.25	1.18	1.11	1.04	0.97	0.90
8	1.67	1.59	1.51	1.43	1.35	1.27	1.19	1.11	1.03	0.95	0.87	0.79	0.71	0.63	0.55
9	1.46	1.37	1.28	1.19	1.10	1.01	0.92	0.83	0.74	**0.65**	0.56	0.47	0.38	0.29	0.20
10	1.25	1.15	1.05	0.95	0.85	0.75	0.65	0.55	0.45	0.35	0.25	0.15	0.05	-0.05	-0.15
11	1.04	0.93	0.82	0.71	0.60	0.49	0.38	0.27	0.16	0.05	-0.06	-0.17	-0.28	-0.39	-0.50
12	0.83	0.71	0.59	0.47	0.35	0.23	0.11	-0.01	-0.13	-0.25	-0.37	-0.49	-0.61	-0.73	-0.85
13	0.62	0.49	0.36	0.23	0.10	-0.03	-0.16	-0.29	-0.42	-0.55	-0.68	-0.81	-0.94	-1.07	-1.20

7.2.3 Liveweight value and feed cost

Value (£/bird)	*Feed cost (£/bird)* 1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50
1.50	-0.40	-0.65	-0.90	-1.15	-1.40	-1.65	-1.90	-2.15	-2.40	-2.65	-2.90	-3.15	-3.40	-3.65	-3.90
1.75	-0.15	-0.40	-0.65	-0.90	-1.15	-1.40	-1.65	-1.90	-2.15	-2.40	-2.65	-2.90	-3.15	-3.40	-3.65
2.00	0.10	-0.15	-0.40	-0.65	-0.90	-1.15	-1.40	-1.65	-1.90	-2.15	-2.40	-2.65	-2.90	-3.15	-3.40
2.25	0.35	0.10	-0.15	-0.40	-0.65	-0.90	-1.15	-1.40	-1.65	-1.90	-2.15	-2.40	-2.65	-2.90	-3.15
2.50	0.60	0.35	0.10	-0.15	-0.40	-0.65	-0.90	-1.15	-1.40	-1.65	-1.90	-2.15	-2.40	-2.65	-2.90
2.75	0.85	0.60	0.35	0.10	-0.15	-0.40	-0.65	-0.90	-1.15	-1.40	-1.65	-1.90	-2.15	-2.40	-2.65
3.00	1.10	0.85	0.60	0.35	0.10	-0.15	-0.40	-0.65	-0.90	-1.15	-1.40	-1.65	-1.90	-2.15	-2.40
3.25	1.35	1.10	0.85	0.60	0.35	0.10	-0.15	-0.40	-0.65	-0.90	-1.15	-1.40	-1.65	-1.90	-2.15
3.50	1.60	1.35	1.10	0.85	0.60	0.35	0.10	-0.15	-0.40	-0.65	-0.90	-1.15	-1.40	-1.65	-1.90
3.75	1.85	1.60	1.35	1.10	0.85	0.60	0.35	0.10	-0.15	-0.40	-0.65	-0.90	-1.15	-1.40	-1.65
4.00	2.10	1.85	1.60	1.35	1.10	0.85	0.60	0.35	0.10	-0.15	-0.40	-0.65	-0.90	-1.15	-1.40
4.25	2.35	2.10	1.85	1.60	1.35	1.10	0.85	0.60	0.35	0.10	-0.15	-0.40	-0.65	-0.90	-1.15
4.50	2.60	2.35	2.10	1.85	1.60	1.35	1.10	0.85	0.60	0.35	0.10	-0.15	-0.40	-0.65	-0.90
4.75	2.85	2.60	2.35	2.10	1.85	1.60	1.35	1.10	0.85	0.60	0.35	0.10	-0.15	-0.40	-0.65
5.00	3.10	2.85	2.60	2.35	2.10	1.85	1.60	1.35	1.10	0.85	0.60	0.35	0.10	-0.15	-0.40
5.25	3.35	3.10	2.85	2.60	2.35	2.10	1.85	1.60	1.35	1.10	0.85	0.60	0.35	0.10	-0.15

7.3 Sensitivity analysis - egg production

The following tables illustrate the sensitivity of gross margin values (£/bird) to changes in the variables indicated with all other factors held constant. The boxed value(s) represents the central gross margin assumption used in Section 5 of this report.

7.3.1 Egg quantity and egg price

	Quantity (dozen/bird)														
Price (p/doz.)	17.5	18	18.5	19	19.5	20	20.5	21	21.5	22	22.5	23	23.5	24	24.5
60	-7.47	-7.17	-6.87	-6.57	-6.27	-5.97	-5.67	-5.37	-5.07	-4.77	-4.47	-4.17	-3.87	-3.57	-3.27
70	-5.72	-5.37	-5.02	-4.67	-4.32	-3.97	-3.62	-3.27	-2.92	-2.57	-2.22	-1.87	-1.52	-1.17	-0.82
80	-3.97	-3.57	-3.17	-2.77	-2.37	-1.97	-1.57	-1.17	-0.77	-0.37	0.03	0.43	0.83	1.23	1.63
90	-2.22	-1.77	-1.32	-0.87	-0.42	0.03	0.48	0.93	1.38	1.83	2.28	2.73	3.18	3.63	4.08
100	-0.47	0.03	0.53	1.03	1.53	2.03	2.53	3.03	3.53	4.03	**4.53**	5.03	5.53	6.03	6.53
110	1.28	1.83	2.38	2.93	3.48	4.03	4.58	5.13	5.68	6.23	**6.78**	7.33	7.88	8.43	8.98
120	3.03	3.63	4.23	4.83	5.43	6.03	6.63	7.23	7.83	8.43	9.03	9.63	10.23	10.83	11.43
130	4.78	5.43	6.08	6.73	7.38	8.03	8.68	9.33	9.98	10.63	11.28	11.93	12.58	13.23	13.88
140	6.53	7.23	7.93	8.63	9.33	10.03	10.73	11.43	12.13	12.83	13.53	14.23	14.93	15.63	16.33
150	8.28	9.03	9.78	10.53	11.28	12.03	12.78	13.53	14.28	15.03	15.78	16.53	17.28	18.03	18.78

7.3.2 Feed quantity and feed price

	Quantity (kg/bird)														
Price (£/t)	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
230	8.13	7.90	7.67	7.44	7.21	6.98	6.75	6.52	6.29	6.06	5.83	5.60	5.37	5.14	4.91
240	7.68	7.44	7.20	6.96	6.72	6.48	6.24	6.00	5.76	5.52	5.28	5.04	4.80	4.56	4.32
250	7.23	6.98	6.73	6.48	6.23	5.98	5.73	5.48	5.23	4.98	4.73	4.48	4.23	3.98	3.73
260	6.78	6.52	6.26	6.00	5.74	5.48	5.22	4.96	4.70	4.44	4.18	3.92	3.66	3.40	3.14
270	6.33	6.06	5.79	5.52	5.25	4.98	4.71	4.44	4.17	3.90	3.63	3.36	3.09	2.82	2.55
280	5.88	5.60	5.32	5.04	4.76	4.48	4.20	3.92	3.64	3.36	3.08	2.80	2.52	2.24	1.96
290	5.43	5.14	4.85	4.56	4.27	3.98	3.69	3.40	3.11	2.82	2.53	2.24	1.95	1.66	1.37
300	4.98	4.68	4.38	4.08	3.78	3.48	3.18	2.88	2.58	2.28	1.98	1.68	1.38	1.08	0.78
310	4.53	4.22	3.91	3.60	3.29	2.98	2.67	2.36	2.05	1.74	1.43	1.12	0.81	0.50	0.19
320	4.08	3.76	3.44	3.12	2.80	2.48	2.16	1.84	1.52	1.20	0.88	0.56	0.24	-0.08	-0.40

7.3.3 Egg sales and feed cost

	Egg sales (£/bird)														
Feed cost (£/bird)	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38
10	-5.15	-3.15	-1.15	0.85	2.85	4.85	6.85	8.85	10.85	12.85	14.85	16.85	18.85	20.85	22.85
11	-6.15	-4.15	-2.15	-0.15	1.85	3.85	5.85	7.85	9.85	11.85	13.85	15.85	17.85	19.85	21.85
12	-7.15	-5.15	-3.15	-1.15	0.85	2.85	4.85	6.85	8.85	10.85	12.85	14.85	16.85	18.85	20.85
13	-8.15	-6.15	-4.15	-2.15	-0.15	1.85	3.85	5.85	7.85	9.85	11.85	13.85	15.85	17.85	19.85
14	-9.15	-7.15	-5.15	-3.15	-1.15	0.85	2.85	4.85	6.85	8.85	10.85	12.85	14.85	16.85	18.85
15	-10.15	-8.15	-6.15	-4.15	-2.15	-0.15	1.85	3.85	5.85	7.85	9.85	11.85	13.85	15.85	17.85
16	-11.15	-9.15	-7.15	-5.15	-3.15	-1.15	0.85	2.85	4.85	6.85	8.85	10.85	12.85	14.85	16.85
17	-12.15	-10.15	-8.15	-6.15	-4.15	-2.15	-0.15	1.85	3.85	5.85	7.85	9.85	11.85	13.85	15.85
18	-13.15	-11.15	-9.15	-7.15	-5.15	-3.15	-1.15	0.85	2.85	4.85	6.85	8.85	10.85	12.85	14.85
19	-14.15	-12.15	-10.15	-8.15	-6.15	-4.15	-2.15	-0.15	1.85	3.85	5.85	7.85	9.85	11.85	13.85

20	-15.15	-13.15	-11.15	-9.15	-7.15	-5.15	-3.15	-1.15	0.85	2.85	4.85	6.85	8.85	10.85	12.85

7.4 Sensitivity analysis - pullet rearing

The following tables illustrate the sensitivity of gross margin values (£/bird) to changes in the variables indicated with all other factors held constant. The boxed value(s) represents the central gross margin assumption used in Section 5 of this report.

7.4.1 Point-of-lay bird price and chick cost

	Point-of-lay price (p/bird)														
Chick cost (£/bird)	360	370	380	390	400	410	420	430	440	450	460	470	480	490	500
0.25	-0.46	-0.36	-0.26	-0.16	-0.06	0.04	0.14	0.24	0.34	0.44	0.54	0.64	0.74	0.84	0.94
0.30	-0.51	-0.41	-0.31	-0.21	-0.11	-0.01	0.09	0.19	0.29	0.39	0.49	0.59	0.69	0.79	0.89
0.45	-0.67	-0.57	-0.47	-0.37	-0.27	-0.17	-0.07	0.03	0.13	0.23	0.33	0.43	0.53	0.63	0.73
0.50	-0.72	-0.62	-0.52	-0.42	-0.32	-0.22	-0.12	-0.02	0.08	0.18	0.28	0.38	0.48	0.58	0.68
0.55	-0.77	-0.67	-0.57	-0.47	-0.37	-0.27	-0.17	-0.07	0.03	0.13	0.23	0.33	0.43	0.53	0.63
0.60	-0.83	-0.73	-0.63	-0.53	-0.43	-0.33	-0.23	-0.13	-0.03	0.07	0.17	0.27	0.37	0.47	0.57
0.65	-0.88	-0.78	-0.68	-0.58	-0.48	-0.38	-0.28	-0.18	-0.08	0.02	0.12	0.22	0.32	0.42	0.52
0.70	-0.93	-0.83	-0.73	-0.63	-0.53	-0.43	-0.33	-0.23	-0.13	-0.03	0.07	0.17	0.27	0.37	0.47
0.75	-0.98	-0.88	-0.78	-0.68	-0.58	-0.48	-0.38	-0.28	-0.18	-0.08	0.02	0.12	0.22	0.32	0.42

7.4.2 Feed quantity and price

Quantity (kg/bird) \ *Feed price (£/t)*	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
8.0	1.24	1.16	1.08	1.00	0.92	0.84	0.76	0.68	0.60	0.52	0.44	0.36	0.28	0.20	0.12
8.5	1.16	1.07	0.99	0.90	0.82	0.73	0.65	0.56	0.48	0.39	0.31	0.22	0.14	0.05	-0.03
9.0	1.08	0.99	0.90	0.81	0.72	0.63	0.54	0.45	0.36	0.27	0.18	0.09	-0.00	-0.09	-0.18
9.5	1.00	0.90	0.81	0.71	0.62	0.52	0.43	0.33	0.24	0.14	0.05	-0.05	-0.14	-0.24	-0.33
10.0	0.92	0.82	0.72	0.62	0.52	0.42	0.32	0.22	0.12	0.02	-0.08	-0.18	-0.28	-0.38	-0.48
10.5	0.84	0.73	0.63	0.52	0.42	0.31	0.21	0.10	-0.00	-0.11	-0.21	-0.32	-0.42	-0.53	-0.63
11.0	0.76	0.65	0.54	0.43	0.32	0.21	0.10	-0.01	-0.12	-0.23	-0.34	-0.45	-0.56	-0.67	-0.78
11.5	0.68	0.56	0.45	0.33	0.22	0.10	-0.01	-0.13	-0.24	-0.36	-0.47	-0.59	-0.70	-0.82	-0.93
12.0	0.60	0.48	0.36	0.24	0.12	-0.00	-0.12	-0.24	-0.36	-0.48	-0.60	-0.72	-0.84	-0.96	-1.08

7.4.3 Point-of-lay bird value and feed cost

Bird value (p/bird) \ *Feed cost (p/bird)*	110	130	150	170	190	210	230	250	270	290	310	330	350	370	390
250	-0.58	-0.78	-0.98	-1.18	-1.38	-1.58	-1.78	-1.98	-2.18	-2.38	-2.58	-2.78	-2.98	-3.18	-3.38
275	-0.33	-0.53	-0.73	-0.93	-1.13	-1.33	-1.53	-1.73	-1.93	-2.13	-2.33	-2.53	-2.73	-2.93	-3.13
300	-0.08	-0.28	-0.48	-0.68	-0.88	-1.08	-1.28	-1.48	-1.68	-1.88	-2.08	-2.28	-2.48	-2.68	-2.88
325	0.17	-0.03	-0.23	-0.43	-0.63	-0.83	-1.03	-1.23	-1.43	-1.63	-1.83	-2.03	-2.23	-2.43	-2.63
350	0.42	0.22	0.02	-0.18	-0.38	-0.58	-0.78	-0.98	-1.18	-1.38	-1.58	-1.78	-1.98	-2.18	-2.38
375	0.67	0.47	0.27	0.07	-0.13	-0.33	-0.53	-0.73	-0.93	-1.13	-1.33	-1.53	-1.73	-1.93	-2.13
400	0.92	0.72	0.52	0.32	0.12	-0.08	-0.28	-0.48	-0.68	-0.88	-1.08	-1.28	-1.48	-1.68	-1.88
425	1.17	0.97	0.77	0.57	0.37	0.17	-0.03	-0.23	-0.43	-0.63	-0.83	-1.03	-1.23	-1.43	-1.63
450	1.42	1.22	1.02	0.82	0.62	0.42	0.22	0.02	-0.18	-0.38	-0.58	-0.78	-0.98	-1.18	-1.38
475	1.67	1.47	1.27	1.07	0.87	0.67	0.47	0.27	0.07	-0.13	-0.33	-0.53	-0.73	-0.93	-1.13
500	1.92	1.72	1.52	1.32	1.12	0.92	0.72	0.52	0.32	0.12	-0.08	-0.28	-0.48	-0.68	-0.88