# A critique of methodologies for the comparison of organic and conventional farming systems

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## ABSTRACT

A review is presented of comparative studies of organic and conventional farming systems, with a special focus upon economic criteria. The different categories of comparison methodologies are critically reviewed. Conclusions are that classic experimentation has a valuable part to play but that more qualitative assessment can also be useful and should be encouraged. Careful allowance should be made for major background differences in management when comparing financial profitability. Longer-term case studies, which try to monitor organic systems in their own right, should also be encouraged.

*Keywords: organic and conventional farm types; farm surveys, field studies; case studies; economics*

## INTRODUCTION

The management of organic farming (OF) systems rests upon a fundamentally different set of criteria than those for conventional: e.g. a greater focus upon soil biotic characteristics, more sophisticated cropping sequences and an emphasis on nutrient cycling. The key approach to OF is one of *holism* i.e. that 'a system is more than the sum of its parts' (Lund, 1999). There has been a surge of interest in OF in Britain in recent years and an understandable demand to compare its performance with other farm types, especially conventional. This paper attempts to review the options for farm type comparison, with a special focus upon economics.

## ECONOMIC COMPARISONS

Some organic *v.* conventional farm comparisons have considered yield (Berardi, 1978; Lockeretz *et al*., 1981), energy efficiency (Bujáki *et al*., 1995), and environmental impact (Teague *et al*., 1995; Carriker, 1995). However, most work has focused upon economic factors. Lee (1992) neatly divides such comparisons into farm surveys, field studies and case studies and each will be considered here.

### Farm surveys

Several organic *v.* conventional farm type comparison methodologies have been used: sample-groups (SG); matched pairs (MP), and clustered groups (CG). For SG comparisons, simple enterprise gross margin (Reganold, 1995; Cook *et al*.,

1996) or net farm income (Ogini *et al*., 1999) have been measured, and other similar work reviewed by Roberts & Swinton (1996). For the latter, more sophisticated mathematical techniques such as linear and dynamic programming have been used but the majority of authors have utilised enterprise budgets. Two MP farm type comparisons are shown by Klepper *et al*., 1977 and Shearer *et al*., 1981, both of which compare economic performance as gross margins. The CG methodology has been used extensively in the social sciences as a means of deriving groups of similar phenomena having a number of different characteristics and has been used in studying whole-farm incomes of dairy farms in conversion to organic production (Haggar and Padel, 1996) and organic farm incomes (Fowler *et* al., 1998; Fowler *et al*., 2000).

There are a wide range of SG studies, ranging up to examples such as Ogini *et al*., (1999) who compared eight organic with 120 conventional dairy farms. However, data from such studies need to be interpreted cautiously: (1) are similar numbers of farms assessed for each system-type? If not, as for Ogini *et al*., (1999) above, the risk is that anomalous farms in the smaller group will distort the comparison; (2) are the background characteristics similar for the SG of farms studied (soil type, slope, land use history etc.)? Major differences will tend to confound any valid comparisons between SGs. A study by Bender (2001), who compared traditional Amish and conventional farms, clearly showed that they could be separated more by their geological history (glaciated being more fertile than non-glaciated) than by farm-type. By contrast, MPs help to overcome major differences in background characteristics and also lend themselves to multivariate statistics, such as canonical discriminant analysis (Armstrong Brown *et al*., 2000). Some MP comparisons, which have reported on just one pair, can also be very helpful (e.g. Davies *et al*., 1995). Overall, the judicious choice of farms means that MP studies can be a worthwhile means of comparison and this methodology deserves greater use in future. The CG method allows comparisons on 'non-system determined' factors and has the advantages over MPs in that specific circumstances of individual conventional farms do not distort the comparison.

**Field studies**

Such comparisons also represent a diverse range of studies. They seem to be divisible into those: (i) using replicated randomised blocks etc., and; (ii) comparing different production regimes using adjacent parcels of land but not replicated in any statistical sense. (i) above has some good examples, such as comparisons of organic and conventional apple and grain production (Swezey *et al*., 1998; and Hanson *et al*., 1997, respectively). Both studies include economic analyses as net returns. References for (ii) above are represented by some very helpful comparisons of different crop rotation designs (Higginbotham *et al*., 1996; Leake, 1996; Clark *et al*., 1999). There are also some excellent comparisons of low-input/integrated *v.* conventional rotations (Green *et al*., 1996; Vereijken & Kloen, 1993). In these references, gross/net margins are commonly used for economic assessment. Other comparisons are simply of adjacent fields, with each following either an organic or conventional regime (such as Hasey *et al*., 1997 for kiwifruit) and mostly compared for gross revenue.

Reviewing the relative merits of (i) and (ii) above is difficult and it is suggested that applying the classical experimental approach is inappropriate. Whilst tightly structured, statistically valid designs are valuable, less structured qualitative assessments should also be appreciated as potentially useful.

### Case studies

Much is now known about the potential value of case studies and they have an important part to play in monitoring organic (Kloen & Vereijken, 1999), low-input (Murray & Butler, 1994) and integrated (Hares *et al*., 1996) farm types. Although comprising largely qualitative assessments, they do allow detailed quantitative measurement of many factors including economic performance. An especially useful type of case study monitors changes over time during conversion from conventional to organic and afterwards (e.g. a vineyard study by White, 1996) and similar, long-term research is to be encouraged for the future.

## CONCLUSIONS

For organic *v.* conventional comparisons, attempts should be made to take account of the inherent differences, such as management effort per unit of production. Valid comparisons based on economic analyses of field data will be compromised if such differences are not appreciated (Lee, 1992). Longer-term studies (i.e. a minimum of 10 years) should also be encouraged. Additionally, OF systems need to be studied *in their own right*. During the next decades, good quality case studies will be needed which monitor the dynamics of changes over time and help in a better understanding of organic farming systems.

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