ORGANIC FARMING AND AGRICULTURAL SUSTAINABILITY

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Introduction

Organic farming is increasingly recognised, by consumers, farmers, environmentalists and policy-makers, as one of a number of possible models for environmental, social and financial sustainability in agriculture. It has taken a long time to get this far. Organic farming's roots can be traced back more than 100 years, to various individuals and movements concerned about soil conservation, pesticide use, resource use, animal welfare, land stewardship, nature conservation, diet, human health and social justice. Certified organic production dates back nearly 30 years (70 years in the case of Demeter-certified bio-dynamic production), with production standards reflecting the evolving priorities and objectives of organic farming. But the main role of organic production standards and certification has been to define a distinct market for the products, so that consumer willingness to pay for the benefits of organic farming can be harnessed to compensate producers for internalising external costs. As such, the market developed as a means to achieving the ethical objectives of organic farming, not an end in itself.

Recent years have seen very rapid growth in organic farming. In 1985, certified and policy-supported organic production accounted for just 100,000 ha in western Europe (EU and EFTA), or less than 0.1% of the total agricultural area. By the end of 1997, this figure had increased to 2.3 million ha, more than 1.6% of the total agricultural area (Foster and Lampkin, 1999). It is likely that by the end of 1998, nearly 3.0 million ha was managed organically, representing a 30-fold increase in 13 years. These figures hide great variability within and between countries. Several countries have now achieved 5-10% of their agricultural area managed organically, and in some cases more than 30% on a regional basis. Countries like Austria, Italy, Sweden and Switzerland, and this year the UK, have seen the fastest rates of growth. But a number of others still languish below the 1% level. Alongside the increase in the supply base, the market for organic produce has also grown, but statistics on the overall size of the market for organic produce in Europe are still very limited. Recent estimates have placed the retail sales value of the European market for organic food at £3-5 billion in 1997.

70% of the expansion in the land area has taken place in the last five years, since the implementation in 1993 of EC Regulation 2092/91 defining organic crop production, and the widespread application of policies to support conversion to and continued organic farming as part of the agri-environment programme (EC Reg. 2078/92). The former has provided a secure basis for the agri-food sector to respond to the rapidly increasing demand for organic food across Europe. The latter has provided the financial basis to overcome perceived and real barriers to conversion.

Despite some obvious successes in terms of consumer demand and supply growth, many policy makers, academics and farming leaders are still uncertain about the potential contribution of organic farming to the future development of mainstream agriculture, and to sustainability issues in particular. Organic farming is considered by some to be too idealistic and restrictive. What is needed, they argue, is an intermediate approach, such as integrated crop management that is not as 'extreme' as organic farming and is therefore more likely to be acceptable to the majority of farmers. Policy-makers face a difficult choice. Should they encourage more organic farming, which may offer more environmental and other benefits than the intermediate approaches, but will only be adopted by a minority of farmers? Or should they encourage the intermediate approaches, which, although the environmental benefits are more limited, may be adopted by more farmers, with possibly greater overall impact? And if, contrary to expectations, organic farming did become widely adopted, how could we feed a growing global population? This paper seeks to address a number of these questions.

Sustainable agriculture, organic farming and agricultural sustainability

The debate about sustainable agriculture has focused frequently on questions of definitions, ranging from broad definitions of sustainable development (e.g. WCED, 1987) to definitions reflecting social, economic and environmental concerns in an agricultural context. Those involved in organic farming research have watched this debate with some bemusement, particularly when faced with comments such as:

'sustainable agriculture represents an objective while organic farming is merely a set of practices'

as if organic farming practices were not determined in the context of specific objectives such as those set out in the IFOAM standards (IFOAM, 1998). Similarly confusing is the phrase:

'sustainable and organic agriculture'

implying that organic farming is something other than sustainable, while there exists some other approach which is sustainable (often low-input sustainable agriculture (LISA) or integrated crop management (ICM) approaches, using reduced rates of external inputs but not going as far as organic farming).

Lockeretz (1990) suggested that the word sustainable had become so overused in the process that it had become synonymous with *'good'* and thereby virtually meaningless. Others have attempted to replace sustainable with other words, such as *'regenerative'*, reflecting the previous history of attempting to change the 'O' (organic) word. All are doomed to failure so long as the concept of sustainable agriculture (or for that matter organic farming) remains poorly understood or a focus for misrepresentation.

Of the multitude of sustainable agriculture definitions which exist, my own preference is for a slightly modified version of that used in New Zealand (MAF, 1994):

Sustainable agriculture is the use of farming systems and practices that maintain or enhance:

- *the supply and quality of food and fibre*
- *the financial viability of farm businesses*
- *the social and cultural identity of rural communities*
- *the natural resource base*
- *other ecosystems that are influenced by agriculture*

Implicit within this definition is a recognition that simply sustaining or maintaining a resource which may already be degraded is not enough – hence the use of the word 'enhance'. The multi-objective nature of sustainability (encompassing environmental/biological, economic and social issues is also clear. Less obvious are the differing time-perspectives (particularly of individual objectives such as viability of farm businesses and protecting the natural resource base), and the potential for conflicts or trade-offs between the different objectives. Pretty (1995) argues that: *'it is important to clarify what is being sustained, for how long, for whose benefit and at whose (and what) cost, over what area and measured by what criteria'*. This implies assessing and trading off values and beliefs. It also implies that sustainability is a relative rather than an absolute term. Campbell (1994) puts it thus: *'attempts to define sustainability miss the point that, like beauty, sustainability is in the eye of the beholder .. It is inevitable that assessments of relative sustainability are socially constructed, which is why there are so many definitions'*.

In this context, organic farming can be defined as:
'*an approach to agriculture which aims for social, environmental and economic sustainability and animal welfare by:*

- *minimising use of external resources*
- *maximising use of locally-derived renewable resources and agro-ecosystem management*
- *using the market to compensate for internalising external costs.'*

As such, organic farming shares the fundamental objectives of agricultural sustainability and deserves to be assessed alongside LISA/ICM as a mainstream part of sustainable agriculture. Indeed, the concept of sustainable agriculture owes a considerable debt to organic farming, not least the first significant usage of the term in the context of the 1977 IFOAM conference 'Towards a Sustainable Agriculture' (Besson and Vogtmann, 1978). This predates many of the recorded first uses of the term in the North American literature.

These definitions raise some key issues about attempts to determine the sustainability of different farming systems.

Firstly, the existence of multiple objectives (common to almost all attempts at definitions) implies the potential for conflict between the objectives, or at least a trade-off between them. It is highly unlikely that all objectives can be met fully simultaneously. Those of an economics persuasion might recognise the relevance of the concept of a *Pareto* optimum or at least a *Pareto* improvement in this (loosely analogous) context. As a minimum, agricultural sustainability might be improved overall if performance can be improved with respect to any one of the objectives, without causing a worsening with respect to any of the others. A (sustainability) *Pareto* optimum might be said to exist where it is no longer possible to improve performance with respect to any of the objectives without causing a worsening elsewhere (*pace* Pareto). Most would recognise the possibility of trade-offs between objectives in this situation – but how can such trade-offs be evaluated?

Secondly, the significance attached to each of these objectives depends on the standpoint of the individual: a farmer might attach highest weighting to the viability of the farm business, a politician might be most concerned about food security or social/cultural objectives, while the environmentalist will focus primarily on the environmental objectives.

It is highly unlikely that the Holy Grail of perfect agricultural sustainability can ever be achieved. The best that can be hoped for is incremental improvements in the right direction. It is therefore fundamentally incorrect to claim that either organic or integrated/LISA systems represent a sustainable agriculture. More relevant is the extent of their relative contributions to agricultural sustainability.

An assessment of the sustainability of different farming systems requires the definition of criteria to determine whether, or how well, the sustainability objectives have been achieved. These criteria may be used to define a simple dividing line separating sustainable and unsustainable practices and systems (e.g. Vereijken, 1994). This concept is not dissimilar to the approach of existing organic farming standards with permitted and prohibited practices. Alternatively, criteria could be developed to measure the degree of sustainability, with improvements beyond the basic minimum level of sustainability also receiving recognition.

Closely linked to the use of such criteria is the use of indicators to represent complex systems (OECD, 1996; EPA, 1995). As Dabbert (1997) explains, indicators may be close to the concept or issue under scrutiny, with high validity but often difficult or expensive to obtain, or they may be further removed from the issue, of lower validity as a result, but often easier or less costly to obtain. The art of indicator selection is to achieve an appropriate balance between closeness, validity and detail on the one hand, and cost and managerial usefulness on the other.

Sustainability of organic farming

The aim in this paper is to provide a generalised assessment of the performance of organic farming with respect to sustainability objectives. Where possible, contrasts are made with conventional intensive and integrated farm systems, although comparisons of this type are scarce. A more specific assessment of organic milk production, using the framework outlined above, can be found in Lampkin (1997). The analysis is structured around the five sustainability objectives listed above, namely the supply and quality of food and fibre, the financial viability of farm businesses, the social and cultural identity of rural communities, the natural resource base, and other ecosystems that are influenced by agriculture.

Objective 1: Supply and quality of food and fibre

Food quality and safety are key concerns for consumers, processors and governments, particular in relation to health concerns such as fats, BSE, pesticide residues and most recently genetically modified organisms (GMOs). The evidence on the food quality and safety impacts of organic farming is mixed (see, for example, Lampkin, 1990). Various studies show advantages for organic farming in specific instances (for example nitrate and Vitamin C levels in leafy vegetables), but also disadvantages such as lower protein levels in milling wheat and poor visual appearance of some fruit and vegetable crops due to pest and disease damage. Some studies have shown positive impacts on fertility, morbidity and mortality of animals fed organically produced diets. Other studies have shown that organic farming cannot always guarantee freedom from contamination by pesticides, BSE, GMOs, heavy metals and other pollutants because of cross-contamination problems. However, the restrictions in organic production standards on the use of practices which might lead to these problems do reduce significantly any real or perceived risk that consumers might face. Critics have also pointed to the potential for increased levels of natural toxins and harmful organisms in organic food, based on the theoretical notion that removal of pesticides will lead to higher pest and disease pressure. These claims have not been substantiated by actual studies and do not take account of the need to design organic systems specifically to minimise pest and disease pressure. What is clear from all the evidence is that the way food is produced affects its quality. What is not yet clear is that organic systems are consistently better than other farming systems, or what the implications are for human health, particularly given interactions with diet, lifestyle and environmental factors.

For many, security of supply in the context of a growing global population is a more significant issue, particularly given the association of organic methods with lower levels of production. For example, crops yields are 20-40% lower in organic systems compared with conventional systems in western Europe (Lampkin and Padel, 1994). Rotational constraints prevent crops being grown so frequently on arable farms, so that the overall yield reduction for cereal crops may be 40-50%. On the other hand, attempts to model the likely impacts of widespread adoption of organic farming (various authors in Lampkin and Padel, 1994) suggest that grain legumes are likely to increase substantially, while vegetable crops will stay stable or increase slightly, and other crops such as oilseeds and sugar beet will decline by as much as 75%. But most of these assumptions reflect current demand patterns, which place more emphasis on horticultural crops and less emphasis on crops for processing such as oilseeds and sugar beet. The extent to which these crops are produced organically will depend on the market demand for them and this is still very difficult to predict. Future livestock production levels are equally difficult to determine. It is reasonable to suppose that the production of ruminant livestock might decline by 10-30%, and that pigs and poultry production levels might be substantially lower as a consequence of reverting to land-based, extensive systems.

Whether these levels of output reduction represent significant threats to global food security depends on a number of factors, including:

- the consumption (and availability) of non-renewable or degradeable resources, in particular soils, water and energy, to produce the required levels of output
- the assumption that relative yield declines observed in a northern European context will apply in other parts of the world, particularly in some less-developed countries (including parts of eastern Europe), where resource-poor farmers are unable to afford purchased inputs – in such situations yields can even be higher using the information-intensive, agro-ecosystem management approaches which characterise organic farming (Pretty, 1995).

- the consumption of crops which can be used directly for human consumption by livestock and and the impacts of shifts to reduced-meat diets which might take place through education or simply through increases in the costs of feeding animals due to increasing scarcity of inputs. Organic farming, with its emphasis on farm-produced feed for livestock (particularly in grassland areas not suited to crop production), is likely to result in significant reductions in the total quantities of cereals and other crops used to feed livestock.

Objective 2: Financial viability of farm businesses

The financial viability of farm businesses is seen as a key sustainability objective, at least in the medium term, as farmers cannot continue indefinitely where financial returns are low or negative. Various studies (see, for example, Lampkin and Padel, 1994) have demonstrated that the financial performance of organic systems is typified by lower yields, lower costs for external inputs such as fertilisers and sprays and higher labour costs due primarily to diversification and marketing activities. In general terms, premium prices are required to maintain comparable incomes, although this is more true for crops than for livestock. In some cases, the efficiency gains from changing to clover and biological nitrogen fixation may be such that no premium at all is necessary. In most cases, premium prices and cost savings are sufficient to achieve similar farm incomes to conventional systems.

In recent years, particularly in the UK but also in many other countries around the world, the demand for organic food has strengthened considerably and supply shortages have resulted in very high prices. Recently, this has been associated with a significant fall in prices for conventional products, in part due to policy and exchange rate changes, but also a reflection of significant oversupply in this sector. Models of the costs of conversion to organic farming prepared for the Ministry of Agriculture, Fisheries and Food by the author illustrate the impacts of the changing policy support framework and the widening price differential in the UK (Table 1). Under these circumstances, organic farming may be significantly more profitable than conventional, despite lower yields and the costs of conversion, traditionally seen as a major barrier to change.

Table 1 Organic farming conversion models: net margins[$] (£/ha) for different farm types, 1997 and 1999 price assumptions

Farm type	*Conventional*		*Transitional**		*Organic*	
	1997	*1999*	*1997*	*1999*	*1997*	*1999*
Specialist dairy	1489	1192	1566	1297	1860	1796
Mainly dairy	1077	829	1137	929	1356	1306
Stockless arable	799	764	848	1100	942	1356
Mainly arable	692	507	627	521	654	592
Lowland livestock	655	401	589	434	595	569
Upland livestock	450	279	459	413	482	450
Hill livestock	338	274	326	321	318	288

[$] Gross margin less those fixed costs which change directly as a result of conversion, excluding labour
* 5 year average, with limited access to premium prices during official 2 year conversion period

In this context, a real concern about the widespread adoption of organic farming is the potential for erosion of premium prices as supply increases, leading to reductions in farm incomes. The 1999 conversion models, run under pessimistic price assumptions, give cause for optimism that incomes can still be maintained at acceptable levels. In addition, a number of other factors need to be considered: expansion of demand as more outlets stock organic products, improvements in the efficiency of processing, marketing and distribution through economies of scale, and improvements in technical efficiency on the part of organic producers. But there is a more interesting possibility: to the extent that falling conventional prices are a result of over-supply in conventional markets, the expansion of organic farming and the associated reduction in total output should help to increase prices for conventional producers and reduce the need for set-aside. While this may not improve the relative profitability of organic farming, it should lead to increased incomes for all farmers. This potential to reverse Cochrane's agricultural treadmill, where increased output leads to lower prices and lower incomes, leading in turn to increases in output in a vain attempt to restore incomes, suggests that conventional producers should benefit from, not be threatened by, an expansion in organic farming.

Objective 3: Social and cultural identity of rural communities

In most countries, agriculture plays a significant role in the social and cultural life of rural communities. It does this by helping to maintain the viability of the social infrastructure including schools and community facilities. It also contributes to maintaining the cultural heritage, for example minority languages in many peripheral regions. Yet agriculture, particularly in Europe, is characterised by an ageing population, with many young people not convinced that there is a long-term future for them in farming. Their departure from rural areas contributes further to the spiral of decline.

Several criteria can be identified to assess the contribution of different farming systems to this sustainability objective, including numbers employed, incomes and returns to family labour. Several authors in Lampkin and Padel (1994) conclude that organic farms can achieve similar labour incomes and returns to family labour as average conventional farms. Numbers employed on organic farms tend to be 10-20% higher as a result primarily of higher value, labour intensive enterprises, as well as value adding processing and marketing activities. Less easy to estimate are the contributions which organic farming makes to small farm survival, job security and job satisfaction, although it is likely that organic farms score highly in this regard given improved consumer perceptions of organic farmers and the emphasis on fair trade principles. The assessment of the contribution of organic farming to social and rural development policy objectives is now becoming a more important topic for debate and research, which should generate better information on this topic in future.

Objective 4: Natural resources

Conservation of natural resources has been identified as a key sustainability issue, particularly given the reliance of intensive systems on high levels of external inputs. If further intensification is seen as a preferred route to meeting global food requirements in the next century, then the resource use implications become highly significant. Reducing dependence on external inputs while maintaining or enhancing productivity is already a key issue for resource-poor countries and farmers.

Several authors have commented on the potential contribution of organic farming with respect to the conservation of non-renewable or endangered resources, in particular soils, water, genetic biodiversity, minerals and energy (e.g. Lampkin, 1990; Greenpeace, 1992; Unwin, 1995; various papers in ENOF, 1997). Many of the impacts identified are highly site specific, and there may be significant variations between organic farms depending on farm type, intensity and quality of management, as well as between organic and conventional farms. However, in general terms, organic farming systems demonstrate reduced resource consumption per hectare, and, more importantly, per unit of food produced, and corresponding reductions in emissions and pollution, in particular nitrate leaching and greenhouse gases. Where comparisons with integrated/low-input have been made, organic farms also perform better the integrated systems (e.g. Leake in ENOF, 1997).

Objective 5: Other ecosystems that are influenced by agriculture

The impact of agriculture on the wider environment, particularly biodiversity and wildlife habitats, but also on pollution of water courses and the atmosphere, has received widespread attention in recent years. In many cases, the impacts are relatively easily quantifiable as they are closely correlated with resource use – the more resources are used, the more likely it is that waste products contribute to a pollution problem. This is particularly true with respect to the disposal of livestock wastes from intensive livestock systems, especially pig, poultry and feedlot cattle production. In general, organic farming has a positive contribution to make in this regard, despite its apparent reliance on livestock manures, because stocking rates are often lower and highly intensive, non-land based systems are not permitted. Similarly, organic farming can significantly reduce the pollution potential from phosphates, nitrates and pesticides as a result of non-use or reduced use of these inputs (see for example Unwin *et al.*, 1995; Kristensen, 1995).

Increasingly, organic farming is demonstrating its capacity to yield positive biodiversity benefits (see Unwin *et al.*, 1995; Isart and Llerena, 1996). This arises as a combination of the direct effects of not using biocides, as well as the indirect impacts in terms of nutrient availability (e.g. for insects and subsequently birds from wild flowers within crops), and changes in cropping patterns and the management of non-cropped areas providing habitats for key farmland flora and fauna.

Overall assessment

In summary, it can be argued that conventional systems, particularly intensive ones, may perform better with respect to food security and financial viability objectives, but that organic systems perform better with respect to the social, resource use and environmental objectives. Animal welfare is a further area of potential impact, but has not so far been identified as a significant element of sustainability definitions. These generalisations are unsatisfactory, however, to the extent that improved performance for one or other farming system is not consistent across all criteria for a specific objective. Further work is needed to identify an objective way of amalgamating various performance measures (and identifying the best ones) for individual objectives. In addition, some objective means is required to assess the overall level of sustainability, reflecting the priorities or weightings allocated to specific objectives by different individuals.

Future prospects for organic farming

Although growth trends in individual countries have varied considerably, with periods of rapid expansion followed by periods of consolidation and occasionally decline, overall growth in Europe has been consistently around 25% per year for the last ten years, i.e. exponential growth. There is no indication yet of this rate of growth declining. Continued 25% growth each year would imply a 10% share by 2005 and nearly 30% by 2010. At the western European level, 10%, whether achieved by 2005 or 2010, may still sound like a small proportion of the total, but it is very significant in absolute terms. It represents nearly 14 million ha and more than 800,000 farms, compared with the current total of 100,000 holdings. This level of growth has tremendous implications for the provision of training, advice and other information to farmers, as well as for the development of inspection and certification procedures. It also has major implications for the development of the market for organic food, as it progresses from niche to mainstream status, with a likely retail sales value in 2005 of £20-30 billion.

Conclusion

The aim of this paper has been to identify issues which need to be addressed if more objective assessments of the relative sustainability of different farming systems are to be carried out. It is clear that no farming system can be defined as truly sustainable, and that the multi-objective nature of agricultural sustainability means that there are advantages and disadvantages to all of the different approaches currently claimed to be sustainable. Although organic farming is often considered to be a potential model for sustainable agriculture, there are clearly circumstances where intensive conventional systems might also lay claim to the title. The debate needs to be lifted from the current polemical battles between low-input farming, integrated crop management and organic farming. To achieve this, much more work is needed to understand the relative performance of different systems with respect to individual sustainability objectives, and the means by which objectives can be defined and weighted to provide a measure of overall sustainability acceptable to society at large rather than specific interest groups. At the same time, due recognition needs to be given to the potential contribution of organic farming to agricultural sustainability, and in particular its ability to utilise the market mechanism to support these objectives, in combination with an appropriate level of policy support to achieve widespread uptake.

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