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## **Comparative Performance of Organic, Conventional, and Integrated Producers in New Zealand**

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# **Comparative Performance of Organic, Conventional, and Integrated Producers in New Zealand**

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## **Summary**

The Agriculture Research Group on Sustainability (ARGOS) monitors a wide range of environmental, social, economic and management parameters on matched cohorts of organic, conventional and integrated farms in the sheep/beef and kiwifruit sectors. Over six years significant differences have been found in farm costs and revenues between management systems, but few differences have been identified between management systems in “bottom-line” indicators of profitability, and there is greater variability within cohorts than between them. Regrouping of the properties according to farmer typologies does, however, result in the identification of some significant differences in economic outcomes between different “types” of farmers.

Key words: economic performance, organic farming, management system

## **Introduction**

ARGOS (The Agriculture Research Group on Sustainability) has completed the first six years of a collaborative research programme that has intensively monitored farms from the sheep and beef, kiwifruit, high-country, and dairy sectors to examine the sustainability of selected New Zealand farming systems, and to develop a better understanding of the consequences of different farming systems. Economic, environmental, social and management research teams have gathered a wealth of data in order to evaluate the ARGOS null hypothesis that environmental, economic and social characteristics do not differ significantly between different management systems on the participating farms and orchards.

The challenge currently facing the programme is synthesising these findings into a coherent, multidisciplinary account that respects each discipline while providing results of value to farmers and policy-makers whose aim is the improved sustainability of New Zealand farming.

This paper describes the analysis of the financial outcomes over the period on sheep and beef farms and kiwifruit orchards with respect to the management system employed. It also reports the early stages of integration of the financial results with some of the data collected by the social, management and environmental objective teams.

## **Analytical Approach**

Twelve clusters of sheep and beef farms and twelve of kiwifruit orchards were selected on the basis of geographic proximity, farm size, and willingness of farmers to participate in an intensive long-term study. Each cluster included one farm from

the three management systems defined for the sector. The management systems were defined as:

- Sheep/Beef sector: Certified organic; involvement in a quality-assurance audited supply chain (integrated); conventional, minimally audited.
- Kiwifruit sector: Certified Green organic (Hayward); Global GAP certified Green (Hayward), GlobalGAP certified Gold (Hort 16A).

The financial analysis has been based on farm accounts data, supplemented by additional information from farmers and their accountants in order to reallocate costs to categories that are more meaningful in a management sense than the accounting categories commonly used. The integrity of the “bottom-line” reported in the accounts has, however, been preserved in all cases. In order to take a “whole-farm-entity” approach that evaluates all farms on the same basis, irrespective of the ownership and operating structures involved, all internal transfers were excluded, and the income, costs and capital streams of all entities involved have been aggregated. Livestock have all been re-valued using National Average Market Values and Quotable Values New Zealand Ltd has supplied annual updates of capital values for each ARGOS property, based on the most recent Government valuations and the local knowledge of district valuers. Adjustments for the value of unpaid labour have been made using farmer estimates of labour hours, the MAF Farm Monitoring Approach to estimating Wages of Management and current hourly wage rates for farm labour. Changes in feed inventory have been valued using the estimated market price for pasture equivalent dry matter. Accounting data were converted to 2007/08 real values using the CPI.

Analysis of Variance (unbalanced treatment structure) was conducted to determine whether there were significant differences across panels with respect to financial variables. The treatment was the management system and farm cluster was included as a blocking variable to account for differences in location, altitude, etc. As the complete dataset was used in the analysis, season was also used as a blocking variable. In the case of the sheep and beef panels, the relative importance of cash cropping as a source of farm revenue, which varied markedly between farms and accounted for a high proportion of the variability in a number of parameters, was included as a covariate. In the kiwifruit analysis, as a number of the gold orchards grew both gold and green fruit, a covariate “combined orchard” was created to account for this.

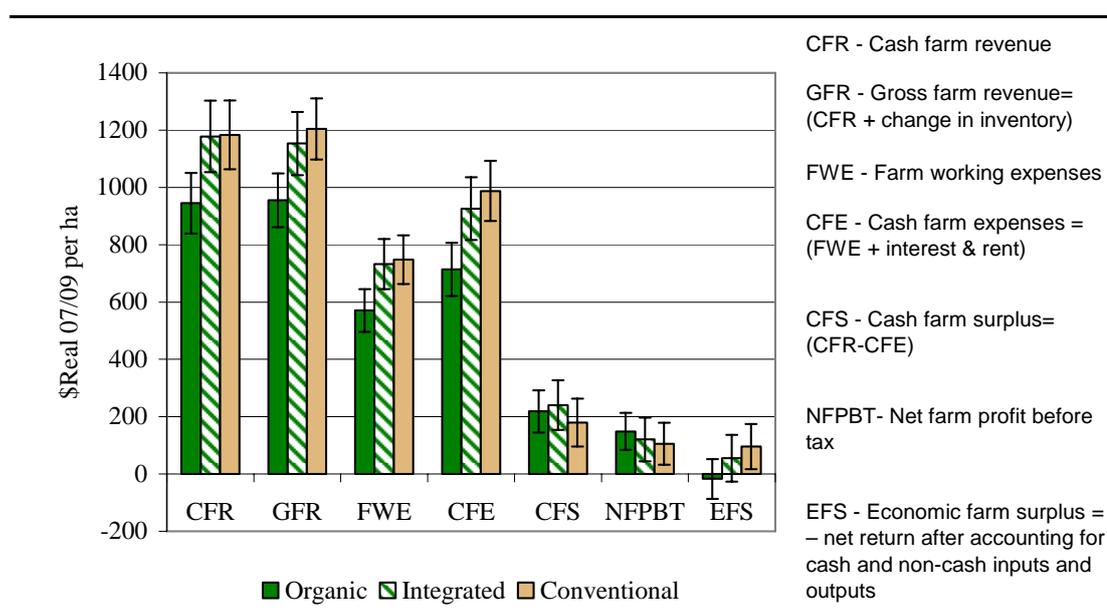
## **Management System (Panel) Effects**

### **Main Financial Aggregates**

The Organic sheep and beef farms in the programme had lower total costs and revenues over the period as a whole than Conventional and Integrated farms, but were not shown to have significantly different financial “bottom-lines”. Stocking rates over the period were also significantly lower on Organic farms. While the mean stocking rate on Organic farms has been 8.3 stock units per hectare, both Conventional and Integrated farms have been stocked at over ten stock units per hectare. The small differences observed between Conventional and Integrated farms were not significant. Statistically significant (at the one percent level) differences

between Organic and other farms were found in Cash Farm Revenue (CFR), Gross Farm Revenue (GFR), Farm Working Expenses (FWE) and Cash Farm Expenditure (CFE). None of the “bottom-line” estimates of farm profitability - Cash Farm Surplus (CFS); Net Farm Profitability before Tax (NFPBT) and Economic Farm Surplus (EFS) - differed significantly (although differences in EFS approached significance ( $F=0.101$ )). However, there are doubts over the validity of some EFS data where farmer estimates of unpaid labour appear high for the size and nature of their properties. Figure 1 shows the means and 95 percent confidence intervals of the aggregate financial variables on sheep and beef farms and their definitions.

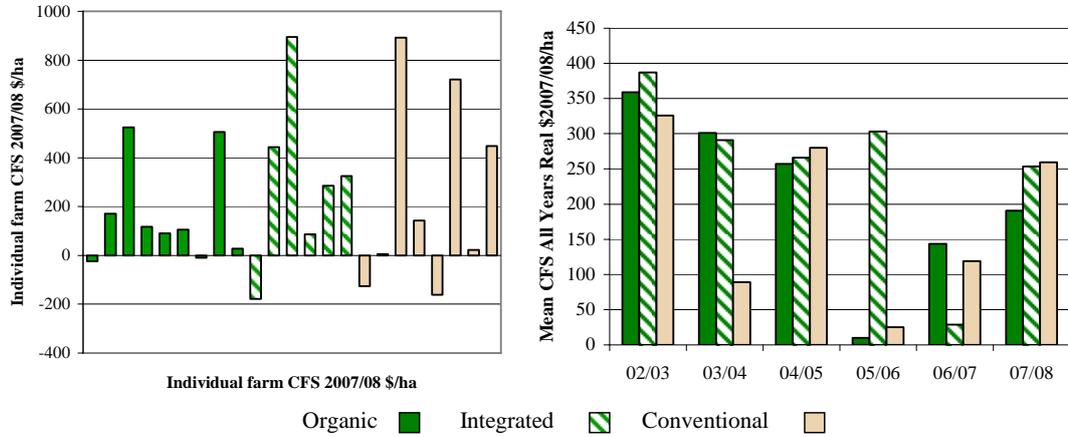
**Figure 1: Sheep and Beef Mean Financial Aggregates (\$/ha) by Management System 2002/-3 – 2006/07**



A result of the very high level of within-panel variation in the “bottom-line estimates in any one year and between years, that exceeds the differences in between panel means, is that the analyses of CFS, NFPBT and EFS have only low powers of detecting differences (probabilities of detecting differences between means were 18 percent, 25 percent and 76 percent respectively). While we have not found differences in these parameters between panels we are unable to say that they do not exist. Figure 2 shows the variability of CFS within the panels in 2007/08 and the between-year variability throughout the programme. The CFS values for all years are expressed in real 2007/08 dollars.

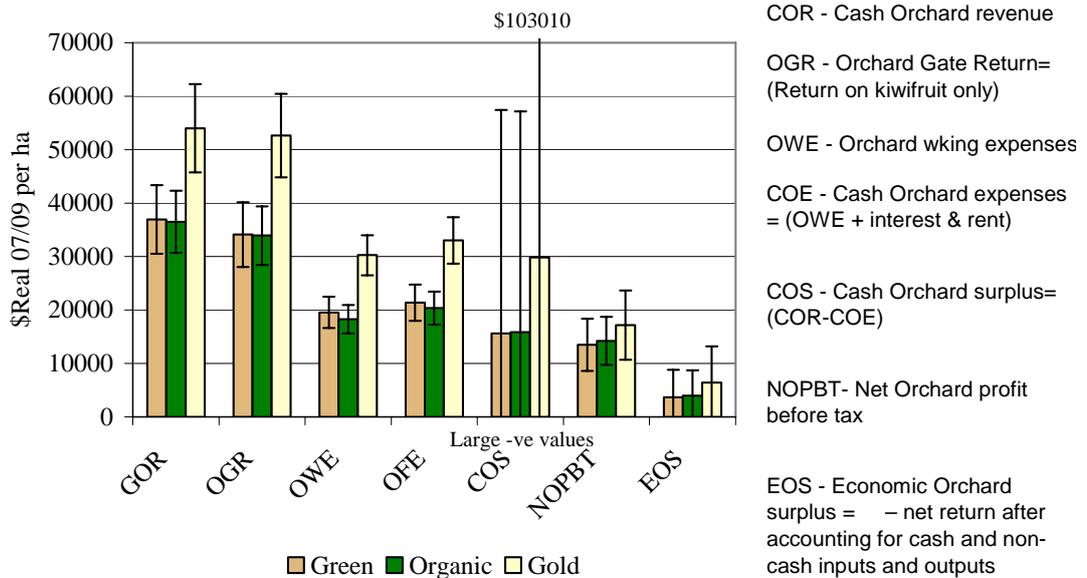
The inability to detect between-panel differences in these variables and the high level of within-panel variation is consistent with both the international literature and with New Zealand farm management understanding (Greer et al, 2008). The range of management skills, adaptive behaviour and learning patterns, which are key determinants of farm financial sustainability amongst farmers in any sector, is very wide and a skilled farmer is likely to achieve good results under any management or production system.

**Figure 2: Sheep and Beef Mean Cash Farm Surplus (\$/ha) by Management System**



Significant differences (at the one percent level) were also detected amongst the kiwifruit panels with respect to total revenues and costs, but in this case it was the Gold farms, which have very much higher yields than other varieties, that differed from Green and Organic orchards, which had very similar mean values for all variables. As in the sheep and beef analysis, it was not possible to detect differences across panels in any of the financial “bottom-line” variables because of the high levels of within-panel variability in these. The mean financial aggregate variables for the kiwifruit sector are shown in Figure 3.

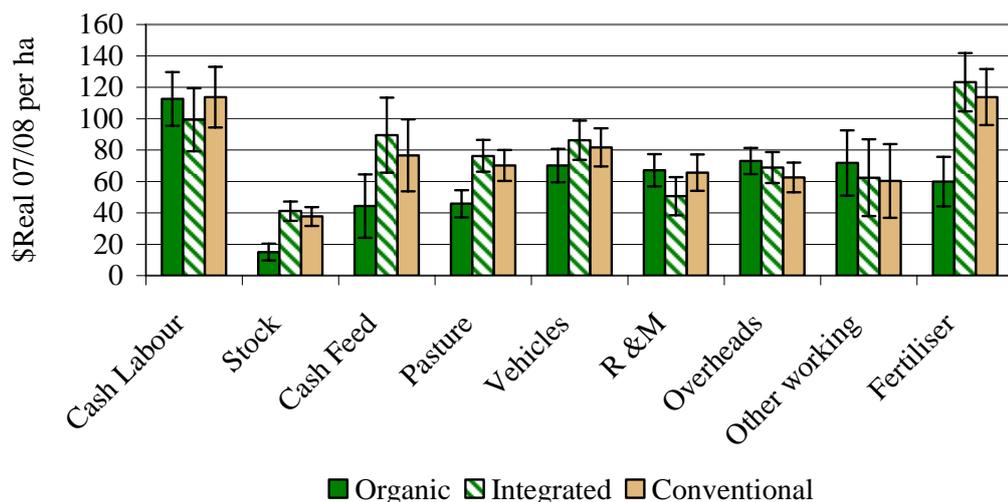
**Figure 3: Kiwifruit Mean Financial Aggregates (\$/ha) by Management System 2002/-3 – 2006/07**



## Individual Working Expenses

Many of the individual farm working expenses shown in Figure 3 have differed across panels in both the sheep and beef and kiwifruit sectors, as was expected. Organic sheep and beef farms have lower animal health, pasture, cash feed, total feed (which includes the value of feed inventory change) and fertiliser expenses than Conventional and Integrated farms. This is expected as lower inputs of animal health products and fertilisers are used on organic farms compared to farms with Conventional or Integrated management systems, and they have had significantly lower stocking rates throughout the period. Several other cost differences are approaching significance ( $F < 20\%$ ). Vehicle expenses are lower on Organic farms ( $F = 0.142$ ), perhaps reflecting less cultivation for pasture renewal, less feeding out, etc., and repairs and maintenance costs have been lower on the Integrated farms studied, although the reasons for this are not clear. The debt servicing ratio was significantly higher for Conventional farms than farms using either of the other two management systems (23 percent compared with 15.8 percent), suggesting a greater level of financial vulnerability. On all farms the mean ratio of FWE to GFR is similar for all panels at approximately 65 percent and although the estimated mean value of the CFE to GFR ratio is higher at 88 percent on Conventional farms than for other farms (80 percent) the difference is not significant. These ratios are higher than farm management guidelines recommend for financial sustainability (50 percent and 75 percent respectively). The MAF Farm Monitoring reports show that this has been the case for New Zealand sheep and beef farms for some years.

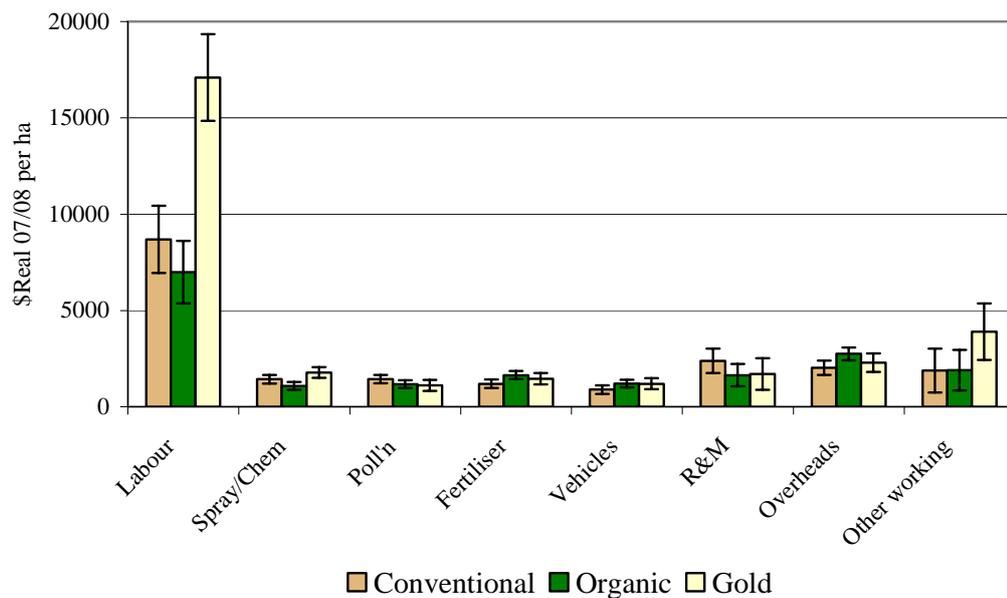
**Figure 3: Sheep and Beef Farm Working Expenses (\$/ha) by Management System 2002/-3 – 2007/08**



On kiwifruit orchards the significantly higher yields from Gold plants have resulted in significantly higher cash labour costs, which comprise the largest component of OWE as Figure 4 shows. Total labour costs are also significantly higher on Gold orchards, although the validity of some estimates of unpaid labour is uncertain.

Spray and chemical costs are, as may be expected, significantly lower on Organic than other farms but fertiliser expenses are significantly lower for Green kiwifruit as the high yielding Gold variety requires more nutrients and composting costs are high on Organic farms. Organic certification costs contribute a large part of the significantly higher overhead expenses on Organic farms. Cost differences approaching significance include higher pollination and repairs and maintenance costs on Green orchards ( $F=0.099$ ;  $F=0.171$ ), but lower vehicle costs ( $F=0.075$ ).

**Figure 4: Kiwifruit Farm Working Expenses (\$/ha) by Management System 2002/-3 – 2006/07**



## Farmer Type Effects

### Farmer Typologies

Under the social objective of the ARGOS programme, a type of cognitive mapping was used to show how sheep and beef farmers and kiwifruit orchardists integrated the economic, social and environmental factors important to their farming systems into a diagrammatic form known as a “causal map” (Fairweather et al 2007). Before the causal mapping was undertaken the Q-sort methodology was used to allow farmers to identify the factors they considered to be most important to their farming systems from lists of factors presented to them. Each farmer then prepared a map showing how these factors causally influenced each other and group maps were constructed for each management system using averaged data. In the sheep and beef sector four different cross-system groupings were identified from the Q-sort data that were later simplified to two farmer typologies, Type A and Type B. The maps of Type A farmers had fewer connections and less emphasis on environmental factors while Type B maps had more connections and emphasise satisfaction, external factors, the environment and family. Type B farmers have been summarized as having “a more profound view of their systems and this manifests wherever they focus their attention, whether it be family, environment or production” (Fairweather

et al, 2007). Of the 32 farmers included in the financial analysis, 28 were assigned Q-sort values; the characteristics of three did not fit either group and one left the programme before the Q-sort interviews were undertaken.

The Q-sort analysis of kiwifruit orchardists identified two farmer typologies; Type 1 (described as the “business” group) who gave more emphasis to post farmgate aspects such as customer satisfaction and requirements and post-harvest quality, and Type 2 (described as the “lifestyle” group) who emphasised family needs, off-orchard activities and the orchard environment as a place to live (Fairweather et al, 2009). Of 31 orchards included in the kiwifruit financial analysis; 24 were assigned a Q-sort value. Table 1 summarizes the Q-sort typologies in relation to management panels in each sector.

Although it was hoped that the causal maps constructed by the sheep and beef farmers and kiwifruit orchardists could be allocated to directly comparable groups this was not the case, since the factors that were most important to participants differed between sectors. However, there are similarities between Types A and 1 in that members of these groups are more closely focused on business performance than those in the second group for each sector. In both cases members of the second group were influenced by a wider range of non-business factors.

**Table 1: Q-sort Farmer Typologies by Management System – Sheep and Beef and Kiwifruit Sectors.**

Sheep and Beef	Type A	Type B	Unclassified
Conventional	4 (40%)	4 (40%)	2 (20%)
Integrated	3 (30%)	5 (50%)	2 (20%)
Organic	2 (17%)	10 (83%)	0
Total	9	19	4
Kiwifruit	Type 1	Type 2	Unclassified
Green	5 (50%)	2 (20%)	3 (30%)
Organic	6 (55%)	4 (36%)	1 (9%)
Gold	5 (50%)	2 (20%)	3 (30%)
Total	16	8	7

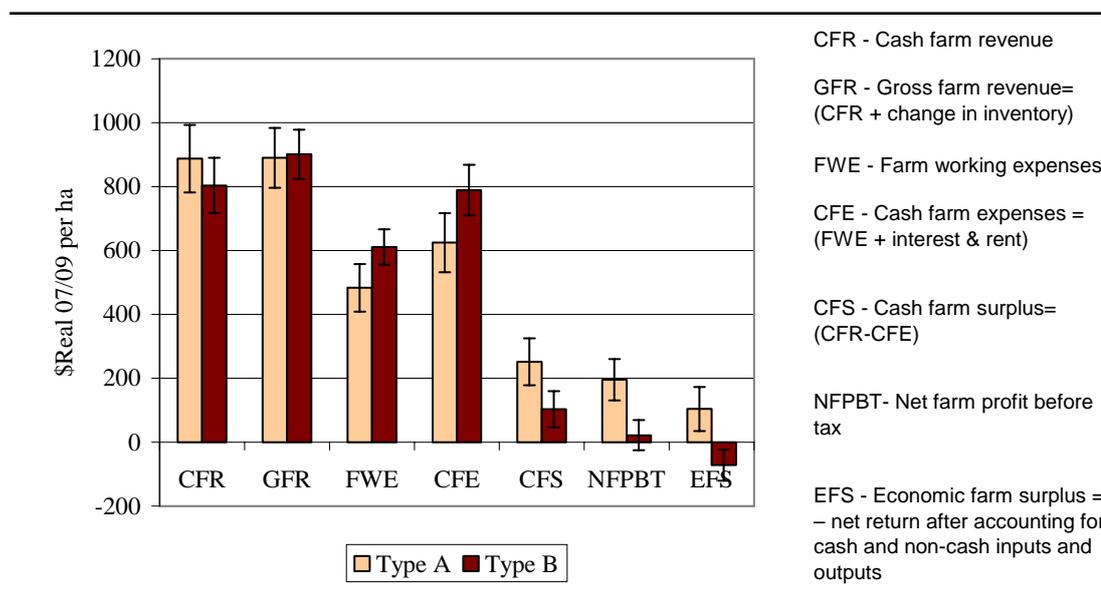
As might be expected, the largest group of Organic sheep and beef farmers have been classified as Type B or broader-focus farmers. However, amongst the Organic kiwifruit orchardists a greater proportion has been classified as Type 1 or business-oriented. Organic kiwifruit farmers have a close relationship with their marketer and a stringent audit system so it is to be expected that all aspects of post-harvest and market conditions would be of particular importance to them.

### **Financial Results in Relation to Farmer Typology**

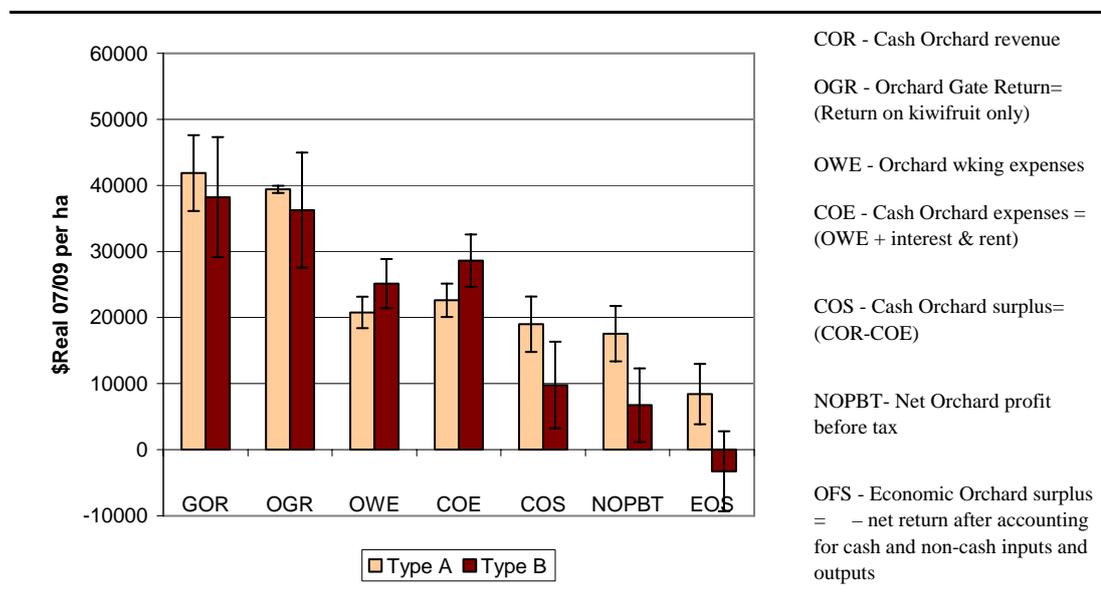
The main financial aggregate variables were re-analysed using Q-sort scores as the treatment and cluster and season as blocking value. Revenues did not differ significantly between Q-sort types, although the analysis had sufficient power to

detect such differences if they were present. For both Type A and Type 1 farmers, working expenses and cash farm expenses were lower than for Type B and Type 2 farmers and the profitability indicators CFS/COS, NFPBT/NOPBT and EFS/EOS were all significantly higher on farms with Type A/Type 1 farmers. Figures 5 and 6 show the financial aggregates by Q-sort type for each sector.

**Figure 5: Sheep and Beef Mean Financial Aggregates (\$/ha) by Farmer Type 2002/-3 – 2006/07**



**Figure 6: Kiwifruit Mean Financial Aggregates (\$/ha) by Farmer Type 2002/-3 – 2006/07**



## Conclusions

While we can say with certainty that the total revenues and costs of the Organic sheep and beef farms in our sample have been lower during the period than those of their Integrated and Conventional counterparts, we have been unable to detect

significant differences in the “bottom-line” measures of farm profitability. However, we are not yet able to say that those differences do not exist, only that the within-management system and between-year variability in the profitability of sheep and beef farms in all management systems means that if significant differences do exist we will need a longer time period or larger samples to detect them. We do know that in most years the range of values of these parameters on Organic farms lie within the ranges of the Integrated and Conventional Farms.

Despite the strong influence of the higher yield of the Gold kiwifruit variety on farm revenues and costs, we have been similarly unable to detect significant differences in farm profitability between our Kiwifruit panels despite the seemingly large differences in estimated mean values, because of the high sample variances.

Lower variability in individual cost parameters has allowed us to detect many differences in these, with most significant results reflecting expected differences that result from the high yields of Gold kiwifruit and the input restrictions imposed by Organic certifications systems.

Alignment of some of the data from the other ARGOS objectives with the financial outcomes on farms has proved interesting. Separation of farms by the Q-sort scores derived from the causal maps drawn by farmers, rather than by management systems, has created groupings that are significantly different with respect to farm profitability and costs in both sectors. Farmers who have a narrower, more farm/business-oriented focus (Type A/Type1) achieve greater profitability through tighter cost control rather by generating significantly higher revenues.

Analysis of some of the quantitative sheep and beef environmental and management data in the context of Q-sort groupings has been undertaken on over a hundred environmental and management variables, but very few significant differences have been detected. Most of the environmental variables analysed to date have been related to soils and bird counts, while management variables include, among others, stocking rates, quantity and age of plant and liveweight gains. More analysis will be undertaken in this area as data become available. With the exception of the stocking rates and numbers of motorbikes, none of the management data have differed significantly by farmer type. Type A farmers have had significantly higher stocking rates during the period than Type B farmers (11.6 compared with 8.8) and higher numbers of motorbikes although the relevance of the latter is difficult to interpret. Some differences in soil quality are significant but we are still working on understanding the effects of these. Interestingly, although the attitudes expressed by Type A farmers to increasing bird numbers and biodiversity in general, as well as to other issues such as erosion control and climate change, are less positive than those of Type B farmers, bird numbers and species abundance are actually greater on Type A farms.

The analysis of kiwifruit environmental and management data in relation to Q-sort groupings is not yet complete.

While ARGOS needs more time to further investigate farm and orchard profitability in relation to management systems, the data that we have analysed to date appears to confirm what many in the farm management discipline have always believed to be true – that a good farmer will achieve good results whatever management system

he/she chooses. The analysis of Q-sort data certainly appears to support the view that “sticking to one’s knitting” and focusing on a limited number of important factors for the individual farming operation has the best financial outcomes. It is too early to draw conclusions on the impact of this approach on social and environmental sustainability.

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