Farm Systems Change Case Studies

Optimising Dairy Farming

Insights from successful dairy farms

Ministry for Primary Industries
Manatū Ahu Matua

Foreword

MPI's Farm Systems Change initiative was developed to understand how changing consumer preferences, public expectations and environmental limits are bringing new opportunities but also new demands and constraints on dairy farming.

Our aim was to learn from farms finding ways to adapt and thrive in the changing environment, understand what makes them successful, and share what we learned with the wider sector.

Twenty case study farms were handpicked through MPI contacts and industry networks as examples of strong performers with a commitment to improving environmental and animal health outcomes, along with financial performance and business resilience.

The farms span different regions, climates and soil types, with herd sizes ranging from 250 to 2,900 cows and production systems from 2 (lower input) to 5 (higher input). They include farmer-owned, equity partnership, corporate, iwi and share milking structures. All are pasture based.

The individual case studies are available on **MPI's website**. This document provides insights from analysis of the first 15 published case studies as a group. The farms exhibit the enormous variation in dairy farm systems across New Zealand, but some similarities have also been identified and are discussed in this document.

The intent is to draw out some key aspects of what could determine success from a triple bottom line (environmental, animal and financial) perspective, and contribute to wider discussion about how to make it easier for other farms to find their own pathway towards a more sustainable and resilient future.

As with any project of this nature, the work could not have been done without the co-operation of the farmers concerned. They recognise that there is always room for improvement, and therefore, welcomed the case study process in highlighting areas where more could be achieved. We would like to thank them for their time and enthusiasm for the project to date and their willingness to share their experiences.

Summary

The team has analysed the performance of some of New Zealand's better dairy farms over five years from 2012 to 2016. This analysis represents the findings from the first 15 published case studies. Although each farm is different, a number of themes, principles and practices have been identified that can contribute to the discussion about how to enable more dairy farmers to improve their environmental, animal welfare and financial outcomes.

The farmers have achieved great results through being highly skilled at taking a whole of system approach to optimise their farm businesses. They are committed to gathering and using information and being curious about what drives results. They are willing to adapt and change to achieve their objectives and understand the importance of quality advice when monitoring and planning the future of their farm businesses. Above all they have a positive view of the industry and its future.

The farm systems demonstrate the relationship between feed efficiency, cow welfare and environmental performance and how this translates to economic performance and resilience.

Key findings from the analysis of the milk production systems include:

1. **The cows have access to greater volumes of high quality feed than industry norms.**
2. **Cow condition, health and welfare are of a high standard as a result.**
3. **A high proportion of feed goes to milk production rather than cow maintenance.**
4. **This has led to production efficiency by producing a greater volume of milk per unit of feed.**
5. **That production efficiency has contributed to capital efficiency and return on assets.**
6. **Through these outcomes the farms have achieved resilience through having the capacity to be agile and adapt to external factors such as climate and price volatility as they arise.**

These factors are expected to have also resulted in better environmental outcomes but the precise impacts of the changes in farm practice proved to be inconclusive. More data over a longer period of time is needed to demonstrate the benefits of these actions.

It was clear that these farmers take responsibility for environmental stewardship. They have matched farming activities to the capabilities of the land and are actively looking after the natural resources upon which they depend. However, they also highlighted the challenges associated with accessing quality advice to support them in achieving their environmental objectives.

The farmers demonstrated a habit of investing in on-farm changes to improve system performance and increase resilience on their farms.

Investments of this type were identified on nearly all of the farms over the study period with many making adjustments year after year. These were mainly targeted to increase feed utilisation and quality and enhance cow condition, which in turn provided higher productivity and capital efficiency.

Along with environmental benchmarking, the process of analysing the farms highlighted some other challenges in determining farm system and financial performance over time. Firstly, the practice of accurately measuring pasture as an input to the farm system was found to be relatively rare. Secondly, the wide range of financial reporting structures used made it difficult in some cases to determine and then compare farm financial performance from year to year.

THE FARMERS DEMONSTRATED A HABIT OF INVESTING IN ON-FARM CHANGES TO IMPROVE SYSTEM PERFORMANCE AND INCREASE RESILIENCE ON THEIR FARMS.

The People

How well a farm business is performing can be understood through a range of key metrics for efficiency, animal welfare, profitability and the environment. However, underpinning this are the people who are responsible for the decision-making that ultimately drives those outcomes. The research has shown that while the personal goals and objectives of the case study farmers differ, how they position their farm systems to deliver to these objectives is quite similar.

Taking a whole system approach

Without exception, the farmers in the group take a whole of system approach to farming. Aspects such as pasture management, feed utilisation, cow health and performance, environmental management, staffing, financial performance and capital efficiency are considered as part of the whole system rather than individually.

THEY ACKNOWLEDGE THERE IS ALWAYS ROOM FOR IMPROVEMENT AND STRIVE TO CONSTANTLY EXPLORE LIFTING THE BAR THROUGH LEARNING.

They demonstrate a strong attention to detail and an emphasis on doing all the things well rather than focusing on one aspect, potentially to the detriment of others. This broad thinking ensures the best decisions are made to capitalise on opportunities.

Committed to gathering and using information and continuing to learn

All of the farmers demonstrated a commitment to learning and discovering ways to improve their farming system. They look forward, not back when making decisions, and are always striving to achieve their objectives by being better at what they do.

The gathering and use of information about their farm system, and understanding the drivers of performance are a critical part of their success. They acknowledge there is always room for improvement and strive to constantly explore lifting the bar through learning.

Willing to adapt and change to achieve objectives

The farmers displayed a willingness to use their information and learnings to make changes and adjustments to their business. All farmers in the group were prepared to take risks up to their personal level of risk tolerance to achieve the objectives of their farm business. They consider change as an investment rather than a cost, which demonstrates the positive strategic approach they take to decisions.

The benefit of advice

The farmers involve their key advisors in both the planning and monitoring of their farm businesses. Advisers are part of an integrated team that understand the farm business objectives and help in the analysis of data and information used for business monitoring and planning. The diversity of thought appears to be a critical part of the decision-making process.

A dedication to the industry

The farmers demonstrate a passion for the industry and how it makes a positive contribution to their communities. They have a commitment to developing the next generation of farmers, caring for their livestock and investment in the environment. Many are involved in a range of projects to lift the profile of the industry as a place to work. They are dedicated to building the capability and quality of their own teams and their businesses.

The milk production system

Efficiency

The case study farms demonstrate the broad range of approaches to dairy farming in New Zealand. The milk production systems within the case study group are efficient because the farmers are paying careful attention to both feed supply and the welfare needs of the cow. Many of the farmers are actively investing in improving system performance and minimising waste to further enhance their system efficiency.

The overall feed supply on the farms is estimated to have been relatively stable over the survey period. Figure 1 suggests that over the five-year period, the case study farms have maintained a consistent ratio of feed grown (dairy platform and support) to feed purchased.

Figure 1: Percentage of feed grown (green) or purchased (blue) over 2012-2016

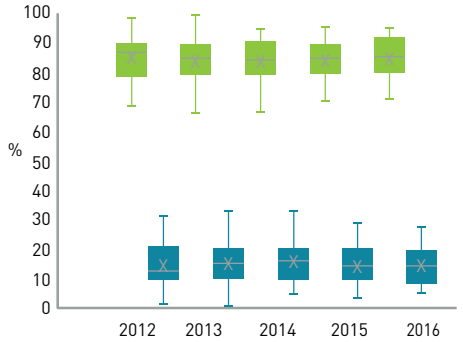
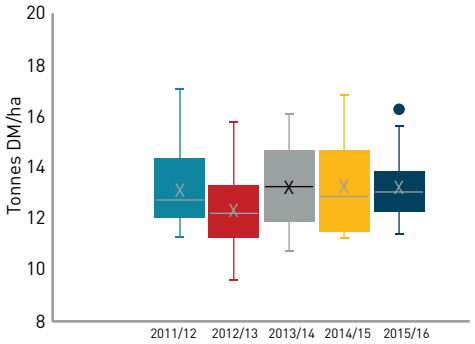


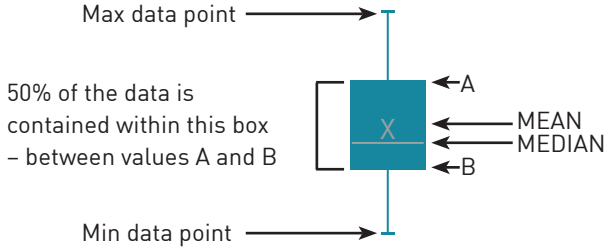
Figure 2: Annual estimated pasture harvested per pasture hectare of the case study farms



Meanwhile Figure 2 suggests that pasture harvested on the farms has also been relatively stable over the survey period. The impacts of widespread drought during the 2012/13 season are shown by the noticeable fall in pasture harvested across the farms in that season.

Across the fifteen farms, the average pasture grazed by cows on the milk platform was steady at 68 percent of the annual ration available to them. The remaining 32 percent is made up of other feed grown on support systems and purchased feed supply. This gives the farmers a higher level of control over a third of the feed rationing to optimise feed efficiency in their system.

Understanding box and whisker diagrams



Outliers = will show as dots outside of the whiskers. Outliers are defined as those values that are greater or less than 1.5 x the difference between value A and value B.

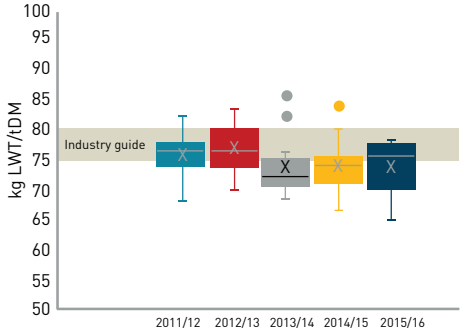
Within the sample, many of the farms have increased feed efficiency by investing to reduce feed waste. Removing cows from pastures in the wet and winter and improving feed management off-pasture to minimise loss have been common improvements that have driven feed efficiency.

Some farms have increased cow numbers to meet the increased feed availability, while other farms that have less overall feed available have reduced numbers to achieve the same feed supply and cow welfare objectives. On average the cows are estimated to have access to a greater volume of feed than industry norms.

This can be demonstrated by the measure of comparative stocking rate.

Comparative stocking rate

Figure 3: Estimated comparative stocking rate (kg LWT/tDM) of case study farms over the five years



New Zealand dairy industry guidelines suggest that optimal Comparative Stocking Rate (CSR [1]) is achieved between 75 and 80 kg LWT/t DM. Over the study period the case study farms were mostly at the lower end of this range. This indicates that the cows in the case study group have access to greater amounts of feed to support their productivity and efficiency levels.

1 See Appendix 1: Methodology – Comparative Stocking Rate

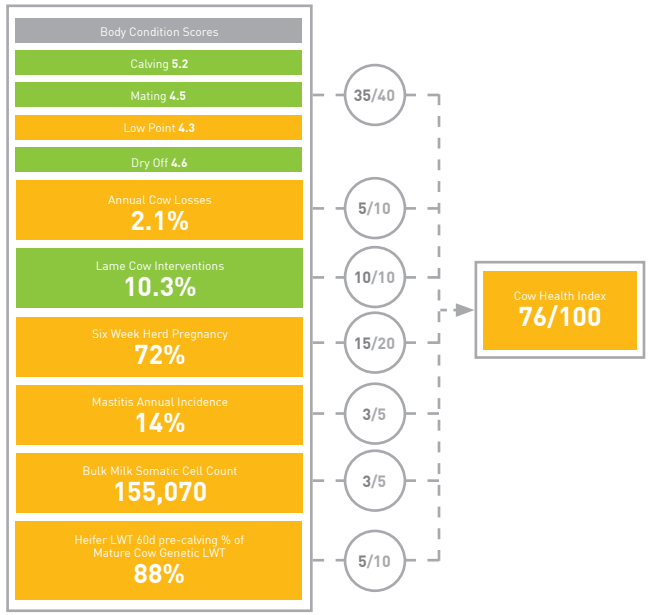
The Cows

A well fed, fit and healthy milking herd is one of the most critical components of the dairy production system. On the case study farms, cow health and welfare contributes significantly towards production efficiency, and often as a further income stream in surplus stock revenue.

The cow health index

The cow health index was used in the case study analysis as a key indicator of combined health and performance metrics and includes important cow health and welfare targets in its make-up. A worked example of the index is demonstrated below and populated with average values from the case study farms for the 2014/15 season.

ON OUR CASE STUDY FARMS, COW HEALTH AND WELFARE CONTRIBUTES SIGNIFICANTLY TOWARDS PRODUCTION EFFICIENCY...

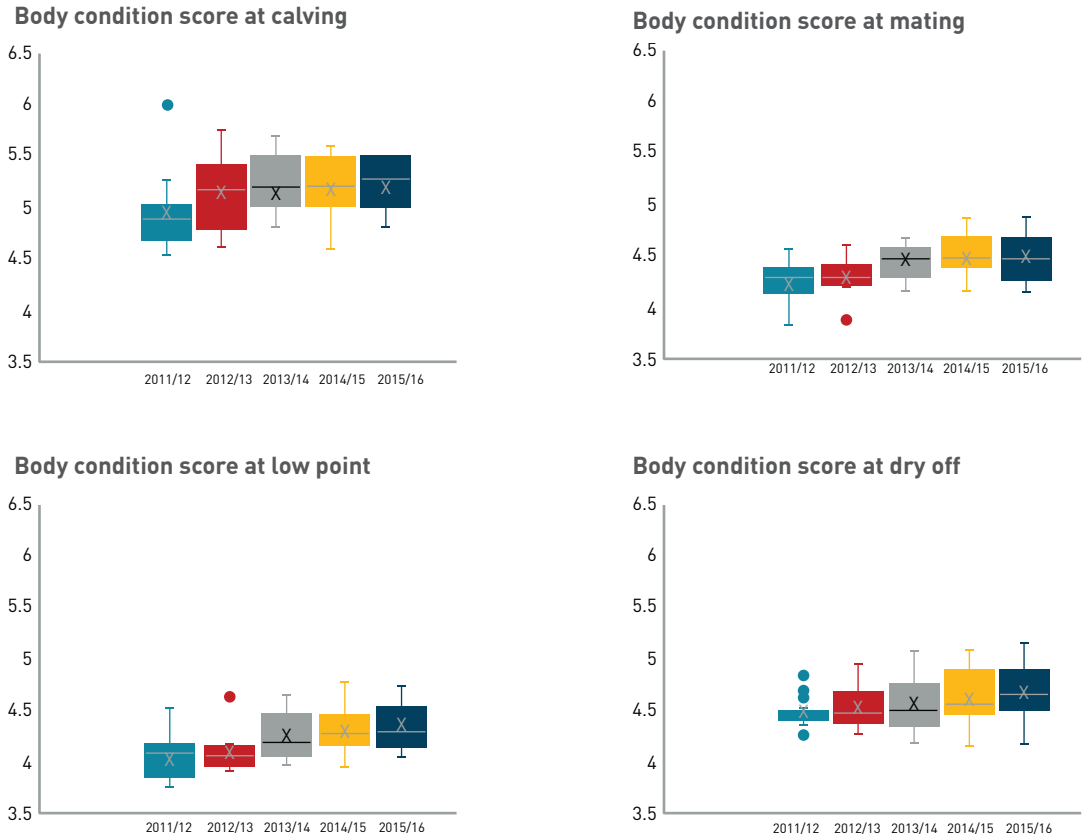


The index is designed to focus efforts on improving cow health in areas that will make the most difference to cow performance. While the maximum value is 100, this score is not required to ensure the milking herd is fit and healthy and achieving optimal performance. The traffic light system will guide efforts to those areas that will achieve the greatest impact.

The case study farms generally demonstrated good performance when compared to industry averages for each individual metric. But there is still room for better cow health outcomes across a number of the metrics detailed in the index, which could deliver further gains in system performance.

Figure 4 shows how cow body condition score[2] (a critical component of the cow health index) of the case study herds improved over the study period, which was evident at all monitoring points across the seasons.

Figure 4: Cow body condition scores for the case study farms at four monitoring points across the seasons monitored



2 Visual assessment of animal condition with a scale of 1-10. Targets are 4-6, peaking at calving time. When BCS of any animal falls below 3, urgent remedial action must be taken to improve condition (Dairy Cattle Code of Welfare; December 2016).

Improving herd body condition scores has been the key contributor to overall improvement of the Cow Health Index over the study period, and a herd six-week pregnancy rate[3] well above the national average of 66 percent[4].

Benefits of these improvements include more days in milk for the herd, lower numbers of cows failing to get in calf and less requirement for replacements in the herd.

Replacements

The farms have shown a consistent replacement rate of 20 percent over the study period, below the national average of 22 percent[5], which is a difference of eight animals per year for the average New Zealand herd [6]. This reflects enhanced animal health which has led to good mating performance and low annual cow loss rates (1.6 percent) versus an industry average of 2.2 percent.

Conversion of feed to milk

Cow efficiency is a major component of the success of the case study farms. The relationship between feed availability, a fit and healthy milking herd and how that translates to milk production is clearly demonstrated by the case study group. The result is increased efficiency through a greater proportion of feed going directly to milk production.

Figure 5 shows that the estimated feed conversion rates on the case study farms improved after the 2013 drought year, i.e. there was a general decrease in the amount of feed eaten per kilogram of milk solids produced. When looking at the proportion of feed going into milk versus that for cow condition[7] in Figure 6, the case studies show a falling proportion of feed going towards cow maintenance over the study period, mirrored by higher proportions for milk production.

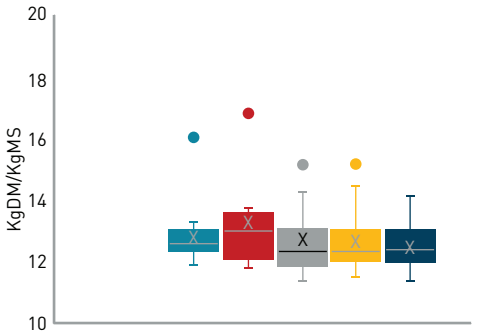
3 Proportion of the herd pregnant six weeks after mating starts.
4 New Zealand Dairy Statistics 2016-17.
5 "Patterns of culling and mortality and their attributed causes in pasture based seasonal calving cows in New Zealand", Compton C et al *Proceedings of the Society of Dairy Cattle Veterinarians of NZVA* 2016.
6 Average herd size is 414 cows (NZ Dairy Statistics 2016/17).
7 An explanation of how this metric is calculated is included in Appendix 1.

The range of factors discussed earlier are all expected to have contributed in some way to this outcome but the sample of 15 farms is too small to determine whether these are the only contributors.

In summary, it appears that by giving the cows access to more feed and improving their condition, the feed conversion on the farms has also improved, delivering higher milk solids production per unit of feed consumed. The combination of capital efficiency and a relatively low break-even milk price has enabled the farms to be more financially resilient.

BENEFITS OF THESE IMPROVEMENTS INCLUDE MORE DAYS IN MILK FOR THE HERD, LOWER NUMBERS OF COWS FAILING TO GET IN CALF AND LESS REQUIREMENT FOR REPLACEMENTS IN THE HERD.

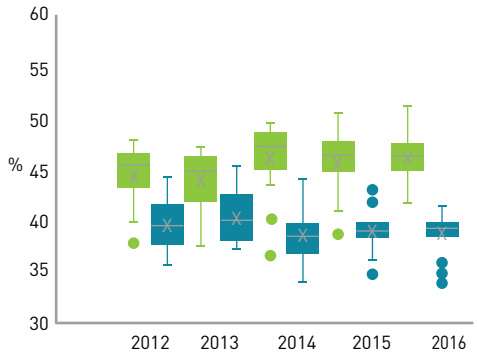
Figure 5: Kilograms of dry matter eaten per kilogram of milk solids produced



Cow efficiency

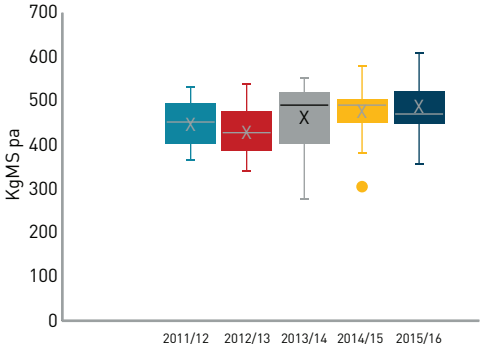
In the case studies, cow efficiency was calculated in two ways. The first was through annual milk solids produced per maximum cows milked. The second method was by measuring annual milk solids production as a percentage of mature cow genetic live weight, which allows for comparisons across breeds and cow sizes. Generally, 100 percent of live weight is used as an objective but this can vary based on local factors and the farm system adopted. Optimal levels typically range from 80 percent for a pasture only system to nearer 120 percent for a total mixed ration system.

Figure 6: Conversion of available feed to milk production (green) and cow maintenance (blue).



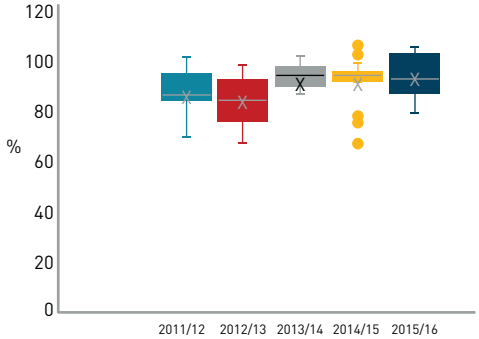
The current New Zealand average is 75 percent[8]. The case study farmers averaged 89 percent over the five years with a range from 61 percent to 105 percent. The final year of analysis showed an average of 93 percent demonstrating an apparent upwards trend. This is shown in Figure 7b.

Figure 7a: Annual milk solids per maximum cows milked



8 Assumes MS/cow of 381kgMS and LWT BV for the average J9 crossbred cow of 510kg.

Figure 7b: Annual milk solids produced as a percent of cow genetic live weight



The farms are on average, producing nearly 25 percent more milk per kg of cow than the New Zealand average. This indicates what could potentially be achieved by the New Zealand industry, including the opportunity to maintain current volumes of milk production with fewer cows.

Many of the case study farmers are using in-shed technology to actively manage feed supply at an individual level to support the volumes of milk produced. They were very good at maintaining their comparative stocking rate (CSR) over the years by either changing cow numbers or purchasing more feed when feed availability dropped due to adverse climatic conditions.

Investing to improve system performance

A key contributor to many of the farms' success has been consistent investing in on-farm changes to improve system performance. Of the 15 farms analysed, 12 farms had undertaken such investments during the five-year period.

THE FARMS ARE ON AVERAGE, PRODUCING NEARLY 25 PERCENT MORE MILK PER KG OF COW THAN THE NEW ZEALAND AVERAGE...

ALL OF THE INVESTMENTS HAVE TAKEN PLACE WITH A LONG TERM VIEW AND A WHOLE SYSTEM APPROACH, A COMMON TRAIT OF THE FARMERS CONCERNED.

Common themes in the on-farm changes that contributed to farm performance include "weather proofing" [9], improving feed utilisation, a focus on cow feeding and performance, managing effluent as a resource rather than a cost, and matching activities to the capabilities of the land.

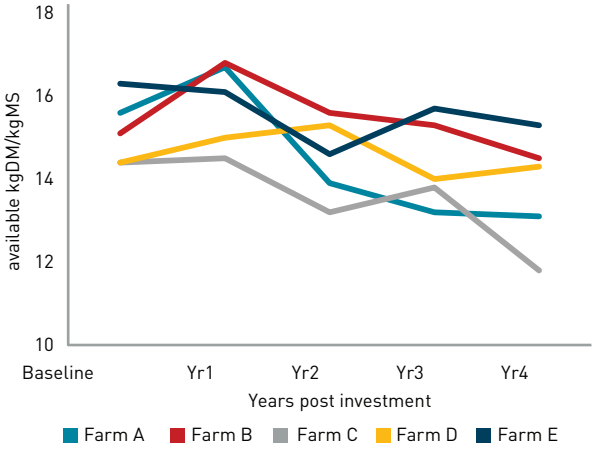
The most common investments that took place were in making better use of the current feed inputs available in the system, i.e. reducing waste. Examples are in-shed feeding systems, feed and stand-off pads and cow housing. Many went further and took opportunities to make better use of resources by investing in effluent recycling systems and other complementary technology.

An important factor in the success of the investments is consideration of the time it takes to realise the benefits. All of the investments have taken place with a long term view and a whole system approach, a common trait of the farmers concerned.

For example, investments in feed waste reduction through alternative feeding systems experienced some lag time during which further investment was required in additional feed stocks as well as extra feeding to improve the body condition of the herd to achieve the efficiency objectives. Figure 8 demonstrates this on five of the case study farms (Farm A to E). Initially more feed was input to the system per kilogram of milk solids produced, before showing a reduction over time as the investment is "bedded in" to the farm system and cow condition and feed stocks reach optimum levels.

9 Examples are alternate feed systems, stand-off pads and cow housing.

Figure 8: Changes in farm feed conversion efficiency post investment



By focusing on improving efficiency and cow productivity, these farmers have grown their business from within existing constraints and inputs.

In two cases, farmers have diversified activities and reduced the size of the milking platform. They have then improved feed use, cow efficiency and productivity through investment in farm system change. These investments show that the capital cost of system changes that are intended to improve production efficiency compare favourably to an alternative of purchasing more land to grow business outputs.

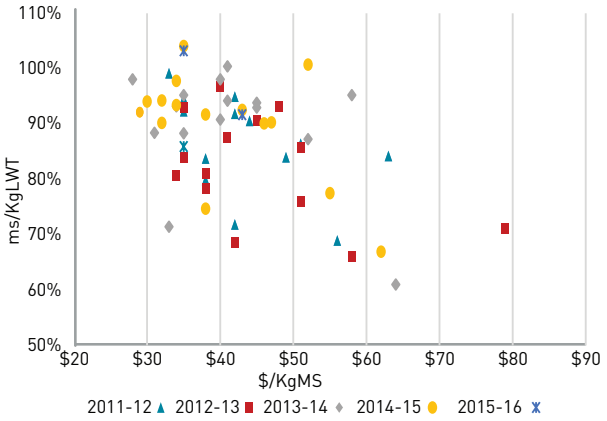
Financial performance

The case study farms have performed well financially despite what has been a challenging period for dairy farming in New Zealand. Very high milk prices in the 2014 season followed widespread drought the previous year. The subsequent two seasons provided some of the lowest milk prices in recent history.

Capital investment

The farms that achieved greater feed and cow efficiency had a lower capital investment per kilogram of milk solids produced despite significant differences in total capital investment on the farms. This is a particularly important factor for farms to stay financially resilient. Figure 9 shows the case study farms that achieved higher milk production per kilogram of cow live weight generally had a lower capital investment level for that season. Some of the farms were able to sustain a level below $40 per kg of milk solids throughout the study period. The industry average for the 2015/16 season was $44 per kgMS produced.[10]

Figure 9: Capital employed per kg milk solids sold (x-axis) vs milk solids produced as a percentage of liveweight (cow efficiency) (y-axis)



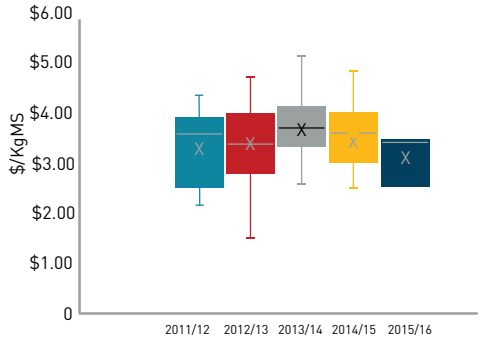
10 DairyNZ Economic Survey 2015-16.

Break even

Break-even was assessed on an EBITDA (earnings before interest, tax, depreciation and amortisation) basis so that the performance of the milk production system could be assessed without the distraction of asset values and debt servicing requirements, which vary greatly across the farm businesses.

The break-even milk price of the case study farms was on average, $3.50 per kg of milk solids produced over the 2012 – 2015 seasons. This is well below the weighted average milk price of $6.10 [11]. Figure 10 shows that for some farms, the break-even milk price increased at the beginning of the study period, increasing the case study average, before beginning to decline before the end. This is attributable to the investments in on-farm changes that took place on those farms during the period, and to the increased expenses funded by the high milk payout in 2014.

Figure 10: Break-even milk price of the case study farms over the study period



Resilience

The combination of capital efficiency and a relatively low break-even milk price has enabled the farms to be more financially resilient.

11 Calculated across the 2012 to 2016 seasons.

This resilience has given the farmers the capacity to be agile and comfortably respond to external factors in a proactive way and with a long term view. Figure 11 shows clearly the impacts of drought (2012/13) and milk price volatility. But what is also noticeable is that the farms were all able to maintain profitable milk production systems throughout the study period and deliver a return on assets (Figure 12).

Figure 11: EBITDA[12] per hectare of the case study farms over the study period[13]

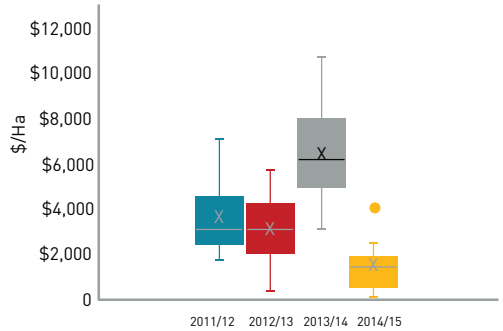
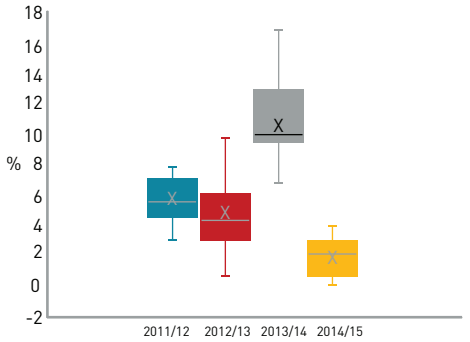


Figure 12: Return on assets of the case study farms over the study period[13]



12 Earnings before interest, tax, depreciation and amortisation.
13 Does not include 2015-16 due to insufficient data.

The challenges of environmental benchmarking

One intent of the project was to be able to quantify environmental outcomes, alongside production efficiency and financial metrics. However, this proved to be challenging and, thus far, inconclusive despite clear evidence of the farmers actively working to enhance the environment for the future of their farm businesses. More data over a longer period of time to enable modelling of long term average business operations will be needed to demonstrate the benefits of these efforts.

Many of the farms have invested in improving their environmental outcomes by focusing on the simple things first. Examples are:

- **targeted fertiliser application via a whole farm soil testing programme;**
- **strategic use of nitrogen;**
- **cropping practices such as minimum tillage and rotation;**
- **land class suitability mapping;**
- **proof of placement technology;**
- **stock exclusion and riparian planting.**

In other examples where significant investments in productivity have taken place, farmers have taken the opportunity to further reduce the environmental footprint of their farming operations at the same time. These have included sophisticated effluent capture and recycling systems and use of technology to increase water, nitrogen and energy use efficiency.

A life cycle assessment analysis of nutrient loss was undertaken on four of the farming businesses that demonstrated a cross section of the group. In addition to the milking platform the life cycle analysis included other support blocks that are used for grazing of animals and cropping activities.

Case study farmers were aware of their environmental impact and made environmental improvements to their businesses, but recognise there are further opportunities for improvement in environmental performance.

For the publication of the case studies, a pragmatic approach was taken to focus the discussion on the environmental challenges on each farm and how the farmers are individually approaching these as responsible stewards of the land. The intent is to highlight the range of options available to other individual farmers to consider for their own farm systems and appropriate for the relevant environmental rules and regulations in their own areas.

Analysing the farms

One of the original project objectives was to demonstrate good environmental stewardship through a range of metrics relevant to the dairy industry. The metrics were to be based on (where available) previous modelling completed for each farm system for nutrient budgeting purposes, using Overseer®.
However, as the first farms were analysed, it became clear that this process was unlikely to deliver conclusive metrics for each of the farm systems concerned. There were examples of Overseer® outputs that were:

- covering only the milk platform, not the whole farm system;
- out of date;
- not completed to protocol;
- completed remotely without a farm visit;
- tailored for specific purposes and not suitable for the purpose of this project;
- completed with a lack of accurate farmer records.

THE CHALLENGE OF BEING ABLE TO QUANTIFY THE IMPACTS OF ENVIRONMENTAL INITIATIVES IS RAPIDLY IMPROVING BUT STILL REMAINS DIFFICULT.

The industry has already moved on substantially from when the analysis took place with industry training programmes to improve capability and refreshment of modelling protocols. The challenge of being able to quantify the impacts of environmental initiatives is rapidly improving but still remains difficult. For example, Overseer® estimates an annual average nutrient budget assuming inputs (management, climate, etc) are constant.

TO ACHIEVE QUANTIFIABLE OUTCOMES, MORE DATA OVER A LONGER PERIOD OF TIME IS NEEDED BEFORE VALID CONCLUSIONS CAN BE DRAWN.

To achieve quantifiable outcomes, more data over a longer period of time is needed before valid conclusions can be drawn. To improve environmental outcomes for their farm systems, farmers are totally reliant on advice. This was shown to be difficult to source, unreliable and in some cases had resulted in sub-optimal management decisions.

Other challenges

Feed measurements

A clear challenge for the industry is to accurately measure the inputs to a farm system. In this case it is feed, or more precisely pasture. For nearly all of the case study farms, the total feed supplied is estimated. This is also the case for much of the industry, so it is therefore difficult to make informed comparisons between the case study farms and the industry as a whole. More information on how the feed inputs were calculated for the case study farms is included in the appendix under "Methodology".

Financial

Scrutiny of the financial reports from the case study farms revealed high variability in financial reporting techniques across the farm businesses. This meant that it took much longer than anticipated to analyse the information to achieve a clear understanding of the financial performance of the milk production systems concerned. Additionally, there were instances where financial reports for the same farm system were difficult to compare from year-to-year, because the business had appointed a new financial service provider.

It was difficult to isolate the costs of milk production from other costs on many of the farms. Nearly all of the farm expenses were allocated to milk production, when in many cases the farms are quite diversified businesses, with other revenue streams that had few or no costs attributed to them.

Appendix 1: Methodology

Pasture input estimation

The estimation of pasture inputs to the farm systems was done by estimating the total feed ration and subtracting supplementary feed and estimated wastage. Each farm and each season was treated separately and calculated accordingly to take account of on-farm practice changes that my have occurred through the study period.

The estimation of pasture harvested was a backwards calculation using the following principles. All estimations were compared with local pasture growth figures and where possible, verified using the UDDER farm systems model.

Cow maintenance

A base estimation of cow maintenance requirements was calculated using the standard cow maintenance requirement equations from *Milk Production from pasture – principles and practices*; Holmes et al

To this, adjustments were made for:

- Pregnancy requirements (2,840 – 3,610 MJME)
- Walking requirements (2-8 MJME per km) dependent on cow size, topography and days in milk
- Condition lost (–28 MJME per kg lost)
- Condition gain (40-50 MJME per kg gained)
- Growing requirements for an adult cow (33 MJME per kg growth)
- Young stock on the dairy platform, grazing days and daily dry matter intake

A change of 1 Body Condition Score = 6.58 percent of the Cow live weight.

Milk production

Table 1: Metabolic energy (MJME) requirements for 1kg of milk solids

Megajoules of metabolic energy per kg dry matter of average feed ration	10.5	11	11.5	12	12.5
Breed					
Jersey	78.5	77	75.5	74	72.5
Cross breed	81.5	80	78.5	77	75.7
Friesian	83.5	82	80.5	79	77.5

Wastage

Feed wastage was also estimated and added to the feed eaten estimation to calculate total feed available. This was based on: on-farm practices; feeding methodologies, forage management and cow/feed interface management.

Comparative stocking rate

Comparative stocking rate was calculated for all of the farms in the group over each of the five years. It is defined as the ratio of total cow live weight to the estimated amount of feed available (kgLWT/tDM). Methodology used was as follows:

- Cow liveweight was calculated as adult cow genetic liveweight that is, the expected liveweight that a well fed cow will achieve at maturity (as measured at a body condition score of 4.5 at 100 days in milk).
- Total adult cow genetic live weight was the cow genetic liveweight multiplied by the total number of cows calved in 12 months.
- All feed available was calculated as all feed grown and brought in to the system for the milking herd (cows calved) including adult dry cow grazing, at an average MJME of 11.
- Feed wastage was estimated (see above).
- Young stock was excluded.
- Heifers were included from 1st June each year.

Information on optimal comparative stocking rates was sourced from: Macdonald, Kevin & Beca, D & Penno, J.W. & Lancaster, J.A.S. & Roche, John. (2011). Short communication: Effect of stocking rate on the economics of pasture-based dairy farms. Journal of dairy science. 94. 2581-6. 10.3168/jds.2010-3688.

Financial

The financial metrics were analysed on an accrual basis rather than cashflow. This means that milk production revenue was attributed to the season it was produced rather than when it was paid. Milk processors in New Zealand generally adopt a practice of progressive instalments, due to the fluctuating nature of dairy product prices.

The final instalment is not confirmed and paid until after the financial year-end for the season to which the payment relates, e.g. announced in September 2017, paid in October 2017 for the season (year) ended 31 May 2017.

For more information on calculating feed requirements for lactating cows visit the DairyNZ website: **https://www.dairynz.co.nz/feed/nutrition/lactating-cows/**

Ministry for Primary Industries
Manatū Ahu Matua
PO Box 2526, Wellington 6140
New Zealand
0800 00 83 33
www.mpi.govt.nz

ISBN: xxxxxxxxxxxxx (online)

May 2018

New Zealand Government