

Key Performance Indicators for the UK Jersey dairy herd for the year ending 31st August 21

A study of herd performance in 53 milk recording herds

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Executive Summary

This is a new study of Key Performance Indicators (KPI) from a cross-section of 53 Jersey dairy herds that milk record with National Milk Records (NMR). It covers the herd performance for the last 12 month period up to 31 August 2021. The previous Jersey study (74 herds) was done in April 2013 (for 12 months data up to 31 December 2012). Each study covers over 70 different parameters describing aspects of longevity, fertility, production and health. The principal objective of the studies is to provide farmers and their technical advisers with accurate and current descriptions of performance levels as the basis for discussion and target setting at herd level.

The method of calculation for the majority of the 38 parameters described in this study is identical in all studies.

For each parameter the 53 herds in the current study are arranged in ascending/descending order. The median is then herd in position 27. It follows that 50% of herds fall above and 50% of herds fall below this median value.

Herd size: Median herd size in 2021 is 135 cows, compared to 125 in the year 2012 (*Table 2*). One herd in four has more than 204 cows and one herd in four has less than 102 cows in the year 2021.

Longevity: Although culling figures did not change over the past 9 years, longevity tended to be slightly less in the year 2021 (*Table 2*).

- The median age at first calving in 2021 is 2.2 years (*Table 1.a*).
- The median age at exit is 6.4 years giving 4.0 years of productive life, and the age at 1st calving reduced by 0.1 year compared to 2012 (*Table 2*).
- The median lactations per cow at exit for 2021 is 4.0, compared to 4.1 in 2012 (*Table 2*).
- The median culling rate in 2021 is unchanged since 2012 at 25% (*Table 2*).

Fertility: All of the fertility parameters, apart from calving interval which remained unchanged at 404 days, have improved over the past 9 years.

- The median conception rate in 2021 is 42% (*Table 1.a*), higher by 2% than that achieved in the year 2012 (*Table 2*).
- Heat detection: The median % of inter-service intervals at 18-24 days (the 1st available oestrus after a failure to conceive) in 2021 is 41%, an improvement of 6% over that in 2012 (*Table 2*). However, one herd in four still detects under 33% of service returns at the first available oestrus showing there is still plenty of opportunity to improve. The median herd % of intervals that are greater than 50 days (suggesting 2+ missed oestrus cycles) in 2021 is 23% (*Table 1.a*), an improvement of 5% from 2012 (*Table 2*). Similarly, in a quarter of herds over 31% of inter-service intervals still exceed 50 days.
- The median submission rate in 2021 is 37% (*Table 1.a*). This is a 5% increase compared to 32% in 2012 (*Table 2*).
- The median pregnancy rate in 2021 is 16% , up by 2% compared to the year 2012 (*Table 2*).
- The median % cows served by day 80 (after calving) in 2021 is 56% (*Table 1.a*). This is 5% higher than in 2012 (*Table 2*). In 2021 one herd in four served less than 36% of cows at least once by day 80 after calving.
- The median % conceived by day 100 (after calving) in 2021 is 35% (*Tale 1.a*). This is just 1% higher than 34% in 2012 (*Table 2*).

Milk production: Compared with 2012, production per cow per year in 2021 is actually slightly lower than that in 2012. This is associated with a slight increase in fat% and protein% recorded in the year 2021.

- The median Lifetime milk per cow per day (since birth) in 2021 is 8.9 kg (*Table 1.a*), higher than that in 2012 by about 1 kg (*Table 2*).
- The median Milk per cow per year (milk per cow place) in 2021 is 5,480 kg (*Table 1.a*). This is lower than that in the year 2012 by 57 kg (*Table 2*).
- The median 305-day yield in 2021 is 5,933 kg, with top 25% of the herds doing an extra of about 900 kg (*Table 1.a*). As calculation method of 305-day yield in InterHerd+ system has changed since 2016, comparison with performance achieved in the year 2012 is not valid to carry out.
- The median protein% content of milk at 3.97% and fat% at 5.41% in 2021 (*Table 1.a*) have modestly improved compared to figures recorded in 2012 (*Table 2*).

Somatic Cell Counts (SCC): Apart from Herd Average SCC (which appear to remain fairly constant, compared to 9 years ago), several SCC parameters have shown a slight improvement in 2021 compared to performance in 2012.

- The median herd SCC in 2021 was almost unchanged from that in 2012 at 201,000 cells/ml of milk (*Table 2*).
- The median Percentage SCC $\geq$ 200,000 cells/ml in 2021 is 21%, lower by 1% compared to the year 2012.
- The median Percentage Dry period cure in 2021 is 70%, up by 3% over that in 2012 (*Table 2*).
- For Percentage of low SCC at the end of previous lactation, the median value is 72% in 2021 compared to 70% in the year 2012 (*Table 2*).

Section 1: Key Performance Indicators for the year ending 31/8/2021

Introduction

While calculating production parameters for an individual herd is relatively straightforward, this does not answer the fundamental questions of “*Is that a good or acceptable level of performance?*” and “*Should this herd be doing better than it is?*” These questions require comparison with the performance in a significant number of other similar herds.

This study provides up to date (August 2021) figures on the performance achieved by a sample of 53 commercial Jersey dairy herds in the United Kingdom. The study presents 34 parameters that cover key aspects of herd longevity, fertility, production and health. The source of data is the monthly milk records obtained from National Milk Records (NMR).

The study demonstrates clearly the wide differences that exist in the industry between the “best” and “worst” levels of performance in commercial dairy herds.

For each parameter the performance levels of all 53 herds are presented in a bar chart. A median (middle) value and inter-quartile range (the level achieved by the middle 50% of herds) are derived for each parameter. A **target** value for on-farm use is proposed for each parameter, based on the performance level currently achieved by the “**best**” **25%** of the herds for that parameter.

These parameters provide farmers and their technical advisers with key information to:

- benchmark and monitor the current performance of individual herds
- identify areas of relative strength and weakness in individual herds
- set realistic and achievable target values
- collaborate with other producers to identify reasons for good and bad performance, and learn from existing best practice

The findings also demonstrate to researchers and technical advisers the areas of greatest variation and potential for improvement.

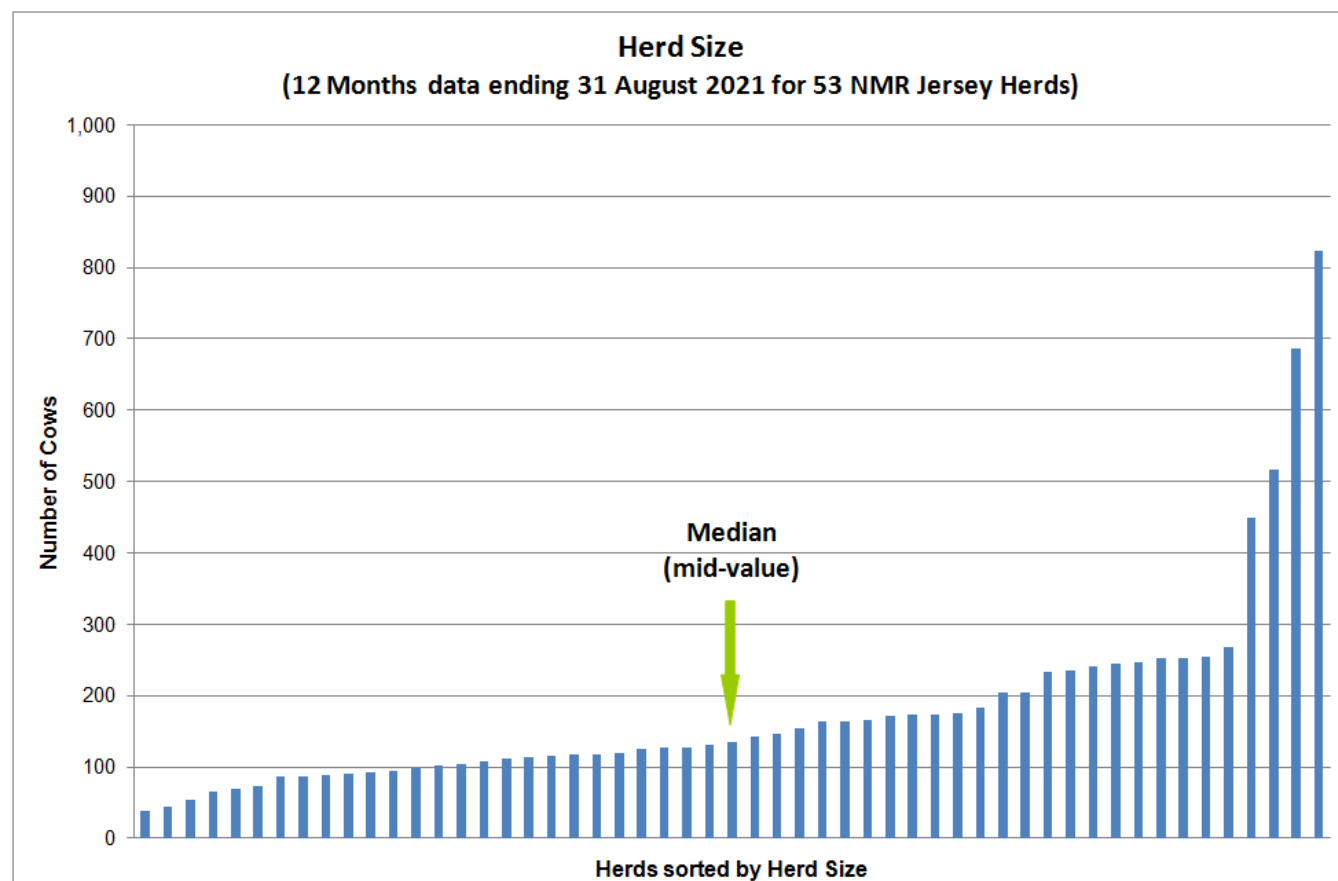
This study is a repeat of that reported in 2013, where the analysis intended to provide an objective measure of national herd performance and how it is changing over time.

The sample of herds

The source of data is the monthly milk records obtained by National Milk Records (NMR). The 53 herds used in the study all fully milk record on a monthly assisted basis and represent large proportion of Jersey herds recorded by NMR. Herds were selected using random numbers to ensure a representative cross-section of the sample. The herds are all predominantly comprised of Jersey cows, and have recorded for a minimum of two years. Herds with poor fertility data (inadequate recording of services and pregnancy diagnoses), as well as herds no longer recording, were replaced with herds selected using random numbers. In total 30 herds were in both the 2012 and 2021 studies.

Herd size for the 53 herds in the present study ranged from 39 to 824 cows, with a median value of 135 cows, as shown in Figure 1. In this sample 25% of herds were below 100 cows, with 15 herds containing over 200 cows.

Figure 1. Herd size of the 53 Jersey herds in the 2021 study



The parameters

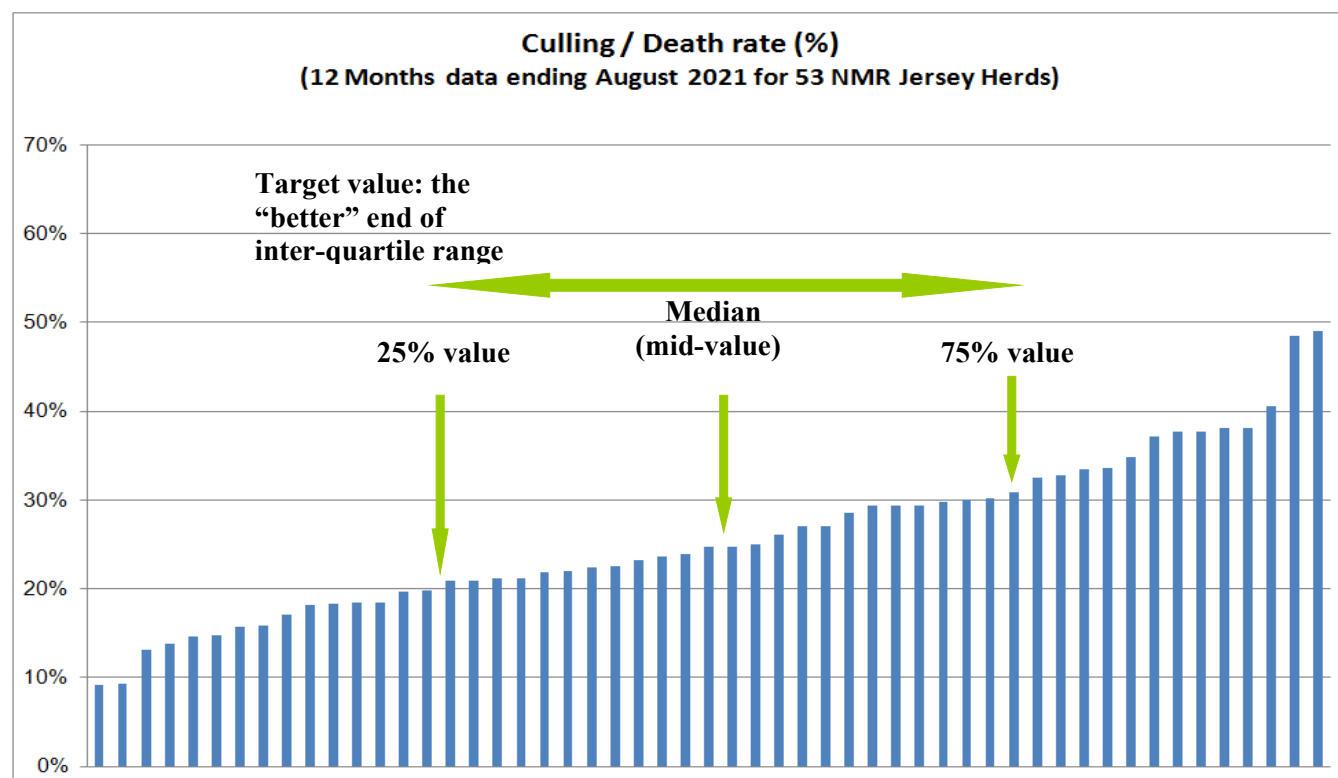
To minimize the impact of short term seasonal changes, the analyses are based on 12 month rolling averages for each parameter. In other words, they represent the performance levels achieved by each herd for the 12 month period from 1st September 2020 to 31st August 2021.

The results of the study are summarized in Table 1. For each parameter there are 4 values:

1. The **median**: The middle value. If the performance levels of all herds are arranged in ascending order, the median is the performance of the middle herd. In essence, half the herds do better and half do worse than the median value. For example, if the conception rates of 5 herds were arranged in ascending order, the median value would be the conception rate of the third herd, leaving 2 herds with better and two herds with worse performance.
2. The **first quartile (25% value) and third quartile (75% value)** describe the lower and upper limits of performance achieved by the middle 50% of herds. 25% achieve “better” and 25% achieve “worse” than the limits for that parameter.
3. The **target** value is the level achieved or bettered by 25% of the herds. This value is the “better” of the **first quartile (25%) and third quartile (75%) values**. For parameters like somatic cell count, culling % and calving interval the target will be the 25% (lower) value, while for others (conception %, protein %, dry period cure %) it will be the 75% (higher) value.
4. The **inter-quartile range** is the difference between the performance of the best and worst 25% of herds (i.e. the difference between the **first quartile (25% value) and third quartile (75% value)**).

The origin of these values is shown in Figure 2. Throughout this document the parameter value is displayed on the vertical Y axis with one bar for each of the study herds arranged along the horizontal X axis in increasing or descending order of the parameter value. The parameter in Figure 2 is the Culling % so the target value is at the lower end of the inter-quartile range (a low culling % is preferable to a high culling %).

Figure 2. A description of the median, inter-quartile range and target values generated for each parameter



The definitions of each parameter are detailed in Appendix 1.

Acknowledgements

The authors are grateful to National Milk Records (NMR) for providing data to prepare this study.

Section 2: KPI Results for the year ending 31/8/2021

Table 1(a). Summary of Key Performance Indicators derived from analysis of 53 Jersey NMR milk recording herds for the year ending 31 August 2021 – Culling, fertility & milk parameters.

Parameter	Median (1)	1 st - 3 rd quartile (25% - 75%) (2)	Target (3)	Inter-quartile range (4)
A. Culling rate	25%	20% - 31%	20%	11%
B. Percentage culled (off take) 100 days after calving	5%	3% - 8%	3%	5%
C. Age at exit (years)	6.4	5.6 - 7.3	7.3	1.7
D. Age at exit by lactations	4.0	3.2 - 4.8	4.8	1.6
E. Percentage Served by day 80	56%	36% - 65%	65%	29%
F. Percentage conceived 100 days after calving	35%	27% - 48%	48%	21%
G. Calving to 1 st service interval (days)	85	75 - 108	75	33
H. Calving interval (days)	404	394 - 422	394	28
I. Age at 1 st calving (years)	2.2	2.0 - 2.3	2.0	0.3
J. Conception rate	42%	35% - 51%	51%	16%
K. %Service intervals at 18-24 days (Heat detection)	41%	33% - 52%	52%	19%
L. Percentage service intervals >50 days	23%	15% - 31%	15%	16%
M. %Cows eligible for service served (Submission rate)	37%	25% - 48%	48%	23%
N. %Eligible for service that conceived (Pregnancy rate)	16%	9% - 20%	20%	11%
O. Lifetime milk / cow / day (kg)	8.9	6.5 - 10.3	10.3	3.8
P. Milk / cow / year (kg)	5,480	4,830 - 6,575	6,575	1,745
Q. Average protein%	3.97%	3.91% - 4.07%	4.07%	0.16%
R. Average fat%	5.41%	5.17% - 5.60%	5.60%	0.43%
S. 305-day milk yield (kg)	5,933	5,307 - 6,837	6,837	1,530
T. 305-day protein yield (kg)	235	210 - 269	269	59
U. 305-day fat yield (kg)	314	285 - 369	369	84

- (1) The median is the middle value (so 26 herds were better and 26 were worse than this value).
- (2) The **first quartile (25% value)** and **third quartile (75% value)** describe the lower and upper limits of performance achieved by the middle 50% of herds. 25%, or one in four, herds achieve “better” and 25% “worse” than the limits for that parameter.
- (3) The **Target** is set at the level achieved or bettered by the **“best” 25% of herds. One in four of the 500 herds in the sample achieved this level or better.**
- (4) The inter-quartile range is the difference between the **first quartile (25% value)** and **third quartile (75% value)**. This gives an impression of how widely herds in the middle 50% differ.

Table 1(b). Summary of Key Performance Indicators derived from analysis of 53 Jersey NMR milk recording herds for the year ending 31 August 2021 – Somatic Cell Count (SCC)

Parameter	Median (1)	1 st - 3 rd quartile (25% - 75%) (2)	Target (3)	Inter-quartile range (4)
V. Average SCC ('000 cells/ml)	201	164 - 250	164	86
W. Percentage SCC $\geq$ 200,000 cells/ml	21%	18% - 27%	18%	9%
X. Percentage SCC $>$ 500,000 cells/ml	8%	6% - 10%	6%	4%
Y. Percentage 1st recording SCC $\geq$ 200,000 cells/ml	21%	15% - 26%	15%	11%
Z. Percentage chronic SCC $\geq$ 200,000 cells/ml	11%	8% - 15%	8%	7%
ZA. Percentage Dry period cure (High:Low)	70%	59% - 79%	79%	20%
ZB. Percentage Dry period protection (Low:Low)	84%	78% - 89%	89%	11%
ZC. Percentage Low at end of previous lactation (SCC $<$ 200,000 cells/ml)	72%	66% - 78%	78%	12%
ZD. Percentage New SCC $>$ 200,000 cells/ml	8%	6% - 12%	6%	6%
ZE. Percentage Dried-off with no SCC $>$ 200,000 cells/ml	44%	32% - 52%	52%	20%
ZF. Threshold Index new high / new low	1.22	1.14 - 1.34	1.14	0.20
ZG. Recovery percentage of new/first/repeat infections	52%	45% - 58%	58%	13%
ZH. Recovery percentage of chronic infections	18%	13% - 26%	26%	13%

(*) **HIGH** SCC is a milk sample with $\geq$ 200,000 cells/ml milk;

LOW SCC is a milk sample with below 200,000 cells/ml milk

(**) **CHRONIC / NEW / FIRST** and **REPEAT** are the Herd Companion categories describing high SCC cows. See Appendix 2 for definitions.

(***) **Dry period protection (High:Low):** The percentage of cows finishing a lactation with a HIGH SCC sample that starts the new lactation with a LOW SCC sample;

Dry period cure (Low:Low): The percentage of cows finishing a lactation with a LOW SCC sample that starts the new lactation with a LOW SCC sample.

(****) **Threshold Index:** The total cows changing from Low to High SCC divided by the total cows changing from High to Low SCC at consecutive milk recordings.

(1) The median is the middle value (so 26 herds were better and 26 were worse than this value).

(2) The **first quartile (25% value)** and **third quartile (75% value)** describe the lower and upper limits of performance achieved by the middle 50% of herds. 25%, or one in four, herds achieve “better” and 25% “worse” than the limits for that parameter.

(3) The **Target** is set at the level achieved or bettered by the **“best” 25% of herds. One in four of the 500 herds in the sample achieved this level or better.**

(4) The inter-quartile range is the difference between the **first quartile (25% value)** and **third quartile (75% value)**. This gives an impression of how widely herds in the middle 50% differ.

Section 3: Comparison of Key Performance Indicators for the year ending 31/12/2012 and the year ending 31/8/2021

The target and median figures from the current study are compared with the results from a similar exercise for the year ending 31st December 2012. Table 2 shows changes in the median and target values for each parameter over the interval. The colour of the 2021 value in Table 2 below indicates whether it has “improved” (green) or “deteriorated” (red), or “unchanged” (black).

Table 2. Comparison of median and target values derived from the two studies of Jersey NMR recording herds for the year 2012 (74 herds) and the year 2021 (53 herds), with 30 the same herds in both studies.

Parameter	Median	Median		Target “Best 25%”	Target “Best 25%”
<i>Year of the Data</i>	<i>2012</i>	<i>2021</i>		<i>2012</i>	<i>2021</i>
Herd size (number of Cows)	125	135		178	204
A. Culling rate	25%	25%		20%	20%
B. Culling / death rate in first 100 days of lactation	6%	5%		3%	3%
C. Age at exit (years)	6.6	6.4		7.8	7.3
D. Age at exit by lactations	4.1	4.0		4.9	4.8
E. Percentage Served by day 80	51%	56%		63%	65%
F. Percentage conceived 100 days after calving	34%	35%		44%	48%
G. Calving to 1 st service interval (days)	89	85		77	75
H. Calving interval (days)	404	404		393	394
I. Age at 1 st calving (years)	2.3	2.2		2.2	2.0
J. Conception rate	40%	42%		49%	51%
K. Percentage service intervals at 18-24 days	35%	41%		42%	52%
L. Percentage service intervals >50 days	28%	23%		21%	15%
M. Percentage eligible for service that served (submission rate)	32%	37%		41%	48%
N. Percentage eligible for service that conceived (pregnancy rate)	14%	16%		17%	20%
O. Lifetime milk / cow / day (kg)	8.0	8.9		9.0	10.3
P. Milk / cow / year (kg)	5,537	5,480		6,164	6,575
Q. Average protein%	3.85%	3.97%		3.93%	4.07%
R. Average fat%	5.30%	5.41%		5.51%	5.60%
V. Average SCC (‘000 cells/ml)	198	201		150	164
W. Percentage SCC >=200,000 cells/ml	22%	21%		18%	18%
X. Percentage SCC >500,000 cells/ml	8%	8%		6%	6%
Y. Percentage 1st recording SCC >=200,000 cells/ml	23%	21%		16%	15%
Z. Percentage chronic SCC >=200,000 cells/ml	11%	11%		9%	8%
ZA. Percentage Dry period cure (High:Low)	67%	70%		77%	79%
ZB. Percentage Dry period protection (Low:Low)	84%	84%		88%	89%
ZC. Percentage Low at end of previous lactation (SCC<200,000 cells/ml)	70%	72%		75%	78%

Appendix 1. Key Performance Indicators definitions

In the following definitions the average population of cows is calculated using animal days. Every day that animal is present in the population at risk during the period of study is a 365th of an animal year. The total animal days is divided by 365 to give animal years, which equates to the average population at risk.

Parameter	Description
A. Culling rate	The number of cows dying or culled during the 12 month period expressed as a percentage of the average cow population for the same 12 month period.
B. Percentage culled / died 100 days after calving	The percentage of heifers/cows calving during the 12 month period that exit within 100 days after calving.
C. Age at exit (years)	The average age (in days) of cows culled/died in the analysis period, divided by 365.24
D. Age at exit by lactations	The average number of lactations completed by cows culled/died in the analysis period.
E. Percentage Served by day 80	The percentage of cows reaching the 80 th day after calving that have been served at least once.
F. Percentage conceived 100 days after calving	The percentage of cows reaching 100 days after calving that have conceived.
G. Calving to 1 st service interval (days)	The average days between calving and 1 st service for all cows served for the first time in a lactation during the analysis period.
H. Calving interval (days)	The interval between calvings, in days, for all re-calvings recorded in the analysis period.
I. Age at 1 st calving (years)	The age at first calving for all cows calving for the first time during the analysis period.
J. Conception rate	The number of conceptions as a percentage of the total number of services (services to cows culled are included) during the analysis period.
K. Percentage service intervals at 18-24 days (Heat detection)	The percentage of all service intervals for cows returning to service during the analysis period that are between 18 and 24 days (equating to one oestrous cycle after the previous service).
L. Percentage service intervals >50 days	The percentage of all service intervals for cows returning to service during the analysis period that are over 50 days.
M. Percentage of cows eligible for service that were served (Submission rate)	The percentage of cows that are eligible for service (42 days+ after calving and not barren or already pregnant) during the analysis period that are served per 21 day (oestrous cycle) period.
N. Percentage of cows eligible for service that conceived (Pregnancy rate)	The percentage of cows that are eligible for service (42 days+ after calving and not barren or already pregnant) during the analysis period that conceive per 21 day (oestrous cycle) period.
O. Lifetime milk / cow/day (kg)	The average of total milk yield divided by age in days (from birth to culling) for cows leaving the herd during the analysis period.
P. Milk / cow / year (kg)	The total milk produced per cow place in the year. The total milk divided by the average population of cows (both in milk and dry).
Q. Average protein%	The weighted average protein% of all milk recorded during the analysis period.

Parameter	Description
R. Average fat%	The weighted average fat% of all milk recorded during the analysis period.
S. 305 day yield (kg)	The average 305 day production for all cows reaching 305 days after calving during the analysis period.
T. 305 day protein (kg)	The average 305 day production of milk protein for all cows reaching 305 days after calving during the analysis period.
U. 305 day fat (kg)	The average 305 day production of milk fat for all cows reaching 305 days after calving during the analysis period.
V. Average SCC (‘000 cells/ml)	The weighted average somatic cell count of all milk recorded during the analysis period.
W. Percentage SCC $\geq 200,000$ cells/ml	The percentage of all recorded milk samples during the analysis period that had an individual SCC reading of 200,000 cells/ml or higher.
X. Percentage SCC $\geq 500,000$ cells/ml	The percentage of all recorded milk samples during the analysis period that had an individual SCC reading of 500,000 cells/ml or higher.
Y. Percentage 1st recording SCC $\geq 200,000$ cells/ml	The percentage of all cows starting new lactations that had a high SCC ($\geq 200,000$ cells/ml) reading at the first milk recording in the lactation.
Z. Percentage chronic SCC $\geq 200,000$ cells/ml	The percentage of all milk samples taken in the analysis period that originated from chronic SCC cows where the current and previous milk samples both had SCC levels of 200,000 cells/ml milk or greater.
ZA. Percentage Dry period cure (High:Low)	Of re-calving cows recorded starting a new lactation during the analysis period: the percentage of cows ending the previous lactation with a HIGH SCC ($\geq 200,000$ cells/ml) that started the new lactation with a LOW SCC ($< 200,000$ cells/ml).
ZB. Percentage Dry period protection (Low:Low)	Of re-calving cows recorded starting a new lactation during the analysis period: the percentage of cows ending the previous lactation with a LOW SCC ($< 200,000$ cells/ml) that also started the new lactation with a LOW SCC ($< 200,000$ cells/ml).
ZC. Percentage Low at end of previous lactation (SCC $< 200,000$ cells/ml)	Of re-calving cows recorded starting a new lactation during the analysis period: The percentage that had a LOW SCC ($< 200,000$ cells/ml) at the last milk recording in the previous lactation.
ZD. Percentage New SCC $\geq 200,000$ cells/ml	The percentage of all recorded milk samples that were of the “New” SCC Category, namely the first HIGH SCC ($\geq 200,000$) in a lactation following one or more low SCC samples.
ZE. Percentage Dried-off with no SCC $\geq 200,000$ cells/ml	The percentage of cows completing a lactation without recording a high SCC (cows recording only LOW SCC samples ($< 200,000$ cells/ml) in the previous lactation).
ZF. Threshold Index new high / new low	Of cows with consecutive milk records in the same lactation, the number of cows changing from Low SCC at the previous to High SCC at the next recording divided by the number of cows going from High SCC at the previous to Low SCC at the next recording.
ZG. Recovery percentage of new/first/repeat infections	Of HIGH SCC cows ($\geq 200,000$ cells/ml) that at the previous recording were either low SCC or not yet in milk, the percentage that were LOW SCC ($< 200,000$ cells/ml) at the following recording.

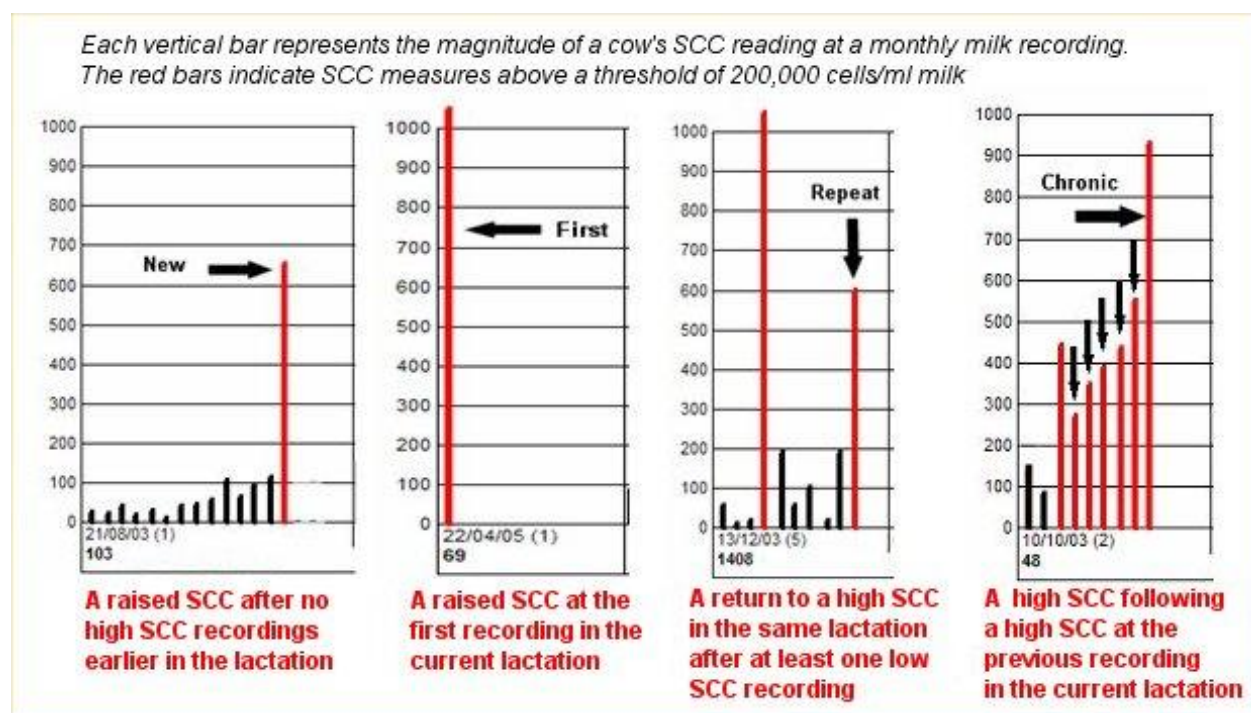
Parameter	Description
ZH. Recovery percentage of chronic infections	Of CHRONIC High SCC cows (High SCC cows that at the previous recording were also High SCC), the percentage of those milked that were LOW SCC (<200,000 cells/ml) at the following recording.

Appendix 2. Herd Companion High SCC Categories

The web-based Herd Companion program (www.nmr.co.uk/Herd-companion) was introduced by NMR in 2003 primarily to support the use of milk recording data to control somatic cell counts (SCC) in dairy herds.

Herd Companion focuses more on the duration of a high SCC infection rather than the magnitude of an individual milk sample. Using a threshold of 200,000 cells/ml milk to indicate infection, the program aims to balance the ability of many cows to self-cure with the need to assist cows where infection is becoming established. While in the region of 50% of cows self-cure after an initial raised SCC this recovery rate falls to less than 20% once a cow has recorded a second high SCC. It is these persistent high SCC cows that require attention before they are damaged irretrievably by a sustained period of infection.

The development of Herd Companion led to the definition of four main categories of high cell count cow, as illustrated below. Each vertical bar represents the magnitude of the SCC at each milk recording in a lactation. Where the bar is black the SCC is below the threshold of 200,000 cells/ml milk. A red bar indicates a SCC level above the threshold.



NEW: The “New” category describes cows recording their first high SCC in the lactation, having recorded one or more low SCCs at earlier recording(s). An infection acquired in the lactation.

FIRST: The “First” category describes cows that are HIGH SCC at their First milk recording in the current lactation. This is an infection that may be related to the dry period.

REPEAT: The “Repeat” category describes a possible re-infection (or failure to cure). A cow that had high SCC recording(s) earlier in the current lactation recorded a LOW SCC in the previous month(s) but has returned to a High SCC at the latest recording.

Chronic: The “Chronic” category describes a cow that is High SCC at the latest recording AND was also High SCC at the PREVIOUS recording(s). So she was high SCC last time and failed to recover. In the example above the cow has 7 consecutive high SCC recordings so has been defined as Chronic for the last 6 months of consecutive high SCC recordings.