DairyCo

Managing costs

Key findings of the Milkbench+ dairy benchmarking programme regarding the efficiency of dairy production in Britain.

February 2013

DairyCo Milkbench+

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This, the second Milkbench+ report, presents some of the highlights of our analysis of the Milkbench+ database. The investigation of total costs of production raises many issues, including just how difficult it can be to make a profit from milk production. However, there are also strong indications that many dairy farmers have the opportunity to take positive steps in managing production costs that could significantly increase financial returns.

The information in this report is from dairy herds with financial year-ends between December 2011 and June 2012 with a sample of 315 farms contributing to the analysis. Although not statistically representative, the sample provides a very good insight into the performance of dairy herds from across Great Britain. This is because Milkbench+ looks at the economic figures down to net margin level (revenue from value of milk, calves at 20 days, other dairy income minus herd replacement costs, dairy variable and dairy fixed costs) as well as a range of physical performance indicators. Thanks to the robust methodology of fully apportioning costs and income of dairy enterprises based on input use and using imputed values where necessary, the analysis can look at the whole range of enterprise types and compare them on an equal footing.

As in the first report, three enterprise types have been identified and analysed. The types were defined by the Milkbench+ data using principle component and cluster analysis.

- **Cows at grass**. Predominantly grass-based and operating at lower yield levels
- **Composite**. Maximum use of family labour and a mixed approach to feeding and housing
- **High-output cows**. Generally housed for more of the year with more intensive use of major inputs.

Many of the findings in the first report were replicated in the latest analysis:

a. The key determinant of profit is total cost of production

b. Average yield per cow is not the main driver of profit

c. The right balance between input use and milk output (herd size and average yield) is essential for high net margin

d. Milk can be produced efficiently from any of the systems identified and at almost any scale of production.

The following summarises the key findings and conclusions from this Milkbench+ report.

Key trends between 2010/11 and 2011/12:

- Milk prices rose on average by about 2.9 ppl
- Total costs of production increased by 1.3 to 2.3 ppl depending on enterprise system
- On average, enterprises in the **Cows at grass** system managed to retain 59% of the increase in milk price as extra net margin, compared with only 36% for **High-output cows** and 23% for **Composite systems**
- Since 2011/12 further price and cost changes have affected the cost of production and net margins.

Key findings:

- The range in milk price was half the range in total cost of production and net margin
- Four specific cost areas explain a minimum of 60% of the difference in net margin between the top and bottom 25% farms in the three enterprise types identified. These are:
    - Feed and forage variable cost
    - Herd replacement cost
    - Labour costs (paid and unpaid)
    - Power and machinery cost
- The best performers in each enterprise type fed less feed per litre and made better use of forage, resulting in a higher proportion of milk from forage and lower feed costs
- The top 25% of producers in each enterprise type had lower herd replacement rates as a result of lower mortality and culling rates. Higher mortality rate results in a significant loss of income and higher replacement cost
- In both the **Cows at grass** and Composite enterprise types, fixed costs explain 70% of the difference in total costs of production between the best and worst producers
- In the **High-output cows** system, fixed and variable costs have an equal share in the difference in total cost of production, with differences in feed cost having the biggest single effect
- Significantly more labour hours are spent per cow on manual tasks in the bottom 25% of herds in all enterprise type.

Conclusions:

- There is no silver bullet which ensures profitability; cost control through effective management is the key
- Achieving the most cost-effective performance levels in terms of milk yield and feed use and in the resulting total costs of production, requires regular recording, monitoring of performance and effective use of the resulting data
- There is no ideal herd replacement rate, understanding the reasons for replacement is more important than the number. Realistic targets should be set as a part of strategic management of individual dairy enterprises
- It is important to maintain a level of fixed costs appropriate to the level of output. Investment should be aimed at improving production efficiency and decreasing unit cost of production.

The findings from this report show there are opportunities for producers to take their business forward by focussing their attention on the most viable options. The findings also help DairyCo – and other organisations whose remit is to support dairy farmers – to target their farm improvement support programmes more effectively.

Introduction

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Milkbench+ is DairyCo's independent, confidential and comprehensive benchmarking service. It provides participating dairy farmers with detailed information on both physical performance and inputs and costs all the way to net margin at enterprise level.

Milkbench+ also provides DairyCo and the industry with uniquely detailed and accurate information about how the production end of the dairy sector really works; what are the key drivers of profit and, just as important, what are the potential pitfalls?

This report shows the findings of the second year of analysis of the Milkbench+ data. The investigation of total costs of production raises many issues, including just how difficult it can be to make a profit from milk production. However, there are also strong indications that many dairy farmers have the opportunity to take positive steps in managing production costs that could significantly increase financial returns.

The information in this report is from dairy herds with financial year-ends between December 2011 and June 2012 with a sample of 315 farms contributing to the analysis (please see Appendix A and B for description of the Milkbench+ database). Although not statistically representative, the sample provides a very good insight into the performance of dairy herds from across Great Britain. This is because Milkbench+ looks at economic figures down to net margin level (revenue from value of milk, calves at 20 days, other dairy income minus herd replacement costs, dairy variable and dairy fixed costs) as well as a range of physical performance indicators. Appendix C details how Milkbench+ calculates total cost of production, net margin and other important variables.

To provide an increased degree of analysis, the sample has been categorised into three distinct enterprise types. However, it is important to emphasise that the report is not about comparing systems but rather to illustrate the significant factors driving performance within enterprise types.

These factors can help farmers identify the main areas to improve the efficiency of their production systems and the sustainability of their businesses.

About Milkbench+

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Milkbench+ is an internet-based benchmarking service that enables British dairy farmers to compare their enterprise performance against other dairy farms. The service provides users with easy-to-understand summaries of input use, costs and income down to the net margin level. Net margin is calculated as revenue (value of milk, calves at 20 days, other dairy income) minus herd replacement cost, dairy variable costs and dairy fixed costs. With this information, individual users of the service can identify opportunities to improve production efficiency and reduce costs, to increase profit from dairying. Readers of this report who may be interested in using the Milkbench+ service on their own farms are encouraged to contact the Milkbench+ team for further information. Contact details are on the back cover.

In addition to providing this service to individual levy payers, the complete Milkbench+ dataset provides a unique opportunity to learn more about the most important factors determining whether dairy enterprises can be profitable or not. This is the second report in the annual series of Milkbench+ reports, which presents some of the highlights of our analysis at this level.

The Milkbench+ assessment is based on production and cost efficiency at the enterprise level; it is not based on accounting principles nor is it a costings service. Thanks to a robust methodology using standardised variables and imputed values where necessary, the analyses can look at the whole range of enterprise types and compare them on an equal footing.

Finally, the greatest care is taken to ensure the information collected is accurate, secure and that confidentiality is maintained. As a result, we are confident that the insights Milkbench+ is starting to give are meaningful and relevant.

Managing costs is the key to profitability

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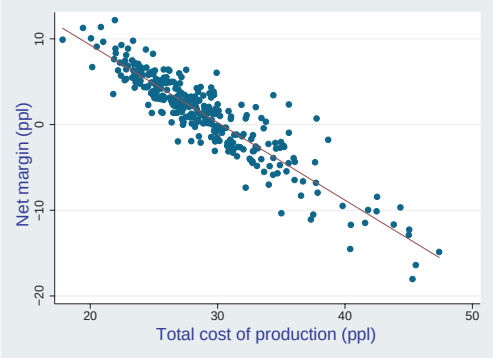
Analysis presented in this report builds on the results presented in the first Milkbench+ annual report, published in January 2012.

Figure 1: Comparison of total cost of production to net margin in 2011/12

R^2=0.84



One of the key findings of the first report was that total cost of production is the key determinant of net margin of British dairy enterprises.

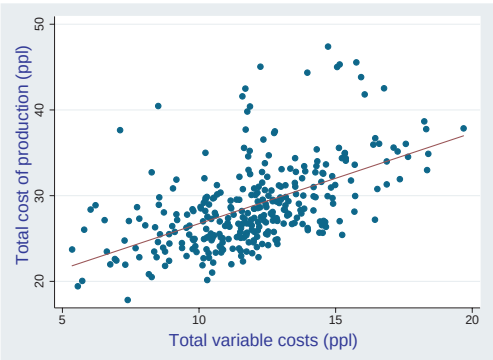
Analysis presented in this report will further improve our understanding of the reasons behind the observed large range in total cost of production and identify the most effective strategies to manage the largest costs.

When interpreting graphs where a best fit line is included such as Figure 1, it is useful to consider the R^2 value. This measures how well this line describes the relationship between the two variables. The closer the R^2 is to 1 the better the line fits the data and the stronger the relationship between the two variables. The R^2 in Figure 1 suggests that total cost of production explained over 80% of variation in net margin in the Milkbench+ 2011/12 sample.

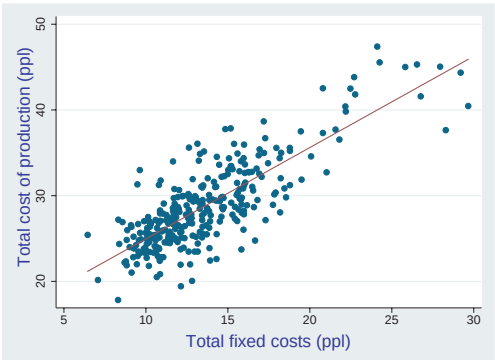
The range in cost of production in Figure 1 is from 18 ppl to 47 ppl. Net margin ranged from -18 ppl to 12 ppl.

Figures 2 and 3: Relationship between variable/fixed costs and total cost of production

R^2=0.30



R^2=0.65



The relatively close relationship of variable/fixed costs and total cost demonstrates the importance of managing both variable and fixed costs to maximise profitability of dairy production systems. The strong relationship with fixed costs and total costs highlights the importance of maintaining a cost structure appropriate to the level of output.

Table 1 summaries the Milkench+ data set for enterprises with year ends between December 2011 and June 2012. Since then, it should be noted, costs have increased significantly.

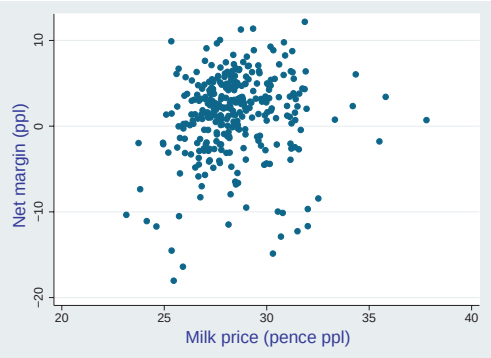
Table 1: Summary of Milkbench+ sample ranked on net margin per litre (ppl)

Milkbench+ 2011/12*	Average	Top 25%	Bottom 25%
Herd size	201	260	146
Milk yield (l/cow/year)	7703	7557	7457
Financial comparison (ppl)			
Milk price	28.4	28.8	27.9
Revenue	**30.1**	**30.6**	**29.6**
Herd replacement cost	**3.3**	**2.6**	**3.8**
Feed and forage cost	9.0	7.8	10.1
Livestock costs	3.0	2.5	3.7
Total variable costs	**11.9**	**10.3**	**13.7**
Labour cost (paid and unpaid)	4.4	3.2	5.8
Power and machinery cost	3.3	2.9	4.0
Total depreciation	2.1	1.7	2.9
Property costs and finance	2.8	2.5	3.3
Overheads	1.0	0.8	1.5
Total fixed costs	**13.6**	**11.1**	**17.5**
Total costs of production	**28.8**	**24.0**	**35.0**
Net margin	**1.3**	**6.6**	**-5.4**

* Columns Top 25% and Bottom 25% are averages for the top and bottom 25% performing enterprises.

Results presented in Table 1 confirm the conclusions from last year's report, that cost of production is the main driver of net margin. Table 1 and Figure 4 show that milk price accounts for only a very small proportion of the difference in net margin between the top and bottom performing farms, with the top 25% farms achieving, on average, a slightly higher milk price than the bottom 25%. On the other hand, total cost of production explains around 90% of the difference in net margin between the groups.

Figure 4: Comparison of net margin with milk price



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Average milk price received by individual enterprises in 2011/12 varied from 23 to 38 ppl. However, this range of 15 ppl is half the range in total cost of production and in net margin for the same period.

Table 1 shows that the bottom 25% farms have higher costs across the board, not just higher feed or labour costs. We can conclude there is no 'silver bullet' which would ensure profitability. Attention to detail and cost control result in improved profitability of the top-performing dairy enterprises.

There are complex interactions between individual variable and fixed costs and their impact on total cost of production can vary across different production systems. Therefore, to be able to explore these relationships in more depth we must first identify different production systems to reduce the variation in the data and provide more meaningful results.

Characterising British dairy farms

The first step towards this was an analysis that has identified the most significant types of dairy enterprises in Great Britain on the basis of what Milkbench+ is telling us about the ways in which they operate. This replicates the approach used in the previous report. This analysis was based on statistical techniques that allow the identification of the most important ways in which dairy enterprises differ and then to 'cluster' similar farms together for a more detailed analysis of the drivers of profit for different farm types (Appendix D provides a more detailed description of the methodology).

The analysis has revealed three major areas in which British dairy farms are likely to differ:

- The feeding strategy adopted - whether feeding is based principally on grass, on a mixed ration or a more traditional mixture of the two
- Intensity of input use - large-scale but low input, intensively housed or smaller-scale operators
- Type of output - low-yielding with high constituents or higher yielding, low constituents producers.

Exploring these differences in more depth has led us to identify three key enterprise types:

- **Cows at grass**. Mainly block calving, predominantly grass based and operating at lower yield levels
- **Composite**. Mostly year-round calving, with maximum use of family labour and a mixed approach to feeding and housing
- **High-output cows**. Mostly year-round calving with some autumn and multi–block calving patterns, higher yields with intensive use of major inputs.

Some of the key differences between these three farm types are highlighted in table 2.

Table 2: Some key differences between main enterprise types, 2011/12

	Cows at grass	Composite	High-output cows
Number of farms	65	88	162
Average herd size (cows)	231	123	230
Total non-forage feed (kg DM/cow/year)	1087	2225	2629
Yield (litres/cow/year)	5741	7750	8465
Proportion of paid labour in total labour requirement (%)	52	27	61
Total cost of production (ppl)	27.3	30.3	28.6
Net margin (ppl)	3.6	-1.3	1.8
Net margin (£/Ha/year)	477	-65	340

Table 2 shows very similar results for the three identified enterprise types as last year's report. Furthermore, it is now possible to relate the information on calving pattern to our three enterprise types:

Table 3: Calving pattern differences between main enterprise types, 2011/12

	Cows at grass	Composite	High-output cows
Total number of farms	65	88	162
All year round calving pattern	20	83	142
Multi-block calving pattern	12	4	10
Autumn-block calving pattern	3	1	10
Spring-block calving pattern	30	0	0

As table 3 shows, businesses with **Cows at grass** had a large proportion of block calving herds, although 20 operated year-round calving. This compared with 94% operating year-round calving with **Composite** systems and 88% of **High-output cows** system. The High-output group also had a significant proportion of autumn and multi-block calving herds. Additional analysis of calving pattern and enterprise performance can found at Appendix E.

Year-on-year comparison of the three enterprise types

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In this section we explore how the performance of the three identified systems developed from 2010/11 to 2011/12. To do this we identified enterprises in the three enterprise types for which we have information covering both production periods to give a matched sample. Table 4 shows how revenues and costs have changed over the two year period for each farming system and the impact on net margins per litre. A minus sign shows a cost that has decreased over the period.

Table 4: Difference in average performance of enterprise types between 2011/12 and 2010/11, expressed as ppl

Difference between 2011/12 2010/11 (ppl)	Cows at grass	Composite	High-output cows
Number of enterprises covering both production periods	46	66	125
Milk price	2.9	2.9	2.8
Revenue	**3.0**	**3.0**	**3.0**
Herd replacement cost	**-0.1**	**0.3**	**0.0**
Feed and forage cost	0.5	0.8	0.9
Livestock costs	-0.1	0.2	0.2
Total variable costs	**0.4**	**0.9**	**1.1**
Labour cost (paid and unpaid)	0.4	0.4	0.1
Power and machinery cost	0.1	0.2	0.3
Total depreciation	0.3	0.2	0.2
Property costs and finance	0.2	0.2	0.2
Overheads	0.1	0.1	0.0
Total fixed costs	**1.0**	**1.1**	**0.9**
Total costs of production	**1.3**	**2.3**	**2.0**
Net margin	**1.7**	**0.7**	**1.0**

Table 4 shows a significant increase in average milk price in the 2011/12 production period across all enterprise types. On average, UK farmgate milk price in the sample increased by 12% between 2010/11 and 2011/12. However, the average price of compound feeds has increase by 18% in the same period. Similarly, pasture land rents and fertiliser have also increased on average by 13% and 14% respectively.

As a result, the higher milk price was not fully translated into higher net margins. On average, enterprises in the Cows at grass system managed to retain 59% of the increase in milk price as extra net margin, compared to 36% and 23% for the High-output cows and Composite systems respectively. The rest of the increase in milk price was consumed by higher costs, especially feed, labour and power and machinery costs.

The next section takes a more detailed look at the differences in performance between 2011/12 and 2010/11 for the individual enterprise types.

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Cows at grass

Table 5: Difference in average performance of Cows at grass systems between 2011/12 and 2010/11, expressed as ppl

	Cows at grass 2011/12	Cows at grass 2010/11	Difference
Number of farms	46	46	
Physical comparison			
Herd size	212	205	7
Herd replacement rate (%)	25	26	-1
Average yield (l/cow/year)	6043	6064	-21
Total non-forage feed (kg DM/cow)	1187	1330	-143
Milk from forage (l/cow/year)	3130	2734	396
Financial comparison (ppl)			
Milk price	29.2	26.3	2.9
Revenue	**31.1**	**28.1**	**3.0**
Herd replacement cost	**3.4**	**3.5**	**-0.1**
Feed and forage cost	7.2	6.7	0.5
Livestock costs	2.8	2.9	-0.1
Total variable costs	**10.0**	**9.6**	**0.4**
Labour cost (paid and unpaid)	4.6	4.2	0.4
Power and machinery cost	3.1	3.1	0.0
Total depreciation	2.3	2.0	0.3
Property costs and finance	3.4	3.2	0.2
Overheads	1.0	0.9	0.1
Total fixed costs	**14.4**	**13.4**	**1.0**
Total costs of production*	**27.7**	**26.4**	**1.3**
Net margin	**3.4**	**1.7**	**1.7**

*Refers to enterprise year ends between December and June. Since June 2012 costs have risen significantly.

Interestingly, for the **Cows at grass** enterprises, the average yield per cow declined slightly between 2010/11 and 2011/12, which is in contrast to the other two systems and the national trend for this period. The **Cows at grass** enterprises have on average fed less non-forage feed per cow.

Weather affects forage quantities and quality and subsequently has a significant effect on the amount of non-forage feed fed. The South West had, in general, good grass growing conditions in 2011/12, however, the North West experienced drought, which would have affected forage availability, yield and the amount of non-forage feed fed.

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In general, although the yield per cow has dropped slightly, milk from forage has increased, resulting in feed cost per litre increasing by the smallest proportion out of the three systems.

Overall, variable costs have increased by a significantly smaller proportion than fixed costs in the **Cows at grass** system. Labour cost rose as a result of an increase in wage rates rather than an increase in labour requirement. On the other hand, power and machinery costs remained the same for the **Cows at grass** system but increased for the other two systems.

On average, the **Cows at grass** enterprises seem to have taken advantage of the higher milk price and lower interest rates and have invested in their dairy businesses. As a result, the depreciation and opportunity cost of capital (part of property costs and finance) have increased between 2010/11 and 2011/12. Hopefully, this investment was aimed at increasing production efficiency and will reduce production costs in the long run.

Composite

Table 6: Difference in average performance of Composite systems between 2011/12 and 2010/11, expressed as ppl

	2011/12	Composite 2010/11	Difference
Number of farms	66	66	
Physical comparison			
Herd size	124	120	4
Herd replacement rate (%)	26	24	2
Average yield (l/cow/year)	7785	7772	13
Total non-forage feed (kg DM/cow)	2228	2344	-116
Milk from forage (l/cow/year)	2036	1706	330
Financial comparison (ppl)			
Milk price	27.4	24.5	2.9
Revenue	**29.2**	**26.2**	**3.0**
Herd replacement cost	**3.3**	**3.0**	**0.3**
Feed and forage cost	9.1	8.3	0.8
Livestock costs	3.0	2.8	0.2
Total variable costs	**12.0**	**11.1**	**0.9**
Labour cost (paid and unpaid)	5.3	4.9	0.4
Power and machinery cost	3.2	3.0	0.2
Total depreciation	2.2	2.0	0.2
Property costs and finance	2.8	2.6	0.2
Overheads	1.1	1.0	0.1
Total fixed costs	**14.7**	**13.6**	**1.1**
Total costs of production*	**30.1**	**27.8**	**2.3**
Net margin	**-0.9**	**-1.6**	**0.7**

*Refers to enterprise year ends between December and June. Since June 2012 costs have risen significantly.

Between 2010/11 and 2011/12, the Composite system has experienced the biggest increase in production costs out of the three enterprise types, on average and as a result retained only 23% of the increase in milk price as net margin. Both variable and fixed costs have increased significantly.

The average amount fed per litre has reduced slightly and milk from forage has increased but feed and forage costs still experienced one of the biggest increases, at 0.8ppl, mainly as a result of higher feed prices.

Labour cost has increased too, because of slightly higher labour use and higher wage rates in 2011/12. Similarly to the Cows at grass system, depreciation and opportunity cost of capital (part of property cost and finance) have increased as a result of investment in 2011/12.

D. High-output cows

Table 7: Difference in average performance of High-output systems between 2011/12 and 2010/11, expressed as ppl

	2011/12	High-output 2010/11	Difference
Number of farms	125	125	
Physical comparison			
Herd size	219	210	9
Herd replacement rate (%)	26	26	0
Average yield (l/cow/year)	8411	8372	39
Total non-forage feed (kg DM/cow)	2569	2569	0
Milk from forage (l/cow/year)	1672	1191	481
Financial comparison (ppl)			
Milk price	28.7	25.9	2.8
Revenue	**30.3**	**27.3**	**3.0**
Herd replacement cost	**3.1**	**3.1**	**0.0**
Feed and forage cost	9.56	8.63	0.93
Livestock costs	3.04	2.86	0.18
Total variable costs	**12.6**	**11.5**	**1.1**
Labour cost (paid and unpaid)	3.8	3.6	0.2
Power and machinery cost	3.3	2.9	0.4
Total depreciation	2.0	1.8	0.2
Property costs and finance	2.6	2.4	0.2
Overheads	0.9	0.9	0.0
Total fixed costs	**12.5**	**11.7**	**0.9**
Total costs of production*	**28.3**	**26.3**	**2.0**
Net margin	**2.0**	**1.0**	**0.9**

*Refers to enterprise year ends between December and June. Since June 2012 costs have risen significantly.

Between 2010/11 and 2011/12, the High-output cows managed to retain 36% of the increase in milk price as extra net margin. The rest of the milk price increase was consumed by increases in costs, especially feed and forage variable cost and fixed costs.

On average, although the total amount of non-forage feed fed per cow remained unchanged, the composition has changed and as a result the energy density of non-forage feed has decreased in 2011/12. Consequently, the amount of milk produced from non-forage feed has decreased and at the same time better utilisation of forage has led to higher milk from forage in 2011/12.

However, feed and forage variable cost increased significantly, by 0.9ppl in 2011/12, mainly through higher feed prices and forage variable costs.

Despite the increase in output, fixed costs in ppl have increased across the board, mainly as a result of increases in input prices and investment.

Profitability and costs in different types of enterprise

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This section examines in more detail what Milkbench+ is telling us about the range in performance, all the way down to total cost of production and net margin, within in each type of system. To do this we have compared the 25% highest-performing farms with the 25% lowest-performing farms (based on net margin ppl) for each system type. Table 8 shows the factors which appear to contribute most to the improved financial performance of the best farms.

Table 8: Performance advantage gained by top 25% of farms compared with lowest 25%

	Cows at grass			Composite			High-output cows		
	Top 25%*	Bottom 25%*	Difference	Top 25%*	Bottom 25%*	Difference	Top 25%*	Bottom 25%*	Difference
Physical comparison									
Herd size	226	174	52	140	80	60	275	215	60
Average yield (l/cow/year)	6177	5625	552	8341	7100	1241	8467	8132	335
Herd replacement rate (%)	21	29	-7	25	30	-5	24	30	-6
Total non-forage feed (kg DM/cow)	1178	1147	31	2206	2138	68	2442	2806	-364
Financial comparison (ppl)									
Milk price	28.6	29.4	-0.8	27.7	27.3	0.4	29.1	28.6	0.5
Revenue	**30.9**	**30.9**	**0.0**	**29.5**	**29.0**	**0.5**	**30.9**	**30.2**	**0.7**
Herd replacement cost	**2.5**	**3.7**	**-1.2**	**2.8**	**4.2**	**-1.4**	**2.5**	**3.8**	**-1.3**
Feed and forage cost	6.5	7.5	-1.0	8.4	9.6	-1.2	8.6	11.3	-2.7
Livestock costs	2.3	3.3	-1.0	2.6	3.6	-1.0	2.6	3.9	-1.3
Total variable costs	**8.8**	**10.8**	**-2.0**	**11.0**	**13.2**	**-2.2**	**11.2**	**15.2**	**-4.0**
Labour cost (paid and unpaid)	3.4	6.3	-2.90	3.8	7.6	-3.8	3.3	4.4	-1.1
Power and machinery cost	2.5	3.8	-1.3	2.7	3.9	-1.2	2.9	4.1	-1.2
Total depreciation	1.9	3.1	-1.2	1.9	3.4	-1.5	1.7	2.4	-0.8
Property costs and finance	2.9	4.1	-1.2	2.3	3.6	-1.3	2.3	2.8	-0.5
Overheads	0.8	1.5	-0.7	1.0	1.8	-0.8	0.7	1.3	-0.6
Total fixed costs	**11.5**	**18.8**	**-7.3**	**11.7**	**20.4**	**-8.7**	**10.8**	**15.0**	**-4.2**
Total costs of production[º]	**22.8**	**33.3**	**-10.5**	**25.5**	**37.8**	**-12.3**	**24.5**	**34.0**	**-9.4**
Net margin	**8.1**	**-2.4**	**10.5**	**4.0**	**-8.8**	**12.8**	**6.3**	**-3.8**	**10.1**
Net margin (£'s/Ha)	**1038**	**-124**	**1162**	**630**	**-888**	**1518**	**1108**	**-515**	**1623**

*Columns Top 25% and Bottom 25% are averages for he top and bottom 25% enterprises ranked on net margin ppl.

[º]Refers to enterprise year ends between December and June. Since June 2012 costs have risen significantly.

Four costs areas explain a minimum of 60% of the difference in net margin between the top and bottom 25% farms in the three enterprise types, although their relative impact differs between systems. These costs are:

- Feed and forage variable cost
- Herd replacement cost
- Labour costs (paid and unpaid)
- Power and machinery cost.

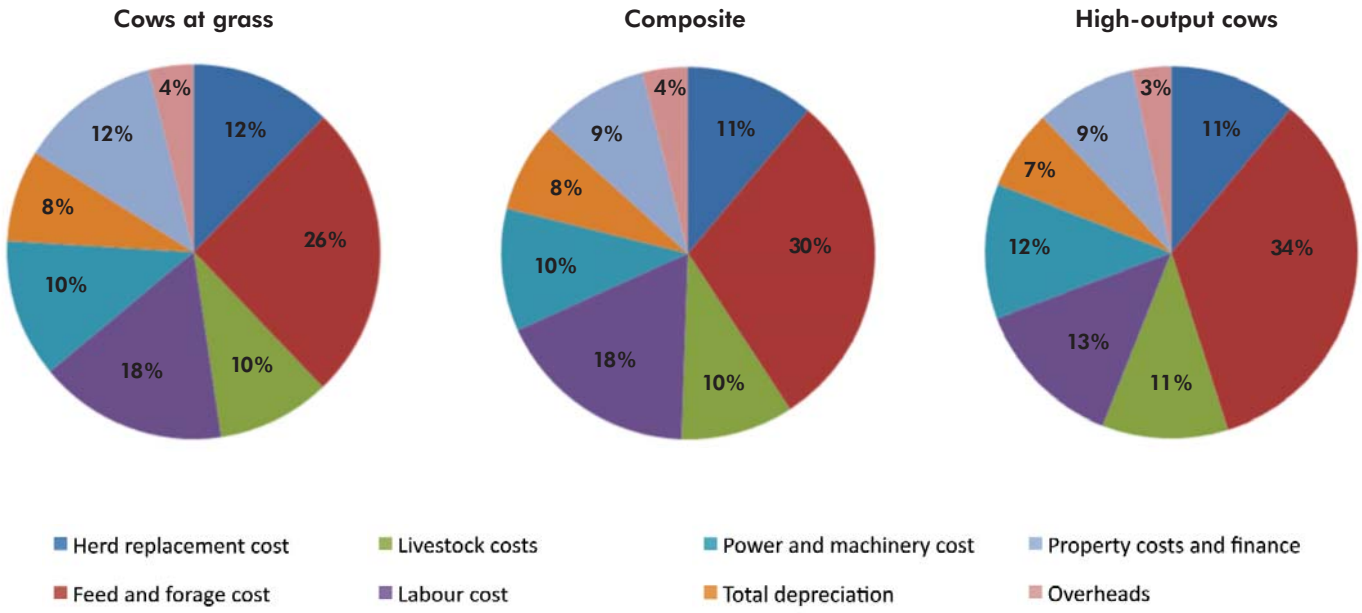
It is interesting that for the **Cows at grass** and **Composite** systems, fixed costs accounted for a significantly larger proportion of the difference in total cost of production compared with variable costs. For the **High-output cows** system, differences in variable and fixed cost made a similar contribution to the overall difference in total cost.

On average, the difference in total cost of production accounted for around 96% of the difference in net margin between the top and bottom 25%. These results support the conclusion that, within any one production period, cost of production is the main determinant of net margin on dairy enterprises.

What can Milkbench+ tell us about the cost structure in each type of system? On average, how big a share do the four drivers of net margin have in the total cost of production?

Figure 5 helps to answer these questions by expressing the share of different costs in total cost of milk production for the average of the three systems identified.

Figure 5: Comparison of costs (%) of the enterprise types



Feed and forage variable cost is the biggest cost category for all enterprise types. It is lowest for Cows at grass and highest for High-output cows, as a percentage of total production costs. When the feed and forage variable cost is added to costs for labour, herd replacement, power and machinery they account on average for about 68% of the total cost of production for the three enterprise types.

D.

These results could tempt us to use partial budgeting/analysis to monitor and evaluate dairy production performance – for example, margin over purchased feed. But the first Milkbench+ report clearly demonstrated the complex interactions between individual variables in dairy production systems and that if we increase one cost, other associated costs are also likely to increase. Therefore, any partial analysis could be misleading.

It is vital that overall physical and financial performance, right through to total cost of production, is recorded, monitored and evaluated regularly to maintain improved efficiency and profitability. So how can we manage these significant costs to improve the profitability of dairy businesses and what are the strategies of the top-performing farms?

DairyCo's independent, impartial, market intelligence service aims to provide transparency and information on dairy markets to assist farmers and those involved in the industry with making informed business decisions.

The Dairy Market Update is our fortnightly newsletter and includes the latest dairy business news from the UK and overseas and what impact it is having on your milk price. It's a 'must have' publication for more than 8,000 people in the industry.

The Monthly Report is another essential tool, with prices and trends on areas including wholesale markets, input costs and retail sales.

For more information on these publications and for the latest information including daily milk deliveries, producer numbers, consumer data and much more then visit
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Managing costs

D.

In this section we will examine in more detail the strategies of the top-performing farms in each enterprise type to manage the big costs identified earlier.

Feed costs

As confirmed in other detailed investigations into dairy business performance, feed and forage variable cost is the largest cost category in any dairy production system. To understand better what the winning strategies for feed and forage are, we have examined in detail the physical and financial performance of the top 25% farms in the three enterprise types and compared their results with the bottom 25% farms.

Cows at grass

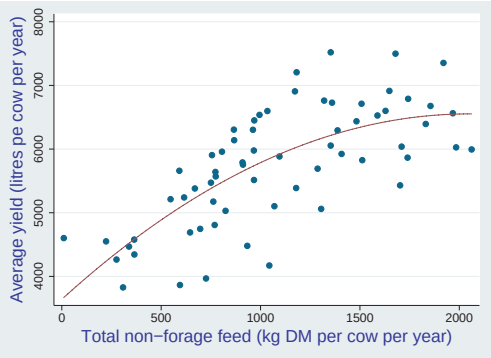
Table 9: Key feed and forage performance indicators for top and bottom 25% farms and the difference between them

	Cows at grass		
	Top 25%*	Bottom 25%*	Difference
Physical comparison			
Average yield (l/cow/year)	6177	5625	552
Stocking rate (LU/Ha)	2.1	1.7	4
Total non-forage feed (kg DM/cow)	1178	1147	31
Total forage fed (kg DM/cow)	2193	2369	-176
Proportion of average milk yield per cow produced from forage (%)	54	52	2
Financial performance			
Total cost of non-forage feed (£/cow)	276	294	-18
Average cost of purchased non-forage feed (£/t DM)	283	300	-17
Total cost of non-forage feed (ppl)	5.0	5.7	-0.7
Total forage variable cost (ppl)	1.3	1.4	-0.1
Feed and forage cost (ppl)	**6.5**	**7.5**	**-1.0**

*Columns Top 25% and Bottom 25% are averages for the top and bottom 25% enterprises ranked on net margin ppl.

Table 9 shows that the top 25% of farms in this system achieved 1.0ppl lower feed and forage variable costs through higher yield, better feed efficiency (based on amount of feed fed and milk yield) , lower purchased feed prices, higher stocking rate and more milk from forage. On a per cow basis, the top 25% farms fed an average 31kg DM more non-forage feed and 176kg DM less conserved forage per cow while producing 522 litres per cow per year more.

Figure 6: Yield response to feed rate



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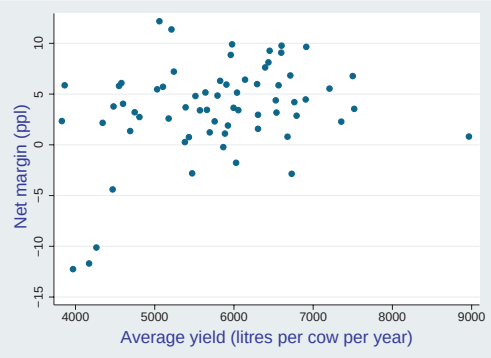
The spread of herds above and below the curve in Figure 6 highlights the range in non-forage feed fed per cow and yield per cow. This relationship is very complex and is affected by a number of factors, including breed and genetics, cows' environment, level of forage use, type of diet and interaction between individual components in the diet. Effective managers will have a good understanding of this relationship for their individual enterprises and will monitor and evaluate it regularly and so optimise their feeding systems. More analysis on the complex relationship will be done next year.

Milk yield on farms feeding around the average level of non-forage feed (1065kg DM per cow per year) ranged from 4170 litres per cow to 6598 litres per cow per year. This difference in performance equates to additional revenue from milk of £710 per cow per year.

However, although the use of feed is an important driver of feed cost, the data clearly demonstrates that yield per cow on its own is not the key driver of net margin.

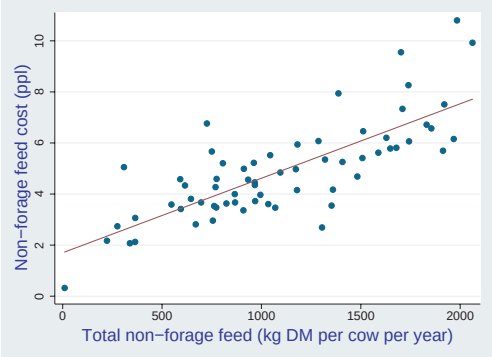
Figure 7: Comparison of milk yield and net margin in ppl



Therefore, higher yields are not always the answer for Cows at grass enterprises. Increasing milk yield beyond a point at which the extra costs (extra feed cost and any other costs associated with feeding at a higher level) outweigh the extra income achieved does not make economic sense. To produce milk at the most cost-effective level requires a good knowledge of individual production systems, regular recording and monitoring of performance and effective use of this information.

Figure 8: Effect of increasing non-forage feed rate on feed cost in ppl

R^2=0.60



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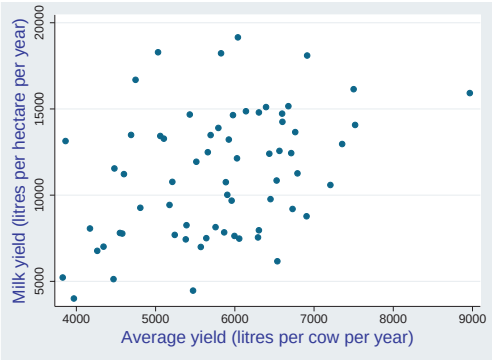
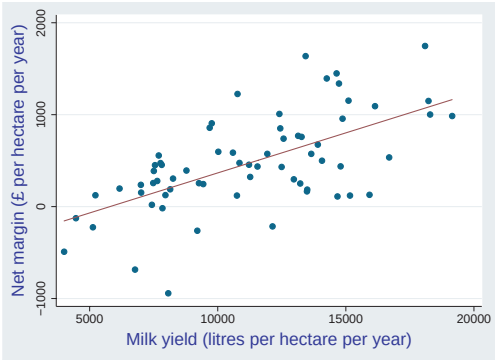
Our Milkbench+ data for the **Cows at grass** system suggests that every additional tonne DM of non-forage feed fed per cow results in a 3ppl higher feed cost, on average.

Figures 9 and 10: Relationship between yield per cow, yield per hectare and net margin per hectare

R^2=0.38





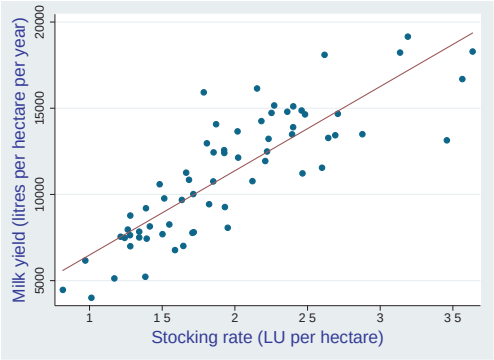
Yield per cow is not a key determinate of net margin. On the other hand, yield per hectare is related to net margin of **Cows at grass** enterprises. Figure 10 shows that for **Cows at grass** enterprises, every 1000 litres of additional yield per hectare achieved an average £87 extra per hectare in net margin.

It could be suggested that milk yield per cow is the main driver of yield per hectare but that is not the case. Yield per hectare is much more closely related to stocking rate than to yield per cow.

D.

Figures 11 and 12: Relationship of stocking rate

R^2=0.71



R^2=0.25

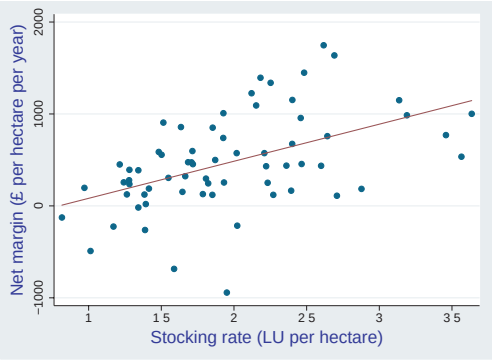


Figure 11 shows that in the cows at grass enterprise type with one more livestock unit (LU) per hectare achieved on average 4885 more litres per hectare as a result of the higher stocking rate. Therefore, stocking rate is directly related to net margin per hectare. Figure 12 indicates that higher stocking rate by 1 LU per hectare delivered on average £403 per hectare extra in net margin for cows at grass enterprises. Higher stocking rates allow for more efficient use of grass and higher yield per hectare, without the need to feed more per litre.

Composite

Table 10: Key feed and forage performance indicators for top and bottom 25% farms and the difference between them in Composite systems

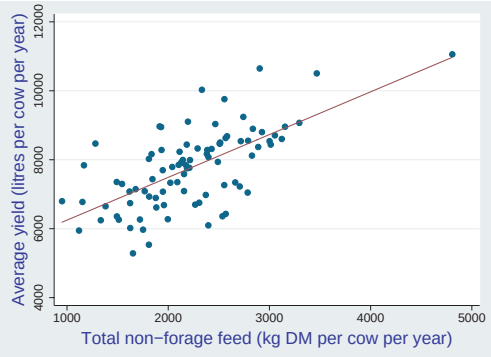
	Top 25%*	Composite Bottom 25%*	Difference
Physical comparison			
Average yield (l/cow/year)	8341	7100	1241
Stocking rate (LU/Ha)	1.8	1.5	0.3
Total non-forage feed (kg DM/cow)	2206	2138	68
Total forage fed (kg DM/cow)	3293	3304	-11
Proportion of average milk yield per cow produced from forage (%)	32	23	9
Financial performance			
Total cost of non-forage feed (£/cow)	597	565	32
Average cost of purchased non-forage feed (£/t DM)	272	271	1
Total cost of non-forage feed (ppl)	7.1	8.0	-0.9
Total forage variable cost (ppl)	1.3	1.3	0.0
Feed and forage cost (ppl)	**8.4**	**9.6**	**-1.2**

*Columns Top 25% and Bottom 25% are averages for he top and bottom 25% enterprises ranked on net margin ppl.

Table 10 shows that the top 25% of farms in this system achieve 1.2ppl lower feed and forage variable costs through higher yield, better feed efficiency (based on amount of feed fed and milk yield), higher stocking rate and more milk from forage. On a per cow basis the top 25% farms are on average feeding 68kg DM more non-forage feed and 11kg DM less forage per cow while producing 1241 litres per cow per year more and achieving 9% higher proportion of total milk coming from forage than bottom 25% farms.

Figure 13: Yield response to feed rate

R^2=0.43

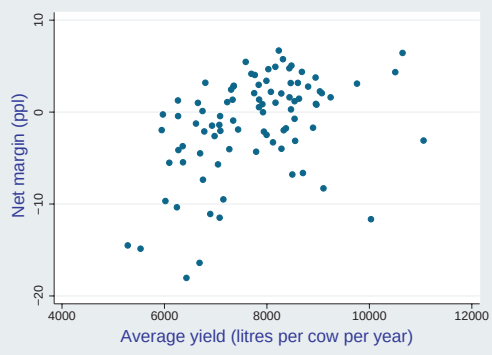


Similarly to the **Cows at grass** system, there is a large variation along the line. The position of herds above and below the line highlights the range in non-forage feed fed per cow and yield per cow. This relationship is very complex and is affected by similar factors experienced in Cows at grass enterprises, namely breed and genetics, cows' environment, level of forage use, type of diet and interaction between individual components in diet.

Milk yield on farms feeding around the average level of non-forage feed (2215kg DM per cow per year) ranged from 7750 litres per cow to 9100 litres per cow per year. This difference in performance equates to a difference in milk revenue of £370 per cow per year.

Despite this, Figure 14 demonstrates milk yield is not the key driver of net margin.

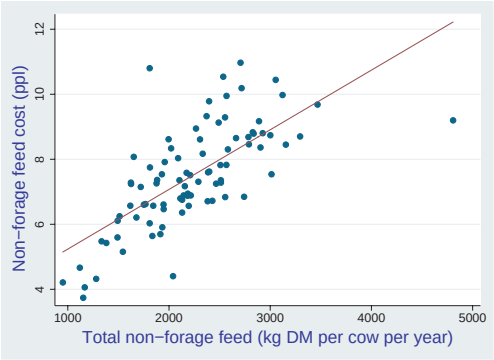
Figure 14: Comparison of milk yield and net margin in ppl



To produce milk at the most cost-effective level requires a good knowledge of individual production systems, regular recording and monitoring of performance and effective use of this information.

Figure 15: Effect of increasing feed rate on feed cost in ppl

R^2=0.44



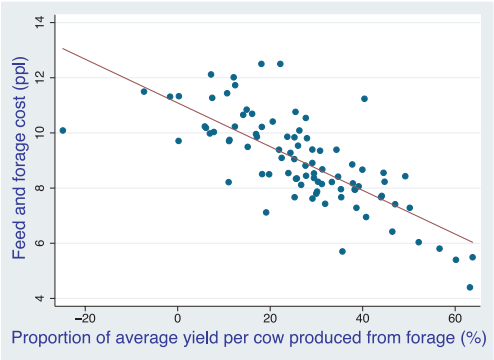
D.

Our Milkbench+ data for **Composite** systems suggest that on average feed costs rise by 1.8ppl as a result of feeding every additional tonne DM of non-forage feed per cow. Efficient use of forage, whether good-quality conserved forage or grazed grass, is an important driver of non-forage feed costs for the **Composite** system. However, relationships between milk from forage and total cost of production is complex. For example, benefits resulting from a higher use of forage can be eroded by unnecessary expenses related to the production and feeding process of forage. There are also a number of different types of forage, with different production costs, nutritional values and costs associated with feeding out.

Figure 16 shows the relationship between feed cost and the proportion of average milk yield per cow produced from forage for the **Composite** enterprise types.

Figure 16: Relationship between feed cost and the proportion of average milk yield produced from forage

R^2=0.58



For **Composite** enterprises Figure 16 shows that a 10% higher proportion of total yield obtained from forage resulted on average in a 1ppl reduction in feed and forage variable costs. The negative values for proportion of average milk yield produced from forage occur when the energy obtained from non-forage feed exceeds the energy required to produce the average yield.

In general, more efficient use of good-quality forage positively affects costs arising from the purchase of other feeds and the process of feeding them – for example labour input, ration mixing and handling. At the same time, research has shown that higher use of forage can have a beneficial impact on cows' rumen health and therefore results in better feed efficiency.

High-output cows

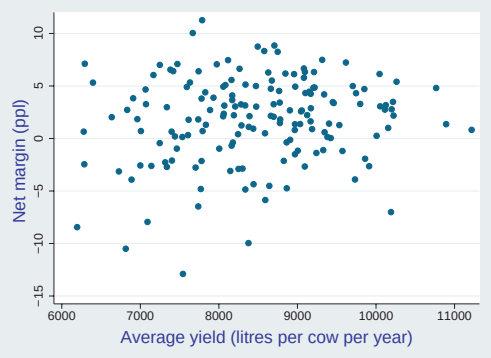
Table 11: Key feed and forage performance indicators for top and bottom 25% farms and the difference between them in High-output cows enterprises

	High-output cows		
	Top 25%*	Bottom 25%*	Difference
Physical comparison			
Average yield (l/cow/year)	8467	8132	335
Stocking rate (LU/Ha)	2.1	1.8	0.3
Total non-forage feed (kg DM/cow)	2442	2806	-364
Total forage fed (kg DM/cow)	3320	3754	-434
Proportion of average milk yield per cow produced from forage (%)	26	11	15
Financial performance			
Total cost of non-forage feed (£/cow)	623	750	-127
Average cost of purchased non-forage feed (£/t DM)	268	282	-14
Total cost of non-forage feed (ppl)	7.2	9.2	-2.0
Total forage variable cost (ppl)	1.1	1.7	-0.6
Feed and forage cost (ppl)	**8.6**	**11.3**	**-2.7**

*Columns Top 25% and Bottom 25% are averages for the top and bottom 25% enterprises ranked on net margin ppl.

Table 11 shows that the top 25% of farms in this system achieve 2.7ppl lower feed and forage variable cost through better feed efficiency (based on amount of feed and forage fed and milk yield), cheaper diet and higher milk yield from forage. On a per cow basis, the top 25% farms are feeding on average 364kg DM less non-forage feed and 434kg DM less conserved forage. They are also producing more milk per cow and achieving 15 per cent more milk from forage than the bottom 25% of High-output cows enterprises.

Figure 17: Milk yield and net margin



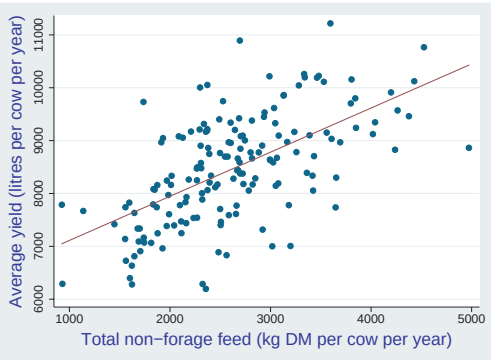
Similarly to the previous two systems, the data for **High-output cows** enterprises shows there is no relationship between yield per cow and net margin (Figure 17).

Therefore, higher yields are not always an answer. Increasing milk yield beyond a point at which the extra costs (extra feed cost and any other costs associated with feeding at a higher level) out-weigh the extra income achieved impacts on the economic efficiency of the enterprise. To produce milk at the most cost-effective level requires a good knowledge of the individual production system, regular recording and monitoring of performance and effective use of this information. Both at an individual cow and herd level as well as considering the genetic influences.

Similarly to the other two systems, there is a large variation in the response of yield to feed.

Figure 18: Milk yield and feed

R^2=0.36



In Figure 18, the spread of herds above and below the line highlights the range in feed fed per cow and yield per cow. As with all the enterprise types analysed, this relationship is very complex and is affected by breed and genetics, cows' environment, level of forage use, type of diet and interaction between individual components in diet.

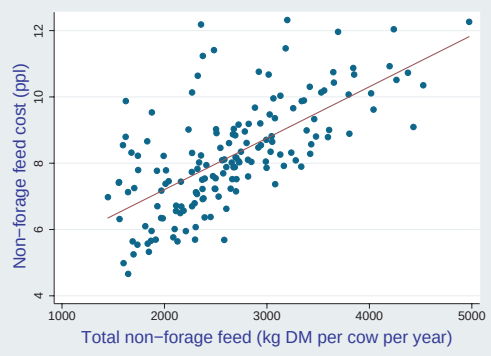
Effective managers will have a good understanding of this relationship for their individual enterprises and will monitor and evaluate it regularly.

Milk yield on farms feeding around the average level of non-forage feed (2625kg DM per cow per year) ranged from 7615 litres per cow to 9340 litres per cow per year. The difference in performance equates to a difference in milk revenue of £495 per cow per year.

In the **High-output cow** system type, feed cost is by far the largest cost and feed efficiency is a major driver of net margin.

Figure 19: Effect of increasing feed rate on feed cost in ppl

R^2=0.50

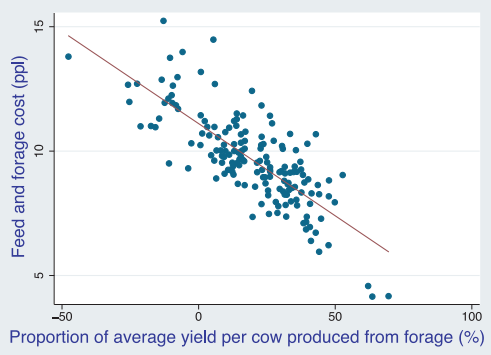


Our Milkbench+ data for **High-output cows** system suggests that on average feed costs rose by 1.7ppl for every additional tonne DM of non-forage feed fed per cow. Efficient use of good-quality forage is not just an important driver of non-forage feed costs for Cows at grass and Composite systems but also has a noticeable impact in the **High-output cows** system. To produce milk at the most cost effective level requires a good knowledge of the individual production system, regular recording and monitoring of performance and effective use of this information. Both at an individual cow and herd level as well as considering the genetic influences.

Figure 20 shows the relationship between feed cost and the proportion of average milk yield produced from forage for the **High-output cows** enterprise type.

Figure 20: Relationship between feed cost and the proportion of average milk yield produced from forage

R^2=0.61



It also shows that High-output cows enterprises with 10% higher proportion of yield obtained from forage had on average 1 ppl lower feed costs. The negative values for the proportion of average milk yield produced from forage occur when the amount of energy obtained from non-forage feed is more than enough to sustain the average yield.

In general, more efficient use of good-quality forage positively affects costs arising from the purchase and feeding process of other feeds. As research shows, at the same time higher use of forage can have a beneficial impact on cows' rumen health and therefore results in better feed efficiency.

Feed costs – conclusion

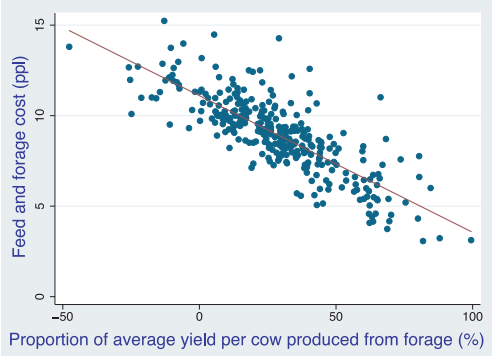
D.

Feed cost in ppl can be thought of as a function of cost of all feed and forage fed and grazed per cow, milk yield and other effects including genetics, cows' environment, type of diet, interaction between the individual components of the diet and health status. Therefore, feed efficiency (amount consumed per litre) has a major effect on feed cost. However, the efficient use of feed and forage only tells half the story. Also important is the proportion and cost of the different feedstuffs in the diet. Non-forage feed is the more expensive part and therefore, response of yield to non-forage feed is an important relationship. It does not make economic sense to produce extra litres if the resulting income does not cover extra costs. Milk to feed price ratio is an important criterion for this relationship.

As mentioned earlier, efficient use of good-quality forage positively affects costs arising from the purchase feed and the cost of feeding other feeds. Therefore, it is an important determinant of feed cost for all three enterprise types identified.

Figure 21: Proportion of average milk yield produced from forage and feed cost

R^2=0.65



Our Milkbench+ data suggests that, across all systems, enterprises with 10% higher proportion of average milk produced from forage achieved an average 0.8ppl lower feed cost. However, relationships between milk from forage and total cost of production is complex. For example, benefits resulting from a higher use of forage can be eroded by unnecessary expenses related to the production and feeding process of forage. There are also a number of different types of forage, with different production costs, nutritional values and costs associated with feeding out.

These complex relationships require further research which is beyond the scope of this report.

Achieving the most cost-effective performance in terms of amount fed, yield, resulting feed cost and total cost, requires regular recording and monitoring of performance all the way to total cost of production and effective use of the resulting data. No matter what feeding system is employed, optimising it to its full potential will undoubtedly improve physical and economic performance.

DairyCo's Feeding+ contains modules on different areas of production, whether it is understanding more about nutrition and rumen physiology or making better-quality silage. The Feeding+ folder is available to all dairy farmers. Further information can be found at
http://www.dairyco.org.uk/technical-information/feeding/

Herd replacement cost

D.

Herd replacement cost is a significant Figure in most enterprises. Unsurprisingly, herd replacement rate is a major determinant of this factor, accounting for 30% of variation in herd replacement cost in the 2011/12 Milkbench+ sample. However, yield per cow, value of culls and value of incoming heifers are also important drivers of herd replacement cost. Research has shown that age at first calving of heifers is also a major factor. Reducing age at first calving, lowers the cost per heifer reared, prolongs longevity and reduces the total youngstock enterprise cost, as fewer heifers are carried in total.

So is there an ideal replacement rate? The performance of the top 25% herds has been analysed to investigate their herd replacement rates and costs.

Cows at grass

Table 12: Key herd replacement and fertility performance indicators for top and bottom 25% farms and the difference between them in Cows at grass systems.

	Cows at grass		
	Top 25%*	Bottom 25%*	Difference
Physical performance			
Average yield (l/cow/year)	6177	5625	552
Percentage of cows calved (%)	78	78	0
Herd replacement rate (%)	21	29	-8
Mortality rate (%)	3	4	-1
Culling rate (%)	14	19	-5
Other (compulsory purchase, breeding sales etc.)	4	5	-1
Fertility culling (% share)	38	42	-4
Lameness culling (% share)	10	8	2
Mastitis culling (% share)	16	19	-3
Financial performance			
Herd replacement cost (£/cow)	159	199	-40
Herd replacement cost (ppl)	**2.5**	**3.7**	**-1.2**

*Columns Top 25% and Bottom 25% are averages for the top and bottom 25% enterprises ranked on net margin ppl.

The bottom 25% farms have an 8% higher replacement rate, mainly because of a 5% higher culling rate.

This led to a higher replacement cost per cow and, with lower yield per cow, resulted in 1.2ppl higher herd replacement cost for these businesses. In the top 25% farms 4% of cows leave the herd for reasons other than culling and death rate. Fertility was by far the main reason for culling in top and bottom 25% farms.

Data earlier in this report shows a large proportion of businesses operating the Cows at grass system were block calving. In these systems the herd replacement rate is largely affected by the need for all cows to calve within a relatively short time (block) to enable the whole herd to be managed as one group. This can result in significant feed and labour efficiencies and reduce costs. Any cows not in calf should be viewed as prime candidates for culling. Heifers which are to calve outside of the main block are often sold in calf. Fertility and health are the main drivers of herd replacement rate for these enterprises, and overall cost of production.

D.

Composite

Table 13: Key herd replacement and fertility performance indicators for top and bottom 25% farms and the difference between the two in Composite systems

	Composite Top 25%*	Composite Bottom 25%*	Difference
Physical performance			
Average yield (l/cow/year)	8341	7100	1241
Percentage of cows calved (%)	75	67	8
Herd replacement rate (%)	24	30	-6
Mortality rate (%)	4	7	-3
Culling rate (%)	18	21	-3
Other (compulsory purchase, breeding sales etc.)	2	2	0
Fertility culling (% share)	21	28	-7
Lameness culling (% share)	14	10	4
Mastitis culling (% share)	15	12	3
Financial performance			
Herd replacement cost (£/cow)	226	296	-70
Herd replacement cost (ppl)	**2.8**	**4.2**	**-1.4**

*Columns Top 25% and Bottom 25% are averages for he top and bottom 25% enterprises ranked on net margin ppl.

The top 25% farms achieved a 6% lower replacement rate – their culling and mortality rates were both 3 percentage points lower. Higher mortality will have a marked impact on profits. In an average-size herd of 200 cows, for example, 3% higher mortality equals six more cows dying on farm instead of being sold as culls, attracting a disposal fee rather than cull cow income.

The higher replacement rate resulted in higher replacement costs per cow for the bottom 25% farms. This factor, coupled with significantly lower yields, resulted in a 1.5ppl higher replacement cost for the bottom 25% farms.

The top 25% farms calved a significantly higher proportion of their herds in a year, on average, compared to the bottom 25%. But the calving percentage of the top 25% **Composite** systems was lower than the top 25% **Cows at grass** system.

High-output cows

Table 14: Key herd replacement and fertility performance indicators for top and bottom 25% farms and the difference between them in High-output cow systems

	High-output cows		
	Top 25%*	Bottom 25%*	Difference
Physical performance			
Average yield (l/cow/year)	8467	8132	335
Percentage of cows calved (%)	72	70	2
Herd replacement rate (%)	24	30	-6
Mortality rate (%)	4	7	-3
Culling rate (%)	18	21	-3
Other (compulsory purchase, breeding sales etc.)	2	2	0
Fertility culling (% share)	28	24	4
Lameness culling (% share)	12	6	6
Mastitis culling (% share)	12	11	1
Financial performance			
Herd replacement cost (£/cow)	215	309	-94
Herd replacement cost (ppl)	**2.6**	**3.8**	**-1.2**

*Columns Top 25% and Bottom 25% are averages for the top and bottom 25% enterprises ranked on net margin ppl.

Similarly to the **Composite** enterprise type, the top 25% farms in the **High-output cows** system achieved 6% lower replacement rate than the bottom 25%, with culling and mortality rates both 3 percentage points lower. As in the **Composite** system, this higher mortality for bottom 25% businesses can have a marked impact on margins. When cull cow prices are high, this can result in a significant loss of income.

The higher replacement rate resulted in significantly higher replacement costs per cow for the bottom 25% farms. Coupled with lower yield, this culminated in a 1.3ppl higher replacement cost for the bottom 25% enterprises.

Herd replacement costs – conclusion

D.

It is essential that individual farms set realistic targets for replacement rates as part of strategic management of their dairy business. The target rate should be based on an acceptable mortality rate and appropriate voluntary culling rate which takes into account fertility, lameness and health. As a part of this process, reasons for culling need to be recorded and monitored. Evaluating reasons for culling over time improves future culling decision making and highlights any risk areas that need attention.

In the Milkbench+ sample, fertility was by far the main reason for culling. Poor fertility can have a very significant effect on dairy herd profitability, through reduced feed conversion efficiency of herds with a higher proportion of cows in late stage of lactation, reduced milk sales, to higher breeding and labour costs. Fertility is not just an important criterion for culling decisions but should be pursued throughout the system – from good youngstock management, to breeding decisions based on selecting the most fertile cows for breeding replacements and selecting sires based on fertility, health and longevity traits.

DairyCo Breeding+ aims to improve dairy farmers' profitability through breeding. It covers topics such as planning matings, selecting sires and herd assessment for replacement breeding. Further information can be found at
http://www.dairyco.org.uk/technical-information/breeding-genetics/breedingplus/

Labour, power and machinery costs and depreciation

D.

In this section we have examined labour cost, power and machinery costs and depreciation costs, which form the main part of fixed costs of dairy businesses. To examine these costs in more detail, we have compared the performance of top and bottom 25% farms in each system.

Cows at grass

Table 15: Key performance indicators for fixed costs in top and bottom 25% farms and the difference between them in Cows at grass systems

	Cows at grass		
	Top 25%*	Bottom 25%*	Difference
Physical performance			
Herd size	226	174	52
Average yield (l/cow/year)	6177	5625	552
Labour hours per cow (hrs/cow/year)	24	32	-8
Share of paid labour in total labour hours (%)	49	50	-1
Financial comparison			
Power and machinery costs (£/cow/year)	152	210	-58
Total depreciation (£/cow/year)	115	164	-49
Labour cost (paid and unpaid) (ppl)	3.4	6.3	-3.1
Power and machinery cost (ppl)	2.5	3.8	-1.3
Total depreciation (ppl)	1.9	3.1	-1.2
Total fixed costs (ppl)	**11.5**	**18.8**	**-7.3**
Total costs of production	**22.9**	**33.3**	**-10.4**
Net margin	**8.1**	**-2.4**	**10.5**

*Columns Top 25% and Bottom 25% are averages for he top and bottom 25% enterprises ranked on net margin ppl.

Fixed costs account for 70% of the difference in total cost of production (ppl) between top and bottom 25% farms with **Cows at grass** systems.

These farms have a greater labour requirement per cow and £107 more per cow is spent on depreciation, power and machinery costs for no extra gain in output. As a result the top 25% farms are achieving 7.3ppl lower fixed cost and higher profit. Table 15 demonstrates the importance of having a cost structure appropriate to the level of output (yield and herd size). Fixed costs need to be kept under control, particularly in lower-yielding herds. It is essential to maintain a level of fixed cost appropriate to the level of output.

Composite

Table 16: Key performance indicators for fixed costs in top and bottom 25% farms and the difference between them in Composite systems

D.

	Top 25%*	Composite Bottom 25%*	Difference
Physical performance			
Herd size	140	80	60
Average yield (l/cow/year)	8341	7100	1241
Labour hours per cow (hrs/cow/year)	33	59	-26
Share of paid labour in total labour hours (%)	34	24	10
Financial comparison			
Power and machinery costs (£/cow/year)	228	280	-52
Total depreciation (£/cow/year)	160	253	-93
Labour cost (paid and unpaid) (ppl)	3.8	7.6	-3.8
Power and machinery cost (ppl)	2.7	3.9	-1.2
Total depreciation (ppl)	1.9	3.4	-1.5
Total fixed costs (ppl)	**11.7**	**20.4**	**-8.7**
Total costs of production	**25.5**	**37.8**	**-12.3**
Net margin	**4.0**	**-8.8**	**12.8**

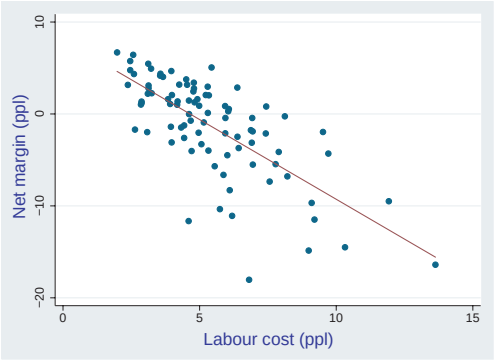
*Columns Top 25% and Bottom 25% are averages for he top and bottom 25% enterprises ranked on net margin ppl.

The bottom 25% farms spent on average 26 more labour hours per cow per year than the top 25% farms.

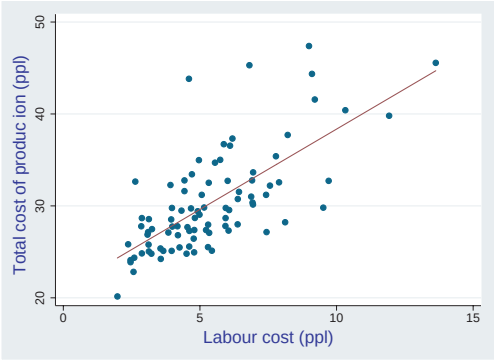
It could be argued that because the bottom 25% farms have on average only 24% paid labour in the total labour requirement, most of the extra labour is from family for which we impute cost and that is not a real cost. However, in Milkbench+ we only account for manual labour in total labour requirement and exclude management time. Therefore, the higher labour requirement for the bottom 25% farms, which have mainly family labour, can result in a lack of time available for management and this can result in overall poor performance through inefficiencies across the board. This is one reason why we see a strong relationship between labour and net margin in Milkbench+.

Figures 22 and 23: Labour costs relationships

R^2=0.51



R^2=0.49



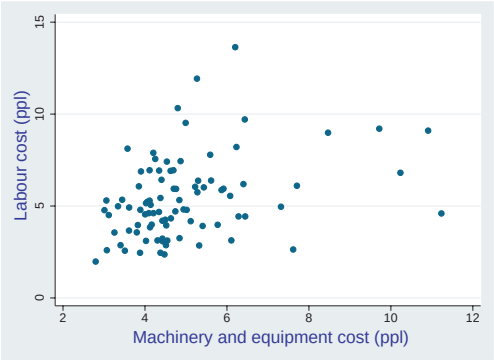
D.

Similarly to the previous Milkbench+ report, Figures 22 and 23 suggest that as labour costs increase by 1ppl, net margin decreases by 1.7ppl as result of total cost increasing by 1.7ppl. Consequently, increases in labour costs result in an extra 70% increase in other costs on top of the original increase in labour cost.

Table 16 shows that the bottom 25% farms have higher fixed costs across the board, not just higher depreciation or just higher labour costs.

It is often believed that labour and machinery and equipment costs can be at least partially substituted for one another. This is often the reasoning behind automated technology and the decision to purchase what are usually expensive machinery and equipment.

Figure 24: Comparison of machinery and equipment cost and labour cost



However, our data appears to suggest that very few farms profit from this trade-off, while most experience an increase in both labour and machinery and equipment costs.

The top 25% farms in **Composite** systems are achieving a higher average yield per cow, using significantly less labour and having £145 lower depreciation, power and machinery costs. As a result, the top 25% farms had 8.7ppl lower fixed costs.

High-output cows

Table 17: Key performance indicators of fixed costs in top and bottom 25% farms and the difference between them in High-output cows systems

D.

	High-output cows Top 25%*	Bottom 25%*	Difference
Physical performance			
Herd size	275	215	60
Average yield (l/cow/year)	8467	8132	335
Labour hours per cow (hrs/cow/year)	28	35	-7
Share of paid labour in total labour hours (%)	64	69	-5
Financial comparison			
Power and machinery costs (£/cow/year)	242	331	-89
Total depreciation (£/cow/year)	140	201	-61
Labour cost (paid and unpaid) (ppl)	3.3	4.4	-1.1
Power and machinery cost (ppl)	2.9	4.1	-1.2
Total depreciation (ppl)	1.7	2.4	-0.7
Total fixed costs (ppl)	**10.8**	**15.0**	**-4.2**
Total costs of production	**24.5**	**34.0**	**-9.4**
Net margin	**6.3**	**-3.8**	**10.1**

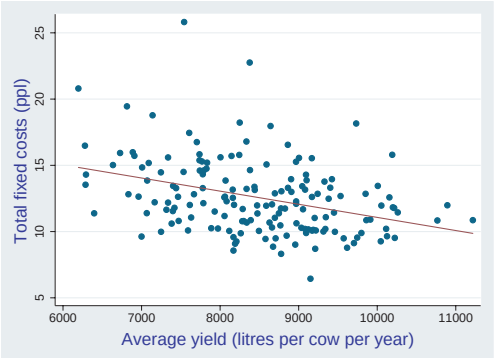
*Columns Top 25% and Bottom 25% are averages for he top and bottom 25% enterprises ranked on net margin ppl.

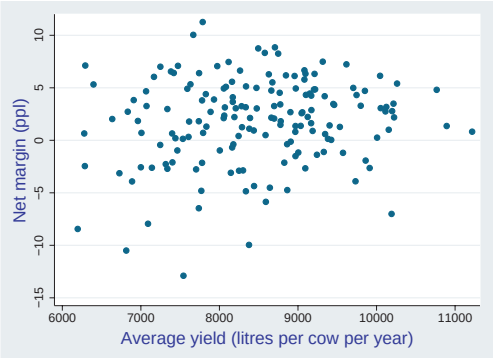
The bottom 25% farms used seven extra hours labour per cow per year, on average and also spent £150 per cow per year more on depreciation, power and machinery costs for no extra gain in output. The top 25% farms achieved 4.2ppl lower fixed costs and higher profit. Investment which results in depreciation is an unavoidable part of any dairy business. However, it is important that investment is aimed at improving production efficiency of a dairy enterprise. It should result in lowering future cost of production in ppl and improving profitability and sustainability of the business, rather than resulting in an inherently higher-cost production system.

It could be concluded that the key to higher net margin (and profit) is to produce more litres per cow and to reduce fixed costs per litre. However, our data indicates that the relationship between average yield and fixed cost in ppl is relatively weak. As Figures 25 and 26 demonstrate, higher yield on its own is not a panacea for lower costs and higher net margin.

Figures 25 and 26: Milk yield and fixed costs

R^2=0.12

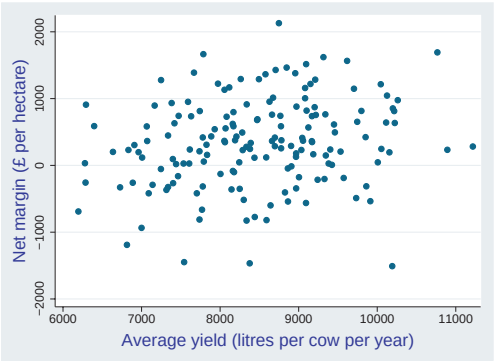




D.

The lack of relationship between average yield and net margin is replicated for net margin in £s per hectare.

Figure 27: The effect of milk yield on net margin in £s



Labour, power and machinery costs and depreciation - conclusion

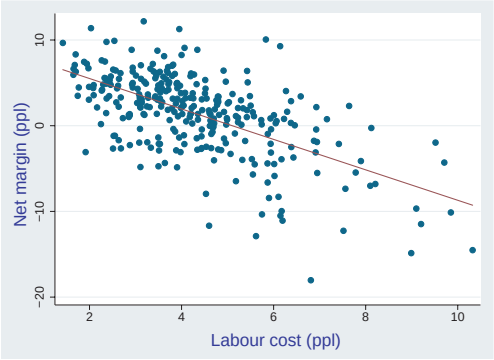
D.

The Milkbench+ 2011/12 data on the three enterprise types identified have, similarly to last year's report, proven that all systems can be profitable if managed effectively. Results of the analysis presented in this report have repeatedly shown us that there is no 'silver bullet' which would ensure profitability. It is the attention to detail and cost control which results in higher net margin of the top-performing dairy enterprises.

The strong relationship between labour cost, total cost of production and net margin that we have demonstrated for the Composite enterprise type holds true for the whole sample as Figures 28 and 29 demonstrate.

Figures 28 and 29: Labour cost relationships for the Milkbench+ 2011/12 sample

R^2=0.42

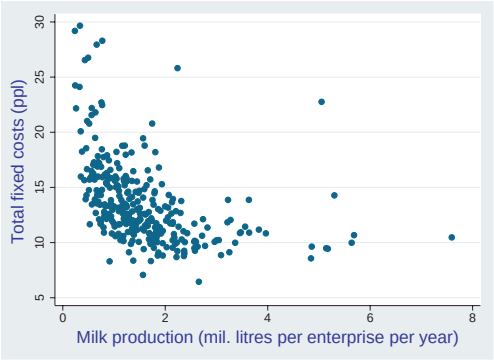


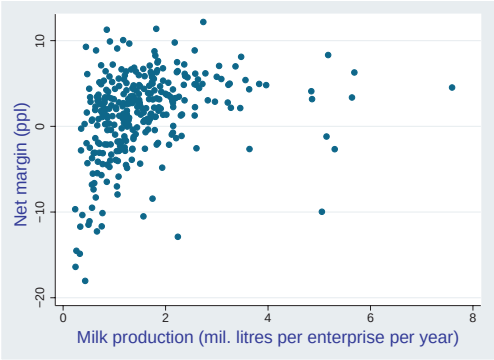
R^2=0.41

Similarly to the **Composite** system, the data for the whole 2011/12 sample suggests that as labour cost increases by 1ppl, net margin decreases by 1.8ppl – a result of total cost increasing by 1.8ppl. Therefore, an increase in labour cost is associated with an extra 80% increase in other costs.

The Milkbench+ data shows that in each of the three enterprise types, the top 25% farms ranked by net margin per litre have larger herds with larger outputs and lower fixed costs. This leads us to question whether there is an effect of economies of scale. This is a complex issue but Figures 30 and 31 briefly explore the economies of scale relationships.

Figures 30 and 31: Relationship of milk production and fixed costs and net margin





They suggest there might be an effect of economies of scale in the sample but this is not statistically conclusive. However, the figures do show that even smaller enterprises are able to control their fixed costs and achieve a high net margin.

It is very important to maintain a level of fixed costs appropriate to the level of output. Investment in fixed costs should be aimed at increasing production efficiency and decreasing unit cost of production.

The analysis has clearly demonstrated just how important it is that a measure of performance of a dairy business fully accounts for all dairy-specific fixed costs.

In Milkbench+, we calculate the full economic cost of milk production including imputed cost for family labour, rent on all dairy forage land (irrespective if it is rented or owned), opportunity cost of tenant capital and depreciation on machinery, equipment and buildings used by the dairy enterprise. Therefore, the resulting total cost of production and net margin are a measure of how efficiently available resources are used in milk production and are a direct proxy for profit of a dairy business, which includes the cost of re-investment.

Appendix F gives more information on imputed values.

Further details about Milkbench+ and benchmarking can be found at
http://www.dairyco.org.uk/technical-services/milkbenchplus/

A report commissioned by DairyCo looking at Measuring, Identifying and Demonstrating factors Affecting Dairy Farm Labour Productivity can be found at
http://www.dairyco.org.uk/resources-library/research-development/business-management/labour-productivity-final-report/

Conclusions

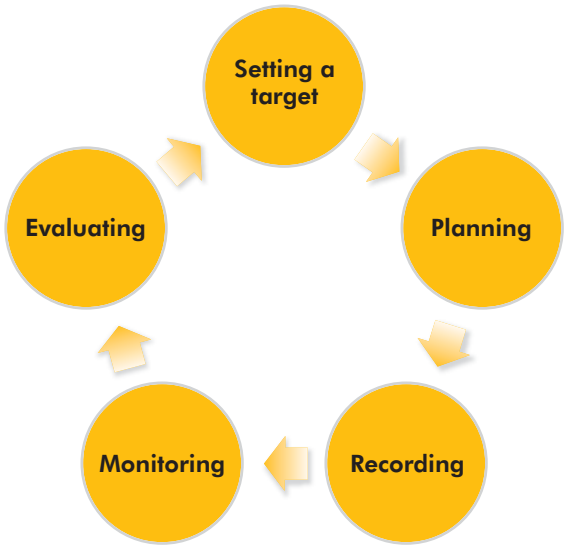
D.

The data for the 2011/12 Milkbench+ sample shows a large range in both total cost of production and in net margin ppl. This presents an opportunity for those enterprises operating at the lower levels of net margin to significantly improve net margin by raising their production efficiency and decreasing total cost of production in ppl.

The comparisons of costs between top and bottom 25% farms across the three enterprise types show that the bottom 25% farms have higher costs across the board, suggesting there is no 'silver bullet' which would ensure profitability. The analysis of the differences in performance between the top 25% and bottom 25% farms has identified ***four cost areas*** that contribute the most to the improved performance of the top 25% farms. Controlling these costs effectively can lead to significant improvement in enterprise performance.

Cost control is achieved through effective management – ensuring all inputs are used efficiently in the production process and that investment is directed at improving production efficiency and reducing cost of production. Strategic management should consist of planning, benchmarking and setting realistic targets; recording performance regularly and monitoring and evaluating whether targets were achieved.

Figure 32: The circle of effective management



Effective management is the key to profitability.

DairyCo's **Planning for Profit** is a two day residential workshop for farmers to attend and get the opportunity to work through real financial and management scenarios for their business. Specialist consultants are on hand to advise and help. For further information visit
http://www.dairyco.org.uk/technical-information/profitability/

Appendix A

Milkbench+ database

D.

The Milkbench+ database holds all the data that has been collected as a part of the Milkbench+ service to British dairy farmers. To produce this report we analysed a subset of the database containing farm accounts with year ends between December 2011 and June 2012. The resulting dataset consists of 315 farms (for a more detailed description of this dataset, see Appendix B). The data is of very high quality, collected on-farm by our team of dedicated data collectors and only after it has been independently validated is it finally included in the Milkbench+ database. In order to compare the wide variety of different systems, some figures are imputed and all other enterprises, including youngstock, are separated out. The imputed figures include rent on land (we treat everyone as tenants), cost of family labour and finance cost of capital employed.

The structure of Milkbench+ is organised into eight clusters:

- Key farm output data
- Feed and forage (Variable costs)
- Herd health and replacement costs
- Labour
- Power and machinery
- Depreciation (Fixed costs)
- Property and finance
- Overheads.

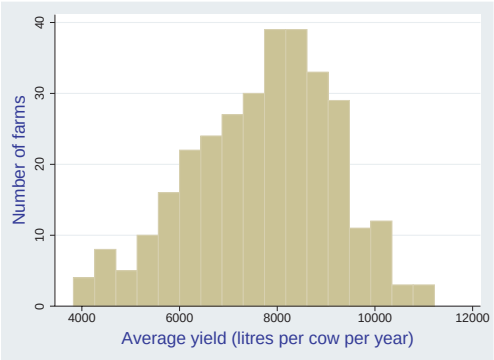
All of the above clusters are related to the dairy enterprise only and exclude youngstock.

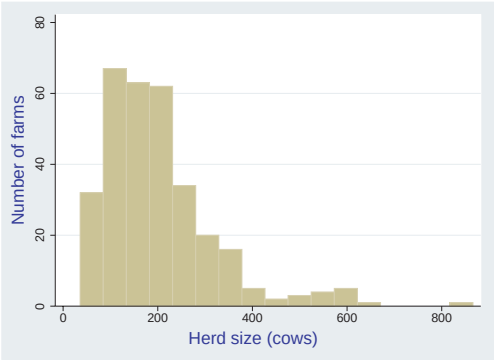
Appendix B

D. Description of the Milkbench+ dataset

Regional breakdown (year ends between December 2011 and June 2012).

Region	Number of farms in Milkbench+ dataset
East	10
East Midlands	9
North East	0
North West	58
Scotland	30
South East	21
South West	78
Wales	50
West Midlands	36
Yorkshire and the Humber	23





Appendix C

Glossary

D.

Herd size – this is the average number of dairy cows in the milking herd during the year.

Yield – calculated from the total amount of milk produced in the year, divided by either the herd size to obtain the average yield per cow per year or by total area allocated to the dairy herd to obtain the average yield per hectare per year.

Milk from forage – is calculated as total metabolisable energy obtained from all non-forage feed fed per cow divided by an energy requirement for 1 litre of milk, this is then subtracted from the average yield per cow.

Proportion of average milk yield produced from forage – is calculated as the share of milk from forage in average yield per cow.

Revenue – consists of value of milk produced, value of calves at 20 days, net value of quota leases (in or out) and other dairy income (slurry to arable land etc).

Gross output – is calculated as revenue minus herd replacement cost.

Cows calved in the year – percentage of cows calved in the year, calculated as the number of cows calved divided by the herd size.

Herd replacement rate – is based on number of cows that have left the herd throughout the year, presented as a percentage share of the herd size.

Herd replacement cost – equates to the number of cows that have left the herd throughout the year, multiplied by the average value of incoming cows and heifers, plus value of dairy bull purchases, minus the total value of all outgoing cows, heifers and dairy bulls.

Non-forage feeds – consist of purchased compound feed, cereals, protein feeds and by-products, plus home-grown cereals, protein feeds and by-products.

Forage – grass silage, hay, non-grass forage and straw (both purchased and home-grown).

Feed and forage cost – equates to actual cost of all purchased feed and forage, plus market value of all home-grown non-forage feed and variable cost of home-grown forage.

Labour efficiency – is calculated as the total number of hours worked by all staff (dairy enterprise only, management time excluded) divided by the herd size.

Labour cost – actual cost of paid labour plus imputed cost for family labour (for manual tasks only, management time excluded as net margin is a reward for management time).

Power and machinery cost – consists of repairs and spares, machinery hire, contracting, fuel, electricity.

Machinery depreciation – imputed depreciation on dairy specific and forage machinery and equipment.

Machinery and equipment cost – power and machinery cost plus machinery depreciation.

Dairy machinery and equipment cost – excluding forage specific power and machinery costs.

Imputed field rent – imputed rent on the hectares of land used for the dairy herd (grassland and forage areas).

Cost of production – consists of all variable, fixed costs and herd replacement cost.

Net margin – equals gross output minus variable costs and minus fixed costs.

Principle component analysis – is a mathematical procedure to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components.

Cluster analysis – is the task of grouping a set of objects (e.g. principle components) in such a way that objects in the same group (called cluster) are more similar (in some sense or another) to each other than to those in other groups (clusters).

All of the above terms used in this report are related to the dairy enterprise only and exclude youngstock.

Appendix D

D. Farm characterisation methodology

1) Selection of groups of variables important to observed heterogeneity in the sample (eg descriptive statistics) and also meaningful for interpretation and further analysis.

2) Principal component analysis on correlation matrixes of the individual groups of variables. Aims to identify new vectors (components) which incorporate most of the variation.

3) Farms are scored alongside the identified (relevant) components, resulting in new variables (individual farm's values of the new components) and these are then used in Ward's cluster analysis. The resulting clusters are then described using the original variables and their groups.

Appendix E

Analysis of Milkbench+ sample by calving pattern

D.

Calving pattern on its own is an interesting criterion for identification of different dairy enterprise types and has a significant effect on costs.

Table A: Performance of herds operating different calving patterns

	All year round	Multi-block	Autumn	Spring
Average performance				
Number of farms	230	25	14	26
Milk yield (l/cow/year)	8023	6965	8225	5435
Non-forage feed (kg DM/cow/year)	2389	1741	1972	888
Labour (hrs/cow/year)	35	32	33	23
Financial performance (ppl)				
Milk price	28.3	28.9	28.7	28.5
Revenue	**30.0**	**30.6**	**30.4**	**30.3**
Herd replacement cost	**3.3**	**3.3**	**3.0**	**3.3**
Feed and forage cost	9.2	8.8	7.9	6.7
Livestock costs	3.1	2.7	2.8	2.7
Total variable costs	**12.3**	**11.5**	**10.8**	**9.3**
Labour costs (paid and unpaid)	4.4	4.3	3.9	4.5
Power and machinery cost	3.3	3.4	3.7	3.4
Total depreciation	2.2	2.0	1.7	1.9
Property costs and finance	2.7	2.9	2.5	3.4
Overheads	1.0	1.1	1.1	1.1
Total fixed costs (ppl)	**13.6**	**13.7**	**13.0**	**14.3**
Total costs of production (ppl)	**29.2**	**28.4**	**26.8**	**26.8**
Net margin (ppl)	**0.8**	**2.1**	**3.6**	**3.5**
Net margin (£/Ha)	**197**	**389**	**551**	**460**

The Milkbench+ data indicates that milk price varied only very slightly between the different calving patterns, with the block calving patterns achieving on average slightly higher milk prices. Block calving patterns also experienced lower total costs of production relative to all year round calving. Subsequently, on average, block calving systems achieved higher net margins through lower variable costs and depreciation.

Based on the level of net margin, Table B looks at the performance achieved by the top 25% of herds under each calving pattern.

Table B: Performance of top 25% herds operating different calving patterns

D.

	All year round	Multi-block	Autumn	Spring
Top 25% performance				
Milk yield (l/cow/year)	8178	6813	8380	6044
Non-forage feed (kg DM/cow/year)	2245	1654	1939	1066
Labour (hrs/cow/year)	27	22	30	21
Financial performance (ppl)				
Milk price	28.7	28.6	29.7	29.5
Revenue	**30.5**	**30.4**	**31.6**	**31.7**
Herd replacement cost	**2.6**	**2.8**	**2.8**	**2.7**
Feed and forage cost	8.3	7.2	8.2	6.1
Livestock costs	2.6	2.7	2.6	2.3
Total variable costs	**10.9**	**9.9**	**10.9**	**8.4**
Labour cost (paid and unpaid)	3.2	3.2	3.4	3.4
Power and machinery cost	2.9	2.8	3.6	2.8
Total depreciation	1.7	1.8	1.3	1.5
Property costs and finance	2.4	2.3	2.4	3.1
Overheads	0.8	0.7	1.1	1.0
Total fixed costs (ppl)	**11.0**	**10.7**	**11.8**	**11.9**
Total costs of production (ppl)	**24.4**	**23.4**	**25.4**	**23.0**
Net margin (ppl)	**6.1**	**7.0**	**6.2**	**8.7**
Net margin (£'s/Ha)	**991**	**1075**	**957**	**1130**

A look at the top 25% performers across the different calving patterns reveals that they all achieved a positive net margin, with total costs of production noticeably lower than the average. In terms of costs, for all year round calving feed and labour costs were two significant areas of difference. This was similar for multi-block calving systems but for spring and autumn calving block enterprises, fixed costs were the most significant difference compared with the averages.

In terms of net margin for the top performers, Milkbench+ data indicates that spring block calving generated the highest margin, due to lower feed and labour requirements. For the average, both autumn and spring calving systems produced the greatest net margin.

On average, the block calving systems achieve significant feed and labour efficiencies as a direct result of the calving pattern, which enables the whole herd to be managed via a more focussed approach. Although this is an important determinate of performance, there are likely to be more complex reasons which further analysis may identify.

Appendix F

Imputed values used in Milkbench+ 2011/12

D.

Family wage rate* (£ per hour)				
Region	**Full time**	**Part time**	**Relief**	**Casual**
Eastern	9.7	8.2	12.1	6.0
East Midlands	10.0	8.5	12.6	6.0
North East	8.0	6.8	10.0	6.0
North West	11.2	9.5	14.0	6.0
Scotland	9.8	8.4	12.3	6.0
South East	10.1	8.5	12.6	6.0
South West	9.2	7.8	11.5	6.0
Wales	9.1	7.7	11.3	6.0
West Midlands	8.9	7.6	11.2	6.0
Yorkshire and Humberside	9.5	8.1	11.9	6.0

* Imputed wage rate for family labour is based on results from Annual Survey of Hours and Ea nings, Office for National Statistics and on Milkbench+ paid labour equivalents for previous periods.

D.

Region	Pasture land rent* (£ per hectare)
Eastern	138
East Midlands	169
North East	144
North West	202
Scotland	98
South East	107
South West	149
Wales	173
West Midlands	184
Yorkshire and the Humber	165

* Pasture land rents are obtained from The Royal Institution of Chartered Surveyors.

Imputed cost of capital* (per cent)	**2.86**

*Imputed cost of capital is calculated as an average between saving and lending rate (based on Bank of England information and discussed with hree high street banks). This rate is hen charged on tenanted capital to calculate opportunity cost of capital.

Acknowledgements

D.

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