Australasian Agribusiness Perspectives
2021, Volume 24, Paper 17
ISSN: 2209-6612

A study of cow and farm performance during a change from a pure-bred to cross-bred seasonally-calving pasture-based herd[1]

Richard Shephard

Herd Health Pty Ltd, 65 Beet Road, Mafra, Vic, Australia

Abstract

A comparison of cow-level and farm-level dairy farm physical and financial performance measures across a 20-year period when a dairy farm converted from pure-bred to cross-bred cows was undertaken. The study compared the cow- and farm-level changes and described management adaptations implemented to maintain farm-level performance as individual cow physical and financial performance altered with the change in breed. Performance per cow and per hectare were the primary measures monitored and compared. The farm was pasture-based but feeding between 1-2 tonnes of grain per cow per year (Dairy Australia production system 3). Key findings were: the stocking rate increased as the percentage of cross-breed cows increased; cow-production, cow pasture intake, cow gross income and cow gross margin remained stable during the transition from Friesian to crossbreeds, and began increasing again when the herd breed structure stabilised as three-way crossbreeds whilst the six-week-in-calf rate and cow survival increased whilst the not-in-calf rate decreased across the transition to cross-breeds and beyond. Farm stocking rate, pasture consumption, gross income and gross margin per hectare increased over time. The transition to the more fertile cross-bred cows improved farm reproductive performance and this reduced herd overhead and depreciation costs. The key management adaptation was to increase farm stocking rate as the cow transitioned to a smaller and (relatively) lower producing cow. Whilst the smaller cross-bred cow was able to eat and produce less than the pure-bred Friesian cow, it appears the efficiency of converting feed into milk was similar between cow types. The response by management to increase stocking rate as the herd transitioned to a smaller and less productive cow ensured high per hectare performance was maintained or increased. The gain in fertility arising from the transition to a cross-bred cow allowed the herd to remain wholly seasonally calving and this helped to maintain the low cost of production, high pasture intakes and high gross margin. This study demonstrates the superiority of farm-level measures over cow-level measures of performance and emphasises the importance of good adaptive management in optimising the performance of the suite of inputs that is a modern farm. Industry should reduce the focus on per-cow performance and emphasise per hectare measures.

Key words:

---

[1] The author acknowledges the support of Dairy Australia in the conduct of this research.

Introduction

Increasing farm data about the performance of farms and cows in the dairy industry is becoming available. The challenge is how to convert the raw data into information that assists decision making and encourages continuous improvement. Chasing individual performance measures (where more or less is better) instead of focusing on what the combined measures say about overall farm performance, is folly. A dairy farm is a complex system and the most successful farmers are those that do well across all key areas; not those that excel in one or two areas but do poorly in others. The economic principle of equi-marginal returns suggests the most successful and resilient farmers will have roughly equivalent economic performance across all their key measures of performance and will almost certainly not excel in any. Overall performance is the measure that matters.

In the research reported in this paper a case study was conducted to examine the potential for disagreement between (limited) individual farm measures of performance and whole farm performance. The hypothesis is that per cow productivity and per hectare productivity may not be strongly correlated and farming system dependent.

The farming system used effectively determines which are the critical indicators and what are the appropriate targets for the system to use. Application of whole-of-industry aggregated data to determine performance measure targets is inappropriate. Only through the system-based approach to interpretation of farm measures of performance can real problems be identified, and appropriate corrective actions recommended.

The aims of this project were to demonstrate:

1. The importance of a system-level approach to measuring farm performance and interpretation;
2. The value of historical data in interpreting trends in farm performance; and
3. The value of a centralised, complete, maintained and accessible database.

Real farm data was used to demonstrate how farming system changes affected individual measures of performance and to relate long-term trends in these measures to overall farm performance during the farming system change.

The two dairy farms owned by Dr Jakob Malmo in the Macalister Irrigation District have some of the most detailed farm physical and financial data within the Australian dairy industry. The complete data history extends back at least 20 years. This data, and Dr Malmo's detailed history of the farms, provided a near-perfect data set tor a trend analysis of performance measures. Importantly, one of his farms converted from Holstein-Friesian cows to cross-breed cows around 10 years ago with the second farm beginning the conversion five years ago. Both farms have had stable management, constant spring-calving and feeding systems across the proposed study period. Dr Malmo has complete farm reproductive and disease records that support calculation of whole-of-life cow performance.

The key measures such as production per cow, production per hectare, etc. were calculated for each year of the retrospective study and compared against the overall farm financial performance (gross margin) for the farm that first implemented a cross-breeding program. Importantly, the change from Holstein-Friesian to cross-breeds at this Tinamba farm was monitored over time and the impact on individual measures assessed. Some changes are expected such as a decline in per-cow lactation performance. Potentially no change or even an increase in average cow lifetime profitability and per hectare performance can be predicted. The trends and relationships between per cow performance and per hectare performance and farm financial performance are specifically described.

This research will encourage farmers to maintain continuous data collection such that long-term farm datasets can be used for assessing performance and to observe trends in indicators of performance. Analysing these indicators leads to better decisions that help drive farm profitability. This work will also demonstrate the value of effective whole-farm analysis and will encourage farmers to undertake similar analyses. This case study will be of assistance to both producers and advisers. The expected changes in per cow and per hectare performance and their relationship to overall farm profitability will be of great value and may form part of the 'train the trainer' material. This will demonstrate the importance of contextualising performance of an individual (and intermediary) and comparing with whole-farm performance.

Farm History

The history of the Tinamba farm across the study period is as follows.

Cow changes

The original herd was pure-bred Friesian. A two-breed cross-breeding program began around 1998 with the introduction of Jersey into the mating program. The first home-bred cross-breeds entered the herd around 2000. The cross-breeding program changed to become a three-breed program around 2005 with the introduction of red-breed genetics. The herd composition has not yet stabilised to a three-breed cross; the proportion of three-breed animals continues to rise, and a handful of pure-bred Friesian cows remains.

Farm physical changes

The farm has been expanding. This was primarily through the purchase of land from neighbours, the incorporation of beef farming sections into dairying, and access to land previously not available to the milking platform due to roads, through construction of underpasses. The milking platform was originally 166 hectares from 2000 to 2010, increasing to 194 hectares in 2011 and then to 229 hectares in 2015.

Farming system

The farm has always been a pasture-based wholly seasonally-calving (spring) dairy farm. Grain feeding is used to supplement pasture. The average grain intake per milking cow is 1.7 tonnes per cow per year (with at least 1 tonne of supplement fed per cow each year). The average pasture/forage consumption by milking cows was 3.5 tonnes per cow per year. This places the farm feeding system into feeding system 2, which is defined as pasture-based with grain feeding at more than 1 tonne DM per cow per year. The continual use of seasonal calving within feeding system 2 before, during and after the transition from pure-bred to cross-bred cows makes this an ideal study farm for examining the impact of the breed change on per-cow and per-hectare physical and financial indicators and on overall farm performance. The stocking rate history is presented in Figure 1. There was a strong upwards trend in stocking rate from 2000 until 2007. This was followed by a gradually declining trend in stocking rate.

Cow-level Physical Measures of Performance

Breed

The change in herd breed composition is presented in Figure 2. The study period used was 2000–2015 as this includes a period when the herd was mostly Friesian and ends with the herd almost exclusively cross-bred. Complete data existed for this period (was used for financial and physical records, and for cow and herd records).

Figure 1. Milking platform stocking rate by year, 2001-2015

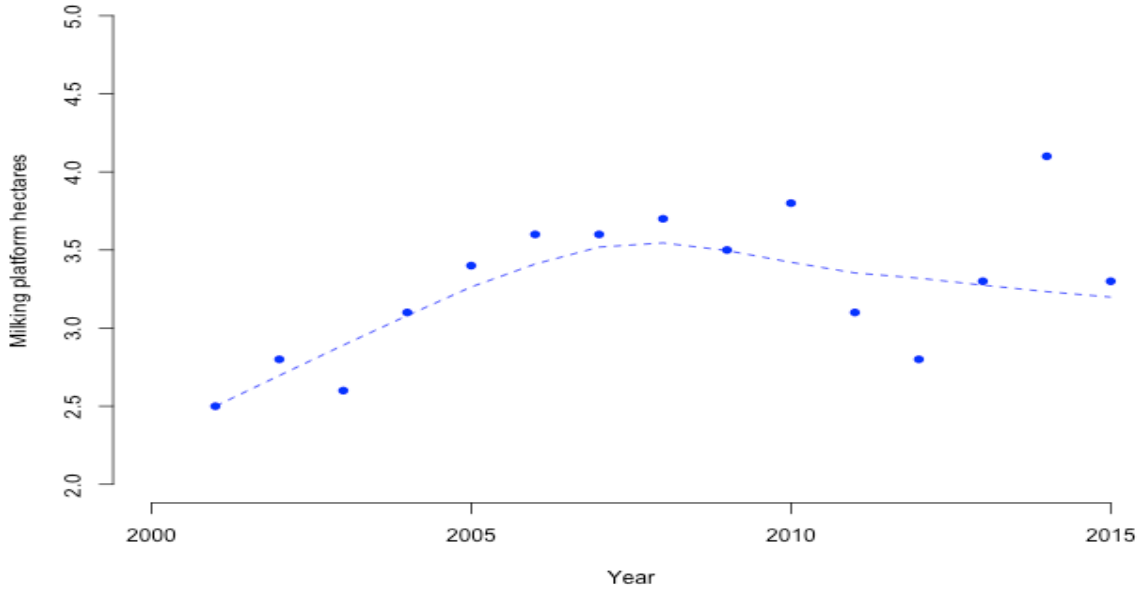
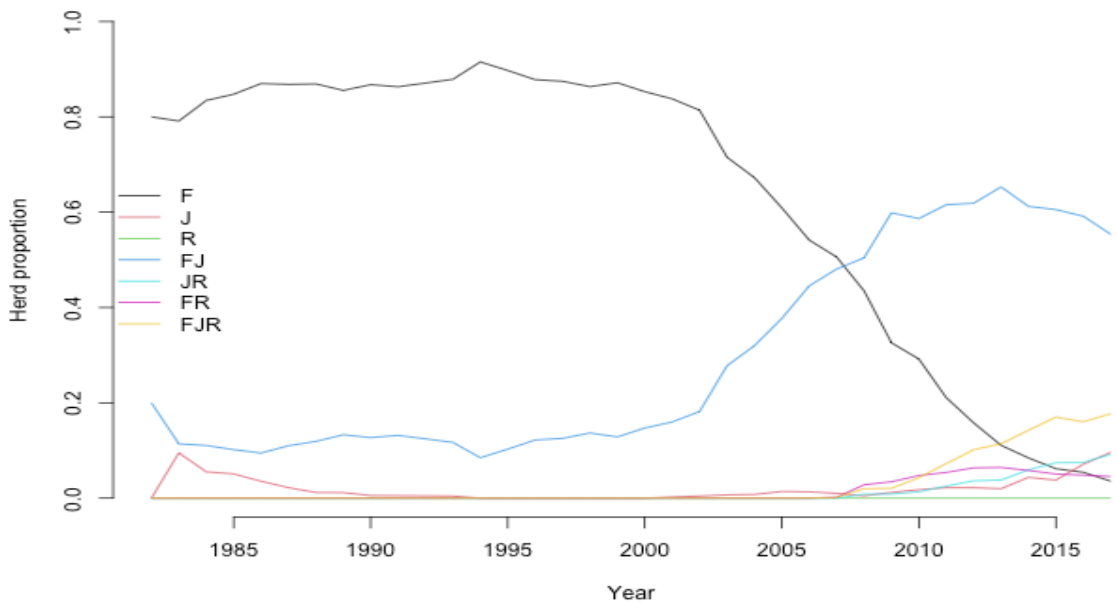


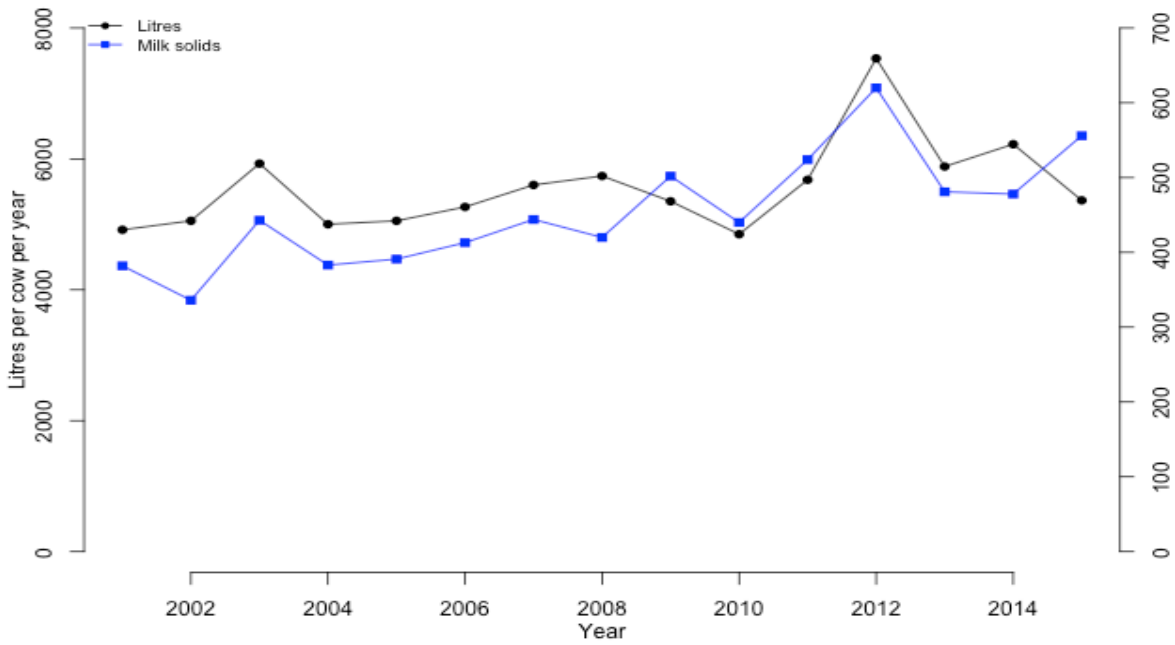
Figure 2. Herd breed composition by year, 1985-2015



Production

Cow physical production is presented in Figure 3. The average lactation curve for each year was ranked. The lactation curves have not changed dramatically but there was a trend away from high litres, fat and protein per cow over time that is reflective of the reduction in pure-bred Friesian genetics in the herd. Genetic gain in production is present in the cross-breed and this became apparent after the herd breed composition had stabilised as predominately cross-breed but was almost certainly happening during the transition from pure-bred (high-producing) Friesian to cross-bred cows and reflects the effective sire selection process employed.

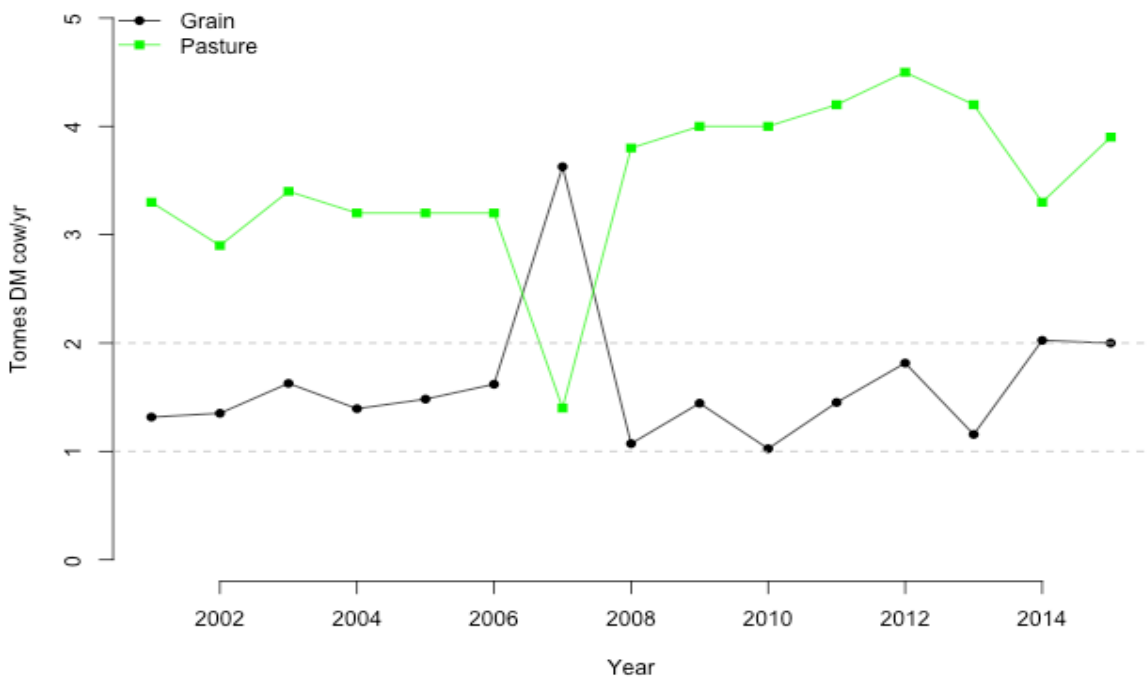
Figure 3. Average lactation milk and milk solids production per cow per year, 2001-2015



Feed intake

The average grain and pasture intakes per cow per year is presented in Figure 4.

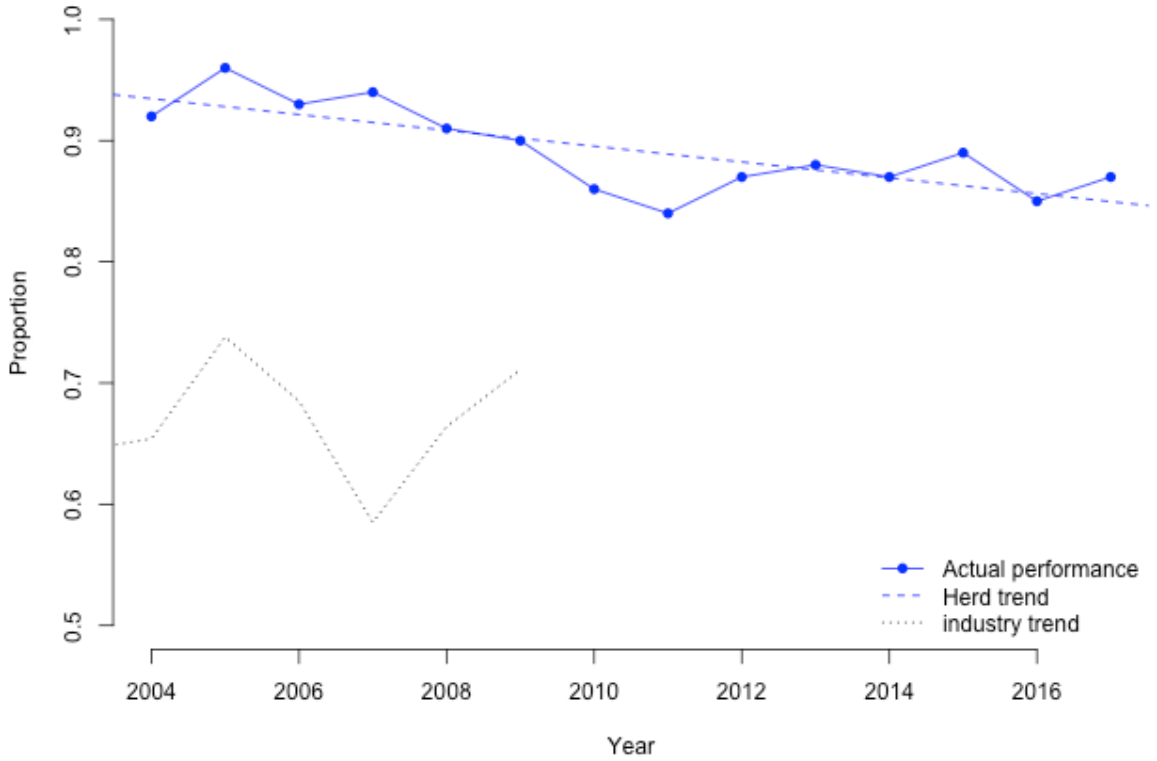
Figure 4. Tonnes consumed per cow per year, 2001-2015



Reproduction

The trends in reproductive performance for three-week submission rate, first-service conception rate, six-week in-calf rate and not-in-calf rate by year is presented in Figures 5 to 8. The trend lines for the herd are presented as dashed lines of the same colour and for industry (median performance) for each measure is presented as dashed black lines. The herd has not experienced any appreciable decline in reproductive performance whilst the general industry trend has been for declining performance in each parameter.

Figure 5. Three-week submission rate by year, 2004-2017



Cow survival

Exploration of cow survival and lifetime production is limited to completed birth cohorts. This is those birth cohorts where all animals have left the herd. This is presented in Figure 9. The proportion of the birth year cohort that were pure-bred animals is presented in Figure 10. There is a trend towards increasing lifetime survival and increasing lifetime milk solids production with increasing birth year—as the herd converts from pure-bred Friesian to cross-breed.

Hectare-level Physical Measures of Performance

The average pasture and fodder consumption per milking platform hectare per year is presented in Figure 11. There has been a trend towards increased pasture/fodder consumption across the study period.

Figure 6. First-service conception rate by year, 2004-2017

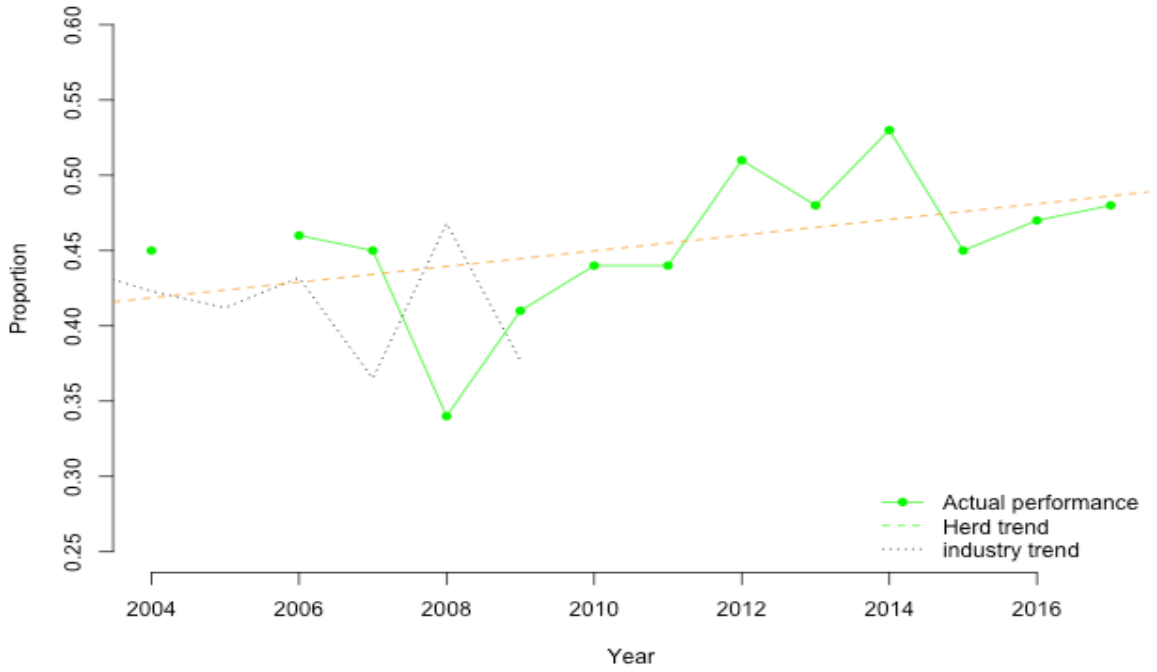


Figure 7. Six-week in-calf rate by year, 2004-2017

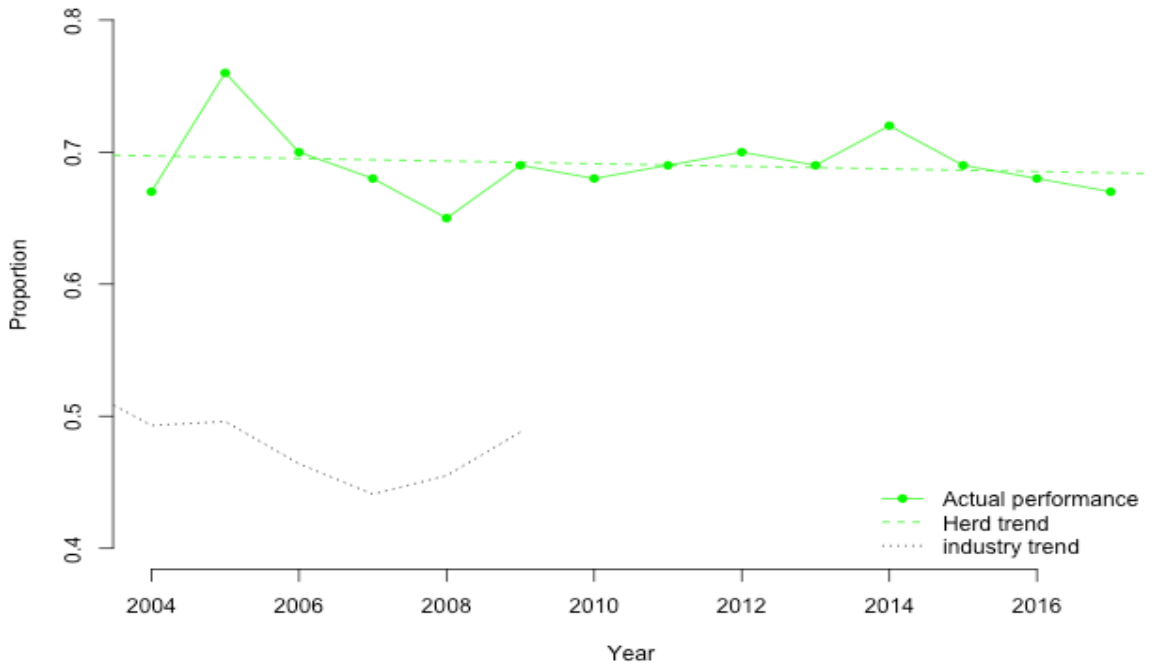


Figure 8. Not-in calf rate by year, 2004-2017

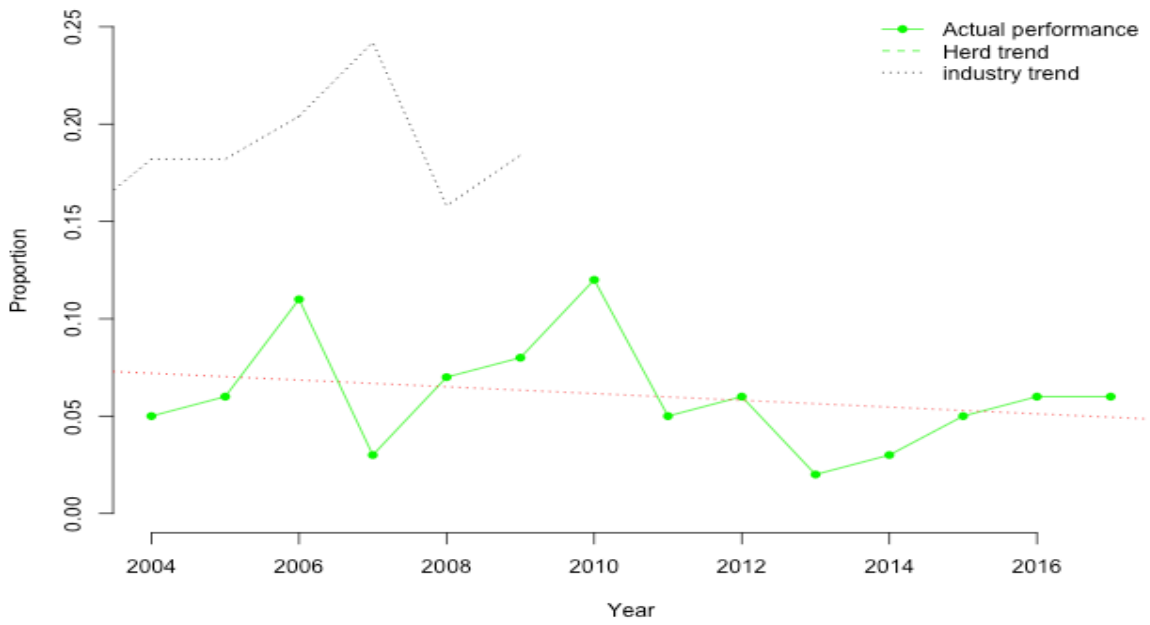


Figure 9. Average cow lifetime survival and production for cow birth cohorts that have no surviving members, 1998-2004

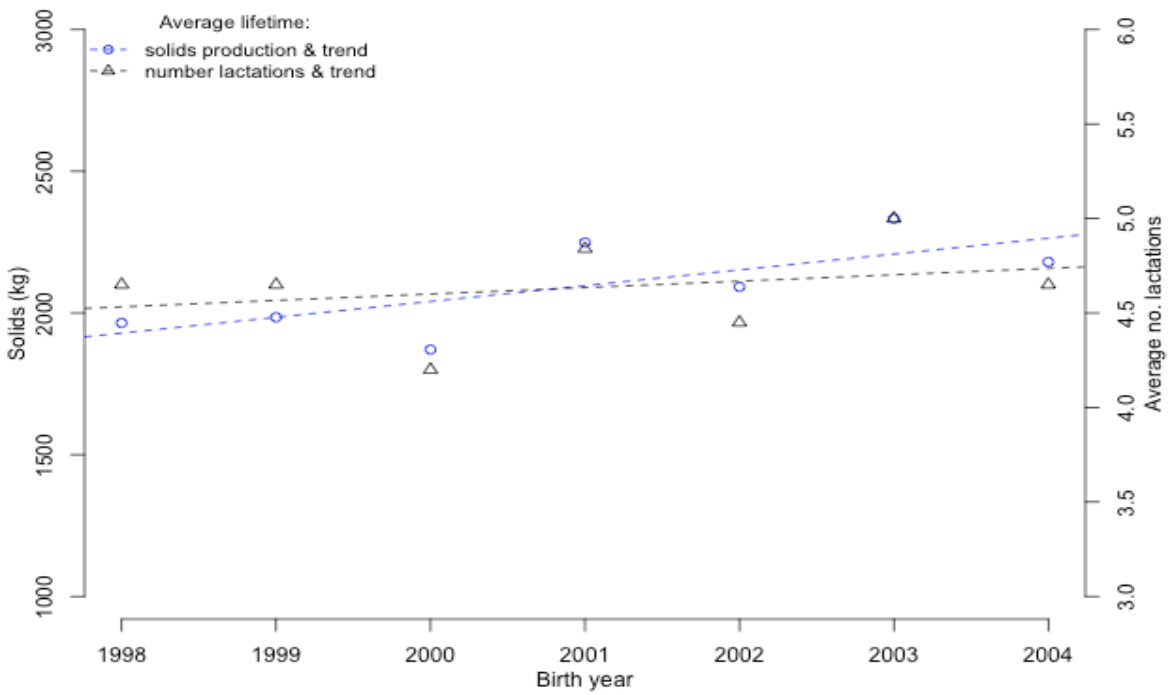


Figure 10. Average purebreed proportion of cow birth cohort by birth year, 1998-2004

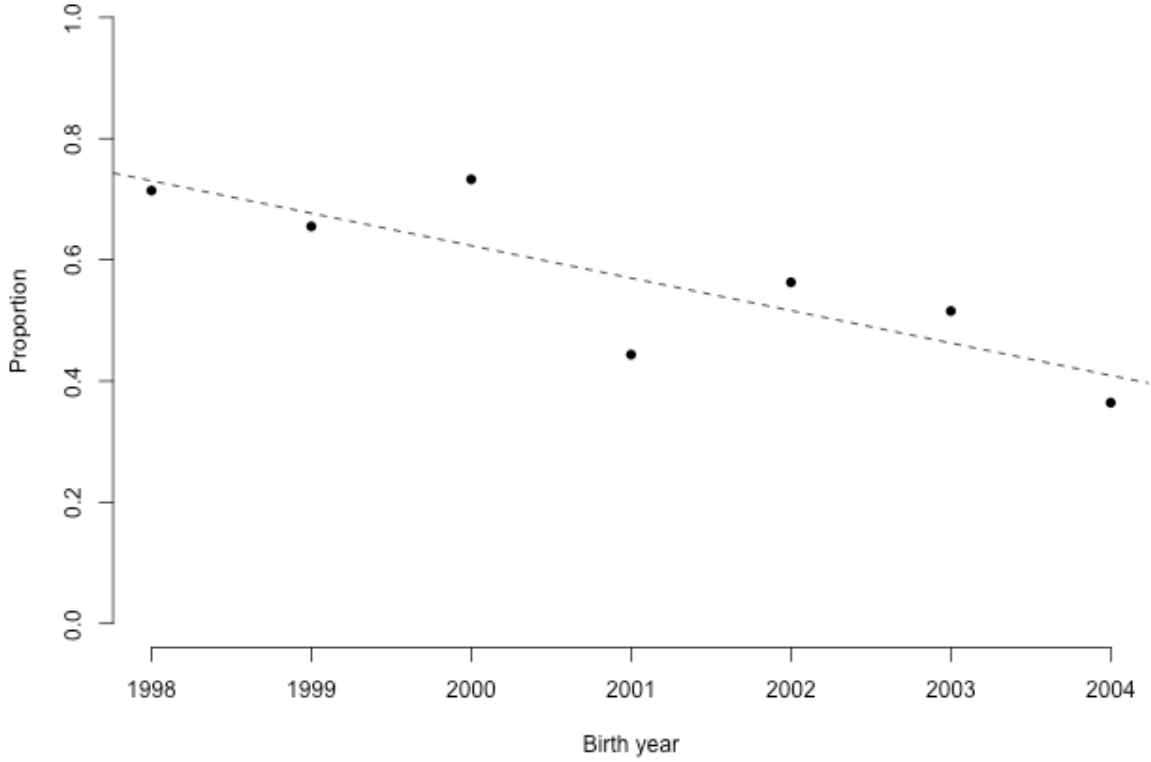
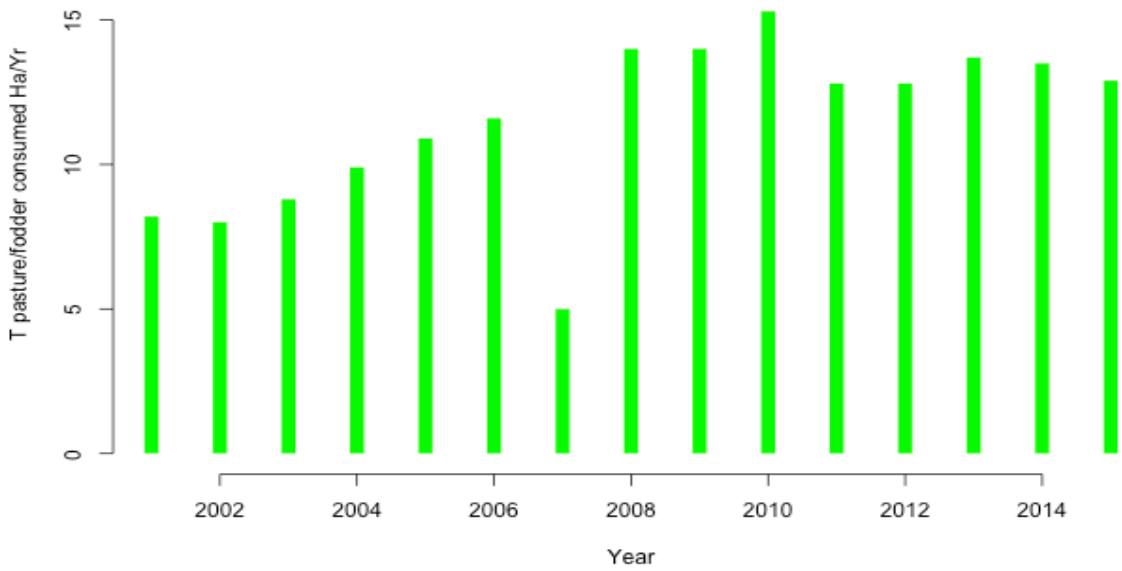


Figure 11. Average pasture and fodder consumption per milking platform hectare per year, 2001-2015

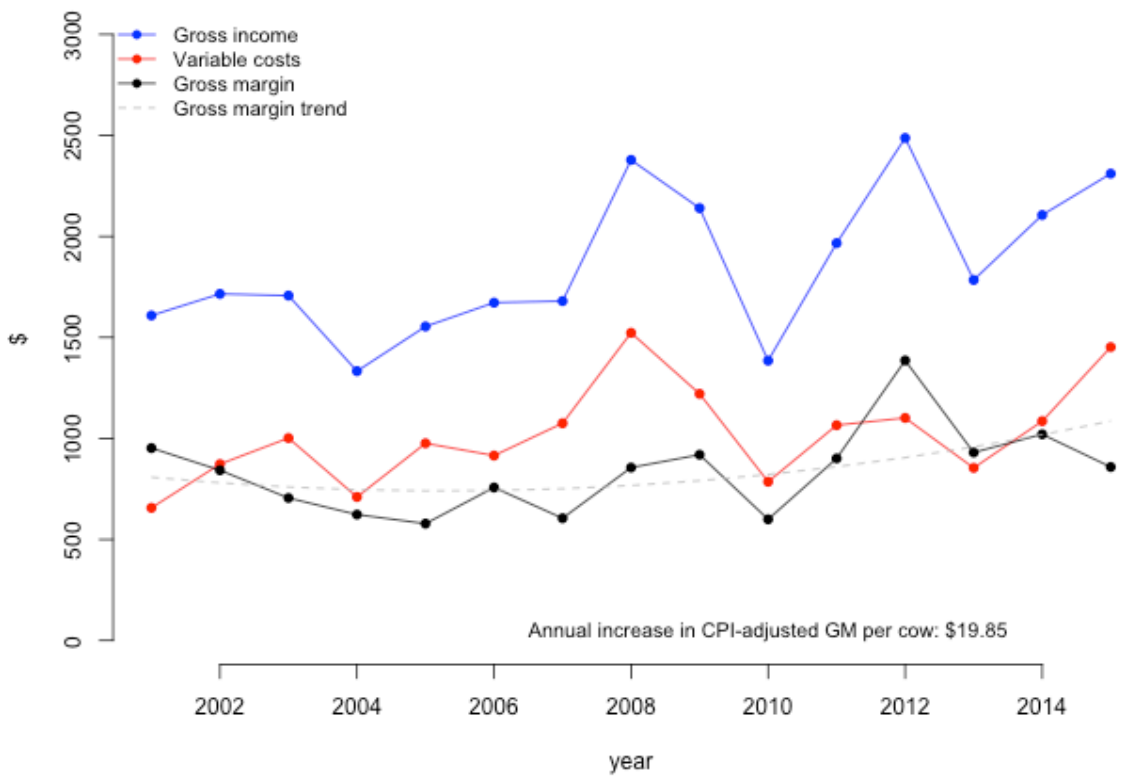


Financial Measures of Performance

Cow-level financial indicators

Cow-level gross income, variable costs, gross margin and annual rate of change in gross margin for the years 2000 to 2015 (CPI adjusted) are presented in Figure 12. Cows decreased in average gross margin returned in the period 2000 to 2007 but have increased since 2007. This temporary reduction in average cow performance was predicted by simulation modelling and is primarily the result of having a mixed herd of cross-bred and pure-bred cows together. However, across the whole of the study period, the cows returned on average an extra $20 of gross margin every year after adjusting for inflation (2015 prices).

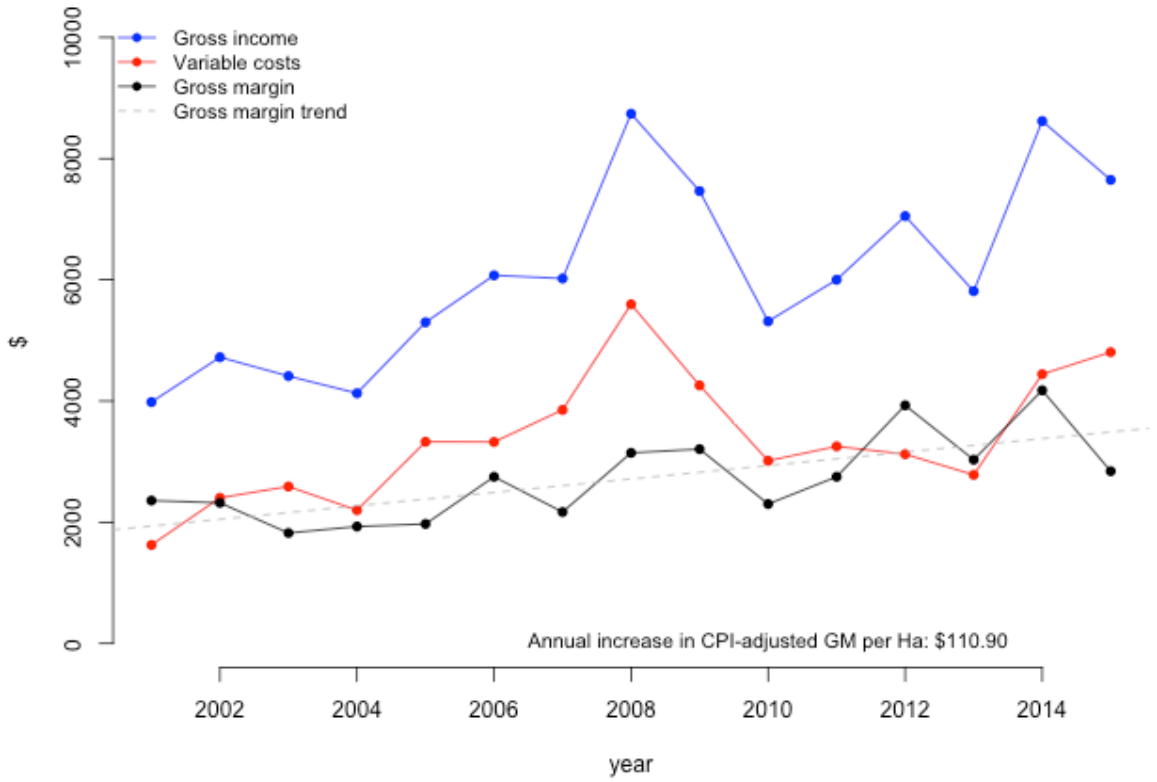
Figure 12. Cow-level gross income, variable cost and gross margin, 2001-2015 (CPI adjusted)



Hectare-level financial indicators

Hectare-level gross income, variable costs, gross margin and annual rate of change in gross margin for the years 2001 to 2015 (CPI adjusted) are presented in Figure 13. Each hectare of the milking platforms has returned an extra $110 in gross margin per year after adjusting for inflation (2015 prices). It is important to note that the hectare-level trend remained upwards during the period of declining per cow gross margin performance.

Figure 13. Hectare-level gross income, variable cost and gross margin, 2001-2015 (CPI adjusted)

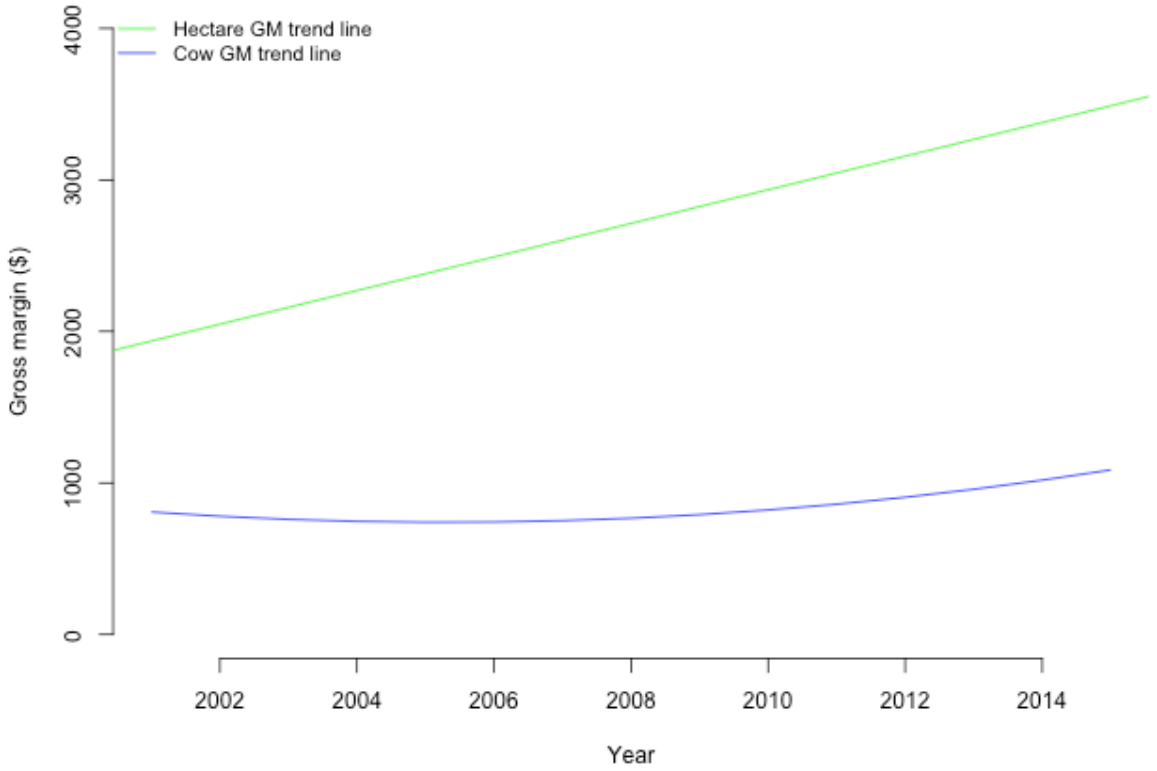


A focus on the change in gross margin trends is presented in Figure 14. The trend in hectare gross margin performance has been linear whilst the trend in cow performance has been curvilinear. The cow-level change in gross margin performance was characterised by a decrease in the early years of the cross-breeding program which plateaued as cross-breeds became the dominant cow in the herd and then increased as the genetic merit of the cross-breed herd improved through effective within-breed sire selection.

The different shapes of the hectare and cow gross margin trends is critical to understanding. The smaller cross-breed cow produces less than a large Friesian so they are expected to generate a smaller gross margin on a lactation basis. However, management predicted these changes and adapted to the reduced production by milking more cows and this maintained the upwards trend in per hectare gross margin performance.

The other critical aspect of understanding these different performance measure trends is that examining and comparing cow performance on a lactation basis provides incomplete economic performance information. One way this farm harvested extra profit from the cross-breed herd is through the improvement in fertility. Whilst the cross-breed cows produce less than their Friesian herd mates on a lactation basis, they provided more lactation than the Friesians on average and therefore their lifetime milk production was similar to or exceeded that of their Friesian herd mates. This means the cross-breed cow, when viewed as an item of capital, had lower depreciation than the comparatively short-lived Friesian.

Figure 14. Cow and hectare trends in annual gross margin performance, 2001-2015



Discussion

The results from this analysis demonstrate that the farm has been and continues to be successful. It is productive and profitable and importantly, it increases profit each year. This study shows that the transition from a pure-bred herd to a cross-breed herd has been successful in this case. This analysis also highlights the problem of viewing any individual (intermediary) performance measure in isolation (except return on assets—the whole-farm indicator).

A (solitary) focus on per-cow performance would have led to the conclusion that the farm had gone backwards in the first half of the 2000s and had only just managed to restore performance to historical levels of last century. The reason why the declining cow-level indicators did not mirror a decline in overall farm performance and profitability was because management adapted to the change—they adapted the farming system to maintain farm productivity and profitability gains. The primary managerial adaptation was to cater for the change from a large, high-producing cow to a smaller, lower-producing cow. This was achieved by increasing herd size and farm stocking rate to compensate for the decrease in cow size and individual cow production. This ensured there were enough mouths and herd demand to eat the pasture.

The improvement in fertility from converting the herd to cross-breeds subsequently resulted in an increase in cow lifetime production. Genetic-driven production gains in the cross-breed cow as a result of effective sire selection subsequently drove an increase in cow lactation production that became apparent after the herd conversion to cross-bred cows had stabilised around 2017. The longer productive life of the cross-breed cow results in reduced annual herd depreciation. The herd depreciates less each year because fewer need to be culled; they milk for more years. However, this

benefit is not fully realised in this herd as management continues to produce surplus heifers. These heifers are bought into the herd and pregnant, lower-producing cows are sold into dairying (there is a long waiting list for these `surplus' cows).

There is no evidence of significant net differences in feed conversion efficiency between the pure-bred herd and the cross-bred herd. Cows with higher productive capacity convert a higher proportion of their feed intake into milk during a lactation (if fed sufficient)—so called `maintenance dilution'. The marginal efficiency of milk production curve is unknown—does it take as much feed and nutrients to increase milk production in a cow from 20L to 21L per day as it does to increase from 40L to 41L? No change in efficiency effects were apparent in the production or financial data suggesting that any impact in marginal efficiency or maintenance dilution at herd level is relatively minor.

The farmers commented that they like their seasonal system. This allows for single calving period, mating period, calf-rearing and allows for a period of dairy shutdown (this is essential because it lets people take overseas holidays). The lower milk price is offset by a lower cost of production but for management it was all the non-financial benefits of a seasonal calving system that were the driving force behind the decision to switch from pure-bred Friesian to a cross-bred herd. Converting to cross-breeds provided the cow fertility that they sought to allow them to maintain the single seasonally-calving farming system they prefer. Effective management meant this conversion to cross-bred cows did not come with a penalty in overall farm production or profitability —if anything, it boosted both. All that changed were the cow-level measures and they don't appear to tell us much when viewed in isolation.

Conclusion

Using individual indicators of performance of parts of a farm system to identify areas of under-performance is not possible. This is because such measures are essentially an average and a change in average performance provides minimal information about marginal change. Good management decisions are based around understanding if the last unit of input generated more income than cost. The marginal response can still be profitable in circumstances when the indicator is increasing and then decreasing just as it can be unprofitable in circumstances when the indicator increases and then decreases. Understanding this is important for indicators of performance to be used to best effect. Indicators of performance are best suited to comparison within farm over time.