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Economics Objective Synthesis Report

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Executive Summary

The research undertaken by the ARGOS Economic Research Objective includes a wide range of research areas, many of which do not involve comparison of data from sector panels. The team monitors and reviews market access factors that may affect New Zealand agricultural producers' opportunity to export products to key markets, such as trade policies, market audit systems, and non-technical trade barriers. Ongoing consumer behaviour research is also undertaken to better understand consumer trends and attitudes towards food. Trade modelling comprises a large component of the Economic Research Objective to investigate the impacts of changes and potential changes in world markets on New Zealand trade. In addition, a bioeconomic model of on-farm weed control has been developed to identify optimum methods of weed control accounting for physical and financial constraints. Another area of research is the assessment of optimal approaches to supply chain management for societal and business outcomes.

There are two areas of Economic Objective research where sector panel data is collected and analysed. Ongoing work comparing financial data between the panels is undertaken in order to assess whether the farm management systems influence financial outcomes. Detailed financial data for four farming seasons, 2002/03 to 2005/06, have been collated and statistically analysed using Analysis of Variance for the majority of the ARGOS sheep and beef farms and kiwifruit orchards. Individual year analyses were carried out for each financial variable for each sector with relative few differences detected. More differences between panels were identified when the entire dataset was converted to 2005/2006 real values. However, high levels of variability within panels and small sample sizes make the power of the analysis weak and the results have to be interpreted with caution.

For the sheep and beef farms no differences between the panels were detected in any of the per hectare income and cost aggregates measures. However, a number of differences between panels were detected for individual cost elements. Organic farms have less stock and fertiliser expenses than Conventional and Integrated farms, which 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. This has not, however, translated into clearly lower pasture and cash and total feed costs on Organic farms. Interestingly, overhead costs are higher on Conventional than Organic farms despite the inclusion of the costs associated with organic certification, and so are other working expenses. The debt servicing ratio was higher for Conventional farms than farms using either of the other two management systems, suggesting a greater level of financial vulnerability.

The income and cost aggregate measures for the kiwifruit orchards showed that orchards growing the Gold variety have higher Gross Orchard Revenues, Orchard Gate Returns, Orchard Working Expenses and Cash Orchard Expenses than orchards growing the Green and Organic varieties, but this is not reflected in the 'bottom line' measures of Cash Orchard Surplus and Economic Surplus. This suggests that the higher per hectare returns achieved by the Gold orchards are being offset by higher production costs but further analysis is needed to confirm this. In particular, Gold orchards have higher cash and total labour costs than orchards growing the other two varieties reflecting the higher productivity of Gold vines. Fertiliser expenses on Gold orchards are higher than on Green orchards, but not Organic orchards where composting costs tend to be high. Overhead expenses are higher on Organic than Green and Gold orchards, which may reflect the costs associated with organic certification. It is important to note that only four Gold orchards were included in the analysis and these results should therefore be interpreted with caution.

The second area of panel analysis involved investigation of the extent to which the indicators used to assess the performance of conventional businesses apply to farm businesses. A number of performance indicators were investigated in a face-to-face survey of ARGOS

farms and orchardists, and analysed in conjunction with financial data. The results indicated that for most parts the performance indicator measures were not related to the financial data, suggesting that caution should be taken when applying conventional performance indicators to the agricultural sector. However, there were some differences between the panels. For the sheep and beef sectors, Conventional farmers have more of their supplies purchased locally than farmers using Organic and Integrated management systems. In the kiwifruit sector, Gold orchards have a higher number of paid staff, higher level of dry matter and greater gross revenue per effective hectare than Green and Organic orchards, which is consistent with the results from the financial analysis.

2. Introduction

The Agriculture Research Group on Sustainability (ARGOS) was established to examine the environmental, social and economic sustainability of New Zealand farming systems, and to develop a better understanding of the environmental effects, and the social and economic consequences of different farming practices.

The Economic Research Objective has the target of monitoring and reviewing the international trends in policy and market access which will, or are likely to, affect New Zealand's market access and returns. This work includes a review of market audit systems and their relevance and application to the New Zealand situation, as well as their importance. From this, six monthly ARGOS reports are produced for the sectors. This also has resulted in co-funded research such as the Food Miles project. In addition a range of presentations, papers and reports have been produced for a variety of end-users including government agencies, sector groups and academics. The Economic team also has ongoing work in consumer behaviour research, both the development of the theory and of applications to assess consumer behaviour and its changes, as well as co-funded projects which have assessed consumer behaviour and its implications for New Zealand agriculture.

Another key objective of the Economics Research Objective is the modelling of impacts of changes and potential changes in world markets on New Zealand's trade, primarily using the Lincoln Trade and Environment Model (LTEM). This is a unique model in that it relates trade through to the production system and to its environmental consequences. The ARGOS project has used the LTEM model in a number of ways.

- A range of policy and market change scenarios have been modelled to assess their impacts on New Zealand agriculture and the results presented through papers and workshops to a range of sector groups and academic forums. This is ongoing work allowing the information collected in the market access part of the project above and changes in trade policy to be assessed. The data collected on-farm as part of ARGOS, including production system and environmental data, are being used on an ongoing basis to update and recalibrate LTEM. Moreover, it is envisaged that more of the data collected under the Environment Research Objective and, it is hoped, under the Social Research Objective will be included in the model in future.

- Two new trade models have been constructed:

    1. A kiwifruit model, which includes a more appropriate range of countries for this sector than the original LTEM, and which identifies separate markets for the three types of kiwifruit to reflect ARGOS panel divisions has been developed to facilitate continued ZESPRI involvement in ARGOS.

    2. A much larger trade model has been constructed which combines the old trade and environment model and the model which allows different types of products in markets (e.g.: organic and conventional). This model has greatly extended the country coverage of original model and updates the database to the latest year possible. It is currently being tested and used to assess the impact of bio-fuel expansion in the USA on New Zealand exports.

    Outputs from the model will also contribute to syntheses across all objectives so that farmers and their sector representatives can identify the best pathways to sustainability. This will be achieved by showing how the different dimensions of sustainability are related, and the trade-offs involved when multiple dimensions are

considered. Priorities for policy will be identified with input from sector leaders and industry policymakers.

The Economic Research Objective is also assessing the management literature on the optimal approaches to management for achieving societal and business outcomes. This has led to research into assessing the role of types of supply chains in business success and to reviews, co-funded by MAF and the AREN network, into what makes a successful business and what factors distinguish agri-business from the generic management literature.

Work is also on-going reviewing the literature on sustainable development, which has led to a number of papers in national and international journals. This literature covers the economic, social, environmental and cultural aspects of sustainability and should contribute to trans-disciplinary analysis under ARGOS.

Literature reviews have been undertaken of the ecological economic, bioeconomic and productivity areas of research. The team is building a new bioeconomic model of on-farm weed control, accounting for the physical and financial constraints and thus optimum method of control, which we hope will also inform the trans-disciplinary research.

Data analysis to underpin the trans-disciplinary synthesis through preliminary work with ARGOS database has begun. This work has focused initially on usability issues and determining the potential extent of the trans-disciplinary data analysis. The economics team has also examined the extent to which the data from all objectives discriminate amongst clusters, sectors and panels.

Much of the work undertaken by the Economic team to assist in achieving the underlying ARGOS objective to date does not involve the comparison of data from the sector panels.

In the farm financial area, however, detailed data for four farming seasons, 2002/03 to 2005/06 have been collated for the majority of farms and initial statistical analysis, reported in Section 2, has been undertaken to test the null hypothesis of ARGOS that:

H_O: There are no significant differences in the environmental, economic and social characteristics and conditions of the management styles on the participating farms and orchards.

The second area of panel analysis involved investigation of the extent to which the information employed to assess the success or performance of conventional businesses applies to farm businesses. This information is based on models of business success that have become important planning, analytical and policy tools in the broader business community, enabling firms to analyse the structure of a particular sector, plan business ventures, and monitor ongoing performance. They also enable policy makers to understand the key elements of business activity within a sector and provide tools to facilitate business development and overall socio-economic growth strategies. The Economic Objective (Zellman, 2007) has examined the degree to which these indictors are related to the financial performance of farms in New Zealand, specifically sheep and beef farms and kiwifruit orchards, using ARGOS farm data. The research also tested the null hypothesis that farms and orchards with different management systems (in different panels) did not differ in the performance indicator measures.

3. The Farm Financial Analysis

3.1 ARGOS Panels and Data Availability

Three panels of farms have been defined in each of the Kiwifruit and Sheep/Beef sectors, on the basis of the growers' involvement with market audit and certification schemes. These schemes impose and/or prohibit particular farm management practices and, as such, may be expected to change the relative magnitudes of costs incurred. An objective of the financial analysis is the estimation of the extent to which these effects influence financial sustainability. The panels are 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); EurepGAP certified Green (Hayward), EurepGAP certified Gold (Hort 16A)

In 2003 twelve clusters of three farms were selected for each sector. By the end of the 2005/06 season, five Sheep/Beef farms had withdrawn from the project, mainly as a result of farm sales, and an additional converting organic farm had been added. Of the growers of gold kiwifruit, only six grow only gold and as the costs and returns to the mix of gold and green fruit on other orchards cannot be separated they have not been included in the analysis, leaving only 30 kiwifruit properties in the panels. Of the six gold-only growers, reliable financial data are available only for four, leaving only a very small sample for analysis. The availability of financial data in each year is summarised in Table 1.

Table 1. Data availability

	2002/03	2003/04	2004/05	2005/05
Sheep/Beef:				
All data available/usable	27 (8C,9I,10O)	28 (8C,10I,10O)	28 (8C,10I,10O)	26 (8C,8I,10O)
Data available in future	5	5	5	5
Data not available	3	2	1	1
Farm withdrawn	2	2	3	5
Kiwifruit:				
All data available/usable	14 (6Gr,7O,1Go)	16 (6Gr,8O,2Go)	16 (7Gr,7O,2Go)	16 (7Gr,7O,2Go)
Operating data only	6	8	8	8
Data not available	10	6	6	6

3.2 Data Collection

Annual farm accounts, which are the main source of financial data that can provided by the majority of farmers, have been collected for each of the four farming seasons. However, as these are prepared primarily for taxation purposes, they usually fail to provide a clear and current picture of the operation of the whole farm entity. In particular, the following issues have been addressed as described:

Historical cost reporting of capital items: Most schedules of farming assets are prepared on a "depreciated historical cost" basis, which, although not likely to lead to major value distortions when applied to plant, machinery and other fixed assets on Sheep/Beef and kiwifruit orchards is not an appropriate approach to ascertaining current capital values. Instead 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. On many of the kiwifruit farms it has not been possible to obtain capital data since the ARGOS orchard is a small part only of a much larger fruit-growing or packing enterprise and no separate data are available.

Ownership structures: Farms in the ARGOS panels are owned and operated under a range of structures including companies, partnerships and trusts. On most Sheep/Beef farms (although this is less prevalent amongst the kiwifruit orchards), more than one of these structures are involved and a range of between-entity transfers occurs for taxation and succession reasons each year. In order to take a "whole-farm-entity" approach all internal transfers have been excluded and the income, costs and capital streams of all entities involved have been aggregated.

Valuing non-cash resources: In comparing the sustainability of business growth and operation between farms it is necessary to assess the extent to which the final cash result has been achieved at the expense of unpaid family labour or by depletion of other non-cash items such as feed reserves and soil fertility and to value those resources where possible. To date "Wages of Management" have been calculated using the approach advocated by the Ministry of Agriculture and Fisheries for each of the industries and unpaid labour over and above the management role that has been reported by farmers has been charged at the prevailing average wage for each industry. Data on feed inventories has been incorporated since 2004/05 and changes in soil P levels have been valued for kiwifruit farms but insufficient data is available to date to do so for Sheep/Beef farms.

Other major enterprises: On several properties a major enterprise other than those normally associated with that farm type is carried out (e.g. contracting) and the resources it uses cannot be separated from those devoted to farming. The resource costs and returns from these ventures could not be excluded from the analysis.

Additional data: In most cases the data obtained from farm accounts has been supplemented with information obtained from farmers and accountants in order, for example, to reallocate costs to categories that are more meaningful in a management sense than the accounting categories used but the integrity of the "bottom-line' reported in the accounts has been preserved in all cases.

Atypical years: In two cases, a year of data has been dropped from the analysis for an individual farm because of the complexity of the capital and operating transactions, outside of ARGOS but included in the accounts in that year.

3.3 Panel Differences

Analysis of Variance (unbalanced treatment structure) was conducted in order to determine whether there were significant differences between panels with respect to financial variables. The treatment was the management system while cluster was treated as blocking variables to account for differences in location, and in the case of the Sheep/Beef panels, the emphasis on cash cropping as a source of farm revenue. Individual year analyses were carried out for each variable with relatively few differences detected, but when the entire dataset was converted to real 2005/06 values using the Consumer Price Index (all groups) more significant results were found. In the real value analysis the season was included as a blocking variable. A number of significant differences have been detected between panels, particularly with respect to individual cost elements in the sheep/beef analysis and income and cost aggregates in the kiwifruit analysis. However, further analysis is required before we can say the lack of any significant panel differences with respect to many other variables reflects an actual lack of difference, or a lack of power to detect any difference, because of the high levels of variability in the data from small samples. Further analysis in this area will be conducted.

3.4 The Sheep/Beef sector

3.4.1 Per hectare income and cost aggregates:

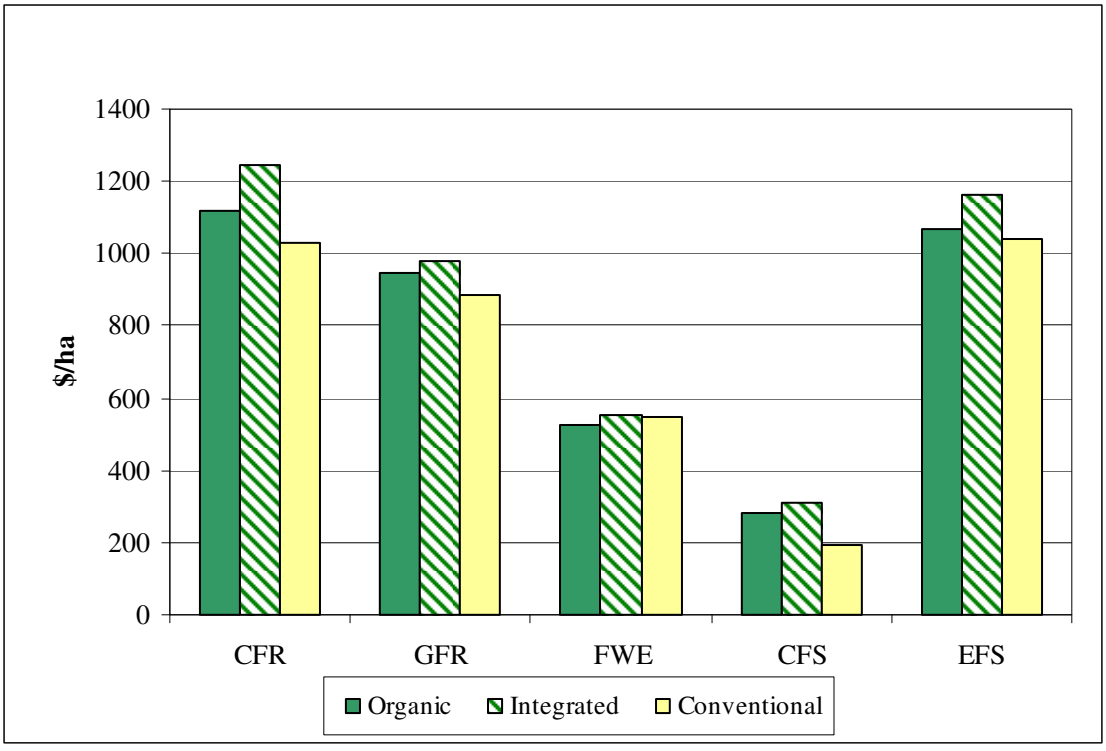

Figure 1. Sheep/Beef panels mean values over four years – major financial aggregates (Real $2005/06 values)

No significant differences were detected in any of the overall financial aggregates between panels in any single year or in the combined data set by the analysis carried out to date. Figure 1 shows the estimated real ($2005/06) mean values of Cash Farm Revenue (CFR);

Gross Farm Revenue (GFR=CFR plus value of inventory changes); Farm Working Expenses (FWE=cash operating expenses i.e excludes debt servicing), Cash Farm Surplus (CFS=CFR- Cash Farm Expenditure, which includes debt servicing) and Economic Farm Surplus (EFS – net return after accounting for cash and non-cash inputs and outputs) over the four years from 2002/03 to 2005/06. Tables showing means and 95 percent confidence intervals are presented in Appendix 1. The EFS (or Operating Profit) is the net return to farming after accounting for inventory changes, depreciation and the use of unpriced resources.

3.4.2 Individual cost elements

Significant differences were, however, detected in individual cost elements between the panels, although skew and kurtosis effects in the data on total feed costs (cash feed costs plus change in feed inventory values) and a slight skew in the pasture renovation cost data necessitates caution in interpreting these results. As feed inventory changes were included only for 2005/06, cash feed costs over the period may provide more meaningful results in future years. Table 2 shows the differences detected between panels.

Table 2. Sheep/Beef panel differences in individual working costs

	Significance of difference	Difference
Stock expenses	1%	(C,I)>O
Cash feed expenses	5%	C>O, C=I, I=O
Total feed expenses	5%	(I>O)(C=I)(C=O)
Cash labour expenses	NS	
Total labour expenses	1%	(I,O)>C
Pasture expenses	1%	I>(C,O)
Fertiliser expenses	1%	(C,I)>O
Repairs and maintenance expenses	NS	
Vehicle expenses	NS	
Overhead expenses	5%	C>O,C=I,I=O
Other working expenses	1%	C>O, C=I, I=O

Lower inputs of animal health products and fertiliser on Organic farms have, as expected, led to significantly lower stock and fertiliser costs on Organic farms than on the Conventional or Integrated farms, although this has not translated into clearly lower feed and pasture renewal costs on these properties. Pasture renewal and maintenance costs are significantly higher on integrated farms than in the other panels and cash feed costs are higher on Conventional than Organic farms. Overhead costs are also higher on Conventional than Organic farms despite the inclusion of organic certification costs under this heading for Organic properties. The higher level of “other” working expenses on Conventional farms does not appear to reflect a consistently higher level of any one of the costs included in this total. Figure 2 shows the mean real values of individual cost elements for each of the panels.

3.4.3 Other key performance indicators

Only one of the other key performance indicators tested differed significantly between panels. The debt servicing ratio was significantly higher at the five percent level on Conventional farms than in other panels.

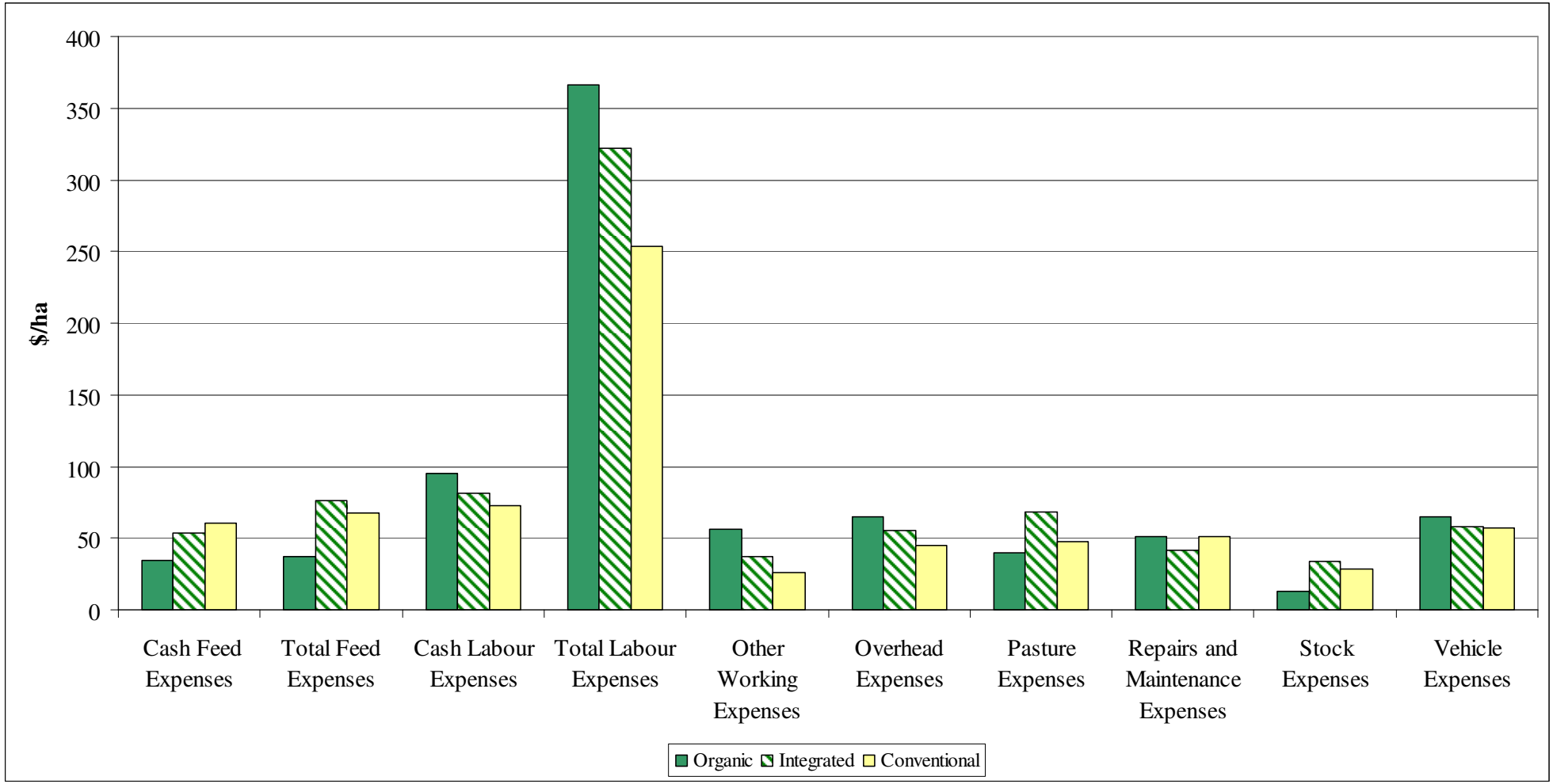

Figure 2. Sheep/Beef panel mean values over four years– individual cost elements (Real $2005/06 values)

3.5 The kiwifruit sector

3.5.1 Per hectare income and cost aggregates

Although the Gold ARGOS kiwifruit orchards have significantly higher costs and returns per hectare than Green or Organic orchards, at this stage of the analysis no significant differences could be detected between panels with respect to Cash Orchard Surplus and Economic Orchard Surplus (see Section 2.4.1 for definitions). Should this be supported by subsequent power analysis it implies that the higher per hectare returns to gold production are being offset by higher production costs. No differences were detected between income and cost aggregates calculated for Green and Organic orchards. Significance levels are presented in Table 3 and estimated mean income and cost values are shown in Figure 3.

Table 3. Kiwifruit panel differences in per hectare income and cost aggregates

	Significance of difference	Difference
Gross orchard revenue	5%	Go>(O,Gr)
Orchard gate return for kiwifruit	1%	Go>(O,Gr)
Orchard working expenses	1%	Go>(O,Gr)
Cash orchard expenses	1%	Go>(O,Gr)
Cash orchard surplus	NS	
Economic orchard surplus	NS	

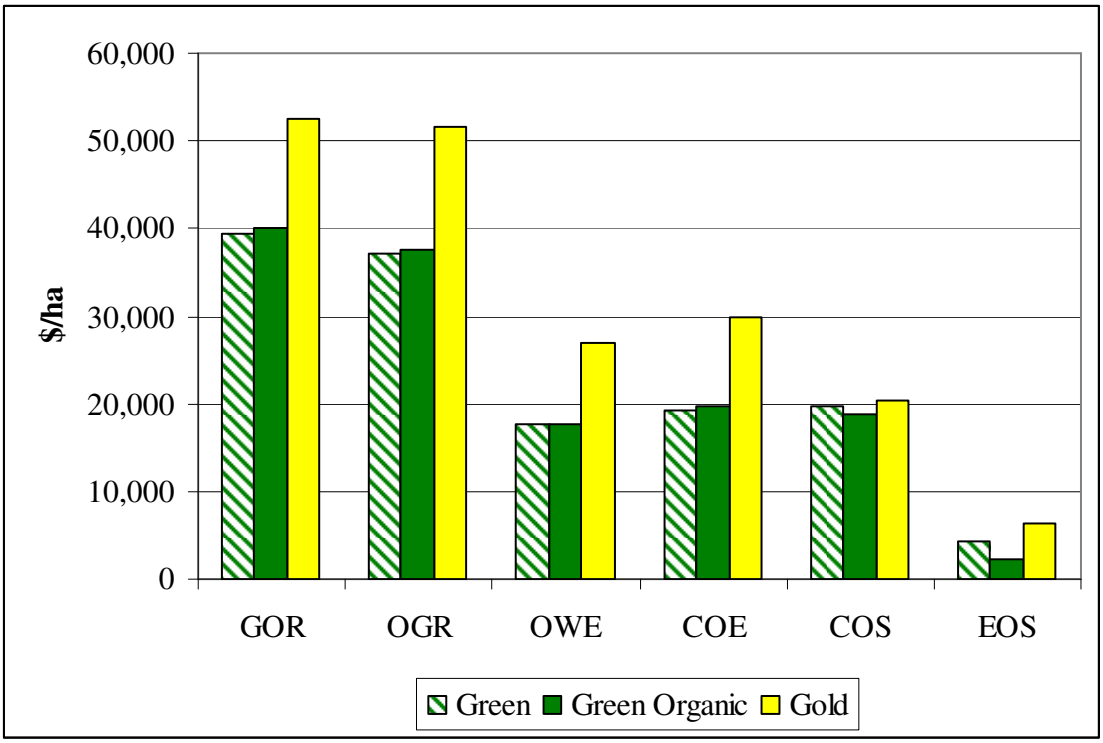

Figure 3. Kiwifruit panels mean values over four years – major financial aggregates (Real $2005/06 values)

3.5.2 Individual cost elements

Few significant differences were detected in the levels of individual orchard costs between the panels. Both cash and total labour costs are significantly higher on Gold orchards than on other orchards, reflecting the costs of picking the high yielding Gold crop. Fertiliser expenses are significantly lower on Green orchards than on higher yielding Gold orchards or on Organic orchards where composting costs are often high. Overhead expenses are higher on Organic than Green and Gold orchards, which may reflect the cost associated with organic certification. The only other difference detected at this level of analysis was that vehicle costs are significantly higher on Organic orchards, perhaps reflecting in part the extra numbers of spraying operations required on these.

Table 4. Kiwifruit panel differences in individual working costs

	Significance of difference	Difference
Cash labour expenses	1%	Go>Gr>O
Total labour expenses	1%	Go>(Gr,O)
Fertiliser expenses	1%	(Go,O)>Gr
Pollination expenses	NS	
Repairs and maintenance expenses	NS	
Spray and chemical expenses	NS	
Overhead expenses	1%	O>(Gr,Go)
Other working expenses	NS	
Vehicle expenses	1%	Gr>O,Gr=Go,Go=O

3.5.3 Other key performance indicators

Only one of the other key performance indicators differed significantly between panels. The ratio of OWE to GOR is significantly higher during the period on Organic orchards than on Green or Gold orchards.

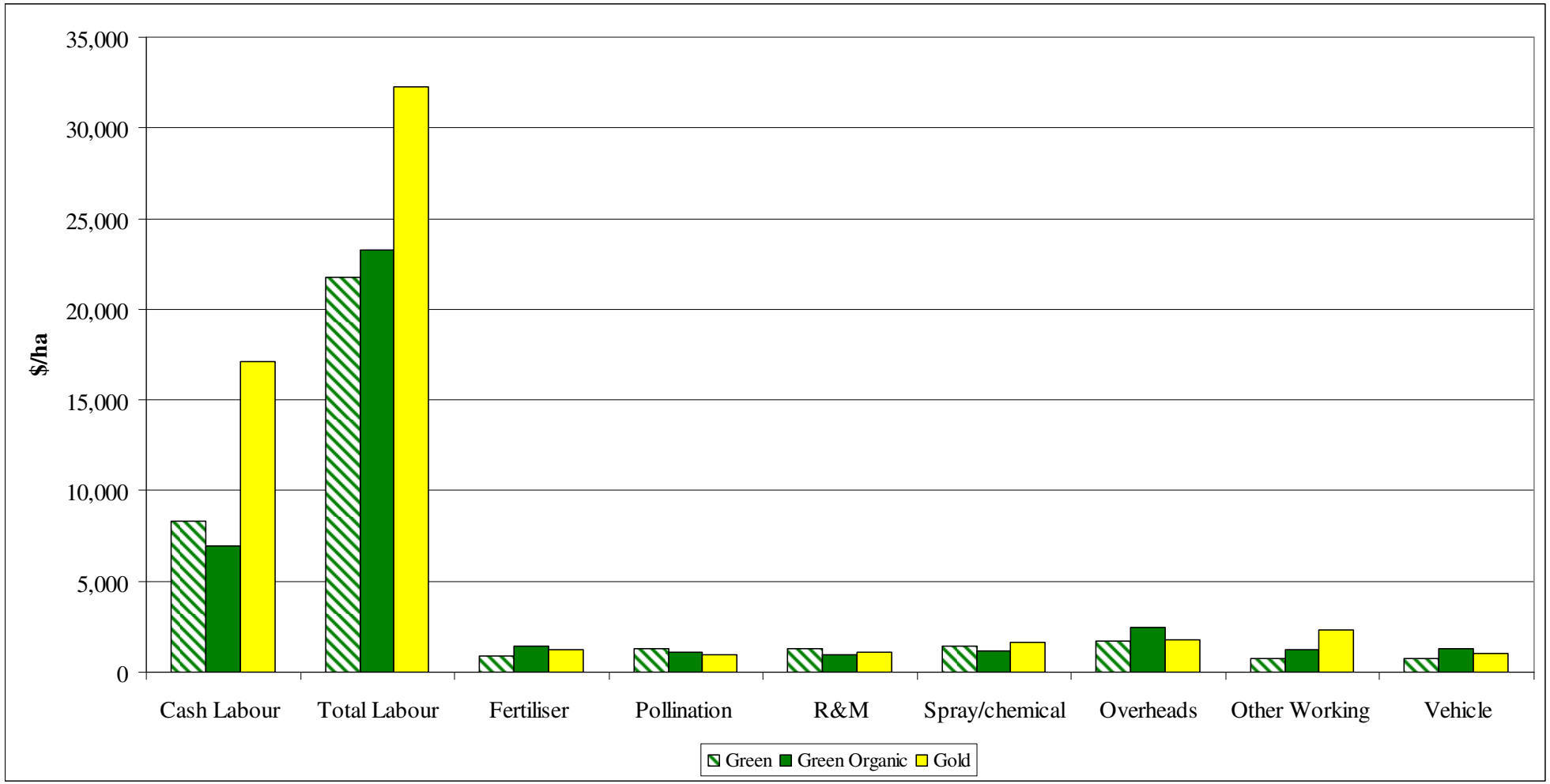

Figure 4. Kiwifruit panel mean values over four years– individual cost elements (Real $2005/06 values)

4. Applicability of Performance Indicators to Farms and Orchards

4.1 Framing the performance indicators

Review of the literature elicited a number of performance indicators that had potential relevance for the assessment of farm business success, which were investigated by means of a "face-to face" survey of farmers and orchardists. The responses were then analysed in conjunction with financial data for the 2004/2005 financial year in the case of the kiwifruit orchards and financial data from the 2003/2004 financial year for sheep/beef farms. (This analysis was completed before the 05/06 rework of all financial data during which some changes to the data were made). Gross farm revenue and cash surplus per effective hectare were used as financial performance indicators. Responses were also analysed in conjunction with other factors derived from the ARGOS database that may potentially affect success. In the case of kiwifruit orchards, one environmental indicator was included (average number of earthworms between and within rows) and one quality indicator (average fruit dry matter). In the case of the sheep and beef farms, the ARGOS database provided one environmental factor (the average number of earthworms). Between panel differences were investigated using analysis of variance for a randomised block design.

The performance indicators investigated included:

1. *Structure of the firm*: (Firm size)	• Number of paid staff • Total number of staff)
2. Business strategy (Business management plan)	• Have a management plan • Number of times refer to management plan • Value of management plan
3. Customer focus (Contact with and feedback from customers)	• Frequency of customer information • Influence of customer information • Percentage sales directly to customers/end-users
4. Quality (Quality grades of products)	• Dry matter (kiwifruit only)
5. Employee relations (Employee turnover)	• Percentage staff turn over
(Absentee rates/sick leave)	• Work days lost due to sickness and injury
(Performance based pay)	• Number of staff on performance based pay • Value of performance based pay
(Training provision)	• Number of staff participated in training • Number of training days

6. *Innovation*

(Use of ICT)	• Importance of ICT usage
(Investment/change in cap.)	• State of current plant and machinery • Planned investments in technology • Changes to management system

7. *Social/ environmental factors*

(% of employees from the locality)	• Number of staff members living locally or on-farm
(% of suppliers locally based)	• % of key supplies obtained locally
(Participation in local/ public policy making)	• Participation in local and national election • Participation in community groups
(Contributions to/ donations to/ participation in local groups)	• Donations to community activities • Value of donation
(Environment)	• Average number of earth-worms

4.2 Success of the performance indicators

4.2.1 Structure of the firm

Kiwifruit sector

On kiwifruit orchards positive relationships were found between the size of the business and aspects of financial performance. Both gross orchard revenue per effective hectare (GOR) and cash surplus per effective hectare (COS) were significantly correlated with the number of paid employees and with the number of employees in total.

The greater the number of staff working on an orchard, the higher is GOR and COS.

Analysis of variance for a randomised block design test found a significant difference (p=5%) between the three different management systems and the “number of paid staff” measure, and descriptive post hoc analysis showed that Gold orchards have more paid employees than Green and Organic orchards. The post hoc analysis also revealed a statistically significant cluster effect for the “number of paid staff” and “total number of staff” measures, so location of orchards is important.

Sheep and beef sector

Conversely, on sheep and beef farms a significant negative correlation was found between both the number of paid staff and the numbers of total staff and CFS per hectare. These results suggest that the more people a sheep and beef farm employs, the lower its CFS. The correlations between the two size measures and GFR were not statistically significant and no management system or cluster effects were found for these indicators.

4.2.2 Business strategy

Kiwifruit sector

Only five of the 30 orchardists stated they have a written management plan, and those that have management plans and those that do not had similar levels of GOR and COS per hectare. The number of times per year that producers consulted their business plans also appeared to have no correlation with GOR and COS, and there was no statistically significant correlation between the value placed on having a written management plan and GOR and COS per hectare.

The value of a written management plan measure did not differ significantly between management systems, but does differ significantly amongst clusters.

Sheep and beef sector

Eleven of the 31 sheep and beef farmers reported having a written business plan. Cross tabulation results showed that a higher proportion of farms with a business plan had gross farm revenue per effective hectare (GFR) that was above the median (63%) than farms without a business plan (35%). No similar trend was found for cash farm surplus per effective hectare (CFS).

Neither the number of times per year that farmers consulted their business plans nor the value they placed on having a written management plan were found to be significantly related to the financial performance measures tested. No management system effect on the perceived value of having a business plan was found.

4.2.3 Customer focus

Kiwifruit sector

The frequency of customer feedback was not shown to have any impact on GOR or COS but it is important to note that 80 per cent of orchards did receive information about customer requirements at least once a month. The low differentiation amongst orchards on this performance indicator made it difficult to ascertain the importance of customer requirement information in the kiwifruit sector. There was a significant positive correlation between the extent to which orchardists believe that the information they receive about customer requirements influences the way they operate their orchard and GOR but not COS. None of the orchards made sales directly to consumers, but marketed their full production through ZESPRI.

An analysis of variance for randomised blocked design was conducted for the “frequency of customer feedback” measure to establish any management system effects, but none were detected.

Sheep and beef sector

Sheep and beef farmers tended to receive information about customer requirements less often than kiwifruit orchards, as only 61 per cent of farmers received this type of information at least once a month. The chi-square results showed that that no differences were detected in the proportion of farms that have above-median GFR and CFS between farmers who receive information at least once a month and those who receive information less frequently. In addition, there was no statistically significant correlation established between the extent to which customer-requirement information influences orchard operations and GFR and CFS

Only eight out of the 31 sheep and beef farms made sales directly to consumers and there was no significant difference found between the number of farms with above median GFR or CFS between these eight farms and the farms that do not make any sales directly to customers.

Potential management system effects for the frequency of customer feedback indicator were explored, but none were detected.

4.2.4 Quality

Kiwifruit sector

Kiwifruit dry matter, relevant only to the kiwifruit sector, was the only quality indicator tested. Orchards were divided into those which have average dry matter above and below the median score for the participating ARGOS orchards. When GOR and COS for these orchards were compared, 63 per cent of orchards with above median dry matter also had above average GOR and COS compared to only 36 percent for orchards with below median dry matter, although the results were not statistically significant.

A significant management system effect was found for this variable and the Games-Howell post hoc pairwise comparison test revealed that the Gold orchards produce fruit with significantly more dry matter than Green and Organic orchards. However, given the properties of gold kiwifruit this is not surprising.

4.2.5 Employee relations

Kiwifruit sector

Thirty-three per cent of orchardists who completed in the questionnaire had paid staff (includes paid employees and paid family members working full-time or part-time). The number of staff members per orchard varied from one to eight, with a median value of zero and mean of 1.27. Twenty-eight of the 30 orchards participating in the questionnaire used contract labour for some operations. There was insufficient variability in the responses from orchards on the employee relations measures to conduct a meaningful analysis. Only one of the 30 orchards had had a staff member resign in the last 12 months; only one orchard had lost paid staff workdays in the last 12 months due to sickness or injury at work; and two of the 30 orchards had a staff member on a pay for performance scheme.

Information on participation in training programmes was also collected. There was no statistically significant difference in GOR or COS between orchards that had either the orchardist or a staff member participate in external/formal training in the last 12 months and those that did not, and no significant correlation between number of training days and GOR or COS.

Management system effects were analysed for the number of staff participating in external/formal training and training days measures, but no statistically significant results were identified. On the other hand, significant cluster effects were found for the number of staff participating in external/formal training measure.

Sheep and beef sector

The sheep and beef farms used paid labour and contractors differently to the kiwifruit sector. Seventy-seven per cent of sheep and beef farms that completed the questionnaire had paid staff (paid employees and family members). The number of staff members per farm varied from one to ten, with a median value of two and mean of 2.16. Twenty-six of the 31 sheep and beef farms used contractors for labour requirements. Seven of the 31 sheep and beef farms had paid employees resign in the last 12 months, but there was no significant correlation between staff turnover and GFR and CFS or between sickness and injury rates and the financial performance measures. Pay for performance schemes were only used by three of the 31 farmers, so their relationship to financial performance could not be assessed.

No significant relationships were established between employee relationships and financial performance on the sheep and beef farms.

4.2.6 Innovation

The questionnaire asked about several specific areas of innovation. Growers were asked to rate their current plant and machinery against commonly available "best technology"; about their plans for future investment in technology, machinery and/or equipment; whether the farm or orchard had undergone management system changes in the last two years with the aim of improving any aspect of the operation; and about the importance that they placed on using information technology and computers for different purposes.

Kiwifruit sector

On kiwifruit orchards no significant relationships were established between financial performance and growers' perceptions of whether their plant and machinery was up-to-date with the best commonly available technology, their expected future investment in technology, machinery and/or equipment or changes in management systems in the last two years.

The importance that the orchardists accorded the use of information technology and computers overall was positively correlated with GOR and COS, although no significant correlations were found between the two financial measures and use of individual computer applications including financial recording, information seeking and e-mail purposes.

Management system effects were explored for two indicators: to what extent plant and machinery is up-to-date with the best commonly available technology, and level of importance that the orchardists placed on using information technology and computers for different purposes. No significant management system effects with respect to the use of most up-to-date plant and machinery and emphasis on using ICT for information seeking were identified.

Sheep and beef sector

In contrast to orchardists, sheep and beef farmers' perceptions of whether their plant and machinery was up-to-date with the best commonly available technology had a significant relationship with GFR but not with CFS. A higher proportion of farmers who perceived their plant and machinery to compare favourably with best commonly available technology had above-median levels of GFR. An analysis of variance with randomised block design test was performed to explore any management system effects for this measurement, but this test did not reveal a significant result.

No significant differences were found in GFR and CFS between those who plan to invest in technology, machinery and/or equipment in future and those who do not, or between those who had made management changes during the last two years and those who had not.

The three innovation questions about the importance farmers place on using information technology and computers for different purposes did not appear to be related to GFR or CFS on sheep and beef farms and there were no management system effects for the three information technology measures.

4.2.7 Social/environmental indicators

Kiwifruit sector

One set of questions covered the producer's support of community activities through sponsorship, monetary donations, or time. The cross tabulation results indicated that a higher proportion of orchardists who engaged in sponsorship or donation activities tend to have above-median GOR and COS (56%) than orchardists who do not engage in sponsorship or donation activities (20%). However, these results were not statistically significant. There was no significant correlation between the value placed on supporting community activities and GOR or COS.

Orchardists were also asked about their participation in community groups. The cross tabulations results suggested that a higher proportion of orchardists who were involved in a community group had above-median GOR and COS (56%) than those that did not participate (20%), but this difference was not statistically significant.

Participation in the local economy has been linked to business success. Consequently, the orchardists were asked where they sourced their chemical, fertiliser, veterinary and seeds supplies. Eighty percent of orchardists obtain all their supplies locally and the variation in the dataset was thus insufficient to analyse statistically.

They were also asked whether their staff lived locally. Twenty-six of the 30 orchards had all their staff (orchardist, family, employees) living either on the orchard or locally. Another indicator of participation in society is the level of participation in national and local elections. All but one orchardist generally participated in national elections and all but three orchardists generally participated in the local elections. There was insufficient variability in the responses to conduct any meaningful analyses of these measures.

Finally, the ARGOS database contained environmental data in the form of number of earth-worms within and between rows of kiwifruit vines. For each orchard, it was established whether the average count of earth-worms was above or below the median count for all ARGOS orchards completing the questionnaire. The chi-square results did not reveal a significant difference in GOR or COS between orchards with above and below median counts of earth-worms between rows or between orchards with above and below median counts of earth-worms within rows.

Management systems effects were explored for the earth worm and local purchasing of supplies indicators, but none were found. Cluster effects were found for the between and within rows earth-worm measure.

Sheep and beef sector

The sheep and beef farmers were also queried about social and environmental indicators. When asked whether they participate in community groups or support community activities through sponsorship, monetary donations, or time, nearly all farmers reported that they were doing this, so there was insufficient variation to conduct a statistical analysis. As in the kiwifruit sector, there was no significant correlation between the value placed on supporting community activities and GFR or CFS.

To establish to what extent the farmers participate in the local economy, they were asked about where they sourced their chemical, fertiliser, veterinary and seeds supplies. Farmers reported purchasing 70 per cent of their supplies locally, 27 per cent regionally and three per cent nationally and overseas. There was a significant positive correlation between percentage of supplied purchased locally and GFR but not between local purchasing and CFS). There was also a significant management system effect for this measurement. The descriptive post hoc analysis revealed that Conventional farms purchase a higher percentage of their supplies locally than Organic and Integrated farms, but the Games-Howell pairwise post hoc comparisons was not statistically significant.

No significant correlation was found between local residence and the financial performance indicators.

All the farmers who participated in the survey generally participated in national elections and all but one of the farmers generally participated in the local elections. The lack of variability for this performance indicator precluded a meaningful statistical analysis.

Finally, the results for the environmental indicator, measured by the average counts of earth-worms in the soil, showed that there was no significant relationship between farms' gross revenues or cash surplus and the number of earth-worms in their soil.

4.2.8 Financial performance

Management system effects were explored for the financial performance data for both the kiwifruit and sheep and beef sectors. Analysis of variance for randomized block design tests revealed a statistically significant management system effect for gross farm revenue for the kiwifruit orchards. Descriptive post hoc data indicate that Gold orchards have higher GOR than Green and Organic orchards, but pairwise post hoc comparison tests did not show statistically significant results. A cluster effect was also found for the COS variable on the kiwifruit orchards.

On the other hand, there were no management system effects for the financial data in the sheep and beef sector. Cluster effects were found for both GFR and CFS.

4.3 Discussion

These results suggest that caution should be used when applying conventional performance indicators to the agricultural sector. For the most part, the indicators did not appear to be related to financial performance. There are several potential explanations for this result. First, the farms and orchards in the questionnaire sample did not represent a random selection of businesses (although ARGOS research does suggest they are representative in some dimensions). If they are able to participate in the ARGOS project because they are more financially secure, then any indicator linked to more successful firms may not have sufficient variation within the sample. For example, if community participation and involvement in ARGOS are both indicative of more successful farms, then one would expect to find few ARGOS farms with low rates of community participation.

A second possible explanation is that the sample size is too small. If data were to be collected on one hundred or several hundred farms, trends in the data might become clearer and more often statistically significant.

The third possible explanation is that these indicators are not particularly useful for identifying successful farms/orchards. It may be the case that the differences between the agricultural sectors and other sectors make these indicators less relevant for agricultural businesses. In particular, farms and orchards are geographically-tied, small in size and frequently family-run. This limits the growth of such businesses. Moreover these farms/orchards are integrated with the physical environment over which there is limited control. Another important factor for many farms and orchards is that their output is part of a larger supply chain and the end product is often exported. The degree of control that a single farm and orchard can have on its product is limited.

Despite these difficulties and reservations, there were suggestions of potentially significant indicators from the questionnaire, but these indicators differ between the kiwifruit and sheep and beef sectors. In the kiwifruit sector, orchard size in terms of number of staff appears to be a relevant indicator as it was positively related to gross orchard revenue and cash orchard surplus per effective hectare. In addition, customer focus may be a relevant indictor of orchard success. Orchardists who change the way they operate their orchard based on information on customer requirements had higher GOR. In the sheep and beef sector, on the other hand, the farm size indicator appears to have a different effect on financial performance than in the kiwifruit sector. There was a negative relationship between the number of staff working on the farm and cash surplus. Innovation, such as up-to-date plant and machinery, may be an important indicator of financial success in the sheep and beef sector, and so may social indicators, such as obtaining supplies locally.

The results also indicate that farms and orchard with different management systems differed in some of the performance indicator measures. In the kiwifruit sector, Gold orchards appear to have a higher level of dry matter, have more staff working on the orchard, and have higher gross farm revenue per effective hectare than orchards growing green and organic kiwifruit. However, whether the Hayward variety was grown conventionally or organically had little bearing on most indicators. These results highlight the fact that the properties of the gold variety are inherently different from the Hayward variety, for example, the gold variety is naturally higher in dry matter than green and organic kiwifruit. Hence, different performance indicators may be relevant for Gold orchards and orchards growing the Hayward variety. In the sheep and beef sector, the results revealed differences amongst the different management systems for one of the social indicators. Farmers using a conventional management system tend to purchase more of their supplies from local businesses than farmers using organic and integrated management systems. This may reflect the more specialised inputs required in organic and integrated production systems

The physical location of the farm/orchard also influenced many of the performance indicators, especially in the kiwifruit sector. Hence, the geographical location of agricultural businesses may also influence their success, and may be a much more important success indicator than standard business indicators.

In summary, this study indicates that many of the indicators of success relevant for conventional businesses may not be applicable to agriculture firms. Consequently, there is a need to identify alternative indicators that are more relevant to agribusinesses. At the same time, it is important to recognise that different agribusiness sectors may require different performance indicators. The differences between kiwifruit orchards and sheep and beef farms presented in this study suggest that a broad-brush approach to establishing performance indicators may be misguided.

Appendix 1. Sheep/Beef panels real ($2005/06) financial data per hectare

(Real ($2005/06), per hectare)

Income and Cost aggregates

Cash Farm Revenue						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	987	80	827	1160	Conv. vs Integrated	N.S
Integrated	1115	85	944	1298	Integrated vs Organic	N.S
Conventional	897	85	726	1084	Conv. vs Organic	N.S
Gross Farm Revenue						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	948	61	825	1089	Conv. vs Integrated	N.S
Integrated	979	64	851	1126	Integrated vs Organic	N.S
Conventional	887	64	759	1036	Conv. vs Organic	N.S
Farm Working Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	526	42	442	626	Conv. vs Integrated	N.S
Integrated	554	44	466	660	Integrated vs Organic	N.S
Conventional	545	48	449	663	Conv. vs Organic	N.S
Cash Farm Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	628	52	523	755	Conv. vs Integrated	N.S
Integrated	665	56	553	800	Integrated vs Organic	N.S
Conventional	748	69	609	920	Conv. vs Organic	N.S
Cash Farm Surplus						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	284	45	194	374	Conv. vs Integrated	N.S
Integrated	311	56	553	800	Integrated vs Organic	N.S
Conventional	192	69	609	920	Conv. vs Organic	N.S
Economic Farm Surplus						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	913	77	759	1079	Conv. vs Integrated	N.S
Integrated	1008	81	846	1183	Integrated vs Organic	N.S
Conventional	888	85	718	1073	Conv. vs Organic	N.S

Operating Surplus						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	428	48	331	524	Conv. vs Integrated	N.S
Integrated	490	48	393	586	Integrated vs Organic	N.S
Conventional	373	54	265	481	Conv. vs Organic	N.S

Individual cost elements

Cash Feed Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	35	5	25	49	Conv. vs Integrated	N.S
Integrated	54	8	39	75	Integrated vs Organic	N.S
Conventional	60	9	42	87	Conv. vs Organic	5%
Total Feed Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	110	47	17	60	Conv. vs Integrated	N.S
Integrated	149	48	52	103	Integrated vs Organic	5%
Conventional	140	49	41	96	Conv. vs Organic	N.S
Fertiliser Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	50	7	36	66	Conv. vs Integrated	NS
Integrated	96	9	78	117	Integrated vs Organic	1%
Conventional	95	11	73	120	Conv. vs Organic	1%
Cash Labour Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	95	8	79	114	Conv. vs Integrated	N.S
Integrated	81	7	68	98	Integrated vs Organic	N.S
Conventional	73	7	60	90	Conv. vs Organic	N.S
Total Labour Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	366	20	325	410	Conv. vs Integrated	5%
Integrated	322	19	284	363	Integrated vs Organic	N.S
Conventional	254	19	216	295	Conv. vs Organic	1%

Other Working Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	60	10	39	80	Conv. vs Integrated	N.S
Integrated	42	8	26	53	Integrated vs Organic	N.S
Conventional	30	7	17	39	Conv. vs Organic	1%
Overhead Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	65	5	55	77	Conv. vs Integrated	N.S
Integrated	56	4	47	66	Integrated vs Organic	N.S
Conventional	45	4	37	54	Conv. vs Organic	1%
Pasture Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	40	3	33	47	Conv. vs Integrated	1%
Integrated	68	5	59	78	Integrated vs Organic	1%
Conventional	48	4	39	58	Conv. vs Organic	N.S
Repairs and Maintenance Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	51	6	39	66	Conv. vs Integrated	N.S
Integrated	42	5	32	54	Integrated vs Organic	N.S
Conventional	51	6	38	68	Conv. vs Organic	N.S
Stock Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	13	1	11	15	Conv. vs Integrated	N.S
Integrated	34	3	28	41	Integrated vs Organic	1%
Conventional	29	3	23	36	Conv. vs Organic	1%
Vehicle Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	65	5	54	78	Conv. vs Integrated	N.S
Integrated	58	5	48	70	Integrated vs Organic	N.S
Conventional	57	5	47	71	Conv. vs Organic	N.S

Key performance indicators

FWE/GFR						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	59.24%	2.81%	53.60%	65.17%	Conv. vs Integrated	N.S
Integrated	55.38%	13.09%	29.09%	90.07%	Integrated vs Organic	N.S
Conventional	62.39%	3.32%	55.73%	69.44%	Conv. vs Organic	N.S
Debt/Asset Ratio						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	12.35%	1.86%	8.61%	17.70%	Conv. vs Integrated	N.S
Integrated	10.79%	1.60%	7.57%	15.38%	Integrated vs Organic	N.S
Conventional	19.29%	3.15%	12.95%	28.73%	Conv. vs Organic	N.S

Debt/Servicing Ratio						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	1047.10%	-49.78%	1147.10%	1147.10%	Conv. vs Integrated	5%
Integrated	1063.59%	-49.78%	1163.59%	1163.59%	Integrated vs Organic	N.S
Conventional	1188.84%	-49.78%	1288.84%	1288.84%	Conv. vs Organic	1%
Real Total EFS						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	157847	86904	-16743	39448	Conv. vs Integrated	N.S
Integrated	179437	88218	2208	63821	Integrated vs Organic	N.S
Conventional	199094	90423	17434	88430	Conv. vs Organic	N.S
Real Total GFR						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	296688	24035	248402	354361	Conv. vs Integrated	N.S
Integrated	335892	27340	280965	401557	Integrated vs Organic	N.S
Conventional	385567	34691	315873	470639	Conv. vs Organic	N.S
Return on Assets						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Organic	0.28%	0.43%	-0.57%	1.14%	Conv. vs Integrated	N.S
Integrated	0.53%	0.43%	-0.33%	1.40%	Integrated vs Organic	N.S
Conventional	1.19%	0.47%	0.24%	2.14%	Conv. vs Organic	N.S

Appendix 2. Kiwifruit panels real ($2005/06) financial data per hectare

Income and cost aggregates

Cash Orchard Revenue						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	39,417	2737	33886	44948	Green vs Green Organic	NS
Green Organic	40,017	2536	34892	45142	Green organic vs Gold	5%
Gold	52,610	4084	44356	60864	Green vs Gold	5%
Orchard Gate Returns						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	37,229	2550	32075	42383	Green vs Green Organic	NS
Green Organic	37,689	2363	32913	42465	Green organic vs Gold	1%
Gold	51,594	3806	43902	59286	Green vs Gold	1%
Orchard Working Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	17,583	905	15754	19624	Green vs Green Organic	NS
Green Organic	17,758	881	15978	19737	Green organic vs Gold	1%
Gold	26,891	1995	22860	31632	Green vs Gold	1%
Cash Orchard Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	19,306	978	17331	21507	Green vs Green Organic	NS
Green Organic	19,629	953	17702	21765	Green organic vs Gold	1%
Gold	29,992	2183	25579	35166	Green vs Gold	1%
Cash Orchard Surplus						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	19,741	2519	14650	24832	Green vs Green Organic	NS
Green Organic	18,793	2416	13910	23676	Green organic vs Gold	NS
Gold	20,280	3718	12766	27794	Green vs Gold	NS
Economic Orchard Surplus						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	4,329	3089	-1979	10637	Green vs Green Organic	NS
Green Organic	2,361	2853	-3465	8187	Green organic vs Gold	NS
Gold	6,418	5101	-3998	16834	Green vs Gold	NS
Operating Surplus						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	21,492	2304	16836	26148	Green vs Green Organic	NS
Green Organic	21,308	2210	16842	25774	Green organic vs Gold	NS
Gold	23,550	3401	16677	30423	Green vs Gold	NS

Individual cost elemants

Cash Labour Expenses

Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	8,341	589	7150	9730	Green vs Green Organic	5%
Green Organic	6,989	953	17702	21765	Green organic vs Gold	1%
Gold	17,096	2183	25579	35166	Green vs Gold	1%

Total Labour Expenses

Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	21,785	1243	19247	24323	Green vs Green Organic	NS
Green Organic	23,242	1148	20898	25586	Green organic vs Gold	1%
Gold	32,303	2053	28111	36495	Green vs Gold	1%

Fertiliser Expenses

Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	876	76	723	1043	Green vs Green Organic	1%
Green Organic	1,402	90	1220	1596	Green organic vs Gold	NS
Gold	1,222	132	955	1520	Green vs Gold	1%

Other Working Expenses

Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	782	389	-4	1568	Green vs Green Organic	NS
Green Organic	1,260	360	532	1988	Green organic vs Gold	NS
Gold	2,289	580	1117	3461	Green vs Gold	NS

Overhead Expenses

Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	1,676	14	1649	1704	Green vs Green Organic	1%
Green Organic	2,487	149	2186	2807	Green organic vs Gold	5%
Gold	1,780	197	1382	2228	Green vs Gold	NS

Pollination Expenses

Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	1,304	85	1133	1475	Green vs Green Organic	NS
Green Organic	1,123	82	957	1289	Green organic vs Gold	NS
Gold	987	126	732	1242	Green vs Gold	NS

Repairs and Maintenance Expenses

Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	1,318	208	897	1937	Green vs Green Organic	NS
Green Organic	984	146	688	1406	Green organic vs Gold	NS
Gold	1,085	235	611	1928	Green vs Gold	NS

Spray/chemical Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	1,404	113	1176	1632	Green vs Green Organic	NS
Green Organic	1,168	105	956	1380	Green organic vs Gold	NS
Gold	1,632	168	1292	1972	Green vs Gold	NS
Vehicle Expenses						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	773	82	607	960	Green vs Green Organic	1%
Green Organic	1,314	102	1109	1537	Green organic vs Gold	NS
Gold	1,005	138	726	1329	Green vs Gold	NS

Other key performance indicators

Real Total Economic Farm Surplus						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
Green	6,498	11347	-16673	32743	Green vs Green Organic	NS
Green Organic	23,286	11299	214	48913	Green organic vs Gold	NS
Gold	39,270	20868	-3343	90157	Green vs Gold	NS
Real Total Gross Farm Revenue						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
2004/05						
Green	151,944	16104	119398	188408	Green vs Green Organic	NS
Green Organic	135,645	14447	106448	168376	Green organic vs Gold	NS
Gold	179,861	25145	129043	239096	Green vs Gold	NS
Farm Working Expenses:Gross Farm Revenue						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
2004/05						
Green	43.39%	2.89%	37.49%	50.22%	Green vs Green Organic	1%
Green Organic	58.93%	3.96%	50.84%	68.30%	Green organic vs Gold	5%
Gold	53.39%	6.89%	39.33%	72.48%	Green vs Gold	NS
Return on Equity						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
2004/05						
Green	0.81%	1.50%	-2.29%	3.91%	Green vs Green Organic	NS
Green Organic	-0.24%	1.48%	-3.29%	2.81%	Green organic vs Gold	NS
Gold	5.73%	2.67%	0.22%	11.24%	Green vs Gold	NS

Asset Turnover Ratio						
Management System	Mean	Std. Err.	95% Confidence Interval		Comparisons	Sig.
			Lower Bound	Upper Bound		
2004/05						
Green	11.55%	1.27%	8.93%	14.94%	Green vs Green Organic	NS
Green Organic	12.21%	1.33%	9.47%	15.76%	Green organic vs Gold	NS
Gold	11.76%	2.10%	7.44%	18.61%	Green vs Gold	NS

Appendix 3. Variables for inclusion in a general linear model

(All cost and income variables on per ha basis)

Sheep and Beef Variables (22)	Kiwifruit Variables (18)
Intensity, scale and nature of production factors:	
SU/ha	Trays/ha
Effective area	Effective area
% turnover from cropping	
Profitability:	
Cash Farm Revenue (CFR)	Orchard Gate Return (OGR)
Gross Farm Revenue (GFR)	Gross Orchard Revenue (GOR)=COR
Farm Working Expenses (FWE)	Orchard Working Expenses (OWE)
Cash Farm Expenditure (CFE)	Cash Orchard Expenses (COE)
Economic Farm Surplus (EFS)	Economic Orchard Surplus (EOS)
Return on Asset	Return on Asset
Liquidity:	
Current ratio	Current ratio
Solvency:	
Equity %	Equity %
Debt Equity ratio	Debt Equity ratio
Financial efficiency:	
FWE/GFR	OWE/GOR
Debt servicing ratio	Debt servicing ratio
Asset turnover ratio	Asset turnover ratio
Major/key costs:	
Cash Labour Costs	Cash Labour Costs
Total labour costs	Total labour costs
Fertiliser costs	Fertiliser costs
Weed and pest costs	Spray and Chemical costs
Pasture costs	
Cash feed costs	
Stock costs	