Key Performance Indicators for the UK national dairy herd

A study of herd performance in 500 Holstein/Friesian herds for the year ending 31st August 2013

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Section 1: Key Performance Indicators for the year ending 31/08/2013

Introduction

This is the fourth annual study describing key indicators of production, fertility and health in commercial black and white dairy herds in the United Kingdom. The Key Performance Indicators (KPIs) are based on milk recording data from 500 commercial black and white herds for the 12 month period ending on 31st August 2013. The herds were selected at random to ensure they are truly representative of all herds (good, bad and indifferent) that milk record with National Milk Records (NMR).

The range in performance across these herds is presented for 32 parameters clearly showing the wide differences in performance, as well as huge potential for improvement in commercial dairy herds. This is a continuation of three earlier studies (2010, 2011 and 2012). The principal objective throughout has been to provide farmers and technical advisers with accurate, up-to-date information on the variation in performance of commercial dairy herds.

Farmers and technical advisers can compare the performance of their own herd with these figures to gauge the relative performance of their herd across fertility, production and health parameters. In other words, for each parameter ***is the performance of their herd good/acceptable/poor when compared to the 500 herds?*** This leads on to ***"Which parameters could/should this herd improve?"*** If this promotes discussion between farmers and technical advisers into the different causes and options for improvement then the study has served its primary purpose.

Following the analysis there is a section on the practical use of these parameters, using the InterHerd+ program. InterHerd+ calculates the parameters in an identical way making the results directly comparable and indicating where a herd would appear if included in the 500 herds sample. A KPI template of 80 parameters for use in InterHerd+ is also available for users to update the KPI parameters to these values from 2013.

Parameter description

For the 32 parameters described in this study, the performance level of each of the 500 herds is presented in a bar chart. The values are displayed in ascending or descending order, depending on whether it is better to have a low (e.g. SCC, calving interval) or high (e.g. dry period cure, conception rate) value. For each parameter a median (middle) value and inter-quartile range (the level achieved by the middle 50% of herds) are also derived.

The **target** value proposed for each parameter (and included in the KPI template) is the level achieved by the **"best" 25%** of the herds for that parameter. In other words, **the target is set at a level currently achieved (or exceeded) by one in four dairy herds over the last year**.

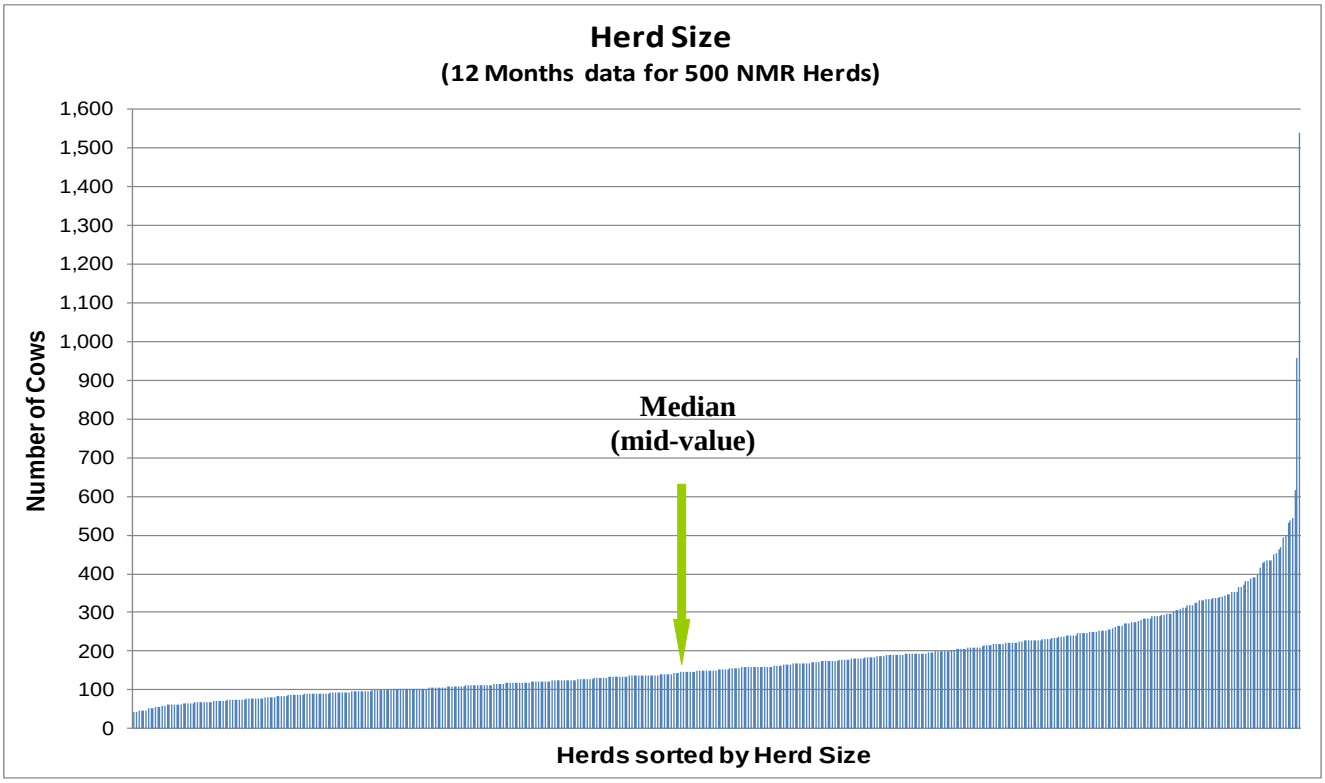
The sample of herds

The source of data is the monthly milk records obtained by National Milk Records (NMR).The 500 herds used in the study all fully milk record on a monthly assisted basis and represent approximately 10% of 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 black and white breeds (Holstein, Holstein-Friesian, Friesian) and have recorded for a minimum of two years. Where possible the same herds used in the 2012 study were maintained for the 2013 herds sample. 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 409 herds (82%) were in both the 2012 and 2013 studies.

Herd size for the 500 herds in the present study ranged from 42 to 1538 cows, with a median value of 152 cows, as shown in Figure 1. In the sample 69% of herds were below 200 cows, with 18 containing over 400 cows.

Figure 1. Herd size of the 500 herds in the 2013 study



The parameters

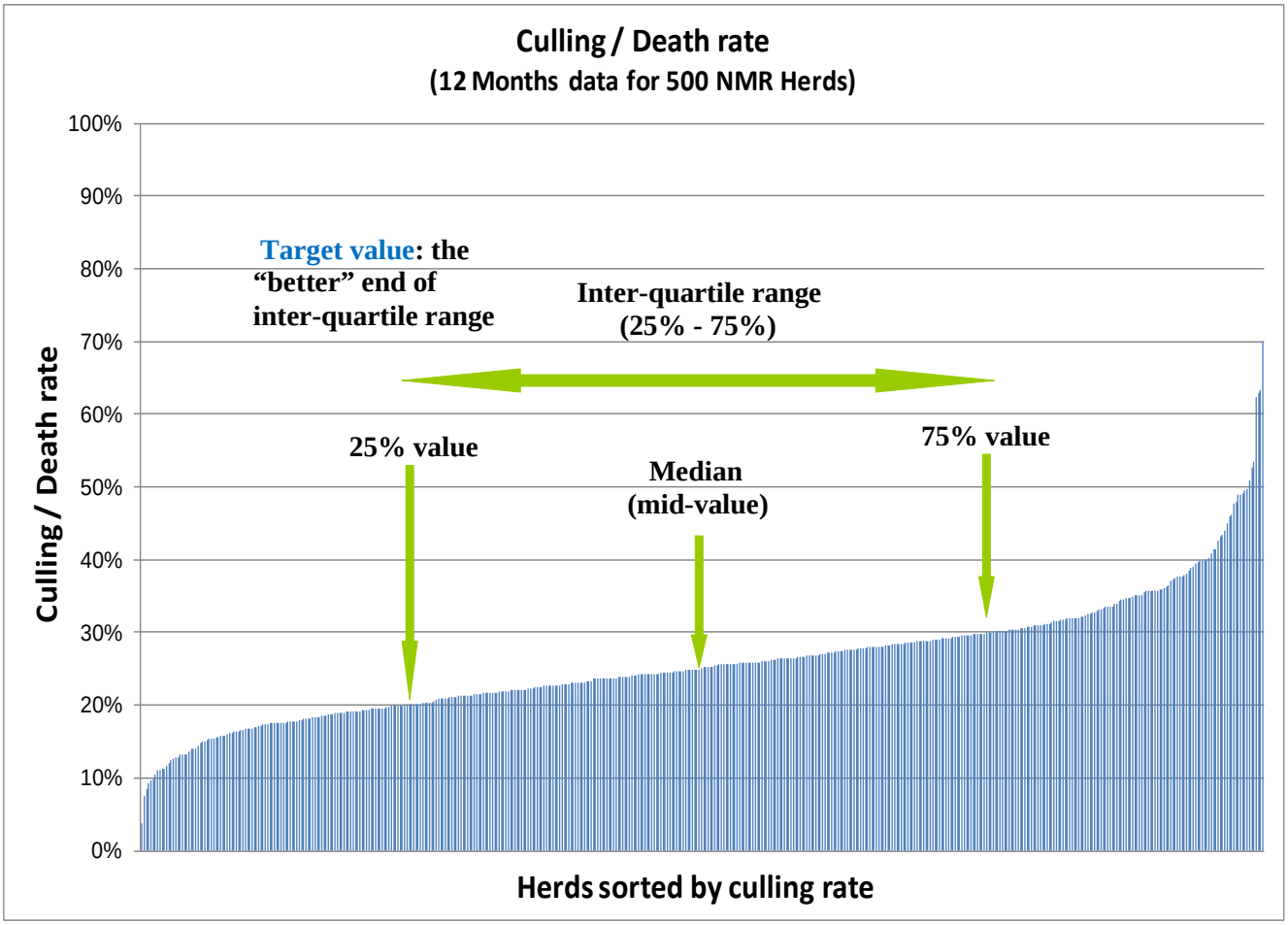
To minimize the impact of short term seasonal changes, the key performance indicator values represent the 12 month rolling averages for each parameter. In other words, they represent the performance levels achieved by each herd for the 12 month period from 1st of September 2012 to 31st of August 2013.

The results of the study are summarized in Tables 1.a & 1.b. 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. Half the herds do better and half do worse than the median 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% 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 in the study. This value is the "**better**" of the **first quartile (25%) or 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. The bars are either in ascending or descending order of the parameter value, arranged so that the "best" quartile, or "target" value, appears closest to the Y axis. 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 very grateful to National Milk Records (NMR) for their assistance and cooperation with the preparation of this study.

Section 2: KPI Results for the year ending 31/08/2013

Table 1.a Summary of Key Performance Indicators derived from analysis of 500 NMR milk recording herds for the year ending 31st August 2013 – Culling, fertility & milk parameters.

Parameter	Median (1)	1st – 3rd quartile (25% - 75%) (2)	Target (3)	Inter-quartile range (4)
A. Culling rate	25%	20% - 30%	**20%**	10%
B. Culling / death rate in first 100 days of lactation	5%	3% - 7%	**3%**	4%
C. Age at exit (years)	6.5	5.8 - 7.2	**7.2**	1.4
D. Age at exit by lactations	3.8	3.3 - 4.4	**4.4**	1.1
E. Percentage Served by day 80	53%	41% - 63%	**63%**	22%
F. Percentage conceived 100 days after calving	29%	18% - 38%	**38%**	20%
G. Calving to 1st service interval (days)	87	77 - 108	**77**	31
H. Calving interval (days)	414	402 - 433	**402**	31
I. Age at 1st calving (years)	2.4	2.2 - 2.6	**2.2**	0.4
J. Conception rate	32%	26% - 39%	**39%**	13%
K. Percentage service intervals at 18-24 days	32%	25% - 38%	**38%**	13%
L. Percentage service intervals >50 days	26%	18% - 36%	**18%**	18%
M. Percentage eligible for service that served	32%	23% - 45%	**45%**	22%
N. Percentage eligible for service that conceived	11%	6% - 15%	**15%**	9%
O. Lifetime milk / cow / day (kg)	11	9 - 13	**13**	4
P. Milk / cow / year (kg)	7,769	6,825 - 8,752	**8,752**	1,927
Q. Average protein%	3.24%	3.17% - 3.31%	**3.31%**	0.14%
R. Average fat%	4.00%	3.87% - 4.16%	**4.16%**	0.29%
S. 305-day yield (kg)	7,577	6,727 - 8,257	**8,257**	1,530

(1) The median is the middle value (so 250 herds were better and 250 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 by the "best" 25% of herds. So, depending on the variable, it is either the **first quartile (25% value) or third quartile (75% value)**.
(4) The inter-quartile range is the difference between the **first quartile (25% value) and third quartile (75% value)**.

Table 2.b Summary of Key Performance Indicators derived from analysis of 500 NMR milk recording herds for the year ending 31st August 2013 – Somatic Cell Count (SCC) parameters

Parameter	Median (1)	1st – 3rd quartile (25% - 75%) (2)	Target (3)	Inter-quartile range (4)
T. Herd SCC ('000 cells/ml)	195	155 – 238	**155**	83
U. % milk samples with **High** SCC (*)	22%	17% - 27%	**17%**	10%
V. % milk samples with SCC >500,000 cells/ml	8%	6% - 11%	**6%**	5%
W. % cows with **High** SCC at 1st recording in lactation (*)	18%	14% - 23%	**14%**	9%
X. % **Chronic** milk samples (**)	12%	9% - 16%	**9%**	7%
Y. Dry period cure (High:Low) (***)	74%	66% - 81%	**81%**	15%
Z. Dry period protection (Low:Low) (***)	86%	81% - 90%	**90%**	9%
ZA. % Low at last recording of previous lactation (*)	64%	55% - 72%	**72%**	17%
ZB. % samples New SCC category (**)	8%	6% - 10%	**6%**	4%
ZC. % cows dried-off with no High SCC samples in the lactation (*)	38%	29% - 46%	**46%**	17%
ZD. Threshold Index new high / new low (****)	1.34	1.21 - 1.49	**1.21**	0.28
ZE. % of cows with New/First/Repeat sample that are Low SCC at next recording (**)	52%	46% - 57%	**57%**	11%
ZF. % of cows with Chronic sample that are low SCC at next recording (**)	17%	14% - 22%	**22%**	8%

(*) – **HIGH** SCC is a milk sample with >=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): A cow that finishes a lactation with a HIGH SCC sample then starts the new lactation with a LOW SCC sample;
Dry Period Cure (Low:Low): A cow that finishes a lactation with a LOW SCC sample then starts the new lactation also with a LOW SCC sample.

(****) The ratio of cows acquiring their index high SCC sample per High SCC cow returning to Low SCC

(1) The median is the middle value (so 250 herds were better and 250 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 by the "best" 25% of herds. So, depending on the variable, it is either the **first quartile (25% value) or third quartile (75% value)**.

(4) The inter-quartile range is the difference between the **first quartile (25% value) and third quartile (75% value)**.

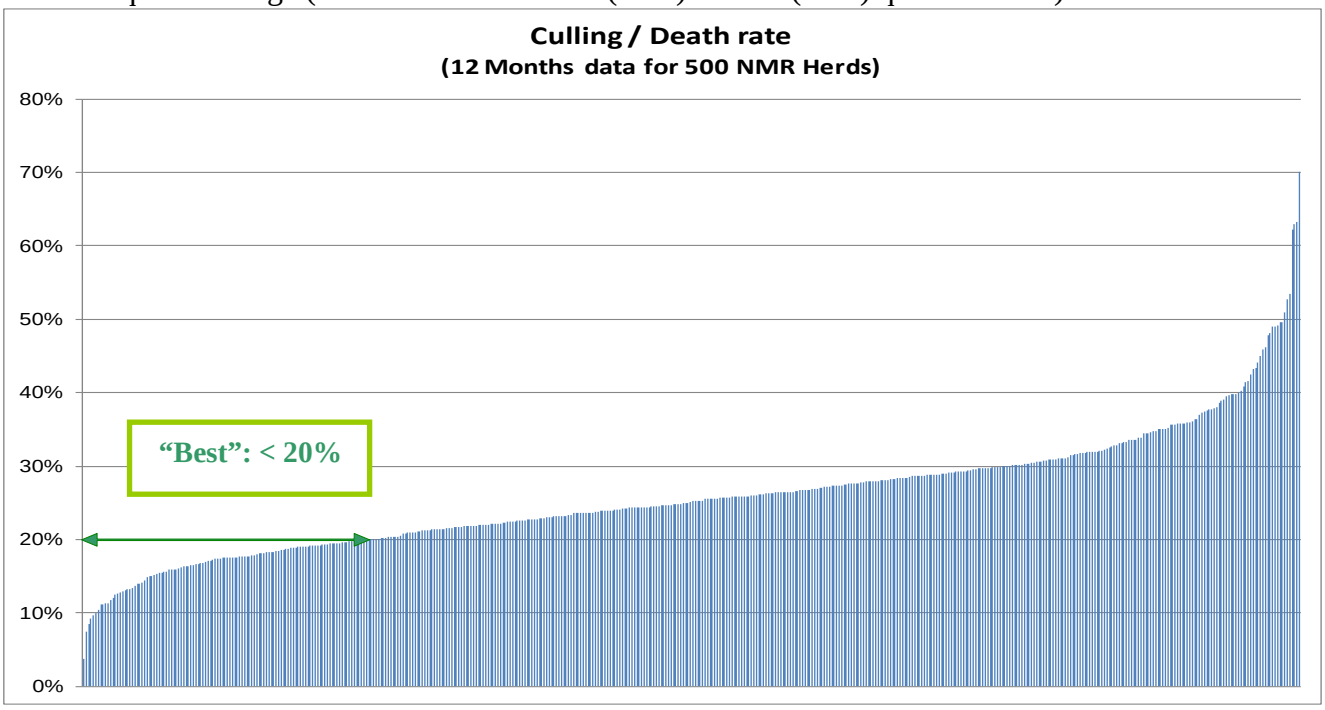
A. Culling/death rate: The percentage of all the cows were culled or died in the last 12 months.

Target (level achieved or surpassed by 25% of herds): 20%

Median (level achieved by the middle herd): 25%

75% level (level achieved or surpassed by 75% of herds): 30%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 10%



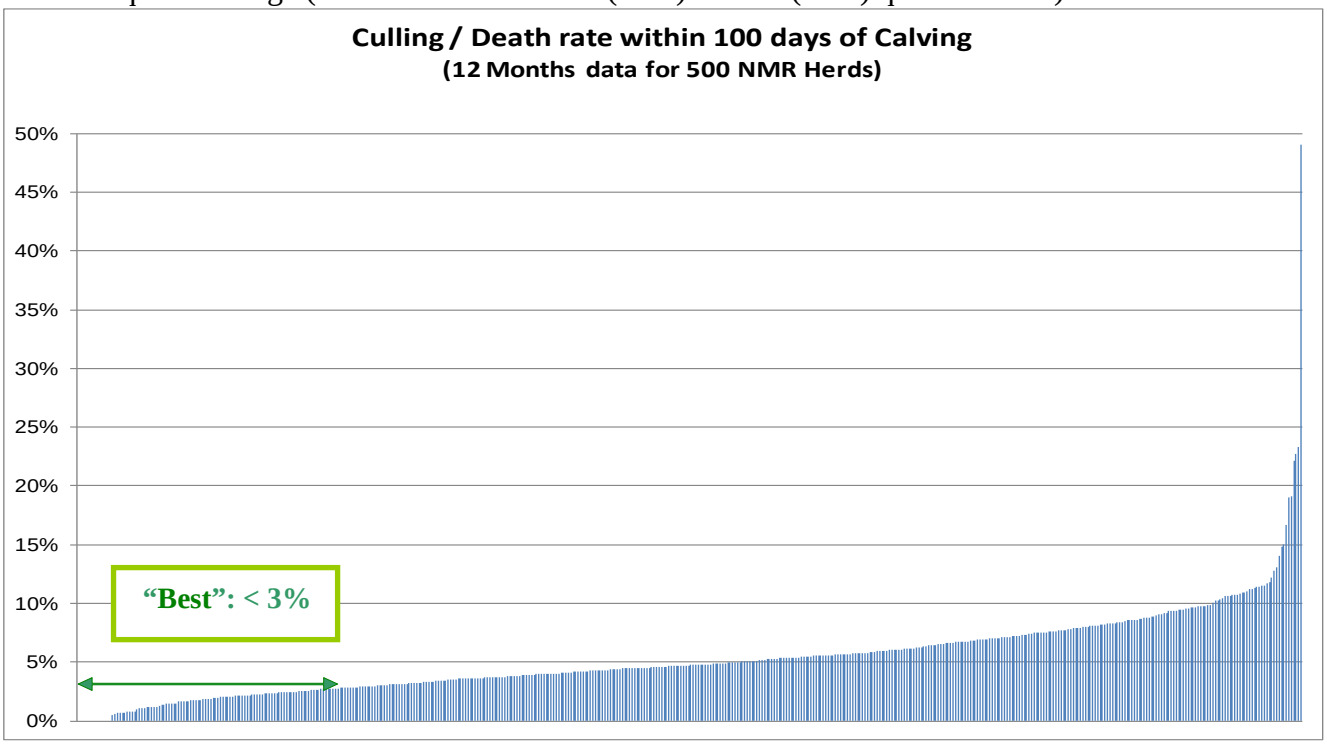
B. Culling / deaths in first 100 days of lactation: The culling % during the first 100 days of lactations during the last 12 months. A possible indicator of "involuntary culling"

Target (level achieved or surpassed by 25% of herds): 3%

Median (level achieved by the middle herd): 5%

75% level (level achieved or surpassed by 75% of herds): 7%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 4%



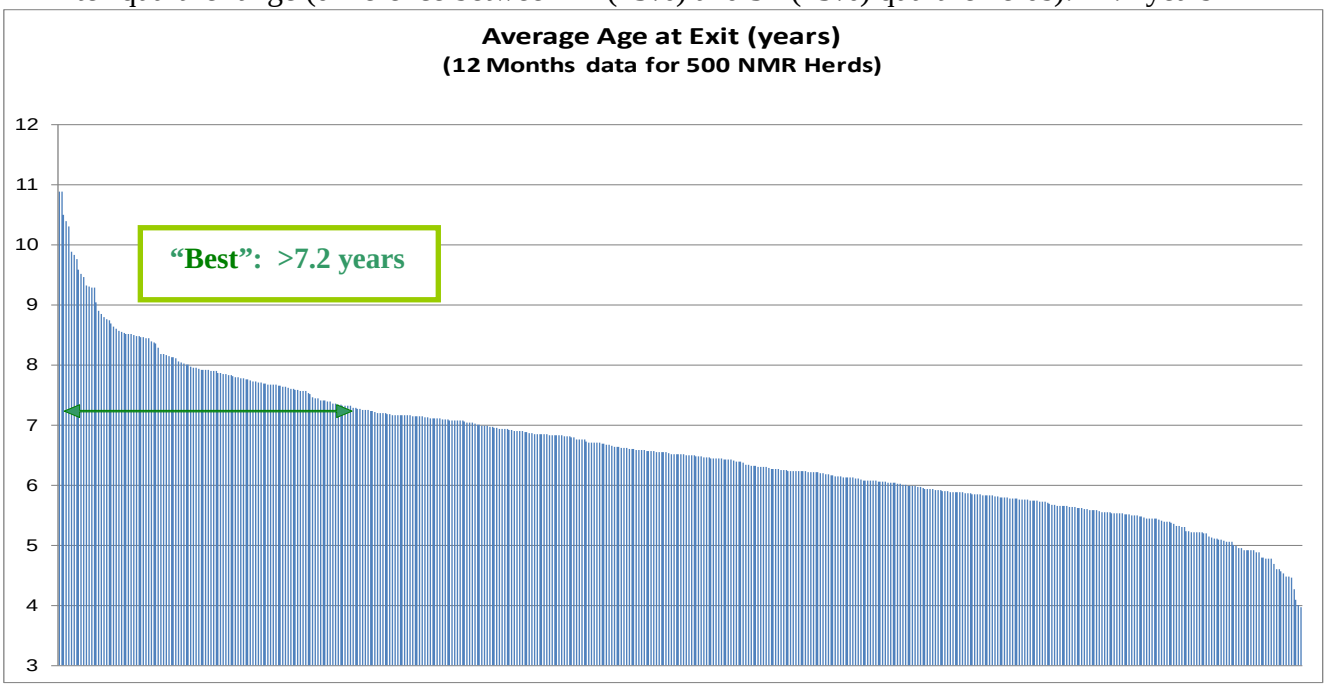
C. Average Age (in years) at exit: The average age of cows leaving the herd in the last 12 month at the time of exit. A potential measure of longevity.

Target (level achieved or surpassed by 25% of herds): 7.2 years

Median (level achieved by the middle herd): 6.5 years

75% level (level achieved or surpassed by 75% of herds): 5.8 years

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 1.4 years



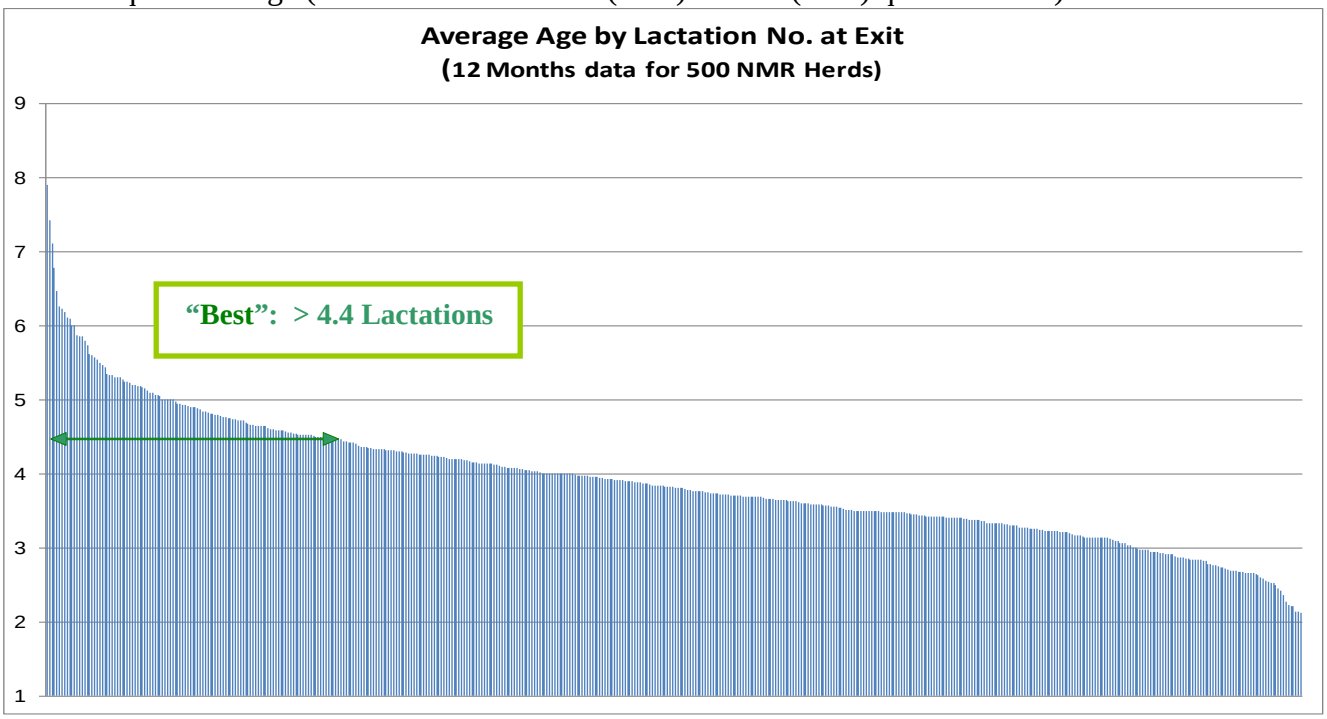
D. Average Age at exit by lactations: The average lactation number of cows leaving the herd in the last 12 months. A potential measure of longevity.

Target (level achieved or surpassed by 25% of herds): 4.4

Median (level achieved by the middle herd): 3.8

75% level (level achieved or surpassed by 75% of herds): 3.3

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 1.1



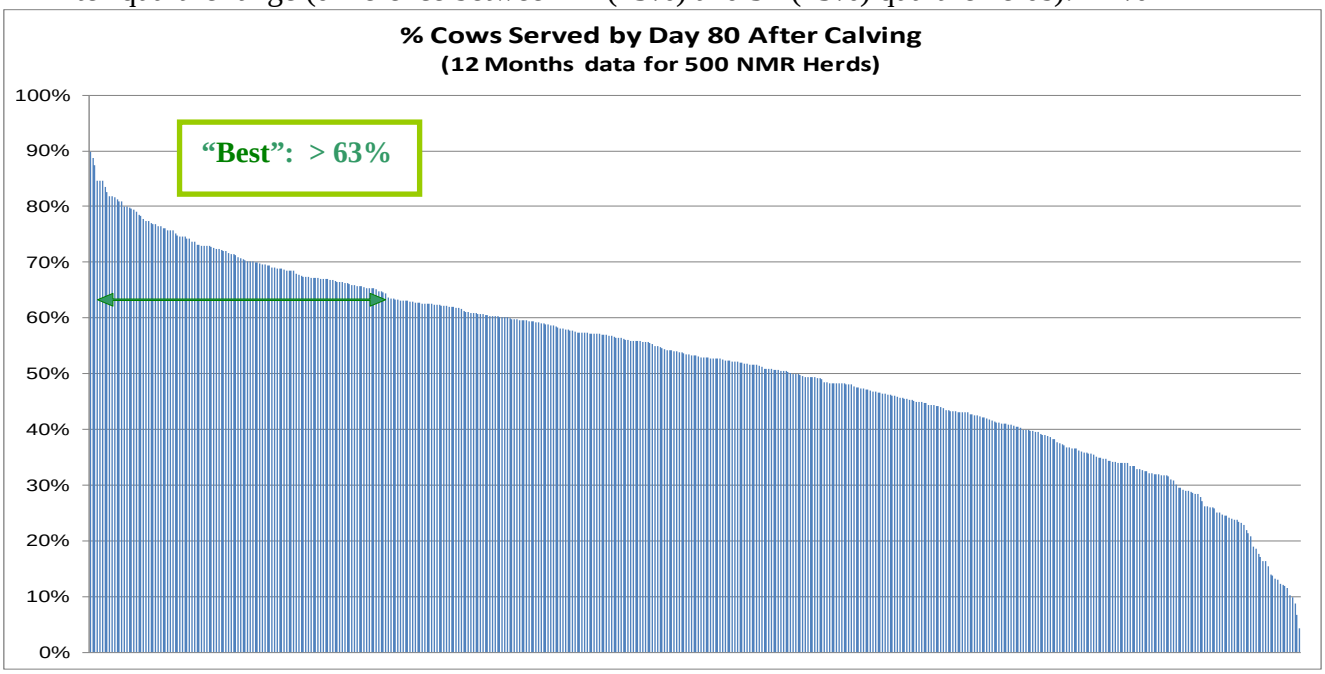
E. Served by day 80: The percentage of calving cows served at least once within 80 days of calving.

Target (level achieved or surpassed by 25% of herds): 63%

Median (level achieved by the middle herd): 53%

75% level (level achieved or surpassed by 75% of herds): 41%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 22%



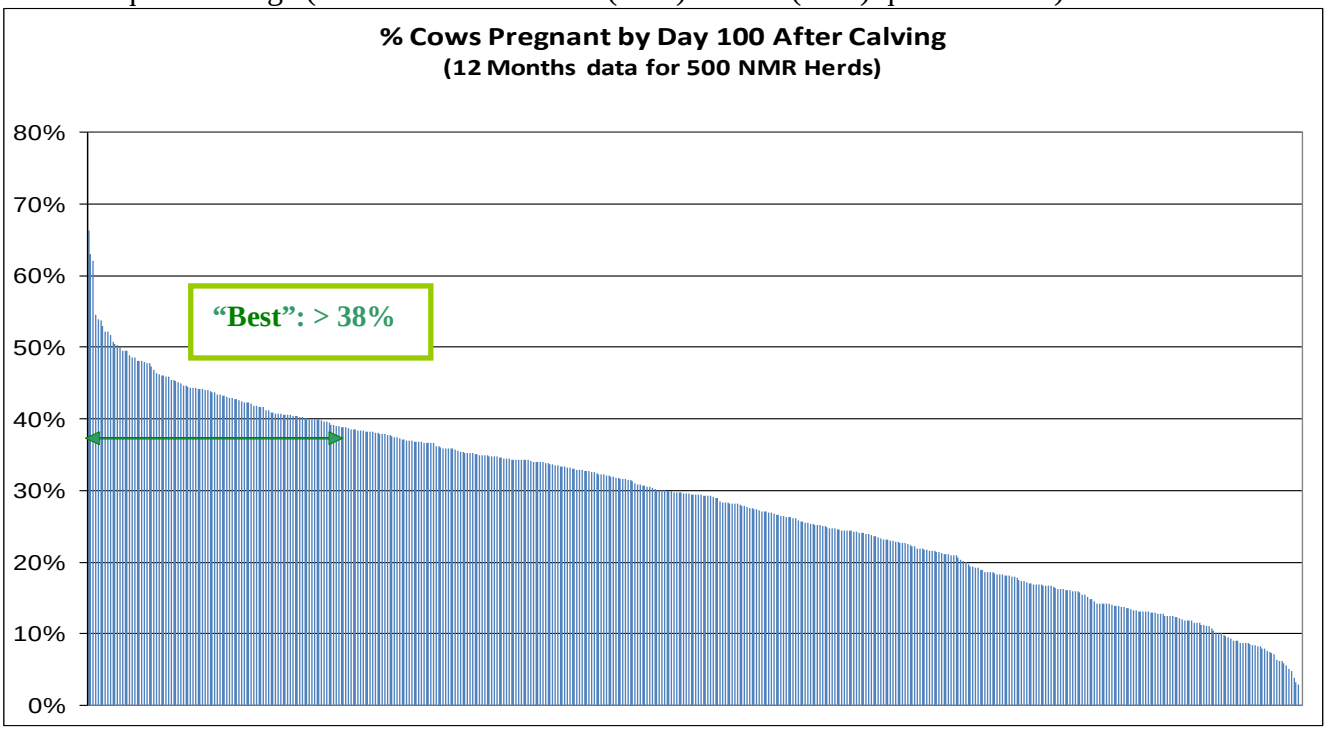
F. Percentage conceived 100 days after calving: The percentage of calving cows that had conceived within 100 days of calving.

Target (level achieved or surpassed by 25% of herds): 38%

Median (level achieved by the middle herd): 29%

75% level (level achieved or surpassed by 75% of herds): 18%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 20%



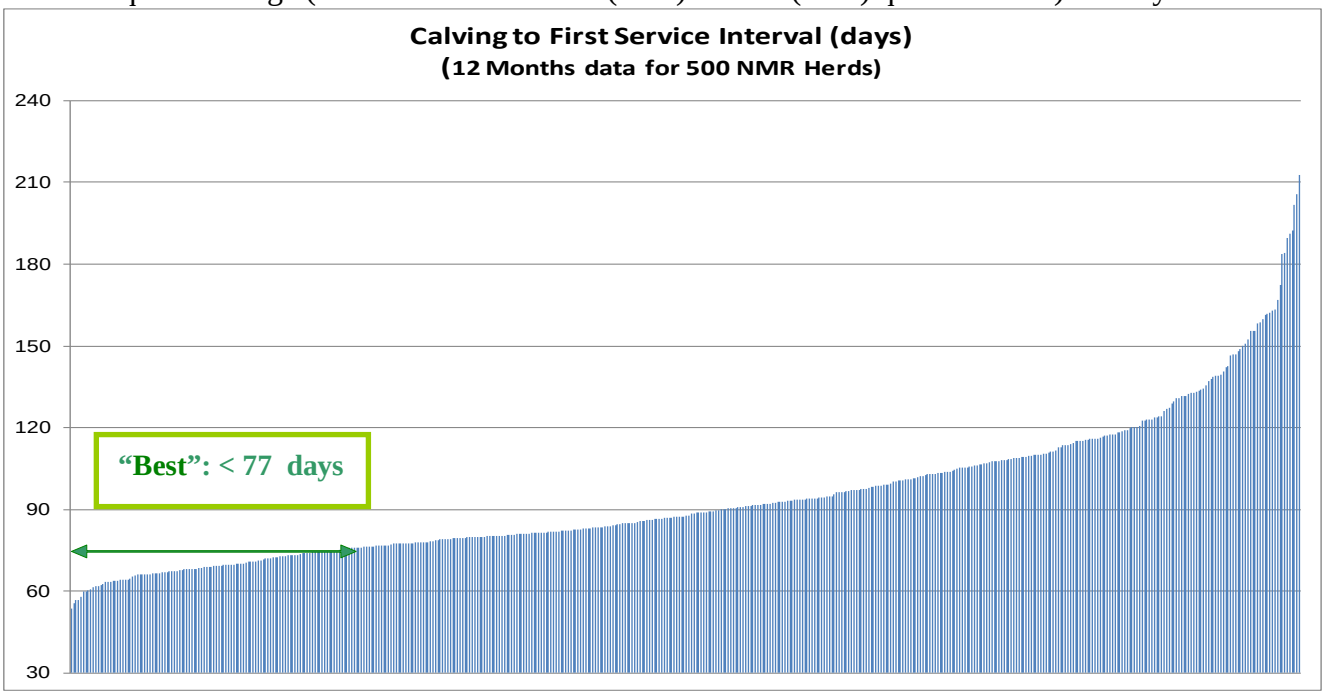
G. Calving to 1st service interval: The average interval between calving and 1st service (in days).

Target (level achieved or surpassed by 25% of herds): 77 days

Median (level achieved by the middle herd): 87 days

75% level (level achieved or surpassed by 75% of herds): 108 days

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 31 days



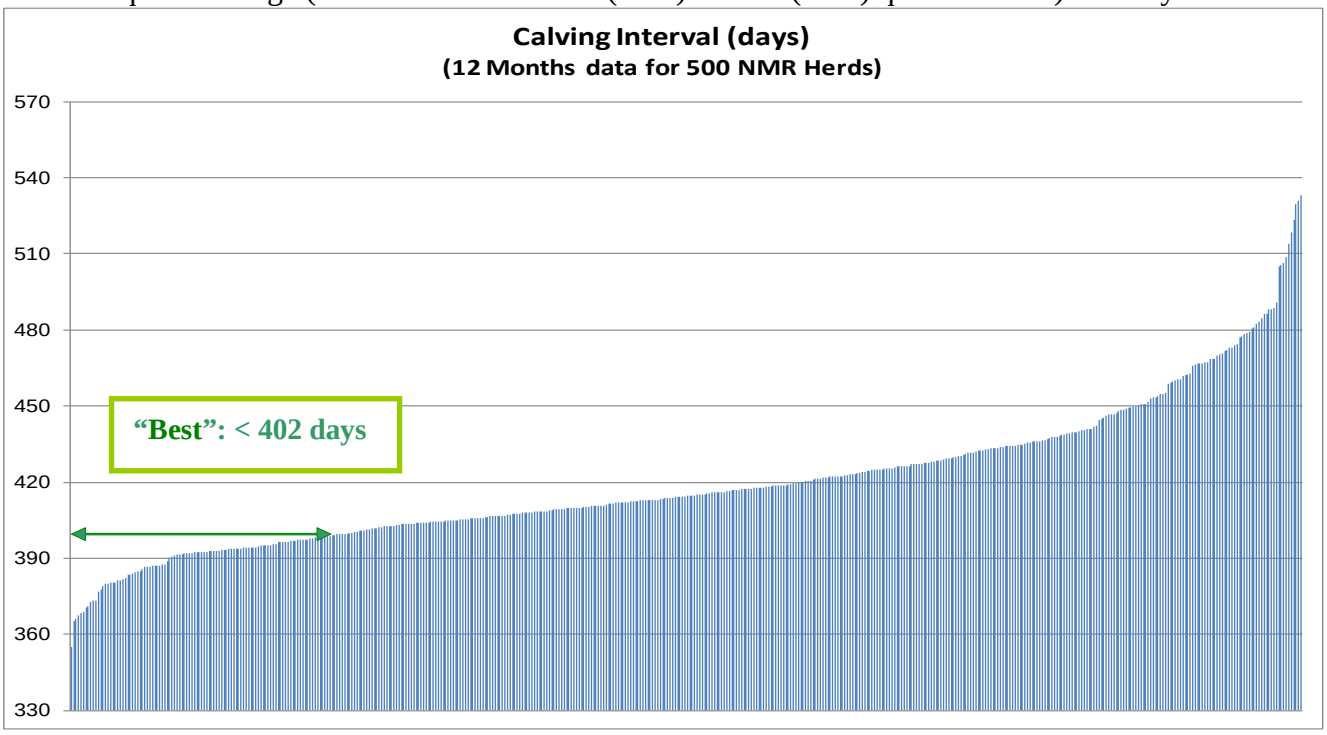
H. Calving interval: The average interval between consecutive calvings (in days).

Target (level achieved or surpassed by 25% of herds): 402 days

Median (level achieved by the middle herd): 414 days

75% level (level achieved or surpassed by 75% of herds): 433 days

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 31 days



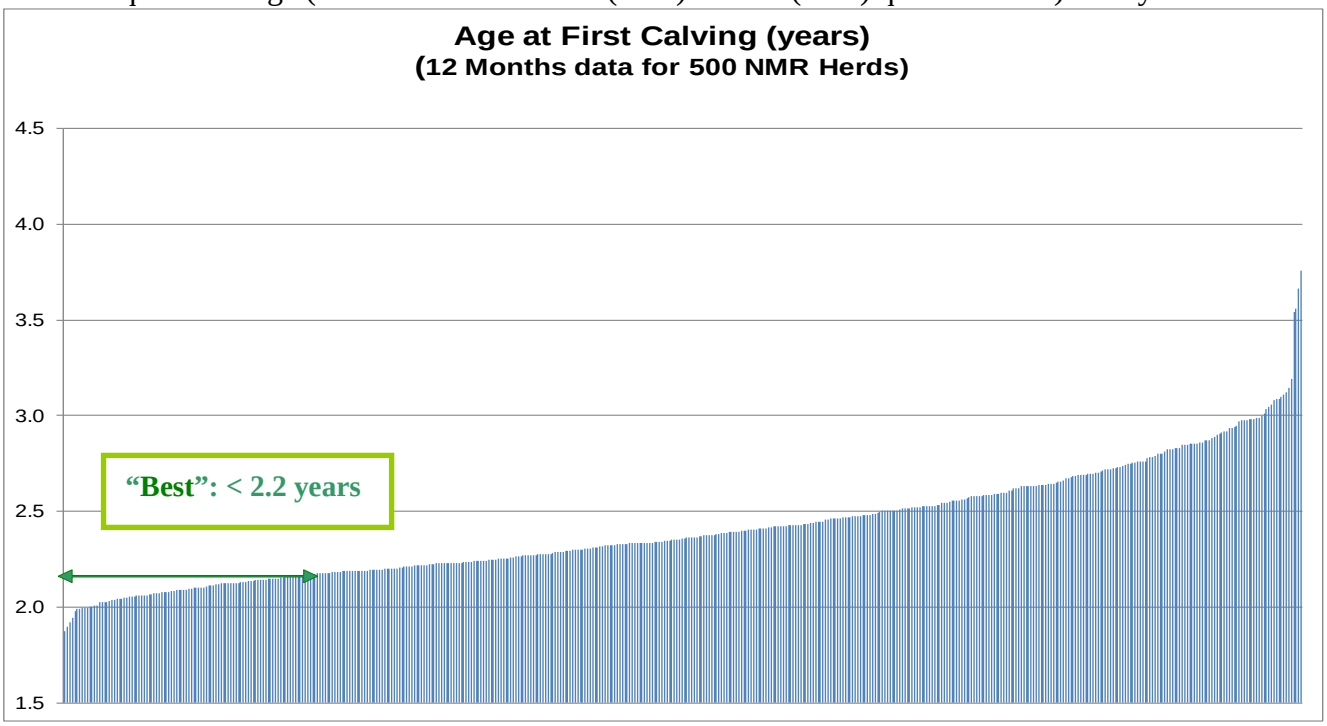
I. Age at 1st calving: The average age of heifers calving down (in years) over the last year.

Target (level achieved or surpassed by 25% of herds): 2.2 years

Median (level achieved by the middle herd): 2.4 years

75% level (level achieved or surpassed by 75% of herds): 2.6 years

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 0.4 years



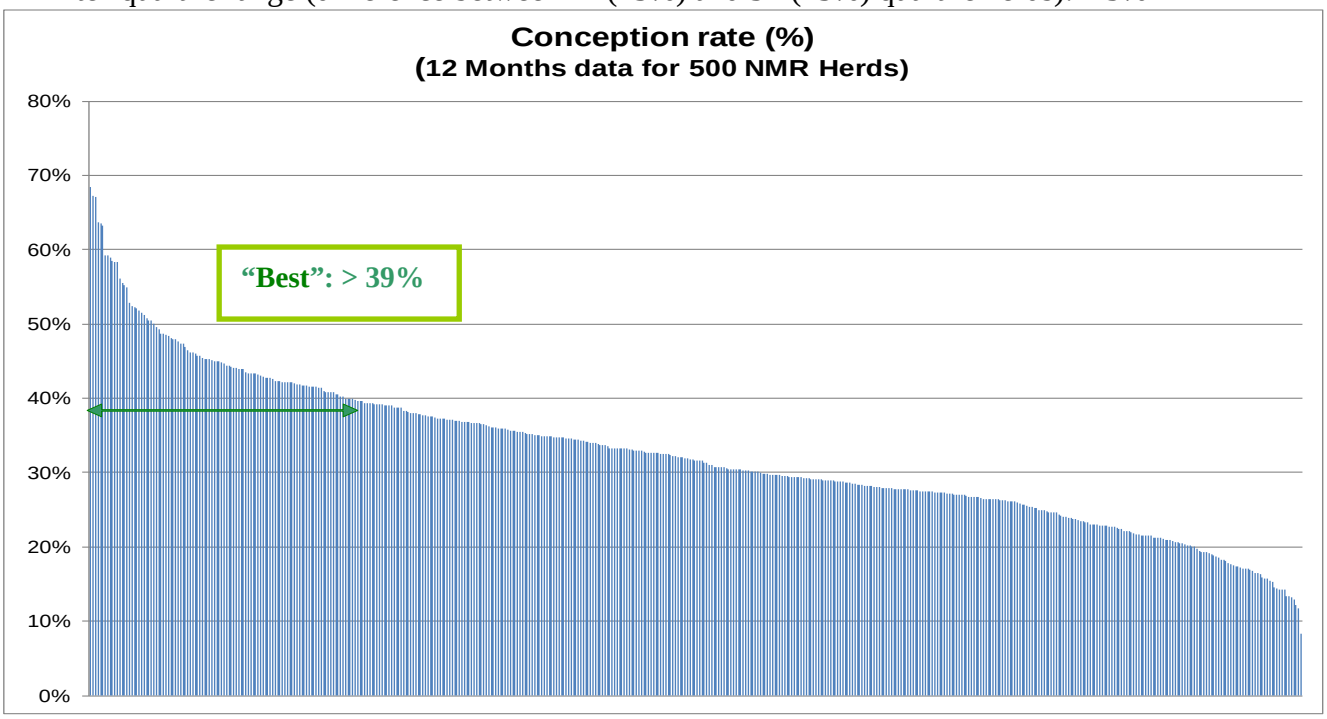
J. Conception rate: The average conception rate for all services in the last 12 months.

Target (level achieved or surpassed by 25% of herds): 39%

Median (level achieved by the middle herd): 32%

75% level (level achieved or surpassed by 75% of herds): 26%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 13%



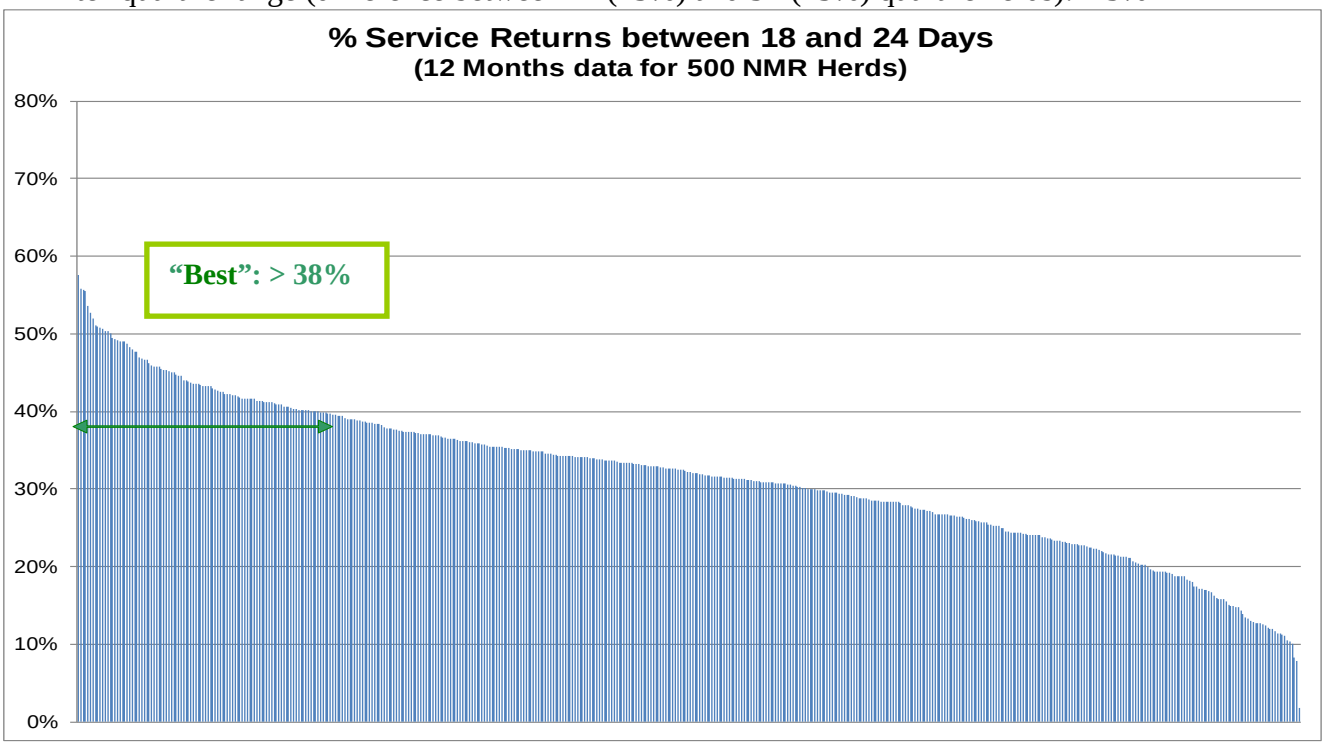
K. Percentage service intervals at 18-24 days: The % of all repeat services occurring 18-24 days (one oestrus cycle) after the previous service. A potential measure of heat detection efficiency.

Target (level achieved or surpassed by 25% of herds): 38%

Median (level achieved by the middle herd): 32%

75% level (level achieved or surpassed by 75% of herds): 25%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 13%



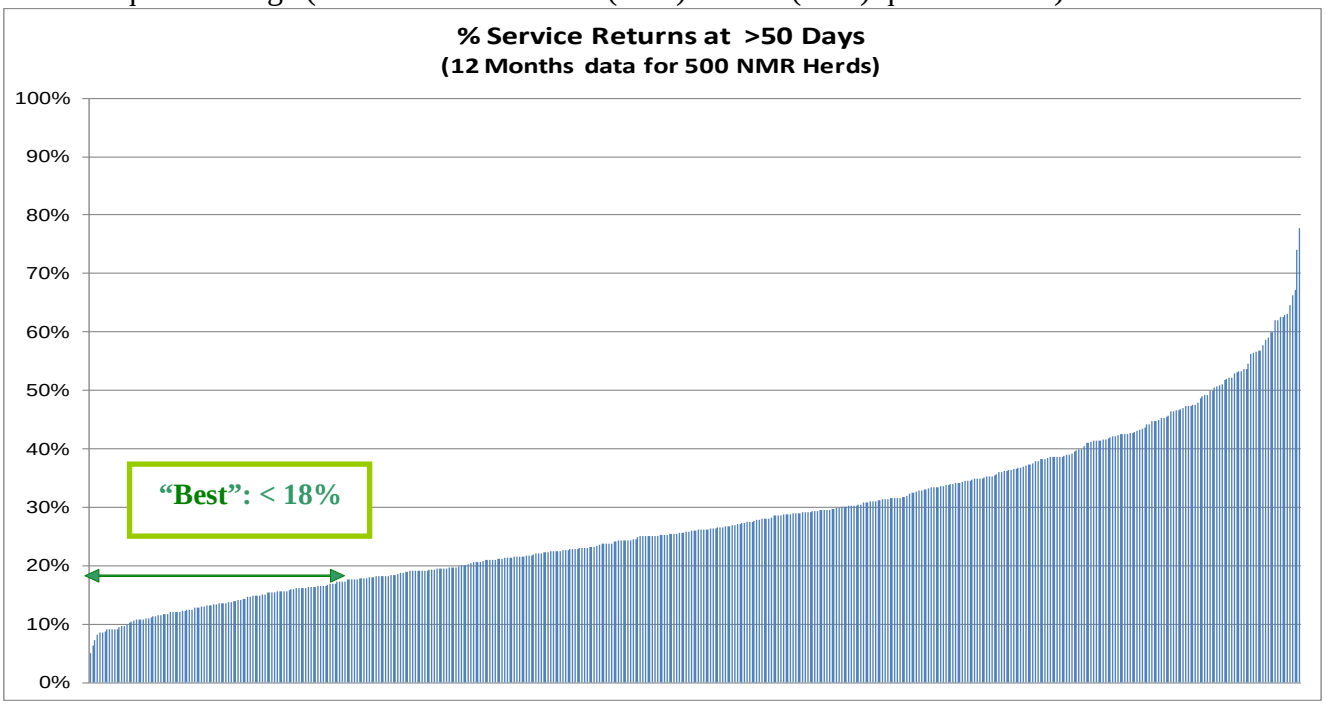
L. Percentage service intervals >50 days: The % of all repeat services with an interval of over 50 days since the previous service. A potential indicator of poor heat detection.

Target (level achieved or surpassed by 25% of herds): 18%

Median (level achieved by the middle herd): 26%

75% level (level achieved or surpassed by 75% of herds): 36%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 18%



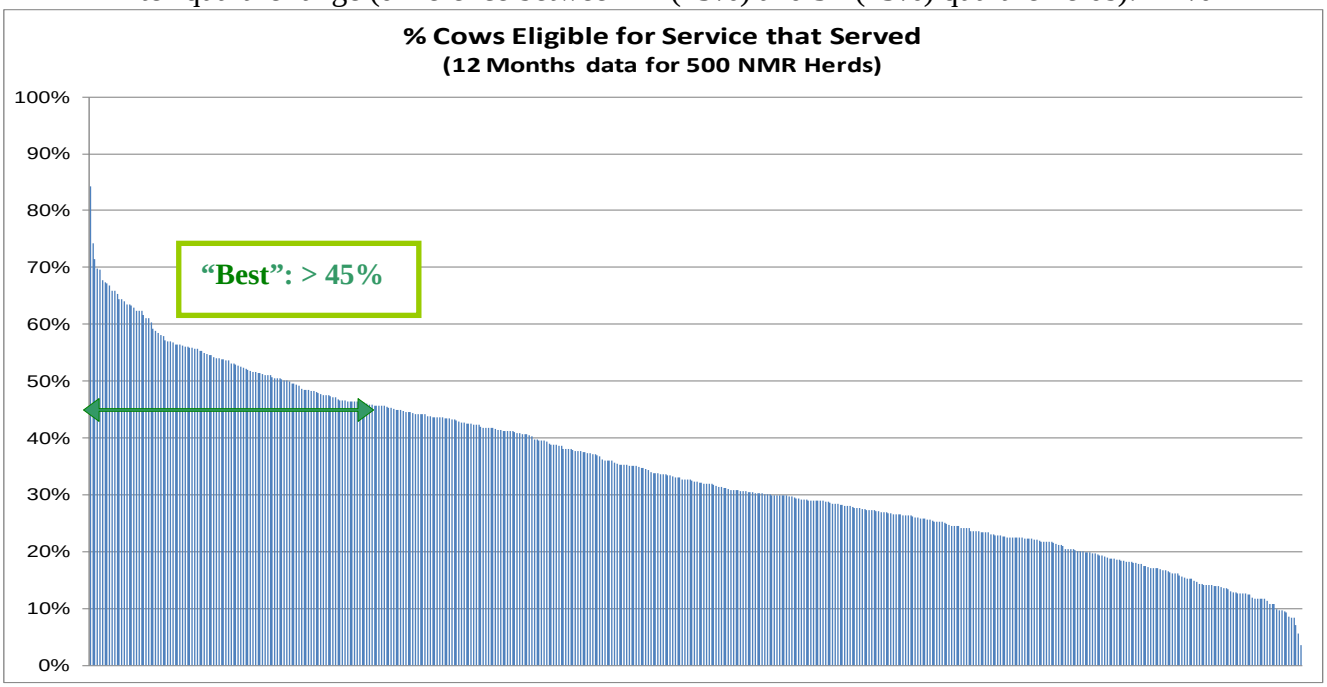
M. Percentage of cows eligible for service were served: The percentage of cows eligible for service (>42 days calved, not barren, not pregnant) that were served.

Target (level achieved or surpassed by 25% of herds): 45%

Median (level achieved by the middle herd): 32%

75% level (level achieved or surpassed by 75% of herds): 23%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 22%



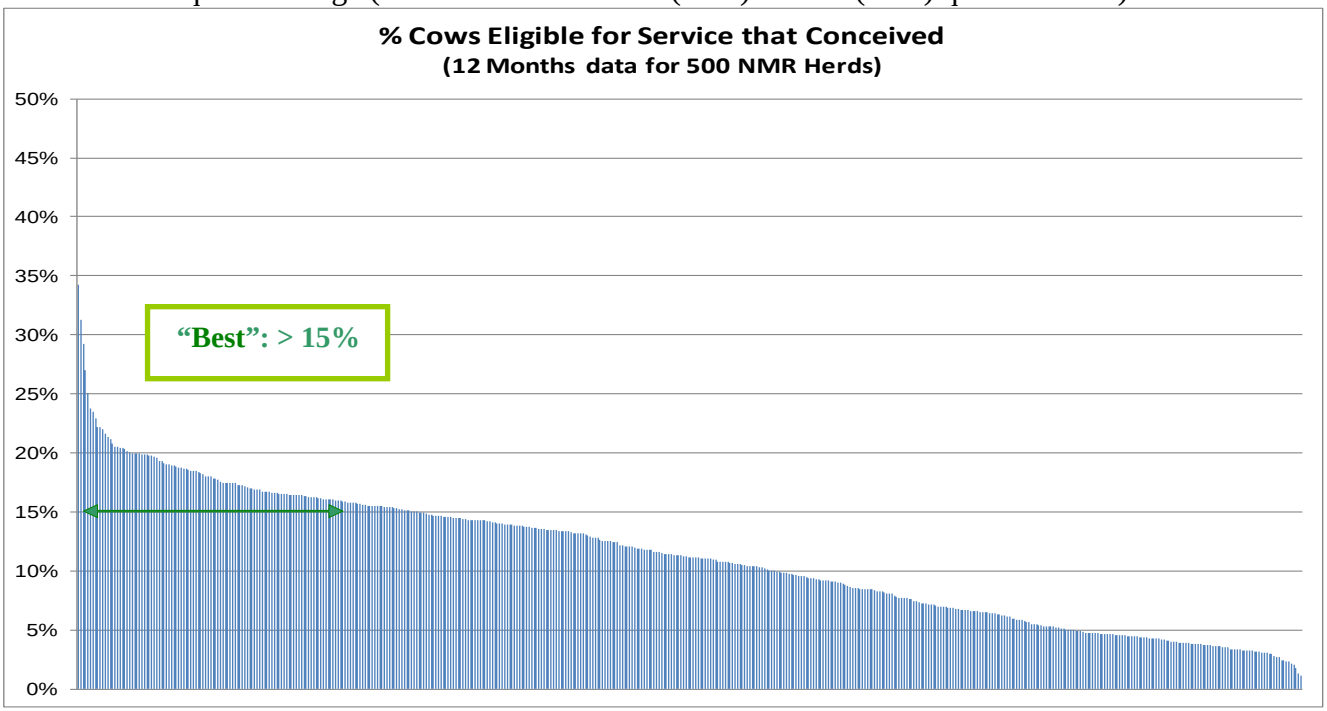
N. Percentage eligible for service that conceived: The percentage of cows eligible for service (>42 days calved, not barren, not pregnant) that conceived.

Target (level achieved or surpassed by 25% of herds): 15%

Median (level achieved by the middle herd): 11%

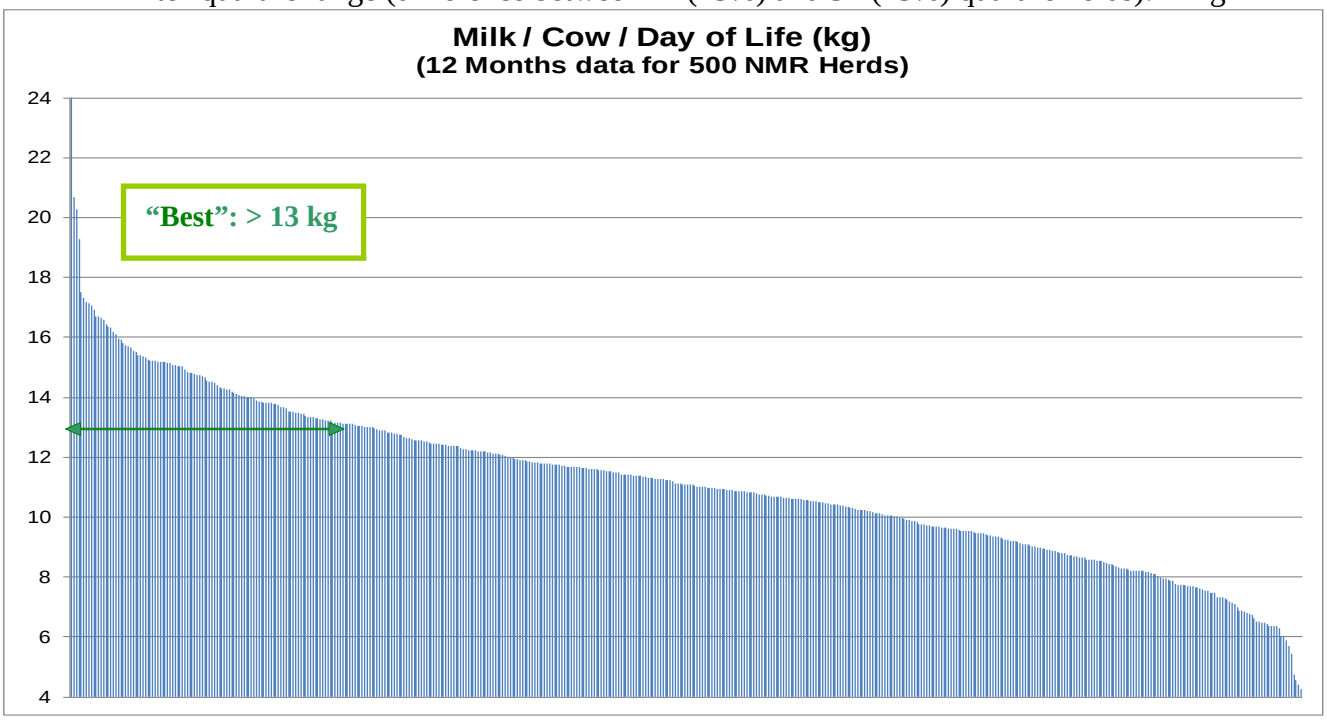
75% level (level achieved or surpassed by 75% of herds): 6%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 9%



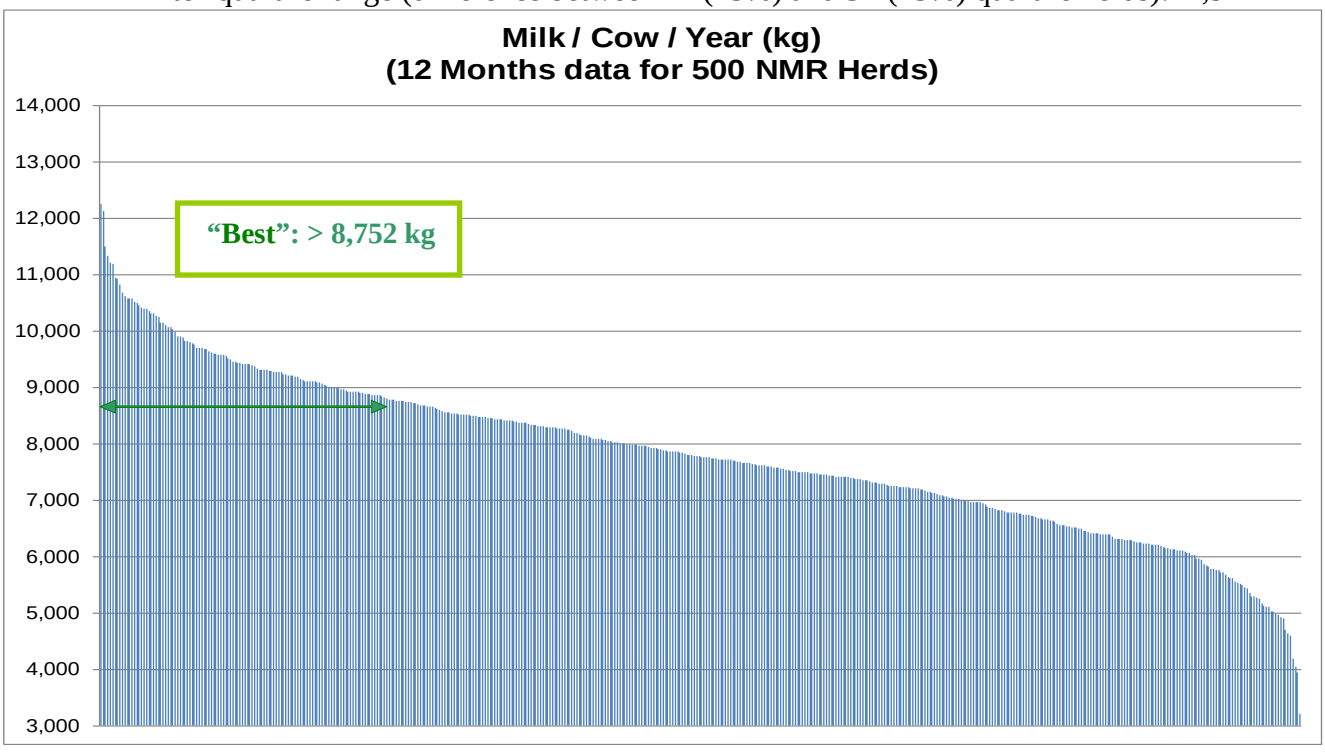
O. Lifetime milk / cow / year (kg): The average daily milk yield of cows in their lifetime (including unproductive periods: time as a heifer, dry period).

Target (level achieved or surpassed by 25% of herds): 13 kg
Median (level achieved by the middle herd): 11 kg
75% level (level achieved or surpassed by 75% of herds): 9 kg
Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 4 kg



P. Milk / cow / year (kg): The average annual milk yield of all cows in the specified year. Total milk divided by the average cow population. A measure of milk yield per cow place in the herd.

Target (level achieved or surpassed by 25% of herds): 8,752 kg
Median (level achieved by the middle herd): 7,769 kg
75% level (level achieved or surpassed by 75% of herds): 6,825 kg
Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 1,927



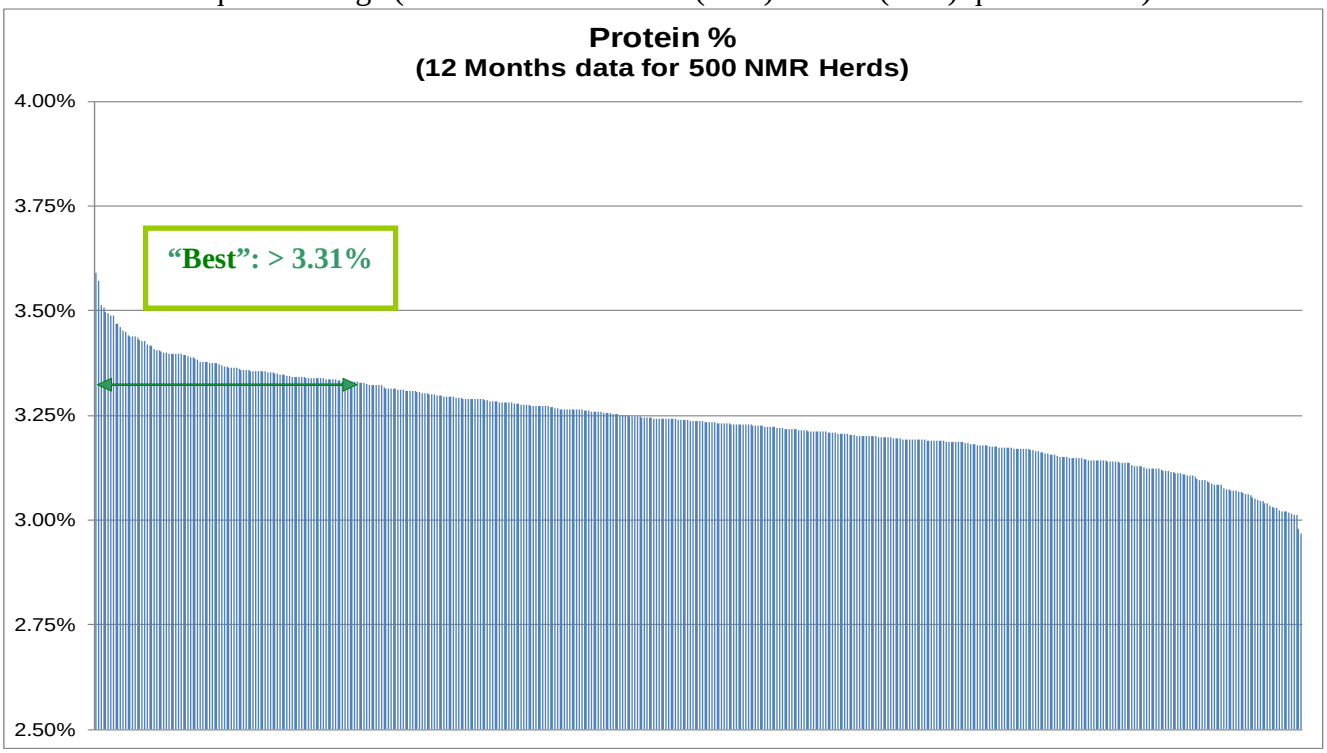
Q. Average protein%: The average % protein of all milk samples taken over the year.

Target (level achieved or surpassed by 25% of herds): 3.31%

Median (level achieved by the middle herd): 3.24%

75% level (level achieved or surpassed by 75% of herds): 3.17%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 0.14%



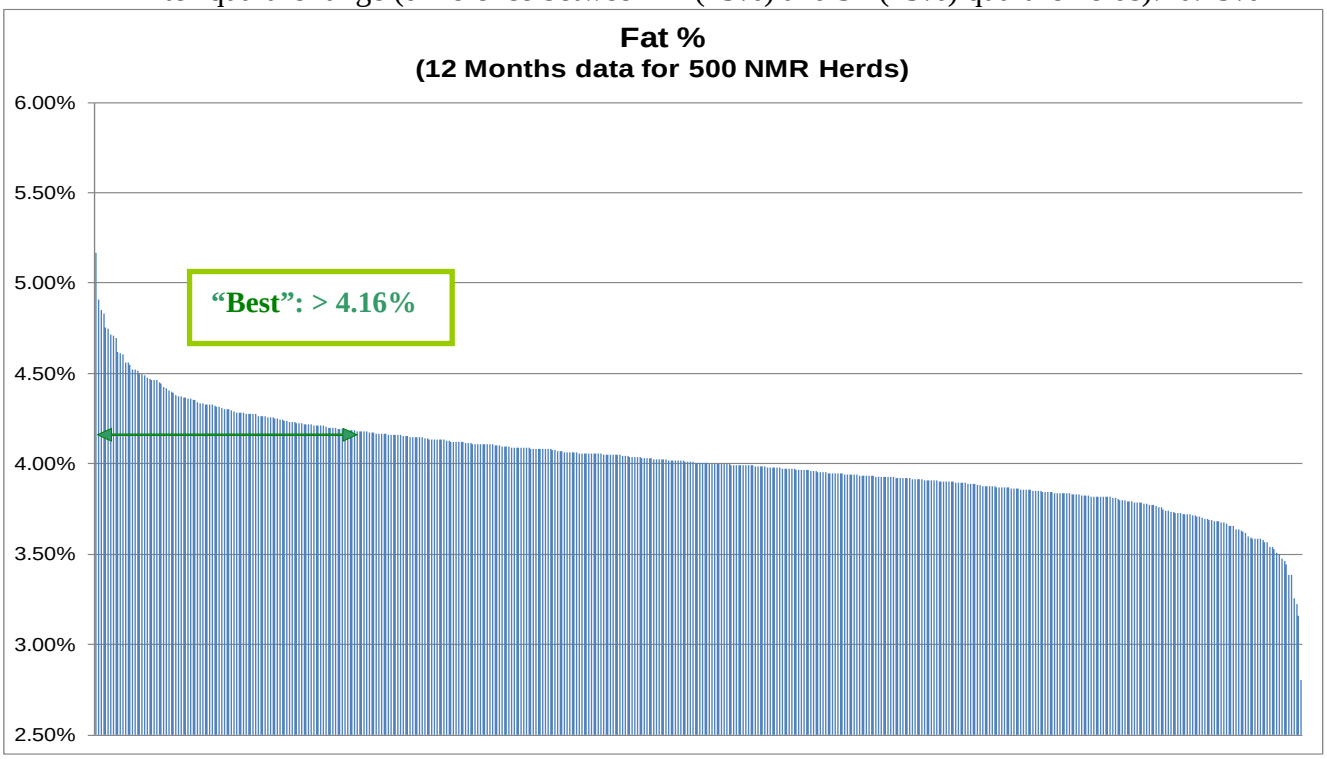
R. Average fat%: The average % fat of all milk samples taken over the year.

Target (level achieved or surpassed by 25% of herds): 4.16%

Median (level achieved by the middle herd): 4.00%

75% level (level achieved or surpassed by 75% of herds): 3.87%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 0.29%



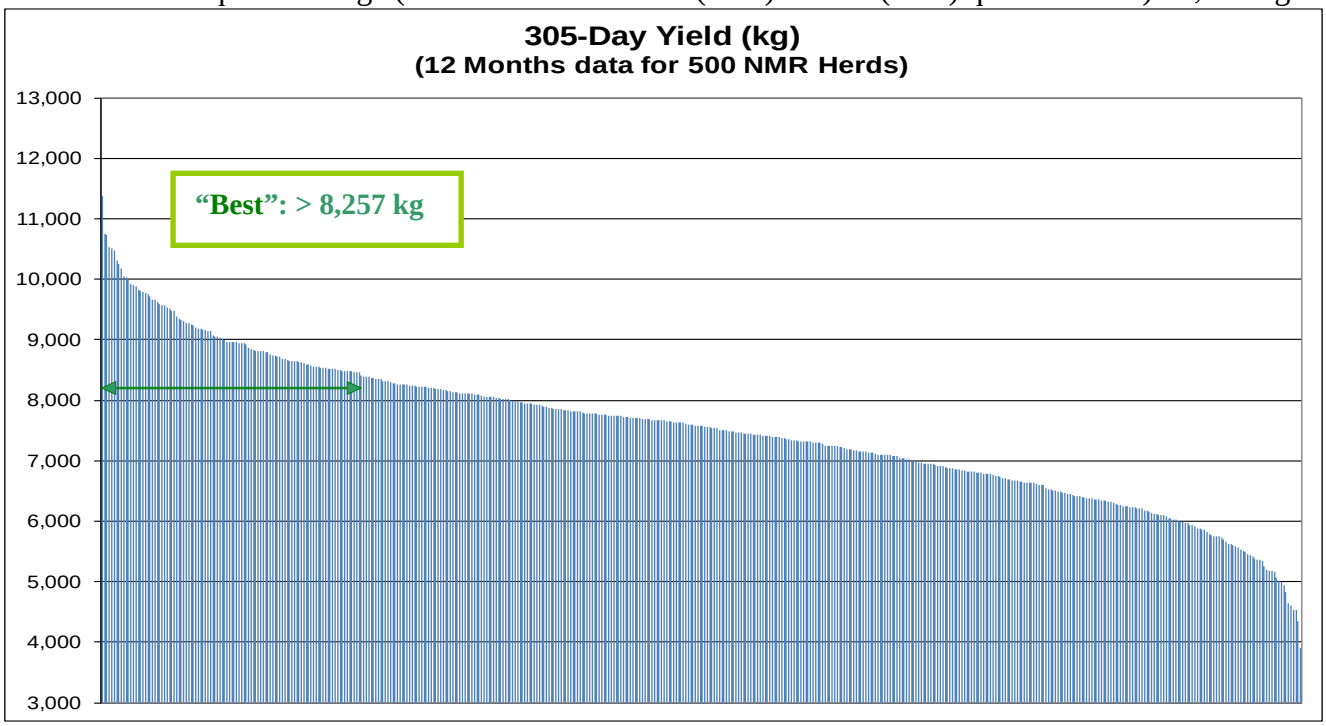
S. 305 day yield (kg): The average yield of cows by day 305 of the lactation.

Target (level achieved or surpassed by 25% of herds): 8,257 kg

Median (level achieved by the middle herd): 7,577 kg

75% level (level achieved or surpassed by 75% of herds): 6,727 kg

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 1,530 kg



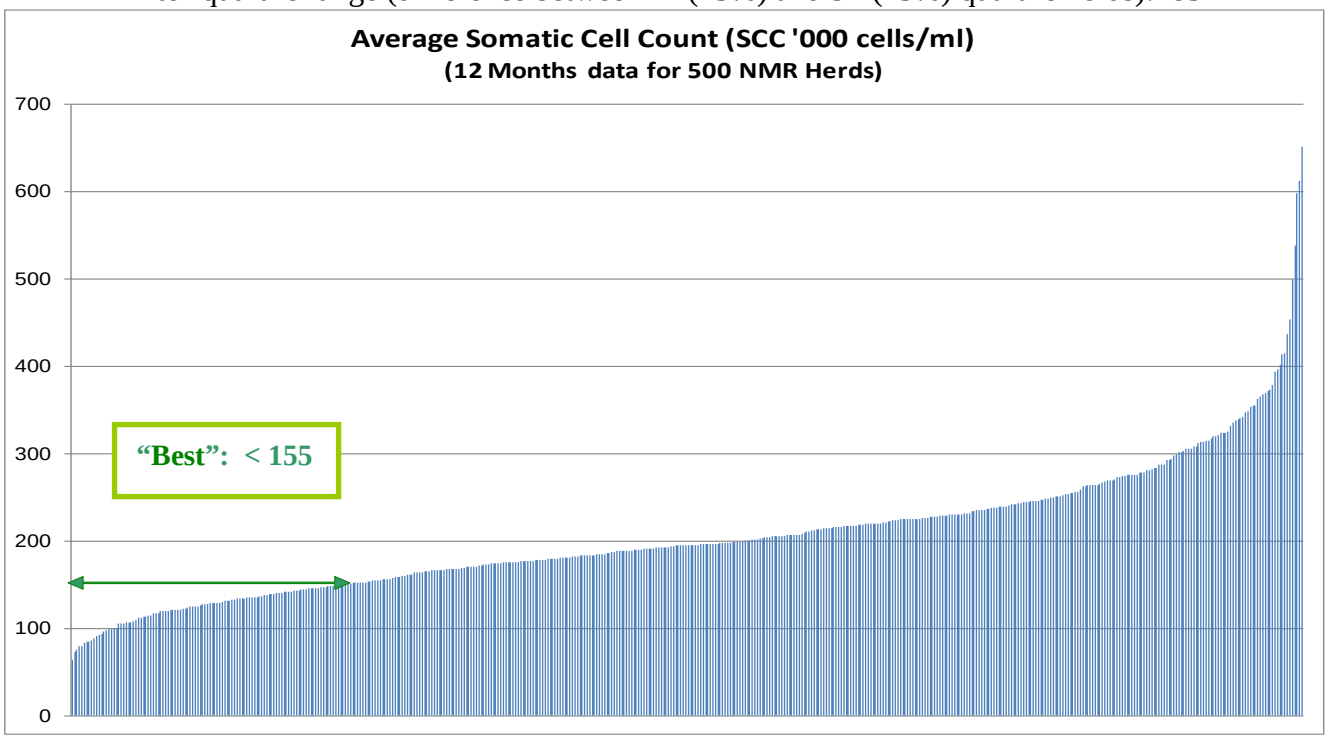
T. Herd SCC ('000 cells/ml): The weighted average SCC of all milk samples taken in the last 12 months.

Target (level achieved or surpassed by 25% of herds): 155

Median (level achieved by the middle herd): 195

75% level (level achieved or surpassed by 75% of herds): 238

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 83



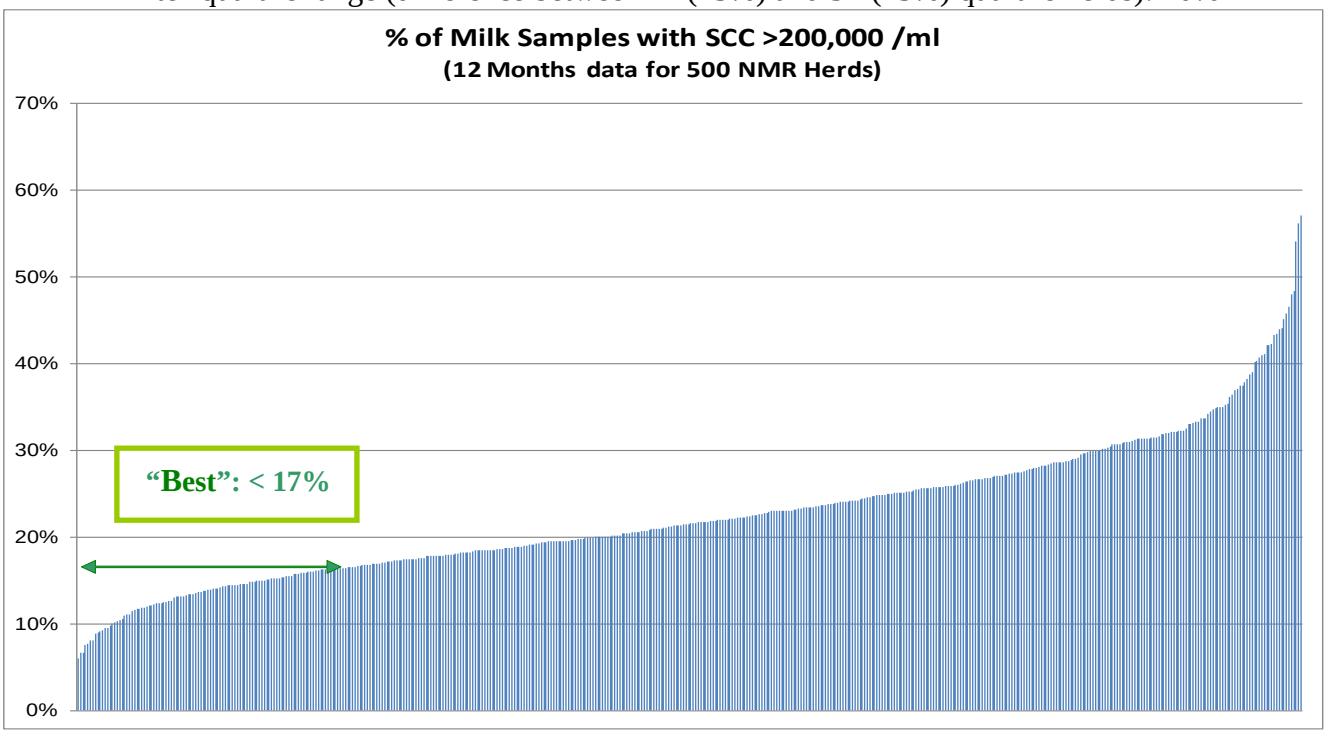
U. Percentage of milk samples with SCC >=200,000 cells/ml: The % of milk samples in the last 12 months with a SCC over 200,000 cells/ml milk. Indicates the size of any reservoir of infection.

Target (level achieved or surpassed by 25% of herds): 17%

Median (level achieved by the middle herd): 22%

75% level (level achieved or surpassed by 75% of herds): 27%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 10%



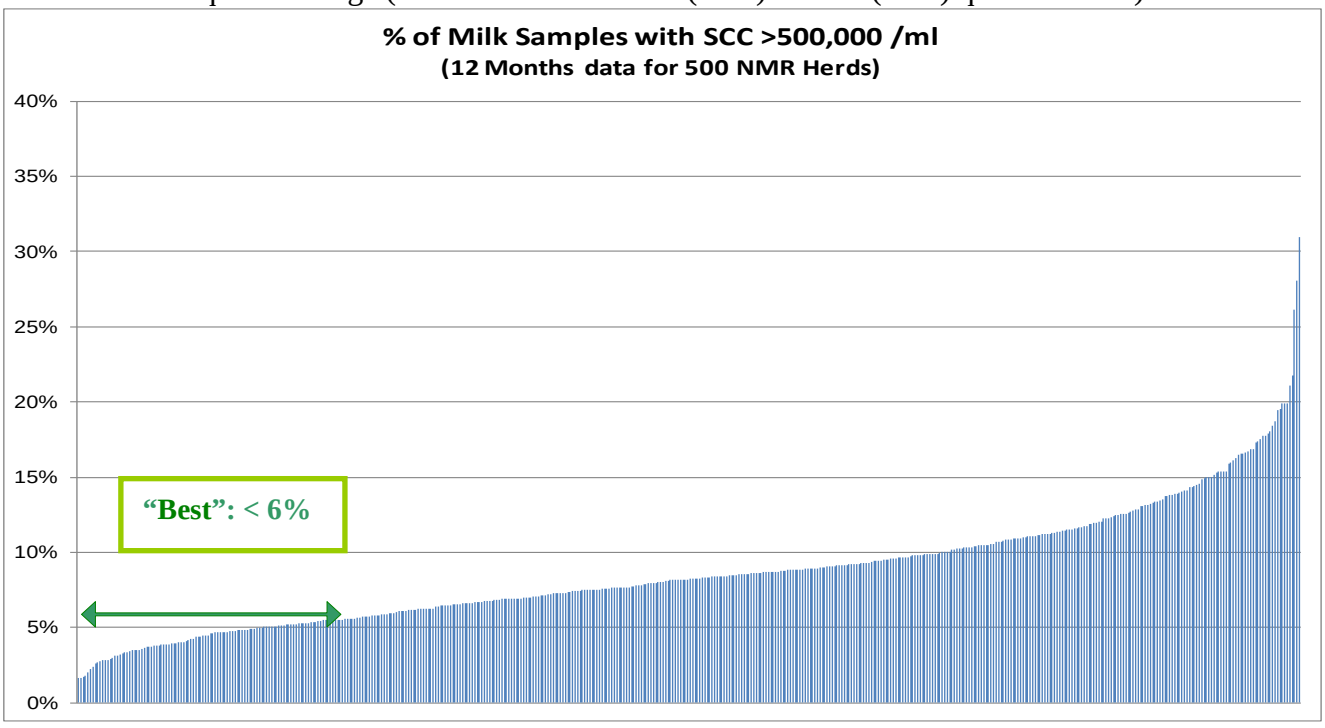
V. Percentage of milk samples with SCC >500,000 cells/ml: The % of milk samples taken in the last 12 months with a SCC over 500,000 cells/ml of milk.

Target (level achieved or surpassed by 25% of herds): 6%

Median (level achieved by the middle herd): 8%

75% level (level achieved or surpassed by 75% of herds): 11%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 5%



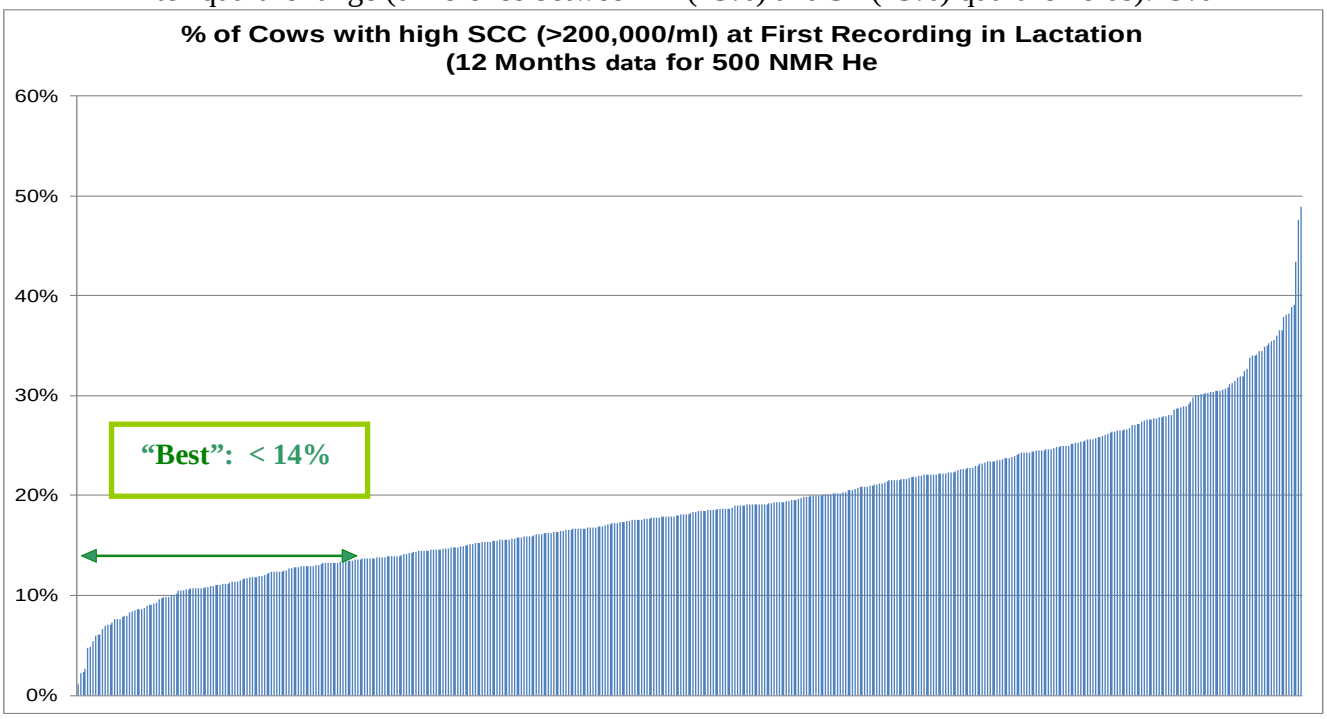
W. Percentage 1st recording SCC >=200,000 cells/ml: The % of new lactations in the last year starting with a high SCC (>200,000 cells) at the first milk recording.

Target (level achieved or surpassed by 25% of herds): 14%

Median (level achieved by the middle herd): 18%

75% level (level achieved or surpassed by 75% of herds): 23%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 9%



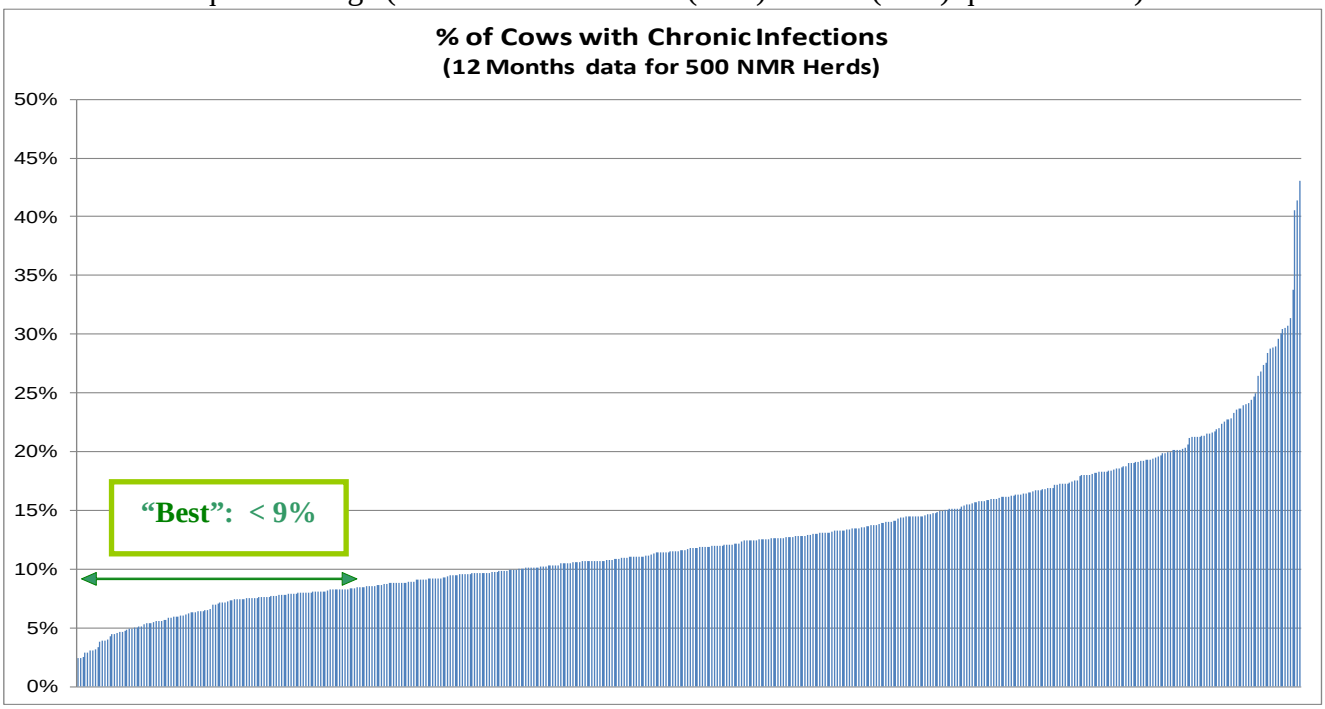
X. Percentage chronic SCC >=200,000 cells/ml: The % of all milk samples taken over the last 12 months that were from CHRONIC cows (cows whose milk was over 200,000 cells at both the CURRENT AND PREVIOUS milk recordings).

Target (level achieved or surpassed by 25% of herds): 9%

Median (level achieved by the middle herd): 12%

75% level (level achieved or surpassed by 75% of herds): 16%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 7%



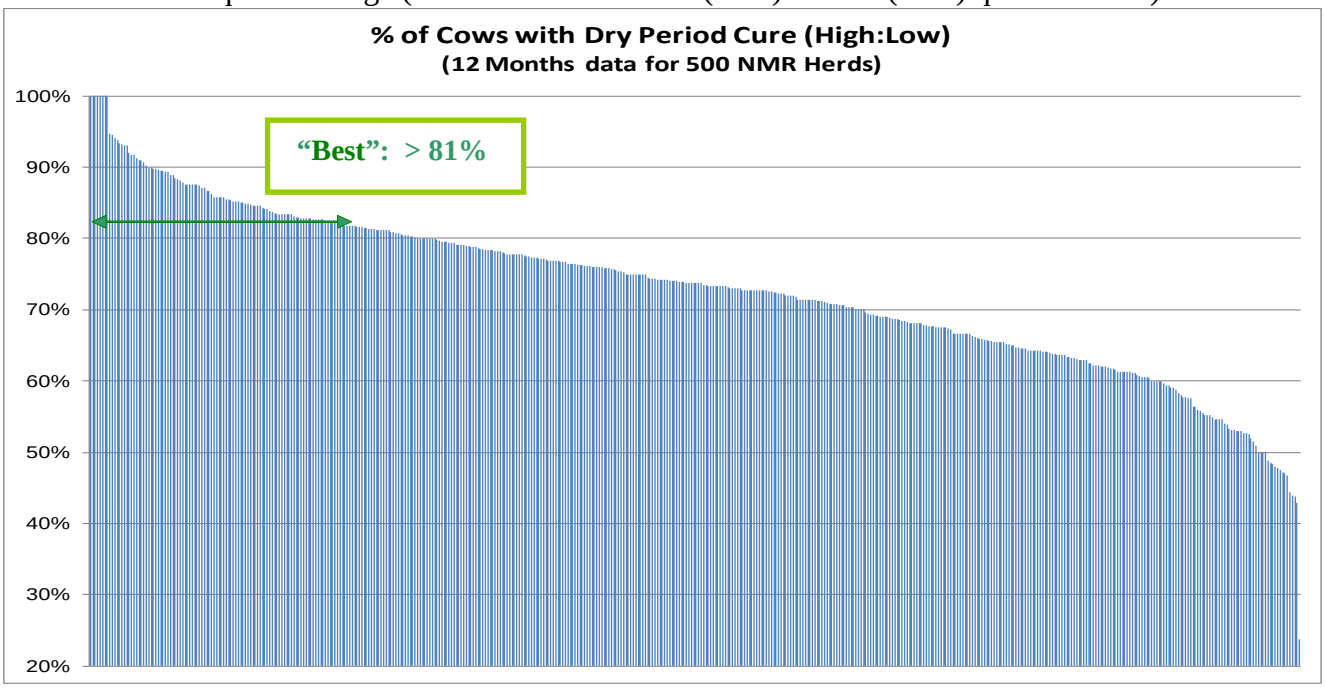
Y. Percentage Dry period cure (High:Low): The % of cows calving in the last year that ended their previous lactation with a high SCC (>200,000 cells), started the new lactation with a LOW cell count (<200,000 cells). The % of high SCC cows "cured" by the dry period.

Target (level achieved or surpassed by 25% of herds): 81%

Median (level achieved by the middle herd): 74%

75% level (level achieved or surpassed by 75% of herds): 66%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 15%



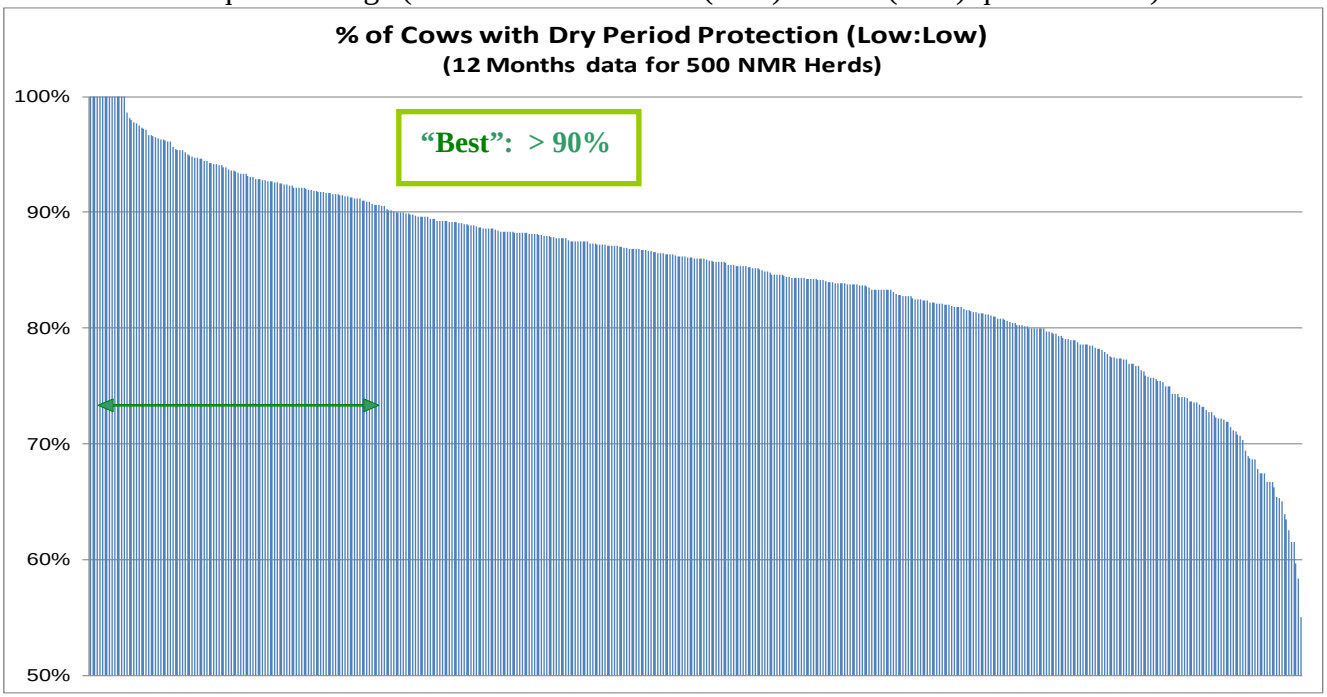
Z. Percentage Dry period protection (Low:Low): The % of cows calving in the last year that ended the previous lactation with a LOW SCC (<200,000 cells) then started the new lactation with a LOW cell count (<200,000 cells). The % of low SCC cows "protected" in the dry period.

Target (level achieved or surpassed by 25% of herds): 90%

Median (level achieved by the middle herd): 86%

75% level (level achieved or surpassed by 75% of herds): 81%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 9%



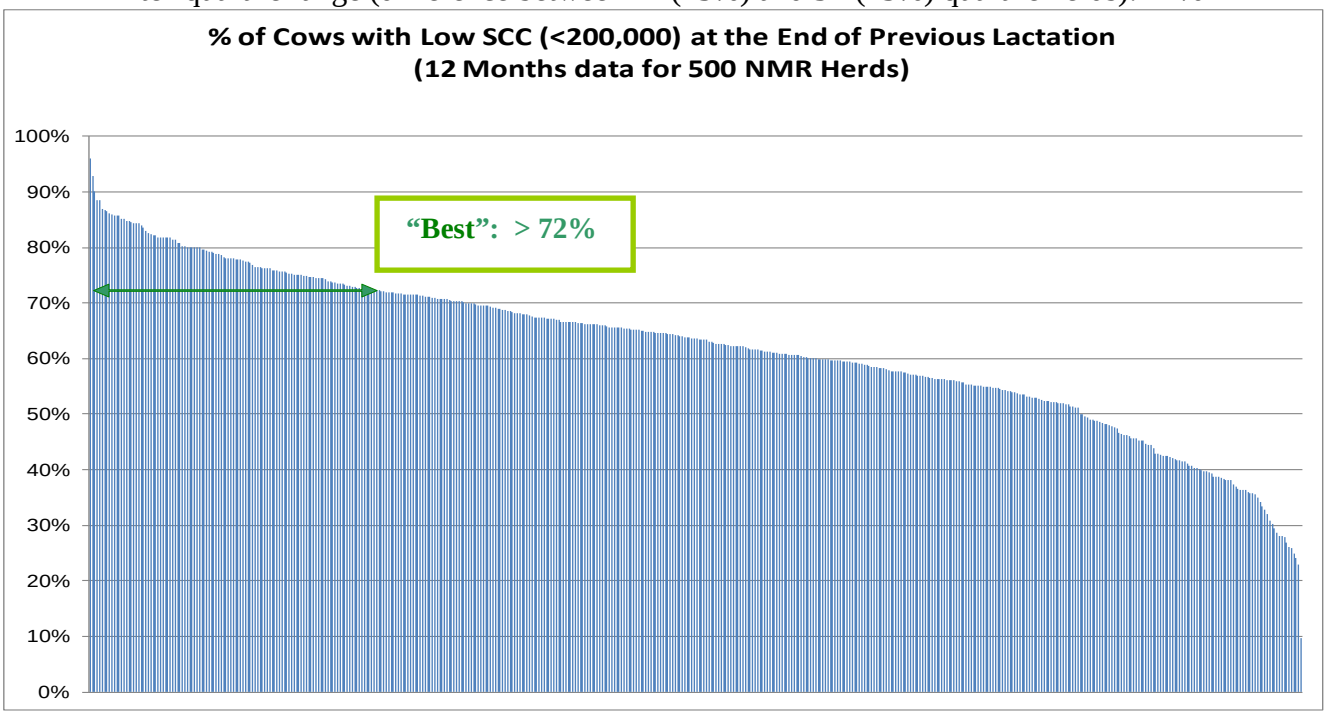
ZA. Percentage Low at the end of previous lactation: The % of cows calving in the last year that ended their previous lactation with a LOW SCC (<200,000 cells).

Target (level achieved or surpassed by 25% of herds): 72%

Median (level achieved by the middle herd): 64%

75% level (level achieved or surpassed by 75% of herds): 55%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 17%



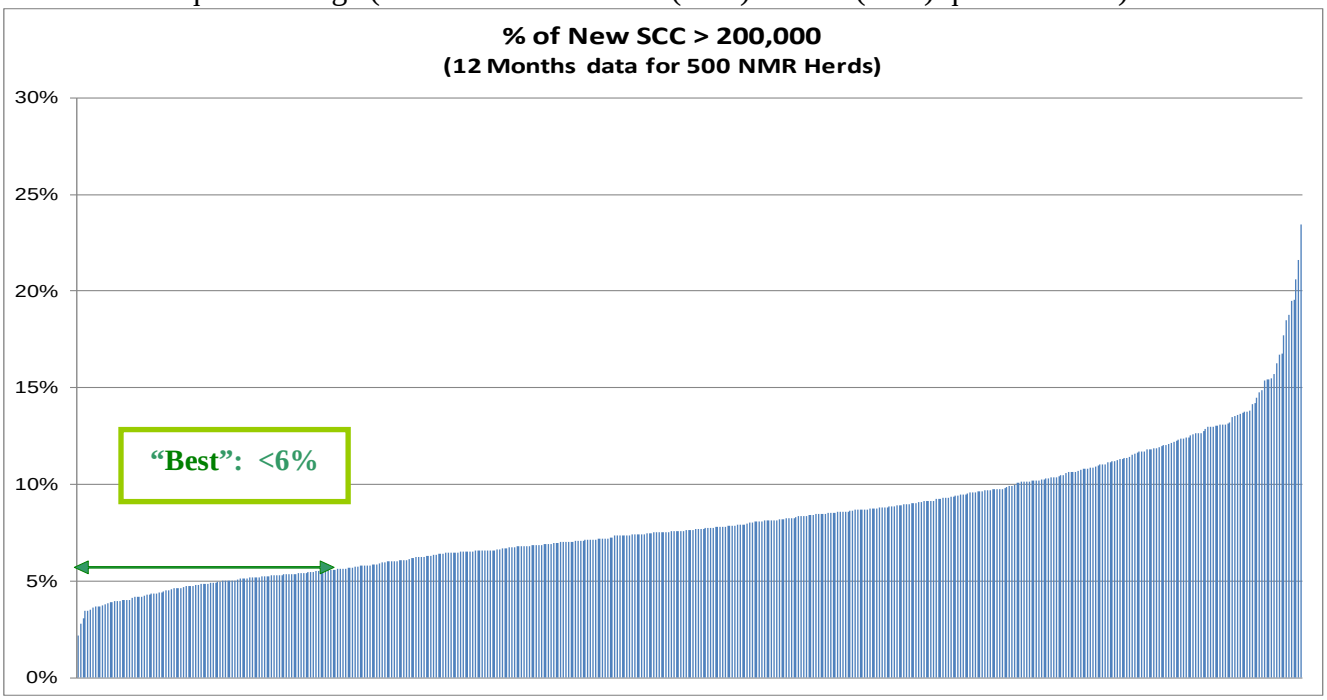
ZB. The percentage of NEW SCC milk samples: Of all milk samples the % that were of the NEW Herd Companion SCC Category (the first HIGH SCC (>=200,000cells/ml) in a lactation following one or more low SCC samples).

Target (level achieved or surpassed by 25% of herds): 6%

Median (level achieved by the middle herd): 8%

75% level (level achieved or surpassed by 75% of herds): 10%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 4%



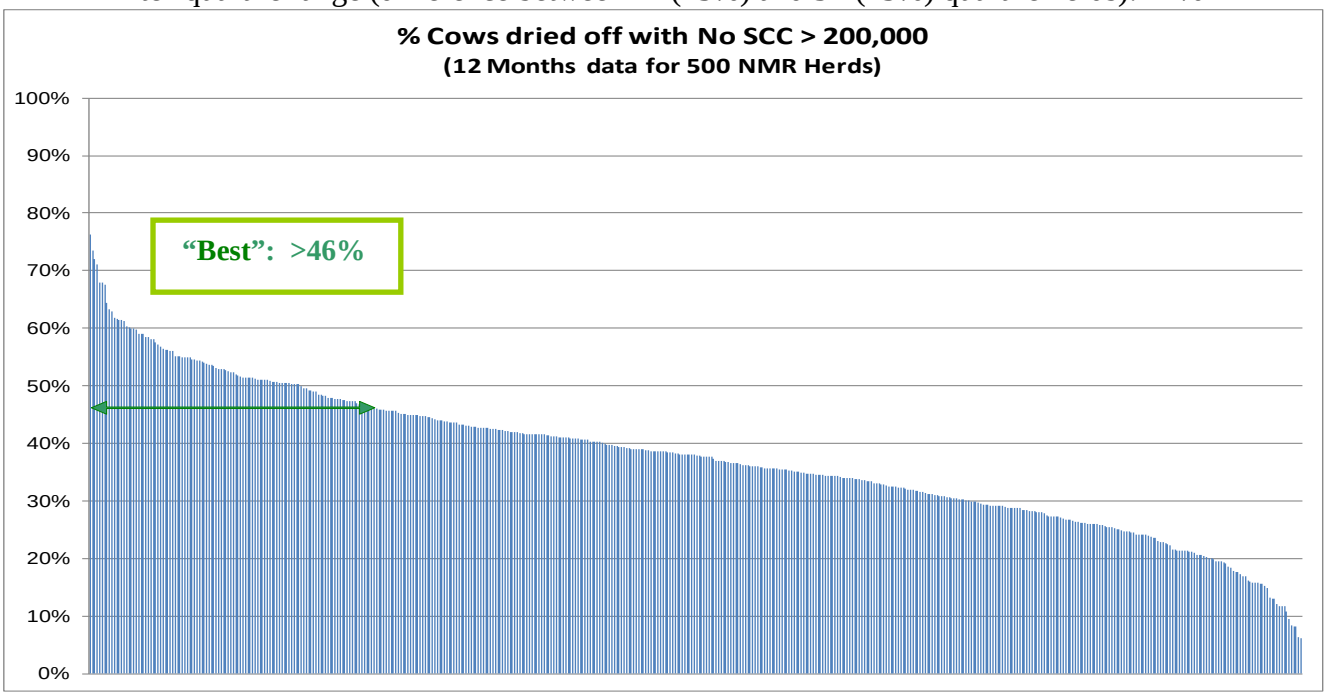
ZC. Percentage Dried-off with no SCC >200,000 cells/ml: The percentage of cows recording only LOW SCC samples (<200,000 cells/ml) in completed lactations.

Target (level achieved or surpassed by 25% of herds): 46%

Median (level achieved by the middle herd): 38%

75% level (level achieved or surpassed by 75% of herds): 29%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 17%



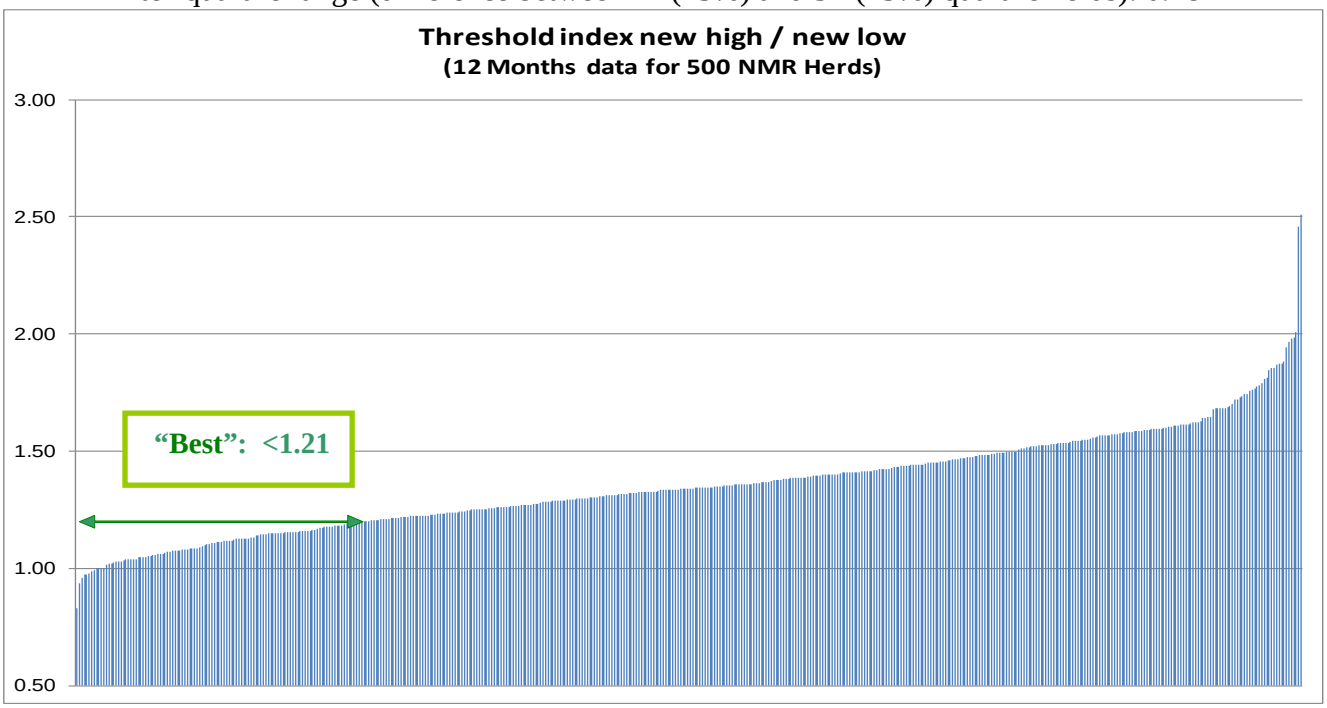
ZD. Threshold Index new high / new low: The total cows changing from Low to High SCC divided by the total cows changing from High to Low SCC at consecutive recordings.

Target (level achieved or surpassed by 25% of herds): 1.21

Median (level achieved by the middle herd): 1.34

75% level (level achieved or surpassed by 75% of herds): 1.49

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 0.28



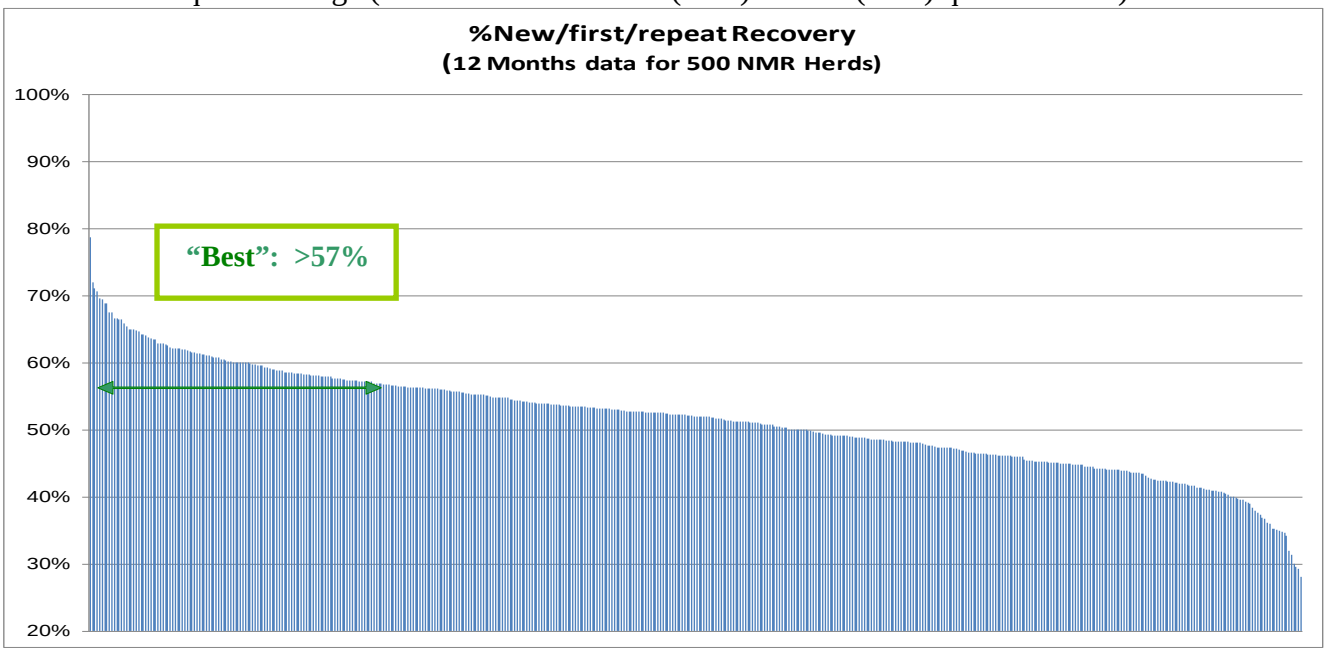
ZE. Recovery percentage of New/First/Repeat infections: Of HIGH SCC cows (>=200,000cells/ml) that at the previous recording were either low SCC or not yet in milk, the percentage that were LOW SCC (<200,000 cells/ml) at the following recording.

Target (level achieved or surpassed by 25% of herds): 57%

Median (level achieved by the middle herd): 52%

75% level (level achieved or surpassed by 75% of herds): 46%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 11%



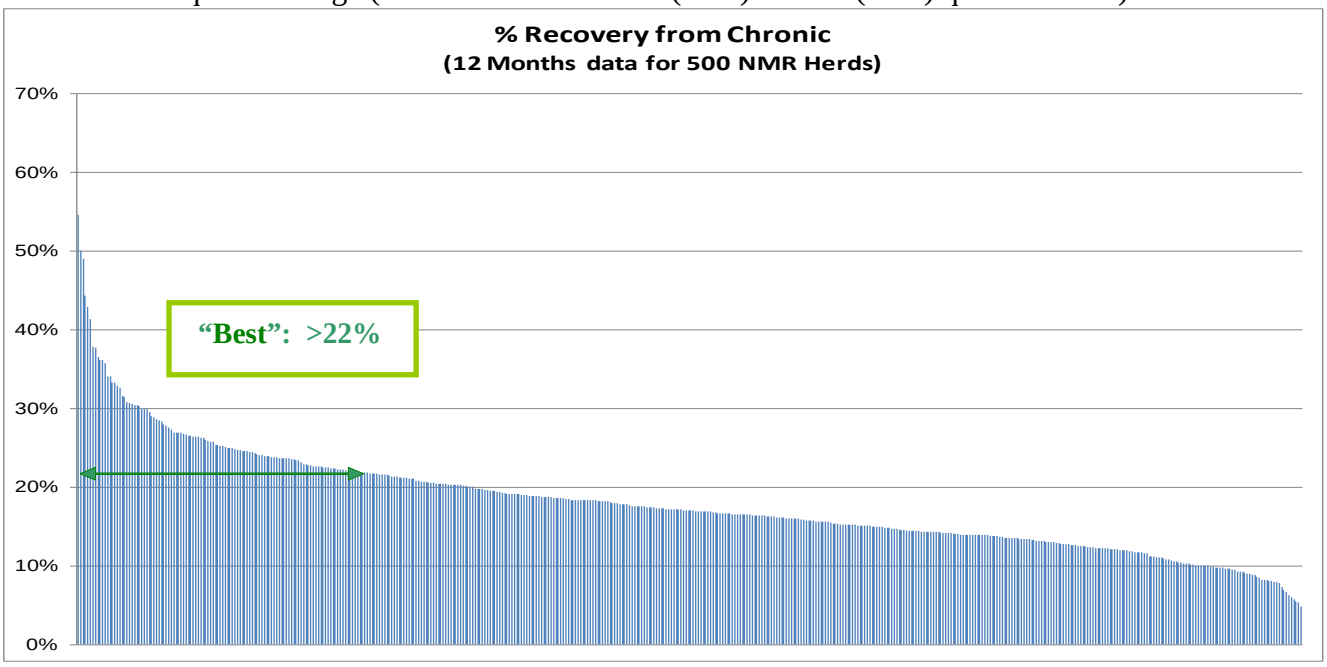
ZF. Recovery percentage of chronic infections: Of cows with two or more consecutive HIGH SCC recordings (>=200,000 cells/ml), the percentage that recorded a LOW SCC (<200,000 cells/ml) at the following recording.

Target (level achieved or surpassed by 25% of herds): 22%

Median (level achieved by the middle herd): 17%

75% level (level achieved or surpassed by 75% of herds): 14%

Inter-quartile range (difference between 1st (25%) and 3rd (75%) quartile herds): 8%



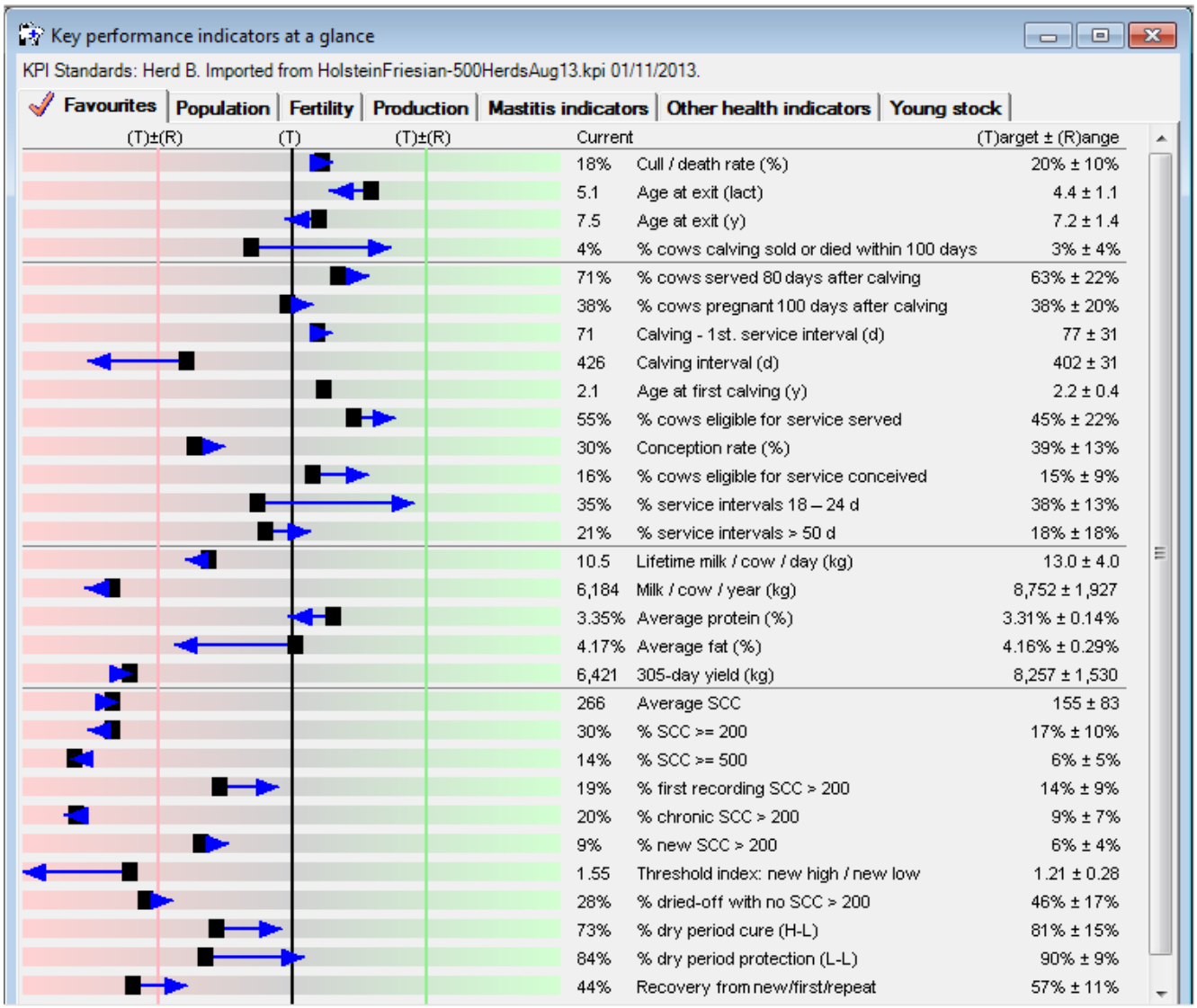
Section 3. The Practical Use of Key Performance Indicators By Farmers And Their Technical Advisers

The figures obtained from this study can be treated as “national standards” with target values set at the level currently achieved on one in four dairy farms. A farmer can readily see where his/her herd would appear for each parameter and focus on discussion in to the causes and options for improvement.

The Key Performance Indicators Report in the InterHerd+ program provides an overview of performance for an individual herd. Parameters calculated from the herd’s milk recording data are compared with the target and inter-quartile range values of the study (Figure 3). This highlights areas of strength and weakness in that herd’s performance.

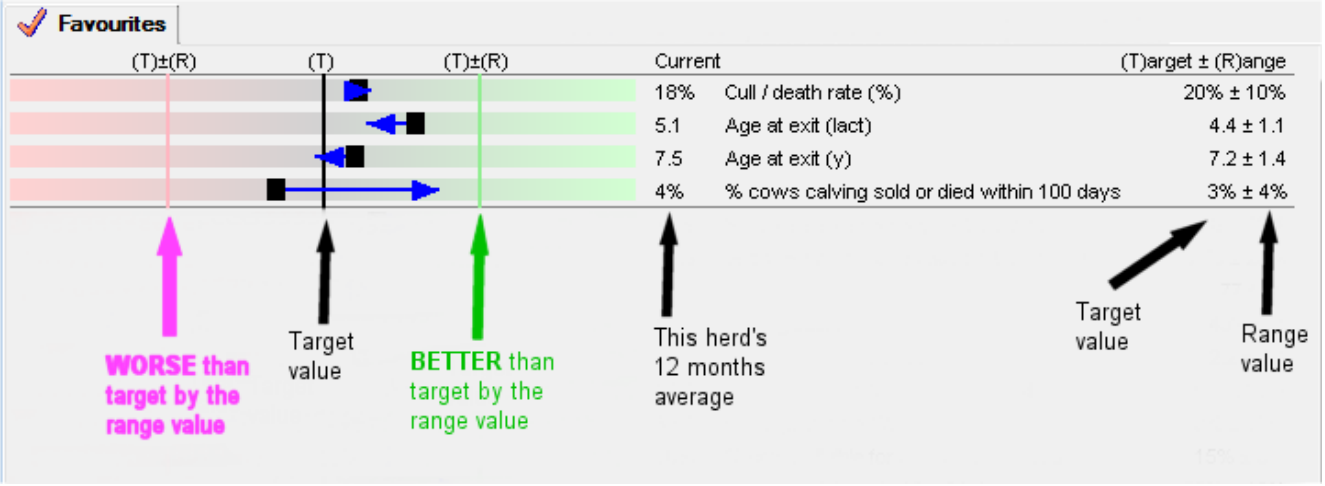
The combination of parameters relating to production, fertility and health, the study acknowledges the dynamic nature of dairy production and the need for high standards across all areas of herd management. Many herds are excellent in one area of production, fertility or health but seldom in all.

Figure 3. The Key Performance Indicator Report of InterHerd+



The meaning of the different lines and values against each key performance indicator are explained in Figure 4.

Figure 4. The KPI Report: The figures explained



The value given to the left of each parameter title represents the herd's performance over the last year. It is the rolling 12 month average for that parameter. In Figure 4 the herd had a cull/death rate averaging 18% over the previous 12 months.

To the right of each listed parameter is a **target** value and a **range** (corresponding to the values given in Tables 1.a & 1.b)**.** In Figure 4 the TARGET value for cull/death rate is 20% with a range of ±10%.

These values are also displayed graphically to the left of the parameter titles. The **target** value is represented by the **vertical black** line. The area to the right hand side is shaded green to denote a performance level that is **better** than the target value. The vertical green line represents "Better than target by the range".

Left of the target line is shaded **red** denoting performance that is **worse** than the target value. The **vertical red** line represents the level that is "**worse than the target by the range value**" (so the performance of the poorer performing 25% of herds). In Figure 4 for culling rate, the red vertical line represents the target (20%) worse by the range (10%) so a culling rate of 30%.

The positions of the black square and blue arrow  show how the current herd is performing for each parameter relative to the specified target and range values. The arrow indicates any direction of change.

- The **black square** is the **12 month rolling average** value for that parameter. So it is the longer-term performance based on the last 12 months of data (the value displayed to the left of the parameter title).
- The **blue** arrow head is the **3 months rolling average** value for that parameter. In other words it is the short-term performance based on the last 3 months only. The line and arrow show the difference and direction of change between the 3 and 12 month average values. Beware that while this may indicate a significant change in herd performance, the blue line may also be influenced by seasonal factors in that 3 month period.

Using the target and range values to highlight a herd's strengths & weaknesses

Herd strengths: This study sets the **TARGET** value to the level achieved by the "BEST" 25% of the 500 herds. Thus in the graphic of Figure 5, any KPI with a black square to the **right (green side) of the black target line** would be "**in the best 25%**" when compared to the 500 study herds. In the herd displayed in Figure 5 there are 9 parameters "better than target" (highlighted in green boxes). This

includes culling/longevity, several fertility parameters and milk protein%, while none of the cell count parameters are "top league".

Herd weaknesses: With the **RANGE** set at the difference between the 25 and 75 percentile herds, the **vertical red line** represents the performance achieved or bettered by 75% of the 500 herds (the target, worse by the range). Therefore, any parameter with a black square to the **left of the vertical red line** would be **"in the bottom 25%"** for that parameter when compared with the 500 study herds. There are 9 parameters highlighted red in Figure 5, including milk yield and most cell counts parameters.

Average performance levels: Parameters that fall between the vertical black and red lines are within the inter-quartile range when compared with the 500 study herds. For the herd in Figure 5 this includes calving interval, conception rate, heat detection and few cell count parameters.

Figure 5. Highlighting the strengths and weaknesses of a dairy herd

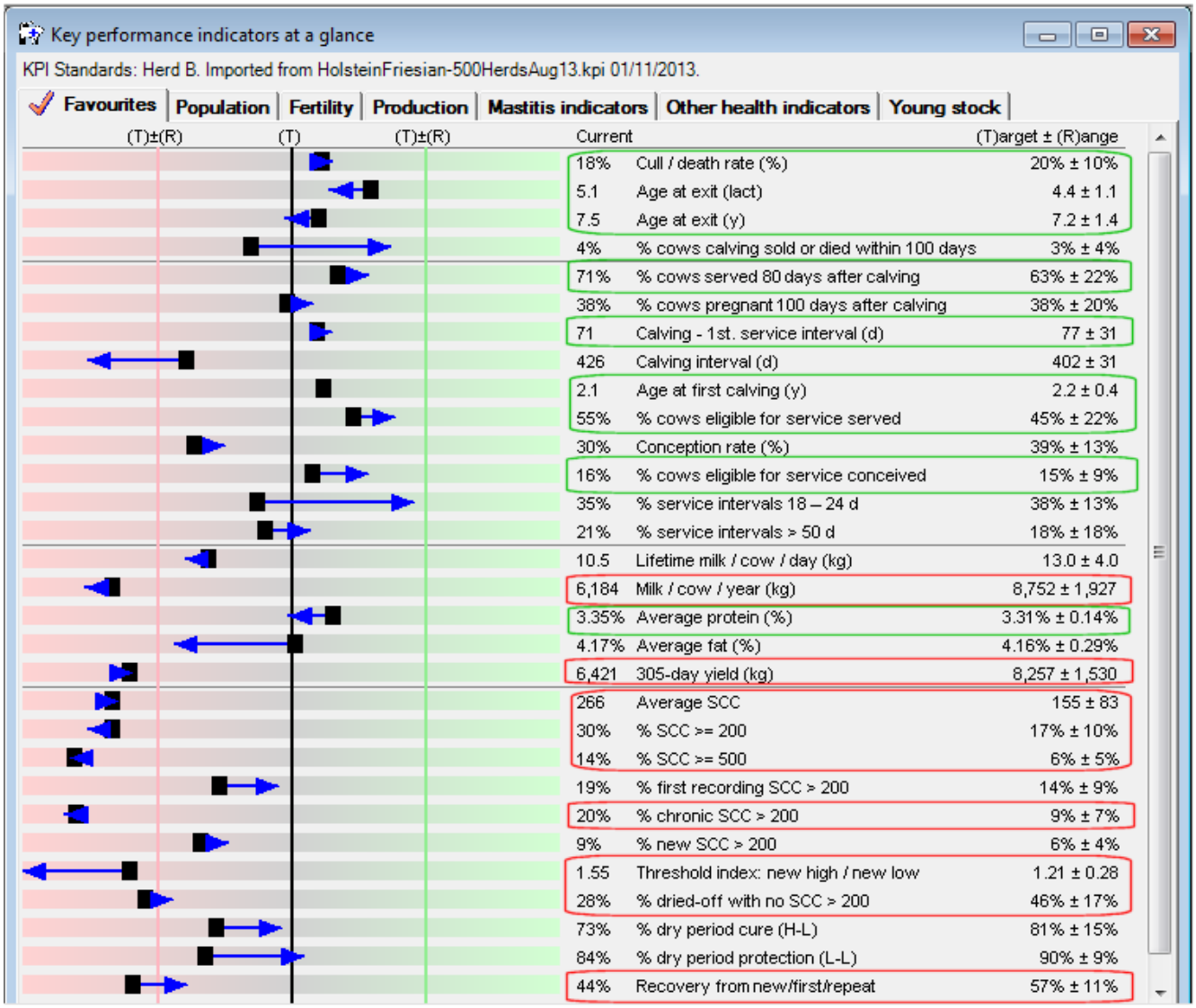


Figure 5 must be treated as a **DISCUSSION DOCUMENT**. The emphasis is on achieving an appropriate balance of performance in production, fertility and health. A parameter in the bottom 25% is not necessarily a bad thing (high yielding herds tend to have lower protein levels). Conversely, single parameters in the "top 25%" performance are not always a good thing. A great conception rate combined with dreadful heat detection is likely to see many more cows culled than good heat detection and average conception. The aim is to **stimulate informed discussion between farmers and their advisers** about **what** is happening **and WHY.**

Section 4: Trends in Key Performance Indicators 2010 to 2013

The target and median figures from the current study are compared with the results from the first study for the year ending 30th September 2010. Table 2 below shows changes in the median and target (top 25% performance) values for each parameter over the three year period. The majority of parameters have improved (green) over the period with the exception of overall culling rate and age at exit which show slight deterioration (red). The lower protein% is offset by a slight increase in milk yield (median value). There is no attempt at identifying any statistical significance in these changes.

Table 2. Comparison of median and target values derived from the study of 500 NMR recording herds in 2013 with the original study in 2010

Parameter	**Median**	**Median**		**Target "Best 25%"**	**Target "Best 25%"**
Year of the Study	***2010***	***2013***		***2010***	***2013***
A. Culling rate	24%	25%		18%	20%
B. Culling / death rate in first 100 days of lactation	7%	5%		4%	3%
C. Age at exit (years)	6.6	6.5		7.4	7.2
D. Age at exit by lactations	3.9	3.8		4.5	4.4
E. Percentage Served by day 80	46%	53%		59%	63%
F. Percentage conceived 100 days after calving	26%	29%		33%	38%
G. Calving to 1st service interval (days)	105	87		87	77
H. Calving interval (days)	424	414		409	402
I. Age at 1st calving (years)	2.4	2.4		2.3	2.2
J. Conception rate	32%	32%		40%	39%
K. Percentage service intervals at 18-24 days	30%	32%		38%	38%
L. Percentage service intervals >50 days	32%	26%		22%	18%
M. Percentage eligible for service that served	27%	32%		37%	45%
N. Percentage eligible for service that conceived	9%	11%		13%	15%
O. Lifetime milk / cow / day (kg)	11	11		13	13
P. Milk / cow / year (kg)	7,665	7,769		8,760	8,752
Q. Average protein%	3.27%	3.24%		3.33%	3.31%
R. Average fat%	3.96%	4.00%		4.12%	4.16%
S. 305 day yield (kg)	7,400	7,577		8,300	8,257
T. Average SCC ('000 cells/ml)	210	195		169	155
U. Percentage SCC >=200,000 cells/ml	24%	22%		19%	17%
V. Percentage SCC >500,000 cells/ml	9%	8%		7%	6%
W. Percentage 1st recording SCC >=200,000 cells/ml	20%	18%		15%	14%
X. Percentage chronic SCC >=200,000 cells/ml	14%	12%		10%	9%
Y. Percentage Dry period cure (High:Low)	74%	74%		80%	81%
Z. Percentage Dry period protection (Low:Low)	84%	86%		89%	90%
ZA. Percentage Low at end of previous lactation (SCC<200,000 cells/ml)	60%	64%		70%	72%

Appendix 1. Key Performance Indicators definitions

The Key Performance Indicators are displayed as both 12 month and 3 month rolling averages.
In the following definitions the average population of cows is calculated using animal days. Every day that a cow is present and in the population at risk during the period of study is a 365th of an animal year. The total animal days is summed and divided by 365 to give animal years, or the average cow 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. Culling / death rate in first 100 days of lactation	The number of deaths/culls within 100 days of calving divided by the average cow population up to 100 days (aggregated total animal days up to 100 days after calving, divided by 365).
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 exist by lactations	The total number of lactations completed by cows culled/died in the analysis period, divided by the number of these culled/died cows.
E. Percentage Served by day 80	The percentage of cows reaching the 80th day after calving that have been served at least once on or by Day 80.
F. Percentage conceived 100 days after calving	The percentage of cows reaching 100 days after calving that have conceived on or by Day 100.
G. Calving to 1st service interval (days)	The average days between calving and 1st 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 1st 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	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 oestrus 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 eligible for service that served	The percentage of cows that are eligible for service (42 days+ after calving) during the analysis period that are served.
N. Percentage eligible for service that conceived	The percentage of cows that are eligible for service (42 days+ after calving) during the analysis period that conceived.
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 average protein% of all milk recorded during the analysis period.
R. Average fat%	The average fat% of all milk recorded during the analysis period.
S. 305 day yield (kg)	The average production by Day 305 for all cows reaching 305 days after calving during the analysis period.

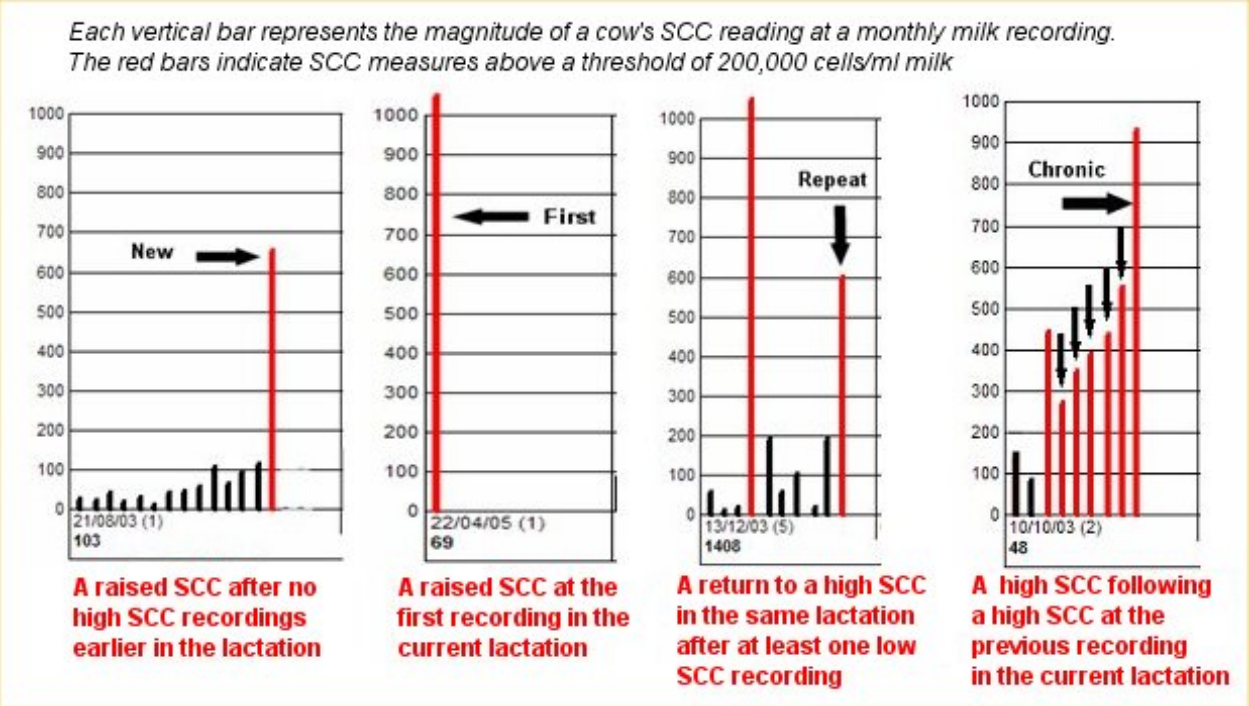
T. Average SCC ('000 cells/ml)	The average somatic cell count of all milk recorded during the analysis period.
U. Percentage SCC >=200,000 cells/ml	The percentage of all recorded milk samples during the analysis period that had an individual SCC reading of 200,000 cells/ml or higher.
V. Percentage SCC >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.
W. Percentage 1st recording SCC >=200,000 cells/ml	The percentage of all cows starting new lactations that had a high SCC (>=200,000 cells/ml) reading at the first milk recording in the lactation.
X. Percentage chronic SCC >=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.
Y. 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 (>=200,000 cells/ml) that started the new lactation with a LOW SCC (<200,000 cells/ml).
Z. 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).
ZA. 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.
ZB. Percentage New SCC >200,000 cells/ml	The percentage of all recorded milk samples that were of the New Herd Companion SCC Category(*), namely the first HIGH SCC (>=200,000) in a lactation following one or more low SCC samples.
ZC. Percentage Dried-off with no SCC >200,000 cells/ml	Of re-calving cows recorded starting a new lactation during the analysis period: The percentage of cows recording only LOW SCC samples (<200,000 cells/ml) in the previous lactation.
ZD. 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.
ZE. Recovery percentage of new/first/repeat infections	Of HIGH SCC cows (>=200,000cells/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.
ZF. 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.