COMPARISONS BETWEEN ORGANIC & CONVENTIONAL PASTORAL DAIRY FARMING SYSTEMS: COST OF PRODUCTION AND PROFITABILITY

Nicola Shadbolt, Terry Kelly, David Horne, Kerry Harrington, Peter Kemp, Alan Palmer, Alan Thatcher

College of Sciences, Massey University, New Zealand

Theme: Farm Management of Food, Fibre and Energy

Peer review

Word Count: 4716

This study represents original research carried out by the authors and is not published elsewhere

The presenting author, Nicola M Shadbolt, is Associate Professor in Farm and Agribusiness Management in the College of Sciences at Massey University, New Zealand where she is Co-Director of the AgriCommerce Programme She is a Registered Farm Management Consultant and was recently made a Fellow of the NZ Institute of Primary Industry Management. Her main research interests include farm and agribusiness strategic management, business and risk analysis and primary industry investment.

COMPARISONS BETWEEN ORGANIC & CONVENTIONAL PASTORAL DAIRY FARMING SYSTEMS: COST OF PRODUCTION AND PROFITABILITY

Nicola Shadbolt, Terry Kelly, David Horne, Kerry Harrington, Peter Kemp, Alan Palmer, Alan Thatcher

College of Sciences, Massey University, New Zealand

Abstract

Organic milk production in New Zealand has expanded in recent years in response to increasing global demand for organic product. Most comparisons between organic and conventional dairying available in the literature are from Europe or North America where the conventional systems are more intensive than conventional systems in New Zealand. This paper compares the cost of production and profitability of certified organic and conventional dairy farming over five years of a Massey University system comparison trial. The difference between these pastoral farming systems was predicted to be less than that noted in the more intensive EU and the US dairy farming systems as fewer changes are required to achieve organic certification. However the results highlight the vulnerability of both pastoral systems to climatic variability and identify the additional risks of organic dairy systems.

Keywords: organic, pastoral dairy farming, system comparison, long-term studies, profitability, cost of production

Introduction

The food industry has been evolving into an array of diverse markets with consumers increasingly demanding healthy, nutritional and convenient food products. Organics is one of these markets offering perceived benefits over undifferentiated commodity goods. Prior to the more rapid expansion of the last decade the motivation for adopting organic practices was farmer concern about risk to their health and the environment from current conventional practices. In the 1990s food scares and the subsequent reaction of policy makers and consumers, as Haring & Offerman (2005) identify, had a strong effect on organic farming development. With demand growing at a faster rate than supply higher prices were achievable. Hallam (2002) states however that the price premium over conventionally produced foods was also necessary due to higher production and distribution costs. Common Agricultural Policy (CAP) support for organics through direct payments to farmers to assist them both through and after conversion to organics has been quite significant in the EU (Neiberg & Offerman, 2002, Haring, 2003). Haring & Offerman (2005) report some imbalance in the support for organic farming; organic farmers received fewer direct payments per hectare and 20-25% lower price support, but they receive 70% higher payments from agri-environmental and LFA payments; overall the organic farmers received 20% more CAP payments than comparable conventional farmers per hectare. Haring & Offerman (2005) noted that ongoing CAP reform in 2003, with some decoupling of payments from production, would further benefit organic farming.

The ability of price premia and government support payments to counter increased costs of production on EU organic farms over the years from 1992 to 2000 was reported by Neiberg & Offerman, (2002). They found that arable farmers achieved quite significant improvements in profit but dairy farmers on average achieved similar or slightly better profitability than their conventional peers. Similarly Jackson and Lampkin (2008) reported that organic dairy farms had slightly higher net farm income than conventional farms in 2005/06.

In the US there is also government support with some states subsidising conversions to organic systems. Funding for multidisciplinary organic research trials has increased in recent years and federal intervention has included assistance with the costs of certification and market facilitation (Greene, 2002).

The Comparative Productivity and Profitability of Organic Dairy Farms.

How to compare?

As the number of organic farms has been increasing so also has interest in how they compare against conventional farms. A range of methodologies have been adopted for this task and a number of measures have been developed with mixed success. In this section the various approaches and measures are presented and discussed with respect to their ability to provide useful comparisons. However as identified by Stanhill (1990) the definitions of organic agriculture include a plethora of principles, practices and ideologies. While certification and international audit has narrowed this range, comparisons across countries should acknowledge the possible impact of differences in certification requirements on resulting productivity and profitability. Also reflected in comparisons should be the differences in government support schemes and price premia that have evolved more recently; Haring (2003) noted that these differ widely between countries.

Another challenge is the holistic approach of organic agriculture which is not compatible with the reductionist mode of conventional scientific enquiry. Stanhill (1990) recommends that comparisons should be made over several years to include a range of growing conditions. He identifies that comparisons made on a whole-system scale and over sufficient years to cover the 3-5 year conversion period impose great difficulties in establishing and maintaining comparative studies on a scale that would satisfy the requirements of both the holistic and reductionist approaches.

From an extensive review of research Stanhill (1990) identified three different methods of evaluating the comparative productivity of organics agriculture. These included comparative observations, field experiments and whole–system experiments.

Comparative observations

Comparative observations are generally taken from commercial farms. These range from anecdotal evidence of organic farmers regarding their change in yields, to measured yields over a number of years from replicate, carefully matched pairs of organic and conventional farms of comparable size, soil and climate. Jackson and Lampkin (2008) recommend such replicates should also be of comparable topography, market distance and tenure. Stanhill (1990) provides further detail on a German trial begun in 1924 in which biodynamic farms were compared with district averages of conventional agriculture, and three studies of matched pairs of organic and conventional farms – a 5-year study in the US cornbelt, a 3 year study of 26 pairs in Switzerland and a group of 40 pairs in West Germany. Similarly in Australia there was a 3-year study (1991-93) of ten paired irrigated dairy farms under biodynamic and conventional management (Burkitt et al, 2007). More recently, in New Zealand, the ARGOS project was set up in 2005 to compare 12 matched pairs of conventional dairy farms with those converting to certified organic products (Phillips et al, 2006).

Lampkin & Padel (1994) and Offermann & Nieberg (2000) provide exhaustive debate on the issues relating to comparing results from (few) organic and (many) conventional farms. Jackson and Lampkin (2008) conclude that using clusters of similar conventional farms has the advantage over paired farm comparisons in that it avoids the documented distorting effect created by the specific circumstances of individual conventional farms. Their methodology is similar therefore to that used by the 1924 German trial. A different approach to comparative observation was taken in New Zealand (MAFPolicy, 2002) when an “expert” group devised a view of what a steady-state organic operation would be like (in the absence of a suitable number of organic farms) and compared that with a conventional model farm.

Unfortunately, as critiqued by Shadbolt et al, 2005, instead of being useful to the debate on organics, the exercise provides an example of how both enthusiasm and bias can create misinformation when checked against reality.

Field experiments

Conventional experimental design enables the statistical significance of differences between experimental treatments to be established. Stanhill (1990) reports limited use of this approach and states they have ranged from fertiliser versus manure-only plots in long-term fertility experiments to strict adherence to the organic "complete system" in a 5-year study of various biodynamic treatments on plots used for organic agriculture. Extrapolating results from these experiments to the whole system is a challenge that Stanhill (1990) identifies as typical to the reductionist approach.

Whole-system experiments

Stanhill (1990) found only two examples of long-term comparison of commercial size organic and conventional farming systems. The Haughley experiment in the UK was begun in 1938 and summarised 35 years later. It compared a virtually completely closed organic farming system with that of conventional open crop and mixed farming systems. The closed system meant the organic farm was fertilised with crop residues and animal manures produced within the farm and the stock (dairy and poultry) were fed exclusively with feed produced by the organic farm. The other was a 5-year comparable systems study in the Netherlands published in 1989.

In a comprehensive evaluation of results from the three methodologies Stanhill (1990) makes various useful observations. On average, and for a wide range of crops, yields within 10% of those obtained in conventional agriculture were achieved by organic agriculture. He found no evidence that organic cultivation methods had any yield stabilising or weather-proofing effects nor was there evidence of a transition or conversion effect (long-term plot experiments showed no yield difference change over periods of up to 7 years). However Kim (2004) and (Pacini et al, 2001) both reported conversion effects with 5 or more years required to achieve a steady-state when changing biological and ecological processes and interactions were understood and had taken effect. Stanhill (1990) reported that the longer period whole system study provided some evidence that the difference in yields for the organic and conventional mixed systems increased with time.

Under the comparative observations methodology there was evidence of modifications in farm practices over time (Stanhill, 1990). This would explain why the difference measured between yields under strictly controlled field experiments were greater than those obtained from observation. Comparative observation methodology therefore captures the experiential learning effect.

The relevance of the results obtained from the whole-system experiment to the debate on agricultural strategies led Stanhill (1990) to conclude that despite the difficulties in establishing and maintaining them, long-term studies should be adopted. He recommends that “they would require long-term support and a stable and independent sponsorship to facilitate interdisciplinary participation in the planning, execution, analysis and publication phases of such a study”.

What to measure?

Some confusion has been created by analysts using spurious or irrelevant measures for their comparisons between two different systems. Strong views are held about what is or is not useful, for example Waterfield (2003) espousing the benefits of using cost per litre rather than some “..meaningless figure such as per cow or per acre” versus per cow and per hectare results being usefully compared by Butler (2002) and Jackson & Lampkin (2008). Relevance is the key to what measure is used and which denominator is the most useful. As Jackson and Lampkin (2008) state “the objective is to isolate the effect of the farming system on profits”.

Reliability of data is also an important issue to consider. The saying “cash is fact, profit is conjecture” has, unfortunately, led to some analysts avoiding the complexity of calculating profit or fully costing production. To calculate per unit of input or output measures from cash however provides misleading results as they do not include non-cash adjustments (output and input inventory changes, depreciation, family labour) so do not portray the complete picture of what is happening to returns and costs on each farm (Shadbolt & Gardner, 2005).

Cost of production is the sum of both cash and non-cash expenses and includes both operational costs that occur irrespective of how the business is funded or owned, and funding costs reflecting business ownership and financing. For dairy farms it is commonly quoted on a per litre, or on a per kilogramme of milk or milksolids basis. As farm business analysis has evolved so also have standardised methods of calculating cost of production, for example Lampkin (2006) quotes, 'standard Farm Business Survey methods', and the International Farm Comparison Network (IFCN) have an agreed methodology they use each year to compare cost of production of milk between 134 typical farms in 44 countries (Hemme et al, 2008). Similarly the New Zealand DairyBase system described by Shadbolt et al (2007) has set standards on how to calculate the non-cash adjustments in farm profitability measures as well as providing standards for calculating liquidity and wealth creation (change in equity).

However, as with the organic standards, the calculations can differ across countries so international comparisons, other than those carried out by the IFCN, need to recognise such differences. For example the Butler (2002) comparison did not include a value for family labour and the value of cow and calf sales was not known

Government support systems provide a further complication as they are sometimes included in the cost of production (by reducing costs) or are excluded and only considered when assessing the overall viability of the farm. The IFCN (Hemme et al, 2008) calculate cost of milk production as a net cost, that is, the total costs of the dairy enterprise (operating costs and funding costs) less related returns. Related (or by-product) returns include net cow, young stock and calf income and, where applicable, government payments. The net cost is then compared against the milk price to see which countries are able to achieve a margin between net cost of production and price (what the IFCN term entrepreneur's profit).

The Farm Business Survey used by Jackson & Lampkin (2008) does not provide net costs but instead prefers to analyse the outputs (from production and government support payments) and inputs separately and then to compare the difference between them. Their cost of production calculation includes imputed costs for family labour, family equity and, like the IFCN, a rental value for the land but excludes related outputs such as government support and forage and other by-products when calculating their "Net Margin over all Costs". However this is not a net cost so cannot as easily be compared with the price paid for milk.

Despite these differences useful comparisons can be made regarding specific costs of organic versus conventional systems, e.g feed, animal health and weed control costs.

Profitability measures commonly used in New Zealand are Return on Assets (RoA) and Return on Equity (RoE). As has been discovered in discussion with fellow partners of the IFCN, these measures are less commonly used in countries where land is not readily traded (due to traditional or institutional constraints) or is difficult to value (there is no land market). If there is no likelihood that the assets can be realised then comparing what they generate with other investment options is a futile exercise. A useful alternative is return on tenant's capital (all land is rented and only non-land assets are included) as calculated by Jackson & Lampkin (2008). Standardised systems for calculating return on capital, RoA and RoE, such as DairyBase (Shadbolt et al, 2007), use the same combination of cash and non-cash adjustments for the cost of production calculation but do not include an imputed rental value for land. Instead land is included as an asset at its current market value. In most southern hemisphere countries and in North America, the RoA and RoE are critical measures of farm business success.

Methodology

In 2001, Massey University set up its Dairy Cattle Research Unit (DCRU) as a whole system comparison between organic and conventional pastoral dairy farming. Unlike the whole systems study reported by Stanhill (1990), the organic farm is not a closed system and can import fertiliser and feed (in the form of grazing and silage from other organic farms). The DCRU began its organic conversion period on 1 August 2001, at which time the unit was split into two similar farms, one conventionally managed and the other organically managed. Like the Haughley whole systems trial reported by Stanhill (1990), the aim was to begin with two units of similar size, soil composition, fertility and herd composition. On 1 August 2003, the organic farm achieved its full AgriQuality organic certification. Being a systems trial, both farms have been managed individually according to “best practice”; thus no attempt is made to do the same thing on one farm as is done on the other farm.

The long-term aim of this research is to better understand organic dairy farming systems by investigating component interactions in these systems, and by determining how impacts and interactions change over time as organic systems mature. Extensive monitoring continues to be carried out on both farms and an inter-disciplinary approach has enabled the spectrum of soils, water, pastures and forage, animal production and health, and economics to be recorded and analysed.

The costs of production and profitability of the two year conversion period and the first year as a certified organic farm were reported by Shadbolt et al (2005). As well as detailed annual reports provided to the funding body, DairyNZ, there has been a range of academic and industry publications on such topics as mastitis management, weeds, animal production and environmental impact. The “difficulties in establishing and maintaining comparative studies on a scale that would satisfy the requirements of both the holistic and reductionist approaches”, as described by Stanhill (1990), have been evident yet they provide a useful on-going tension that the inter-disciplinary team has had to manage. For example, in response to industry demand, trial experiments have recently been carried out on various fertiliser options for the organic unit. However, these trials had to be designed in such a way as to not jeopardise the organic status or credibility of the systems trial.

This paper reports on the comparative economic performance of the organic and conventional units over the five years that the organic unit has been fully certified (03/04 – 07/08). The farm was chosen because of its research capability, but its small size (41.6ha running 88 cows) has meant careful interpretation of economic performance is required. Average levels of production for this farm, at 410 kgMS/cow and 935 kgMS/ha, were above industry averages for this region. Stanhill (1990) identifies that this phenomenon is typical with experimental farms and cautions against making comparisons between them and large-scale commercial units. He also states that the scale effects have to be specifically allowed for in any comparisons.

The small scale of the farms and the fact that they are university farms, introduced costs that were not comparable to commercial farms. In the early years of the trial, all costs were recorded and it soon became obvious that it was the fixed costs that distorted the results the most. The costs per cow (animal health, breeding, feed) and per hectare (fertiliser, pasture and forage, weeds) were useful to compare between the two systems and commercial farms but once fixed costs were included (e.g. labour, repairs and maintenance, vehicle costs, administration) the results were less comparable. The decision was made therefore to provide ‘whole farm’ results from a combination of the actual per cow and per hectare results from each system combined with industry averages for fixed costs. Industry averages were also used to calculate the market value of land each year. The data from the 5 years since the organic unit achieved full certification were used to compare the two farm systems; the two systems were also compared with the Ministry of Agriculture and Forestry (MAF) Monitor Farm for this region. The monitor farm data is based each year on recorded conventional farm data that expert opinion then uses to create a representative set of a ‘typical’ farm. This provides a similar comparison to the ‘cluster of similar conventional farms’ approach used by Jackson and Lampkin (2008).

Results & Discussion

Production and returns have been variable particularly for the organic farm, so it is misleading to extrapolate from the results of any one year’s data (Table 1). During the first year of certification, which was a very good dairy season in the Manawatu, the organic system consistently grew slightly less pasture than did the conventional system and consequently produced less milk (10% less per cow and 12% less per hectare). However the organic system outperformed the MAF farm by 28% more per cow and 16% more per hectare. Production differences continued in the next season (2004-05), which was characterised by a cool wet spring and early summer followed by a warm and dry late summer-autumn period, resulting in reduced pasture growth and milk production levels from the previous season. The 2005-06 season began well with excellent early spring conditions, but began to deteriorate in October with more variable conditions, and a prolonged summer dry spell meant an early dry-off in March for the organic herd, resulting in marked differences in production between the two herds. The 2006-07 season began badly with a cold wet winter and spring, but settled in to a good late summer/autumn so lactation lengths were an improvement on the previous season. Relative to the previous season, milk production was up for the organic herd and similar for the conventional herd. In 2007/08 the climatic challenge was, once again, a dry summer that extended into autumn to produce extreme drought conditions throughout the region. This was the only season the conventional system did not outperform the MAF farm per hectare. The organic system produced less per hectare than the MAF farm every year from 2004/05.

Table 1: Organic-Conventional Comparative Systems Data and MAF Monitor Farm data 2003/04-2007/08

	2003/04			2004/05			2005/06			2006/07			2007/08		
	Conv	**Org**	**MAF**	**Conv**	**Org**	**MAF**	**Conv**	**Org**	**MAF**	**Conv**	**Org**	**MAF**	**Conv**	**Org**	**MAF**
Cows Milked	51	**46**	230	48	**43**	236	51	**45**	265	53	**47**	280	51	**47**	360
Area (effective ha)	21.73	**19.92**	90	21.73	**20.14**	90	21.73	**20.14**	100	21.73	**20.14**	105	21.73	**20.14**	130
Stocking Rate	2.4	**2.3**	2.6	2.2	**2.1**	2.6	2.4	**2.2**	2.6	2.4	**2.3**	2.7	2.4	**2.3**	2.8
Production (kgMS/cow)	457	**410**	320	401	**345**	320	406	**295**	336	392	**332**	336	360	**317**	315
Production (kgMS/ha)	1073	**947**	817	885	**737**	840	953	**660**	890	956	**776**	895	846	**739**	873
Feed Costs ($/cow)	206	**230**	194	432	**532**	205	353	**368**	221	344	**347**	252	435	**555**	369
Cost of Milk ($/kgMS)	3.24	**3.66**	4.28	4.59	**5.70**	4.41	4.60	**6.24**	4.50	4.95	**5.94**	4.66	4.44	**5.60**	5.63
Operating Profit ($/ha)	1742	**1594**	656	456	**166**	637	667	**200**	788	350	**325**	654	3771	**3674**	2852
Return on Assets %	5.6%	**5.3%**	2.2%	1.5%	**0.6%**	2.1%	1.9%	**0.6%**	2.3%	0.9%	**0.9%**	1.8%	9.2%	**9.1%**	6.7%

The inter-disciplinary team was on a steep learning curve during this time and made a number of modifications to the organic system to enable it to better cope with the climatic variation without the usual ‘props’ used by conventional farming. While purchasing in feed and grazing stock off-farm in times of low pasture growth were agreed strategies for the system (as the aim was to maintain cows in milk as long as possible each season) the reality was that both organic feed and grazing were very difficult and expensive to source. By comparison the conventional system could use nitrogen to boost pasture growth or purchase a range of feed supplements to fill any shortage.

The modifications included delaying the start of calving in the spring by two weeks and reducing stocking rate. The aim was to run a stocking rate 10% lower, but the reduction on average has only been 3%. Most important was the need to confirm a source of feed for grazing young stock and dry cows and for grass silage and hay. On the recommendation of an organic advisory group involved in the project, the farm doubled the area of its “run-off”, the land dedicated to supporting the “dairy platform”. All feed transferred from the run-off to the milking platform as silage, hay or as grazing was charged a commercial rate per kilogramme of dry matter to ensure the system was fully costed.

Throughout this research we have used the same MAF value per hectare for land and buildings each year for the two systems when calculating the return on assets. There are insufficient sales of organic land to determine whether it sells at the same value as conventionally farmed land or not. However if we were to value the land based on its production, as is common in New Zealand, then the asset value would be less. As a result the return on assets would be higher than that achieved by the conventional farm but the value of the land and buildings would have dropped by 18%. While the need to have fewer cooperative shares is justified as they are based on production level, not type of milk produced, it is debatable whether the value of organic land is less than conventional. Not only is the land producing milk of higher value but the potential of the land to produce at the higher levels under conventional farming is still there.

Over the five years, the average production per cow of the MAF farm is less than both trial systems (4% less than the organic and 19% less than the conventional, Table 2). However the MAF farm production per hectare is 11% higher than the organic system and 8% less than the conventional system. This comparison against the 'cluster of conventional farms' gave a smaller difference between organic and conventional than the 18% recorded between the two Massey systems. Similarly the ARGOS farms comparison over the first four of this five year period noted 23% more milk per hectare from their conventional farms than their 'in conversion' organic farms (Argos, 2007), and Burkitt et al (2007) measured 36% more milk per hectare under conventional management than biodynamic. However the ARGOS farms began with an 11% difference that progressively increased to a 29% difference over four years while the Massey systems in the same four years began with a 12% difference that increased to a 19% difference and then, in the fifth year, dropped back to 13%.

Net livestock income is higher than the monitor farm in both trial systems; this is most likely due to the greater attention individual cows receive on these smaller units, a fact borne out by the higher amount spent on animal health in both units compared to the monitor farm. The average Gross Farm Income of both the organic and the conventional system exceeds the monitor farm average by 5% and 6% respectively. The organic system averaged 18% better milk price as price premiums increased from 10% in the first year to 16% in the second and then 20% from 2005/06.

However operating expenses on both units also exceed the MAF farm; they have been 8% higher in the organic system and 3% higher in the conventional system. Animal health and feed costs are higher on both. The difference between the two research systems shows both animal health and weed and pest costs being lower on the organic unit but feed and fertiliser being consistently higher.

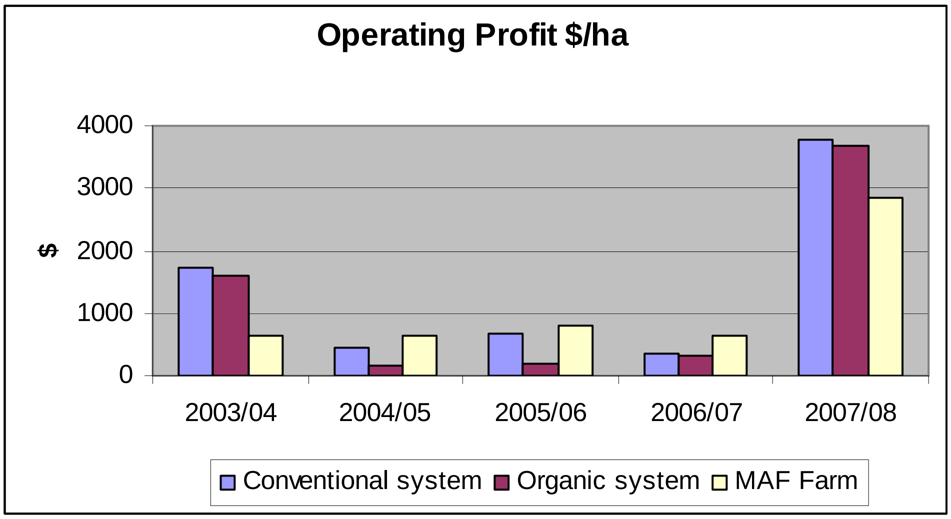
Table 2. The difference in average returns from five years of data between the organic and conventional units and the MAF Monitor Farm (03/04 – 07/08)

	Organic Unit v Conventional Unit	Organic Unit v MAF Monitor Farm	Conventional Unit v MAF Monitor Farm
Kg MS/cow	-16%	+4%	+19%
Kg MS/ha	-18%	-11%	+8%
Milk Price $/kgMS	+18%	+18%	0%
Milk Income $/ha	-3%	-0.1%	+3%
Net Stock Income $/ha	+19%	+61%	+26%
Gross Farm Income $/ha	**-1%**	**+5%**	**+6%**
Animal Health $/ha	-26%	+16%	+36%
Feed & Grazing $/ha	+11%	+34%	+17%
Fertiliser $/ha	+34%	+5%	-27%
Weed & Pest $/ha	-71%	-79%	-38%
Operating Expenses	**+4%**	**+8%**	**+3%**
Operating Profit $/ha	**-15%**	**-3%**	**12%**

Now that the run-off area for the organic system has been doubled, it is hoped that feed costs will be less variable, with limited spot market purchasing when organic feed is difficult to source and costly to purchase. Fertiliser costs have been consistently higher in the organic farmlet; it is hoped that current trials on various products will enable us to manage that cost down over time.

The average operating profit of the conventional unit was $1397/ha (standard deviation $1438), which was 12% higher than the MAF farm. The difference in the averages for the MAF farm ($1232/ha, standard deviation $971) and the organic system ($1192/ha, standard deviation $1509) was small. However, as illustrated in Figure 1, and expressed by the standard deviations, the variation in returns was greater in the organic system. The lower variability in the MAF farm could also reflect the ability of commercial farms to respond more quickly to changing climatic and market conditions than is possible in a university managed trial.

Figure 1: Operating Profit ($/ha) on the MAF farm and for the organic and conventional systems at Massey University from 2003/04 to 2007/08

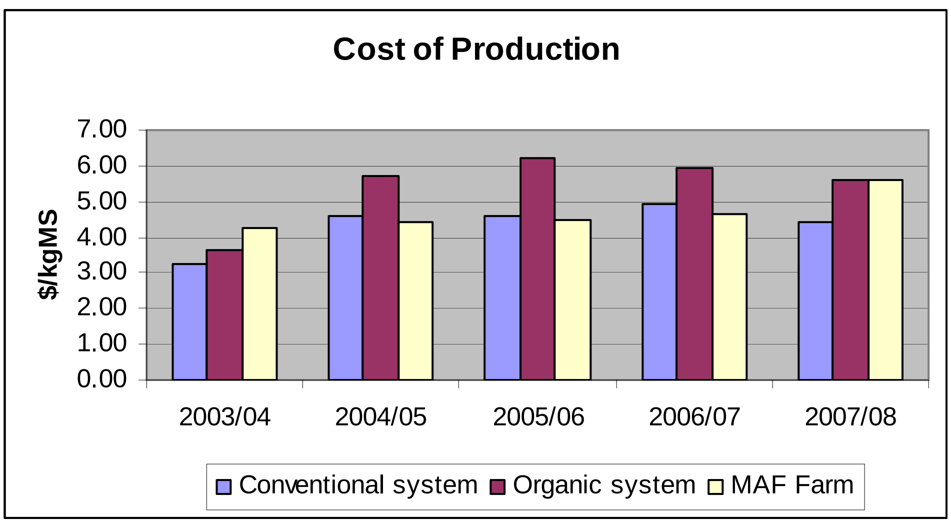


The return on assets is calculated each year as operating profit over opening assets, and the assets are revalued each year. The average RoA over 5 years of both the organic system and the MAF farm was 3.5%, with the conventional system achieving 4%. The RoA for the organic system was 12% lower than for the conventional system.

Over the five years as an organic unit, the lower milk yield has meant that the cost per kg milksolids ($/kgMS) has been 23% greater on average on the organic system than its conventional counterpart. In comparison with the MAF farm however, the costs per kgMS are only 13% greater. The conventional unit produces milk at a cost 8% less than the MAF farm. Again there is greater variability in costs in the organic system than in the MAF farm and the conventional system (Figure 2). However, improved management of feed costs through the doubling of the 'run-off' area for the organic system resulted in a decrease in the cost of production in 2007/08 despite extreme drought conditions.

In the ARGOS trial the difference in profitability (operating profit per hectare) is only available for the first two years. The difference between the paired farms was 5% less for the converting organic farms in year one with 11% less milk per hectare, and 9% less in year two with 23% milk per hectare. Published results from subsequent results are incomplete as only cash (farm working expenses) was reported. The farm working expenses per kilogramme of milksolids on the converting organic farms were 3% and 1% higher in 2005/06 and 2006/07 than their paired conventional farms. Farm working expenses were less by 25% and 28% respectively in those years but so also was milk production so the cash costs per kilogramme of milk produced increased.

Figure 2: Cost of production ($/kg milksolids) on the MAF farm and for the organic and conventional systems at Massey University from 2003/04 to 2007/08



This trial has enabled us to make the comparison between half of the farm changing to organic production with the other half of the farm still being conventional. The conventional system was and still does perform above the MAF monitor farm; it is interesting to note that the organic system, whilst still in transition in some aspects, has delivered similar profitability to the MAF farm.

Conclusion

The impact of climatic variability on pasture production increases the vulnerability of organic systems that cannot utilise the 'props' that are available to conventional systems. Significant modification to the organic system has taken place over the seven years since the trial has begun and the experiential learning of the inter-disciplinary team has been considerable. The 23% higher average cost of production recorded from this trial is consistent with other trials (Burkitt et al, 2007, Butler,2002, IFCN, 2003) and is the result of 18% lower production per hectare and higher feed and fertiliser costs. The ongoing aim of the trial is to find ways to further modify the organic system so as to contain some of these costs. Until that is achieved the organic system lags behind the conventional system on profitability. Contrary results such as those of Neiberg & Offerman (2002) and Jackson and Lampkin (2008), who reported that organic dairy farms had slightly better returns than conventional farms, were obtained from countries with both price premia and government support payments for organic farmers. In New Zealand organic farmers receive just the price premium for milk.

The method used to compare results is also important. If the methodology used for this trial had been that used by Jackson & Lampkin (2008), to compare the organic system with a 'cluster of conventional farms' (the MAF farm), the conclusion would have been that organic dairy farming has a higher cost of production but a similar profitability to conventional dairy farming. The more exact comparison used in this trial leads to a different conclusion and confirms the benefit of long-term studies as espoused by Stanhill (1990). The robustness of this approach also serves as a cautionary note for comparative studies using different methodology.

References

ARGOS (2007) Update on ARGOS Comparative Dairy Research. September 2007. www.argos.org.nz

Blackwell, G.,Rosin, C., Emanuelsson, Phillips, A., Manhire, J. (2007) ARGOS Comparative Dairy Research – an update. Stakeholder Report: January 2007. www.argos.org.nz

Burkitt, L.L., Wales, W.J., McDonald, J.W., Small D.R., Jenkin M.L. (2007) *Comparing irrigated biodynamic and conventionally managed dairy farms. 2. Milk production and composition and animal health*. Australian Journal of Experimental Agriculture, 47, pp 489-494

Butler L J, 2002, *The Economics of Organic Milk Production in California: A Comparison with Conventional Costs*. American Journal of Alternative Agriculture. Vol.17, No.1, pp83-91

Hallam D, 2002, 'The organic market in OECD countries: past growth, current status and future potential', in *OECD Organic Agriculture: Sustainability, Markets and Policies (E-book PDF Format) Co-edited with CABI Publishing 179-186*

Haring, A.M. (2003) *Organic dairy farms in the EU: Production systems, economics and future development.* Livestock Production Science , 80, 89-97

Haring, A.M., Offermann, F. (2005) *Impact of the EU Common Agricultural Policy on organic in comparison to conventional farms.* European Association of Agricultural Economists XI International Congress, The Future of Rural Europe in the Global Agri-Food System. Copenhagen, Denmark, 2005.

Hemme et al (2008) *Dairy report 2008*. International Farm Comparison Network, IFCN Dairy research Centre, Kiel, Germany.

Jackson, A., Lampkin N. (2008) *Organic Farm Incomes in England and Wales 2005/06*. Report of work for the Department of Environment, Food and Rural Affairs. Contract reference: OF 0373.

Lampkin, N.H., Padel, S. (1994) *Economics of Organic farming – an international perspective*. CAB International, Wallingford.

Lampkin, N. (2006) *Data reveals how organic costs compare with those for conventional production*. Gwlad Issue 59, December 2006 – Farming Connect..

MAFPolicy 2002, *Understanding the costs and risks of Conversion to Organic Production Systems*. MAF Technical Paper No.2002/1, Minstry of Agriculture and Forestry, New Zealand.

Neiberg H, Offerman F, 2002, '*Economic Aspects of Organic Farming –the profitability of organic farming in Europe*', in OECD Organic Agriculture: Sustainability, Markets and Policies (E-book PDF Format) Co-edited with CABI Publishing 141-152

Offermann, F., Neiberg, H. (2000) *Economic performance of organic farms in Europe*. Organic farming in Europe: Economics and Policy. Vol.5, University of Hobenheim, Germany

Phillips, A., Carey, P., Greer, G., Emanuelsson, M. (2006) Agriculture research group on Sustainability (ARGOS) Comparative Dairy Research. Stakeholder report: April 2006. Source www.argos.org.nz

Shadbolt, N.M., Gardner, J.W. (2005) *Financial Management.* In Shadbolt N M, Martin S (2005) Farm Management in New Zealand. Oxford University Press, Melbourne

Shadbolt N.M., Kelly T., Holmes C.W. (2005) Organic dairy farming: cost of production and profitability. AFBM Journal volume 2 number 2: 136-145 http://www.afbmnetwork.orange.usyd.edu.au/afbmjournal

Shadbolt, N. M., Newman, M., Lines, I. (2007). *Dairy farm business analysis: Current approaches and a way forward*. (pp. 125-135). In S. O'Reilly, M. Keane & P. Enright (ed(s).). Proceedings of the 16th International Farm Management Association Congress: Peer Reviewed Papers (vol. 1), July 15-20, University College Cork, Ireland. International Farm Management Association.

Stanhill, G. (1990) *The Comparative Productivity of Organic Agriculture*. Agriculture, Ecosystems and Environment, 30, pp 1-26.

Waterfield, W. (2003) Benchmarking as a means of improving the financial wellbeing of organic dairy farms. Source: http://orgprints.org/8426