Key performance indicators (KPIs) for the UK national dairy herd

A study of herd performance in 500 Holstein/Friesian herds for the year ending 31st August 2024

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Executive Summary

This is the 15th annual study of key performance indicators (KPIs), based on a cross-section of 500 UK dairy herds that milk record with National Milk Records (NMR). The study provides up to date KPI benchmark values, representative of the national dairy herd, that farmers and advisers can use to compare against performance of their own herds. The inclusion of data from earlier studies, back to 2010, highlights short and longer-term trends for each KPI.

The majority of KPIs relating to fertility, milk yield, somatic cell count (SCC) and mastitis have improved markedly since the first study in 2010. In contrast, the longevity parameters indicate these fitter, more robust cows have shorter productive lives than in earlier years.

Fertility parameters describing conception and heat detection continue to improve, while calving to 1st service and % served by day 80 have largely stabilised since 2020. The median herd calving interval at 393 days is 7 days less than in 2020 (and 31 days below 2010).

Milk production and constituents KPIs reflect greater emphasis on constituents than milk volume. Protein% and fat% continued to improve year on year (3.36% and 4.29% respectively) while milk yield (305 day yield, milk / cow / year, lifetime daily yield) have all shown a slight decrease since 2020.

The lower yields but higher solid percentages largely balance out. The median herd total solids (kgs of fat+protein) per cow in 2024 (666kg) was almost unchanged from 2020 (663kg). However, the 2024 figure represents a 20% (112kg) increase in total solids per cow over 2010 (666 kg vs 554kg).

Somatic cell counts and mastitis: SCC KPIs have remained relatively constant since 2020 with a median herd SCC of 171,000 cells/ml milk. This remains a huge advance over the equivalent figure of 210,000 cells/ml in 2010. Similarly the proportion of high SCC milk samples (≥200,000 cells/ml) has stabilised at 16%, a huge improvement on the 24% of milk samples in 2010.

The percentage of cows completing lactations without recording any high SCCs (>200,000) continues to improve year on year. In the median herd in 2024 over half (51%) of cows completed lactations without high SCCs, up from 49% in 2020. The equivalent in 2010 was 33% so an increase from one third to one half of cows in 15 years.

Mastitis rate has reduced by 7 cases/100 cows/year since 2020 to 21 cases / 100 cows / year in 2024. In the median herd the % cows completing lactations without recording mastitis has risen consistently from 81% of cows in 2020 to 85% in 2024. In the same period the % cows recording mastitis within 30 days of calving (likely dry period origin mastitis) has reduced from 5% to 3%. The index mastitis rate

after 30 days (likely lactation origin mastitis) has reduced from 19 to 15 cases / 100 cows / year during the same period

Longevity: While the fertility, yield and SCC parameters have improved across the board since 2010, the KPIs related to longevity have shown a contrasting trend. In summary, while cows are increasingly fertile, healthy and productive, the trend is for their removal from herds at a younger age and after completing fewer lactations. The culling rate at 28% in 2024 is unchanged from 2020 but higher than the 24% in 2010.

The productive life (days between 1st calving and culling) was 33 days less in 2024, than 2020 and 218 days less than in 2010. Ever fitter cows are seemingly maintained in the herd for ever shorter durations. There are a number of possible explanations for this which need discussion and understanding. These range from increased culling as a component of disease control (Johne's, TB), to over enthusiasm for potential benefits of genetic gain, to farmers failing to adjust the number of replacements bred in line with the improved robustness of cows. The carbon implications of this could be highly significant if relatively fit older cows are primarily removed to make way for an over production of replacement heifers.

Further Reading

Milk recording focused research:

- Taylor, E. N., Kossaibati, M., Hanks, J., Taylor, N. 2025. Milk recording data highlight improvements in fertility and somatic cell counts but worsening longevity for the UK national dairy herd. [Under peer review].
- Taylor, E. N., Channa, K., Hanks, J., Taylor, N. 2024. Milk recording data indicates the importance of fertility, including age at first calving, on the progression of first lactation cows to second lactation. *PLoS ONE*. https://doi.org/10.1371/journal.pone.0297657
- Taylor, E. N., Kossaibati, M., Hanks, J., Taylor, N. 2023. How are fertility, production and health parameters changing in the national UK dairy herd? Trends in KPIs since 2010. *British Cattle Veterinary Association Congress 2023*. Telford: 19th - 21st October 2023.

Johne's Disease focused research:

- Taylor, E.N., Channa, K., Orpin, P. O., Hanks, J., Taylor, N. M. 2024. Changes in the Johne's disease situation in GB dairy herds over 10 years, as revealed by regular milk ELISA data. Preventative Veterinary Medicine.
  https://doi.org/10.1016/j.prevetmed.2024.106317
- Orpin, P.G., Sibley, D., Hanks, J., Taylor, N. 2022. The National Johne's Management Plan: Using risk and data analysis to optimize Johne's control in dairy herds. Livestock. 27, 1, 2 - 7.
  https://doi.org/10.12968/live.2022.27.1.24

Acknowledgements

Section 1: Description of the study and methods used

1.1　Aims and objectives

This is the 15th 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 2024. Herd selection used random numbers to ensure a representative cross-section of all herds that milk record with National Milk Records (NMR). The principal objective throughout these studies has been to provide farmers and technical advisers with accurate and up-to-date information on the variation in performance of commercial dairy herds.

The calculations used to generate these parameters are identical to those used by the InterHerd+ program allowing farmers and technical advisers to compare the performance of any milk recording herd directly with the 500 herd sample that is representative of the national performance. In other words, for each parameter: **"How does the performance of the herd compare to benchmarked herds? Which KPIs highlight an area of improvement within the herd?**

Following the analysis of individual parameters, the trends since 2010 for a selection of the KPIs are displayed. A KPI template of 80 parameters for use in InterHerd+ is available for users to update the KPI parameters to the target values from the 2024 study.

1.2　The sample of herds

The source of data is the monthly milk records obtained by NMR. The 500 herds used in the study all fully milk record on a monthly assisted basis and are 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 2023 study were maintained for the 2024 herds' sample. Herds with poorly recorded fertility data (inadequate recording of services and pregnancy diagnoses), as well as herds no longer recording, were replaced with new herds, again selected using random numbers. In total, 443 herds (about 89%) were in both the 2023 and 2024 studies.

Herd size for the 500 herds in the 2024 study ranged from minimum 44 to maximum 1259 cows, with a median value of 179 cows, as shown in Figure i. In the sample 60% of herds were comprised of less than 200 cows, with 42 herds containing over 400 cows.
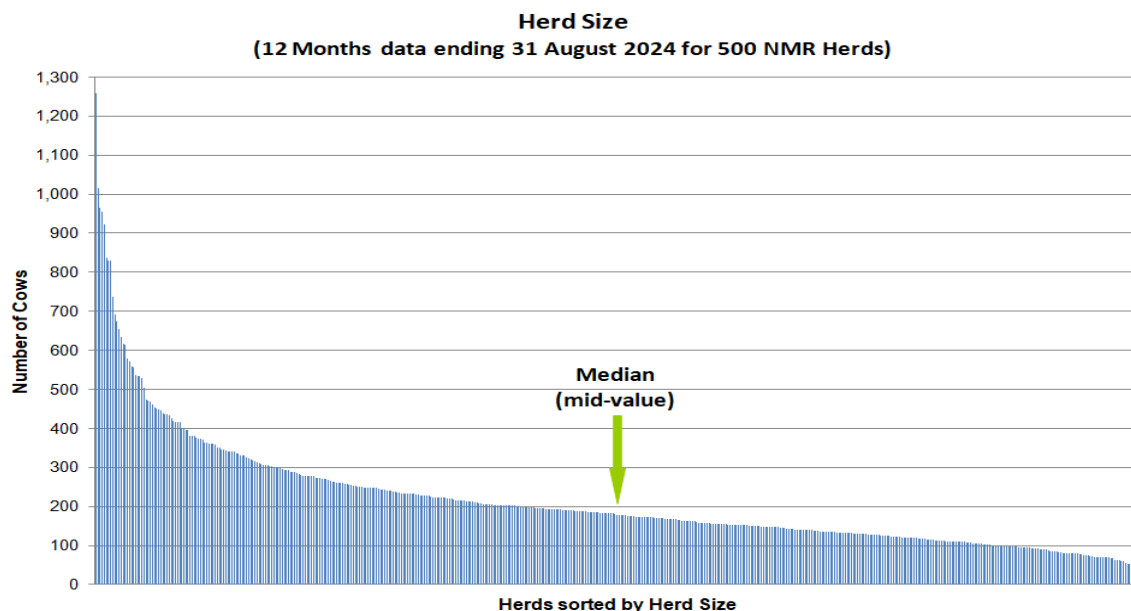
Herd Size
(12 Months data ending 31 August 2024 for 500 NMR Herds)

Figure i. Herd size of the 500 herds.

1.3   Description of parameters

The performance of each of the 500 herds was displayed as a bar chart. The herds are displayed from "best" to "worst", in ascending or descending order depending on whether it is generally preferable to have a low value (e.g. SCC, calving interval) or a high value (e.g. dry period cure, conception rate). The "best" is always on the left side, nearest the vertical Y axis. For each parameter, a median (middle) value and inter-quartile range values (the level achieved by the middle 50% of herds) are also derived (Figure i).

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 that is currently achieved (or exceeded) by 25% of herds over the last year.**

To minimize the impact of short term seasonal variations, the key performance indicator values are calculated using data recorded over a full 12 month period. They represent the consolidated or average performance levels achieved by each herd for the period from 01 September 2023 to 31 August 2024. The definitions of each parameter are detailed in Appendix 1.

The results of the study are summarized in Table 1.

For each parameter, four statistics are presented:

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 (or the average of the middle two herds in an even number of herds). Half the herds do better and half do worse than the median value.

2. The **first quartile (25% value) and third quartile (75% value)**. With the median, these split the herds into four equal groups. The first and third quartile values are 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 used by InterHerd+ 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)**. This gives an impression of how widely herds in the middle 50% differ.

The position of these values is graphically displayed in Figure ii.

As shown below, the parameter value is displayed on the vertical Y axis and bars representing the study herds are arranged along the horizontal X axis. The "best" performing herd is nearest the vertical Y axis with the worst performing herd furthest away.

The parameter described in Figure ii is the herd average SCC so the target value is at the lower end of the inter-quartile range (as a low average SCC is preferable to a high average SCC).
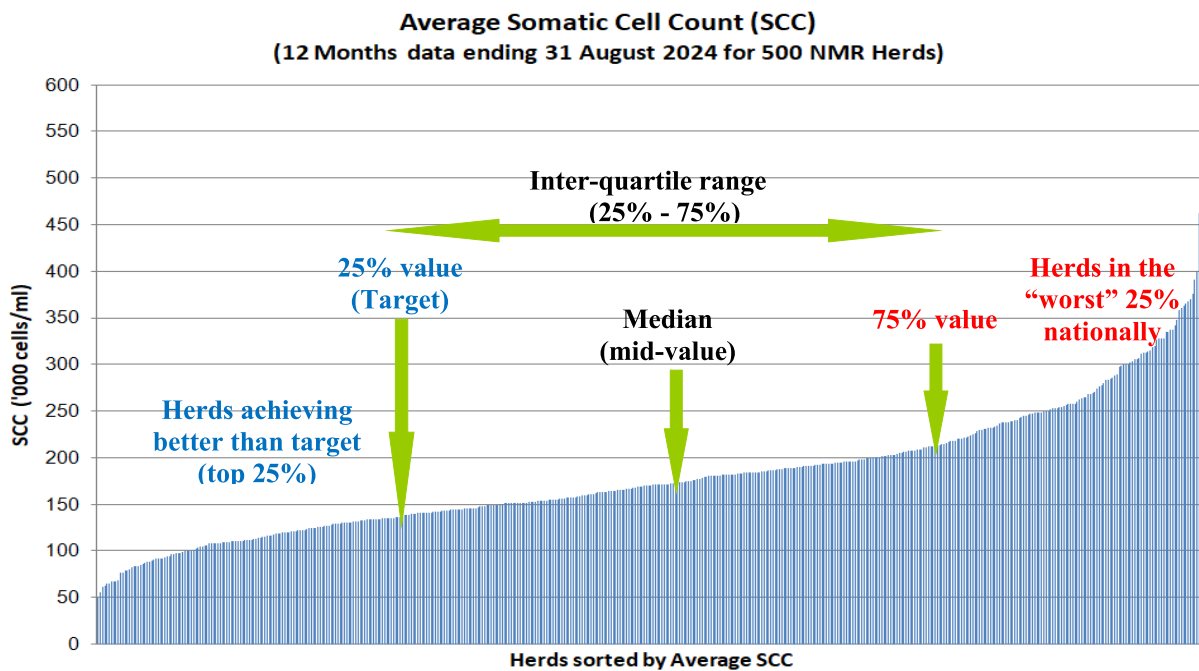
Figure ii. A description of the median, inter-quartile range and target values generated for each parameter.

1.4   Changes to studies from earlier years

1. **Mastitis KPIs:** The results of the study summarized in Table 1 relating to mastitis, including the herd overall mastitis rate (cases/100 cows in milk/year). This is the 9th year that mastitis related parameters have been derived from the survey herds, reflecting the significant improvement in the level of reporting of mastitis by farmers in recent years. While in 2012 less than 20% of herds reported any mastitis, this has risen to 47% of herds in 2024. For the purpose of this study any herd that recorded over 5 cases/100 cows in milk/ year was considered to record mastitis. The mastitis KPIs in this report are calculated based on 236 of the 500 herds (about 47%) that qualified this year.

2. **305 day milk/protein/fat yields:** Until 2015, 305 day yield parameters were calculated from all lactations, including lactations that were shorter than 305 days. In this report, as in all years since 2016, the lactation must be at least 305 days long for inclusion in the calculation. This report also details the 305 day yields (total yield up to and including the 305th day of lactation) of fat and protein. As with the milk yield, these parameters are calculated from lactations that were at least 305 days in length. Note, the exclusion of lactations shorter than 305 days does not apply to the calculation of the **overall lactation yield**. In some herds, when many cows have lactation lengths below 305 days, this can result in lactation yields smaller than the 305 day yields.

Section 2: KPI results for the year ending 31 August 2024

Table 1. Summary of culling, fertility, milk production, somatic cell count and mastitis related KPIs derived from the analysis of 500 NMR milk recording herds for the year ending 31 August 2024.

Parameter	Median (1)	1st – 3rd quartile (25% - 75%) (2)	Target (3)	IQR (4)
Herd demographics/longevity				
A. Exit rate (%)	28%	22% - 33%	22%	11%
B. Exit rate in the first 100 days after calving (%)	5%	3% - 8%	3%	5%
C(a). Age at exit (years)	5.8	5.3 - 6.6	6.6	1.3
C(b). Age at exit (days)	2,132	1,928 - 2,401	2,401	473
D. Productive life (days)‡	1,293	1,101 – 1,565	1,565	464
E. Age at exit by lactations	3.6	3.1 - 4.1	4.1	1.0
Fertility				
F. Percentage Served by day 80	60%	45% - 70%	70%	25%
G. Percentage conceived 100 days after calving	39%	27% - 47%	47%	20%
H. Calving to 1st service interval (days)	79	70 - 98	70	28
I. Calving interval (days)	393	382 - 413	382	31
JI. Age at 1st calving (months)	26.5	25.0 – 29.0	25.0	4.0
K. Conception rate	40%	34% - 47%	47%	13%
L. %Service intervals at 18-24 days (Heat detection)	41%	33% - 49%	49%	16%
M. Percentage service intervals >50 days	19%	12% - 28%	12%	16%
N. % Cows eligible for service served (Submission rate)	42%	30% - 55%	55%	25%
O. %Eligible for service that conceived (Pregnancy rate)	17%	12% - 22%	22%	10%
Production				
P. Lifetime milk / cow / day (kg)	12.5	10.2 - 14.6	14.6	4.4
Q. Milk / cow / year (kg)	8,670	7,274 - 9,835	9,835	2,561
R. Average protein%	3.36%	3.30% - 3.44%	3.44%	0.14%
S. Average fat%	4.29%	4.10% - 4.46%	4.46%	0.36%
T. 305-day milk yield (kg)	8,987	7,683 - 10,124	10,124	2,441
U. 305-day protein yield (kg)	296	256 - 336	336	80
V. 305-day fat yield (kg)	380	326 - 429	429	103
Somatic cell count (SCC)				
W. Herd SCC ('000 cells/ml)	171	134 - 212	134	78
X. % milk samples with High SCC (*)	16%	12% - 20%	12%	8%
Y. % milk samples with SCC ≥500,000 cells/ml	7%	5% - 9%	5%	4%
Z. % cows with High SCC at 1st record in lactation (*)	16%	12% - 20%	12%	8%
ZA. % Chronic milk samples (**)	8%	6% - 11%	6%	5%
ZB. Dry period cure (High:Low) (***)	76%	68% - 85%	85%	17%

Parameter	Median (1)	1st – 3rd quartile (25% - 75%) (2)	Target (3)	IQR (4)
ZC. Dry period protection (Low:Low) (***)	86%	80% - 90%	**90%**	10%
ZD. % Low at last recording of previous lactation (*)	78%	70% - 84%	**84%**	14%
ZE. % samples New SCC category (**)	5%	4% - 7%	**4%**	3%
ZF. % cows dried-off with no High SCC samples in the lactation (*)	51%	42% - 59%	**59%**	17%
ZG. Threshold Index new high / new low (****)	1.20	1.08 - 1.31	**1.08**	0.23
ZH. % of cows with New/First/Repeat sample that are Low SCC at next recording (**)	56%	52% - 61%	**61%**	9%
ZI. % of cows with Chronic sample that are low SCC at next recording (**)	21%	17% - 26%	**26%**	9%
Mastitis				
ZJ. Percentage drying off with no mastitis cases[+]	85%	79% - 90%	**90%**	11%
ZK. Mastitis rate (cases/100 cows in milk/year)[+]	21	14 - 33	**14**	19
ZL. Cows with Index mastitis case by Day 30[+]	3%	2% - 5%	**2%**	3%
ZM. Index mastitis rate after Day 30[+]	15%	10% - 23%	**10%**	13%

(‡)   **Productive life** (days): Difference between age at first calving and age at exit.

(*)   **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):** 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.

+   The mastitis parameters are derived from a group of 236 herds (within the 500 herds in the study) where mastitis rate >5 cases per 100 cows in milk / year.

Section 3: Trends in KPIs from 2010 to 2024

Table 2. Comparison of annual median values and target values in 2010, 2020, 2024 and rolling 3-year average median values (2021 – 2023) for culling, fertility, milk production and somatic cell count (SCC) related KPIs from the study of 500 NMR recording herds in 2010 and 2020 to 2024. KPIs which improved between consecutive studies are indicated by (green) font, KPIs which have worsened are indicated by (red) font.

Parameter	Median				Target "Best 25%"			
Year of the Study	2010	2020	3 year rolling average (21 – 23)	2024	2010	2020	3 year rolling average (21 – 23)	2024
Herd demographics/longevity								
A. Exit rate (%)	24%	28%	27%	28%	18%	23%	22%	22%
B. Exit rate in the first 100 days after calving (%)	7%	5%	5%	5%	4%	3%	3%	3%
C(a). Age at exit (years)	6.6	6.0	6.0	5.8	7.4	6.6	6.7	6.6
C(b). Age at exit (days)	2,393	2,175	2,190	2,132	2,699	2,404	2,438	2,401
D. Productive life (days)	1,511	1,326	1,350	1,293	1,756	1,536	1,585	1,565
E. Age at exit by lactations	3.9	3.5	3.6	3.6	4.5	4.0	4.1	4.1
Fertility								
F. Percentage Served by day 80	46%	60%	60%	60%	59%	70%	70%	70%
G. Percentage conceived 100 days after calving	26%	36%	38%	39%	33%	42%	45%	47%
H. Calving to 1st service interval (days)	105	80	80	79	87	70	70	70
I. Calving interval (days)	424	400	395	393	409	388	382	382
J. Age at 1st calving (months)	28.8	27.1	26.4	26.5	27.6	25.3	25.0	25.0
K. Conception rate	32%	35%	38%	40%	40%	41%	44%	47%
L. %Service intervals at 18-24 days (Heat detection)	30%	39%	40%	41%	38%	45%	47%	49%
M. %Service intervals >50 days	32%	21%	19%	19%	22%	14%	13%	12%
N. %Cows eligible for service served (Submission rate)	27%	40%	41%	42%	37%	51%	53%	55%
O. %Cows eligible for service that conceived (Pregnancy rate)	9%	14%	16%	17%	13%	18%	21%	22%

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Parameter	Median				Target "Best 25%"			
Year of the Study	2010	2020	3 year rolling average (21 – 23)	2024	2010	2020	3 year rolling average (21 – 23)	2024
Milk Production								
P. Lifetime milk / cow / day (kg)	10.5	12.8	12.8	12.5	12.6	15.1	14.8	14.6
Q. Milk / cow / year (kg)	7,665	8,904	8,818	8,670	8,760	9,850	9,916	9,835
R. Average protein%	3.27%	3.32%	3.33%	3.36%	3.33%	3.40%	3.41%	3.44%
S. Average fat%	3.96%	4.13%	4.20%	4.29%	4.12%	4.29%	4.37%	4.46%
T. 305-day milk yield (kg)[+]	8,911	9,255	9,116	8,987	10,052[a]	10,249	10,168	10,124
U. 305-day protein yield (kg)[+]	287	307	301	296	325[a]	337	333	336
V. 305-day fat yield (kg)[+]	354	378	380	380	394[a]	416	423	429
U+V. Milk solids / cow / year (kg)	554	663	664	666	653	757	769	781
SCC								
W. Average SCC ('000 cells/ml)	210	173	169	171	169	138	133	134
X. % SCC ≥200,000 cells/ml	24%	17%	16%	16%	19%	13%	12%	12%
Y. % SCC ≥500,000 cells/ml	9%	7%	7%	7%	7%	5%	5%	5%
Z. % 1st recording SCC ≥200,000 cells/ml	20%	16%	15%	16%	15%	12%	12%	12%
ZA. % chronic SCC ≥200,000 cells/ml	14%	8%	8%	8%	10%	6%	6%	6%
ZB. % Dry period cure (High:Low)	74%	76%	77%	76%	80%	84%	85%	85%
ZC. % Dry period protection (Low:Low)	84%	85%	86%	86%	89%	89%	90%	90%
ZD. % Low at end of previous lactation (SCC<200,000 cells/ml)	60%	76%	78%	78%	70%	83%	84%	84%
ZE. % Percentage Dried-off with no SCC >200,000 cells/ml	33%	49%	49%	51%	43%	57%	58%	59%
Mastitis								
ZK. Mastitis rate (cases/100 cows in milk/year) [+]	36	28	25	21	21	18	15	14
ZL. Index mastitis case by day 30 [+]	5%	5%	4%	3%	3%	2%	2%	2%
ZM. Index mastitis rate after day 30 [+]	22%	19%	16%	15%	14%	12%	10%	10%

(+): Collection of these KPIs started in 2016, not 2010

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The figures below show the changes over the annual KPI studies (2010 to 2024) for a number of important parameters. The values in brackets show the changes in the best quartile, median and worst quartiles values since 2010. Excluding Figure 1, the three lines represent the 1st "best" quartile, median and 3rd "worst" quartile values each year for each parameter.

3.1 Herd size

From 2010 to 2024, the median herd size increased by 39% from 129 to 179 cows. Herd size increased steadily to 2018 and since fluctuated between 169 and 179 cows (Figure 1).
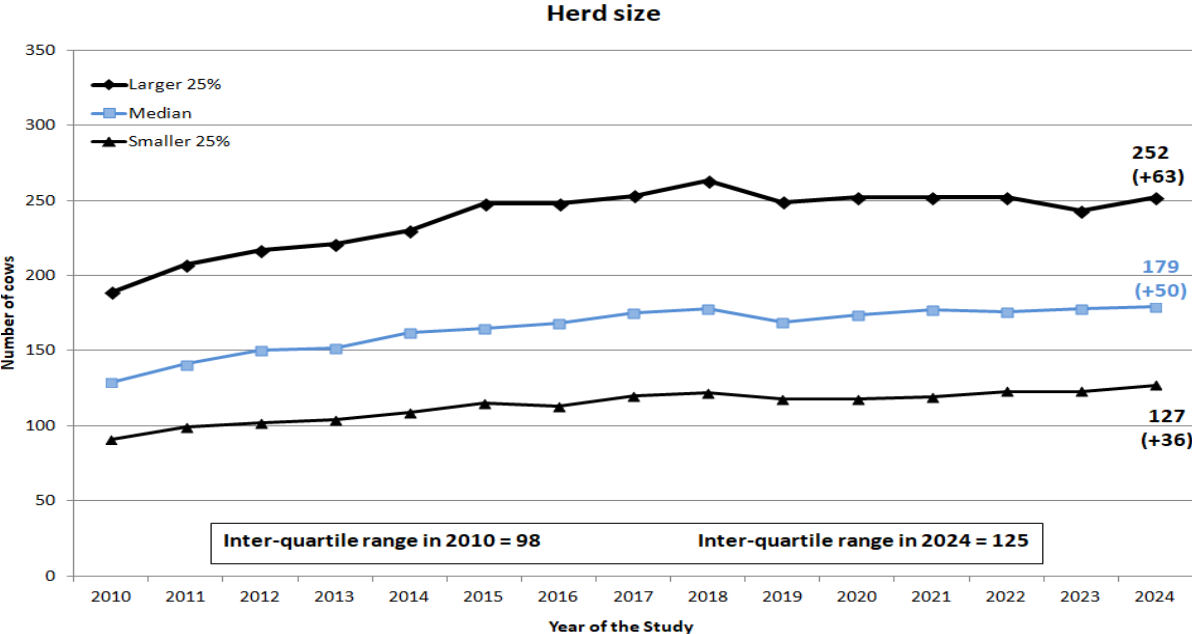
Figure 1. Herd size (number of cows).

3.2   Exit rate and longevity

Exit rates increased from 24% to 28% (Table 2). Exit rates increased from 2011 to 2013 but then returned to 2010 levels, before increasing with fluctuations from 2016 onwards (Figure 2). Age at exit decreased by 12% from 6.6 years in 2010 to 5.8 years in 2024. Age at exit was stable in 2011 and 2012, steadily decreased from 6.5 years in 2013 to 6.0 years in 2017 and then remained stable for six years, followed by a noticeable reduction of 0.2 years in 2024 (Figure 4). Productive life decreased by 12% from 1,511 days in 2010 to 1,323 days in 2021. Productive life improved slightly to 1,359 days in 2022 and 1,367 in 2023, but reduced again by 74 days to 1,293 days in 2024, but productive life remains 14% below 2010 levels (Figure 7).
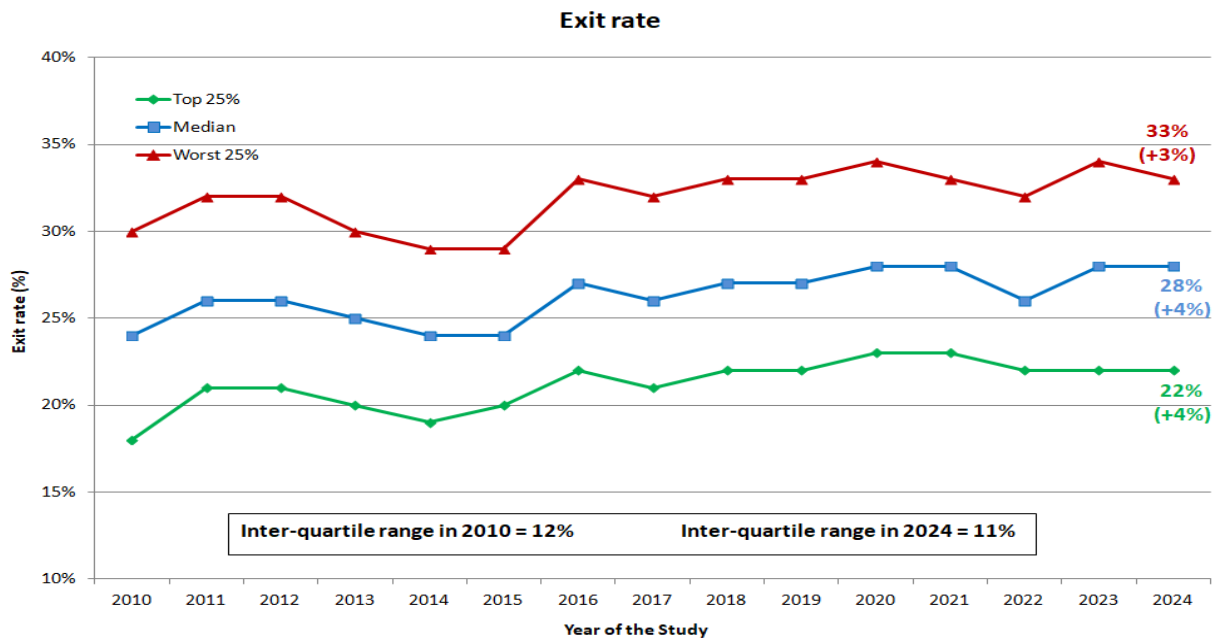
Figure 2. Percentage of cows which exited the herd (culled, died or sold).
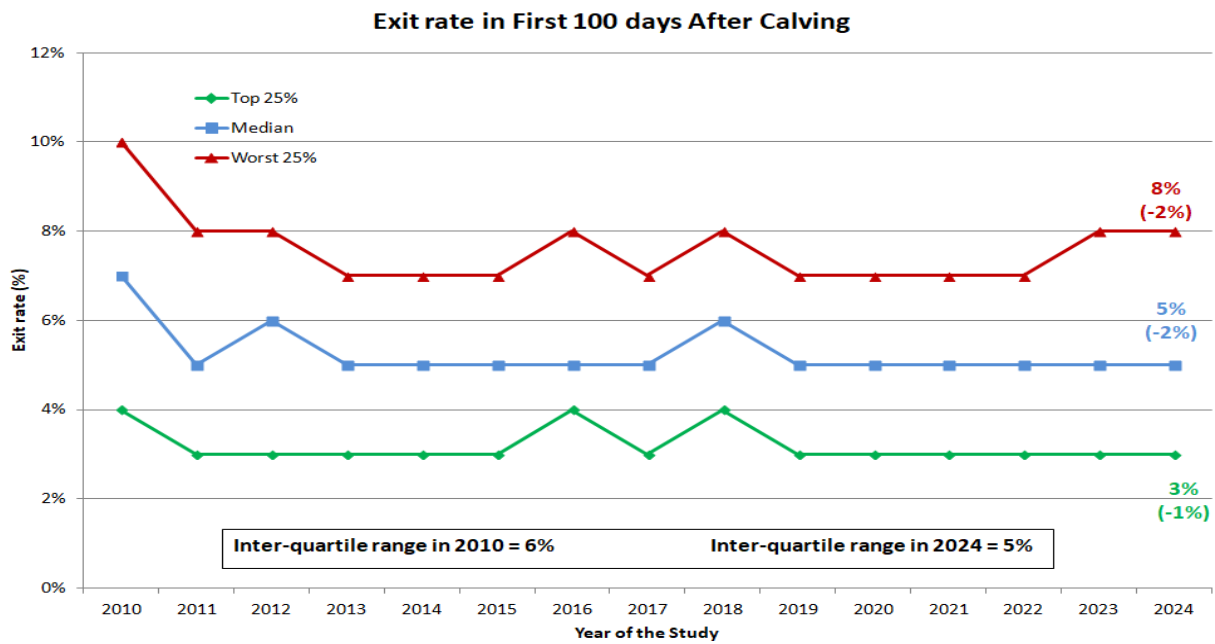
Figure 3. Percentage of cows which exited the herd (culled, died or sold) within 100 days post-partum.
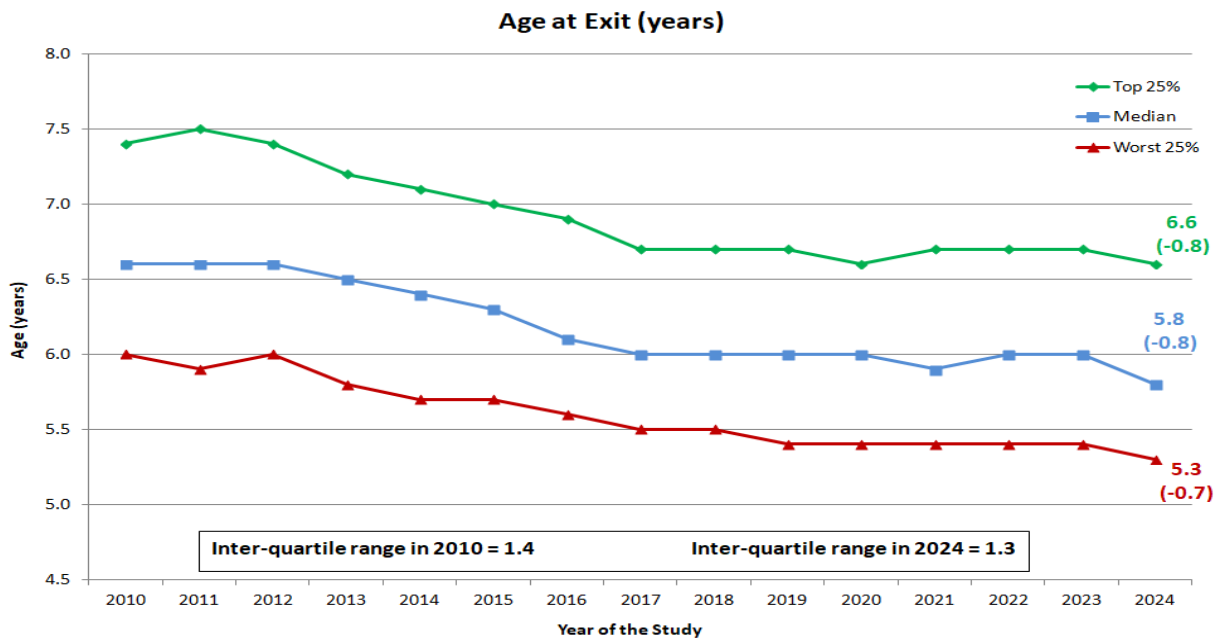
Figure 4. Age at exit (years).
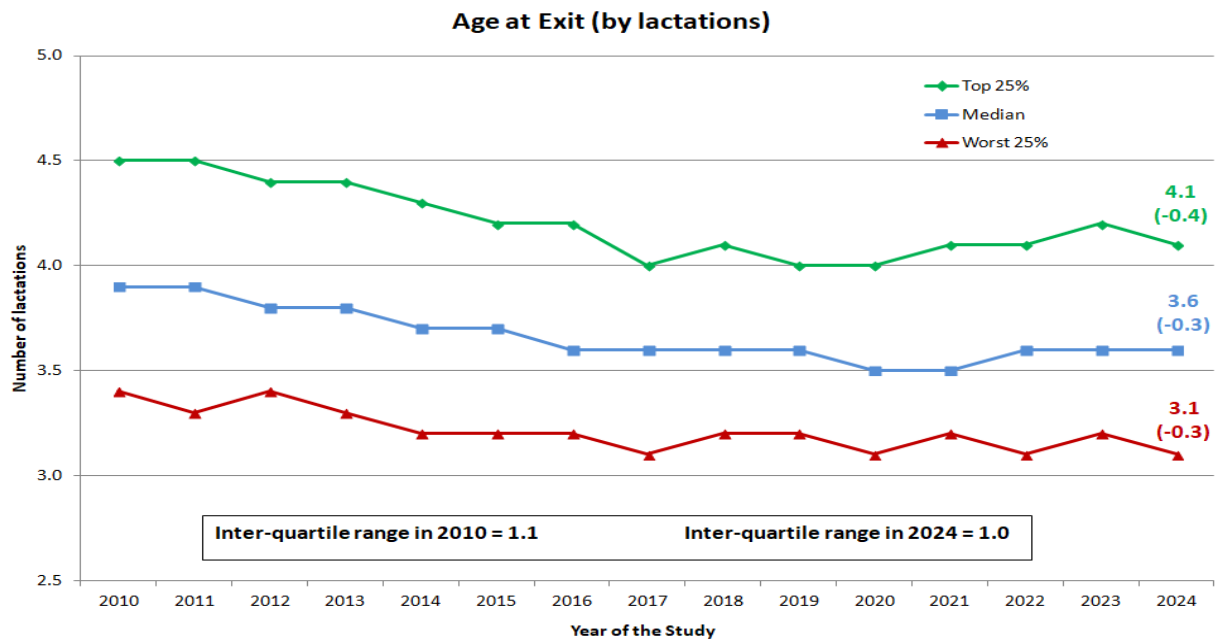
Figure 5. Age at exit (lactations).

3.3 Fertility

Age at first calving was stable from 2010 to 2014 at 28.8 months, but decreased in 2015 to 27.6 months and remained stable until 2020, and then decreased again in 2021 to 26.4 months, with an overall decrease of 4% (Figure 6). The % served by 80 DPP increased from 46% to 60% between 2010 and 2017 and has since fluctuated between 57% and 61% (Figure 8). The % conceived 100 DPP steadily increased from 26% in 2010 to 39% in 2022 onwards (Figure 9). The % service intervals 18-24 days increased with fluctuations from 30% in 2010 to 41% in 2022 onwards (Figure 10). Conception rate increased from 32% to 40%, albeit with some fluctuations (Figure 12). Calving interval has gradually decreased by 7% from 424 in 2010 to 393 in 2024 (Figure 15).
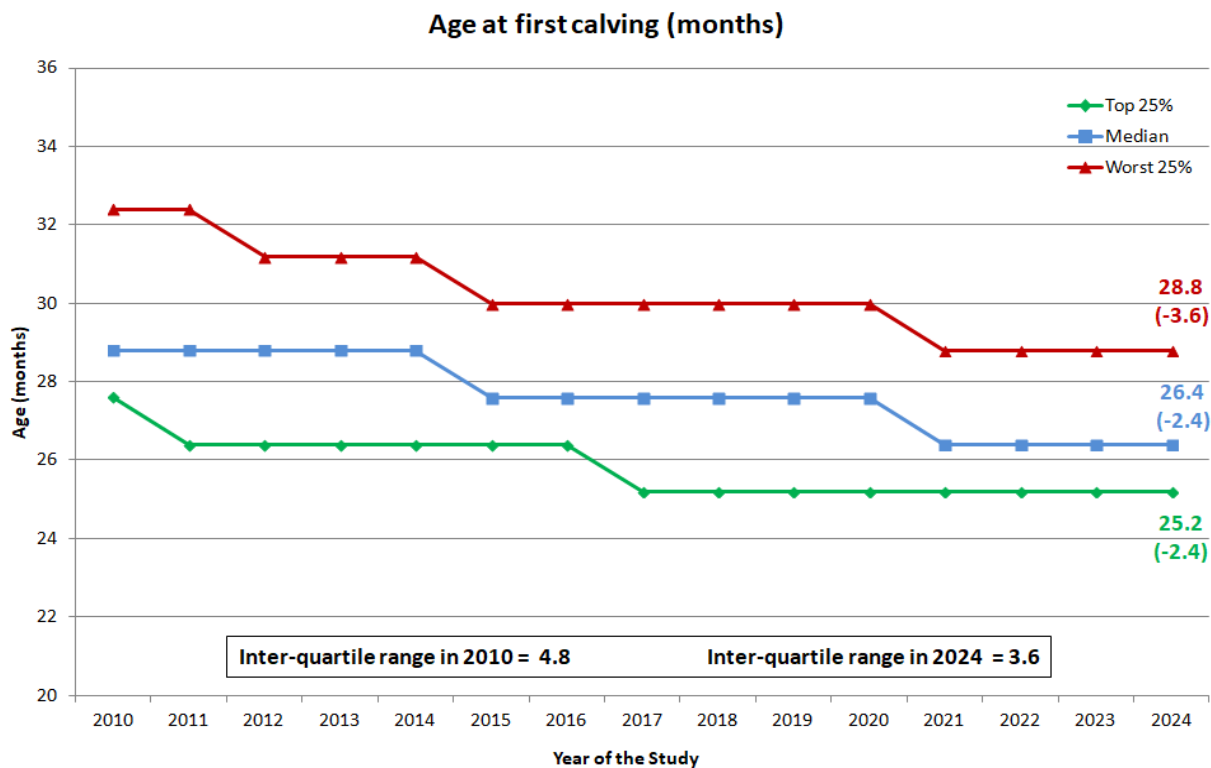
Figure 6. Age at first calving (months).
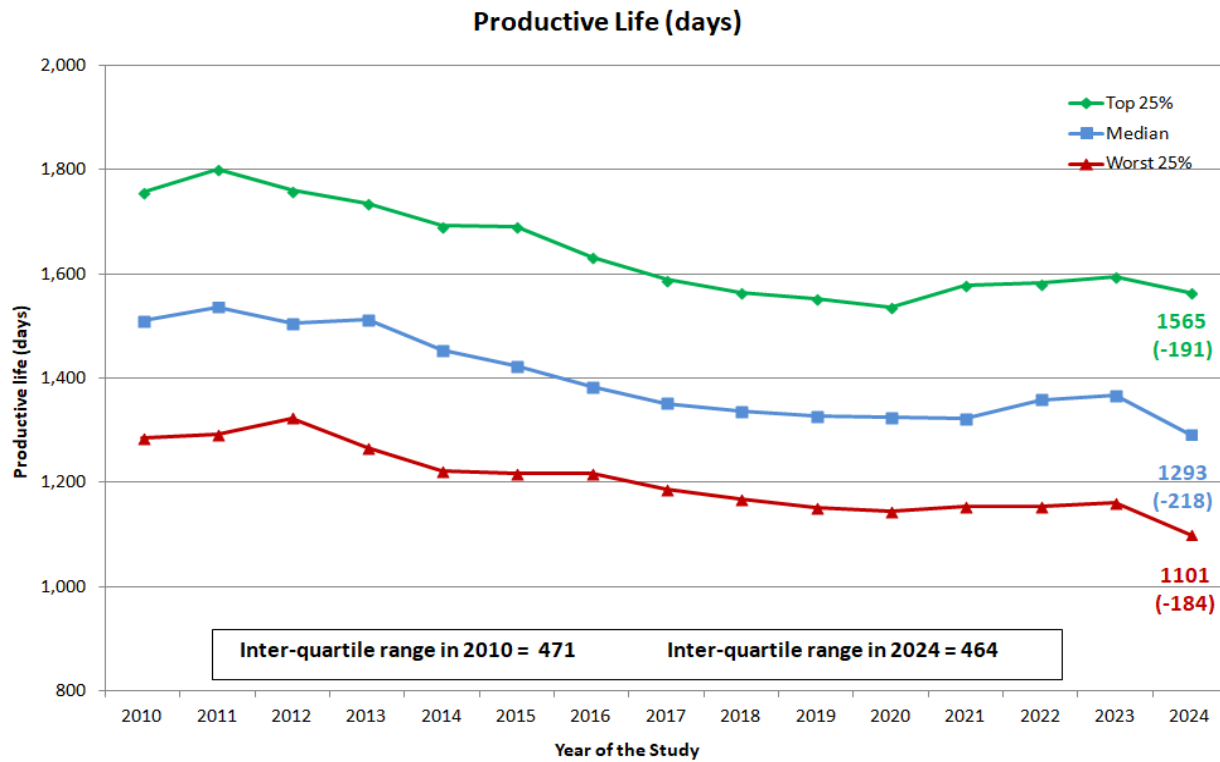
Figure 7. Productive life (age at exit - age at 1st calving) (days).
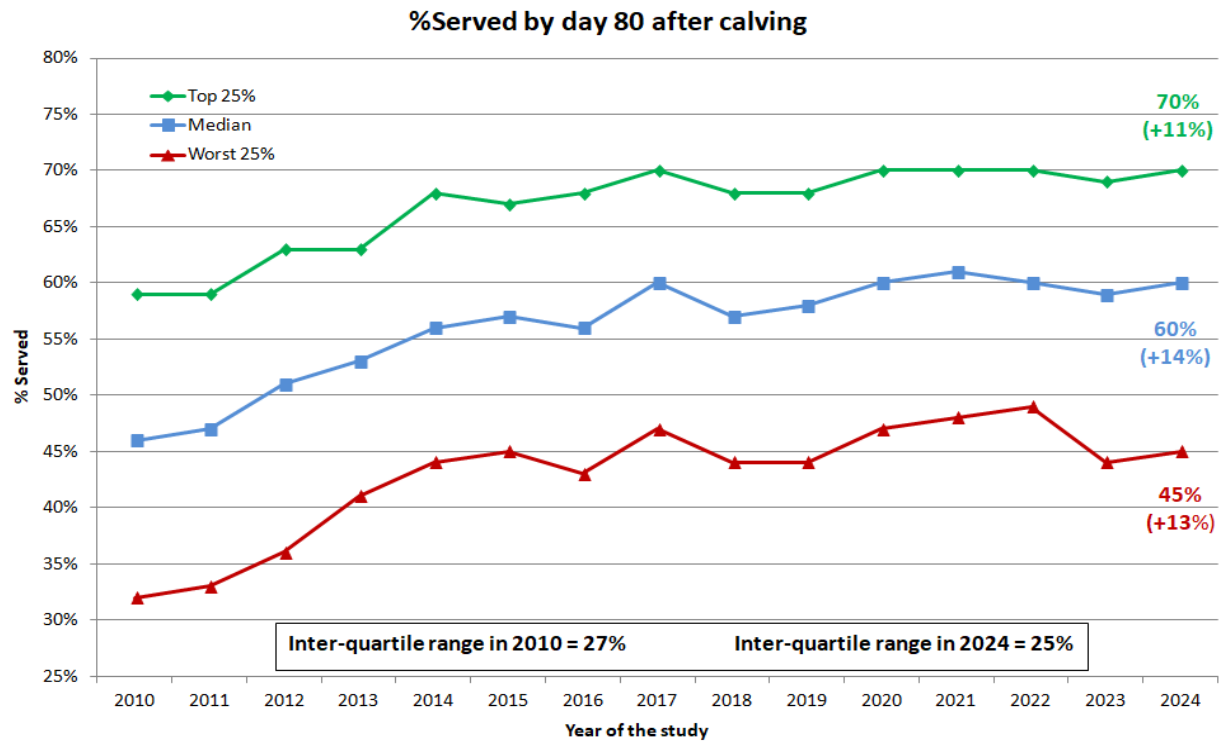
Figure 8. Percentage of cows served by 80 days after calving.
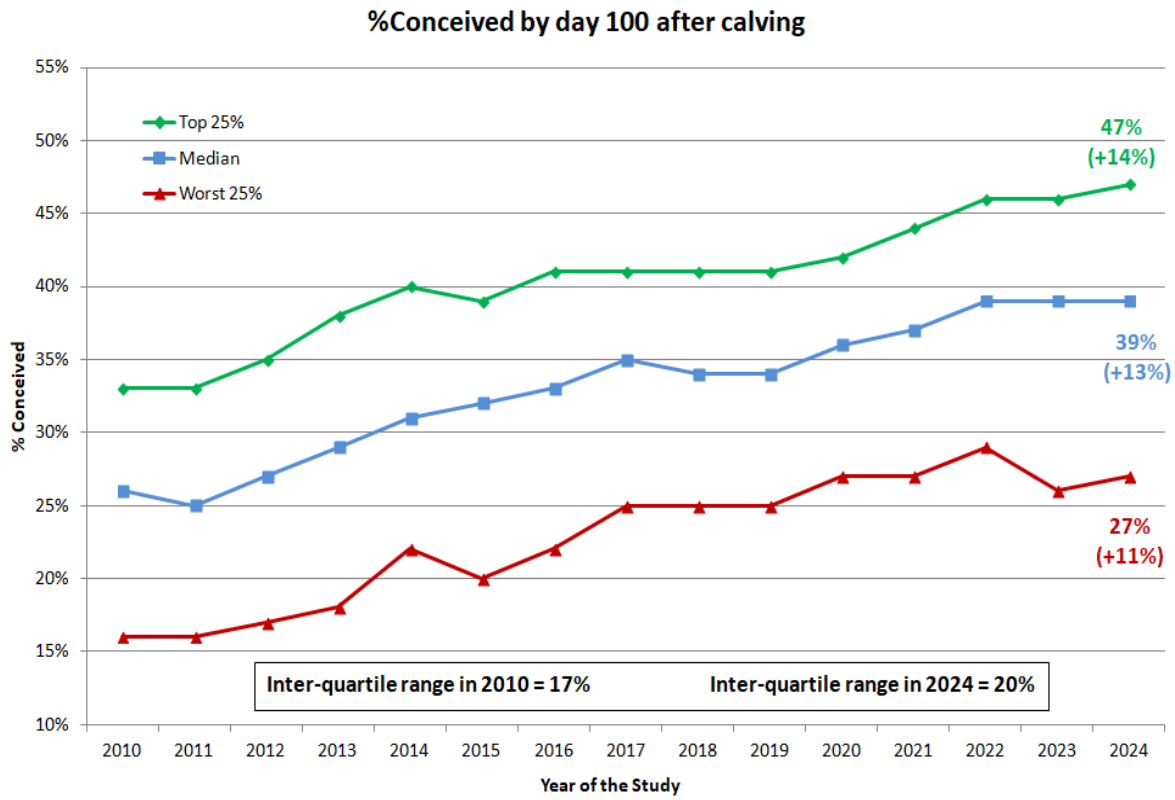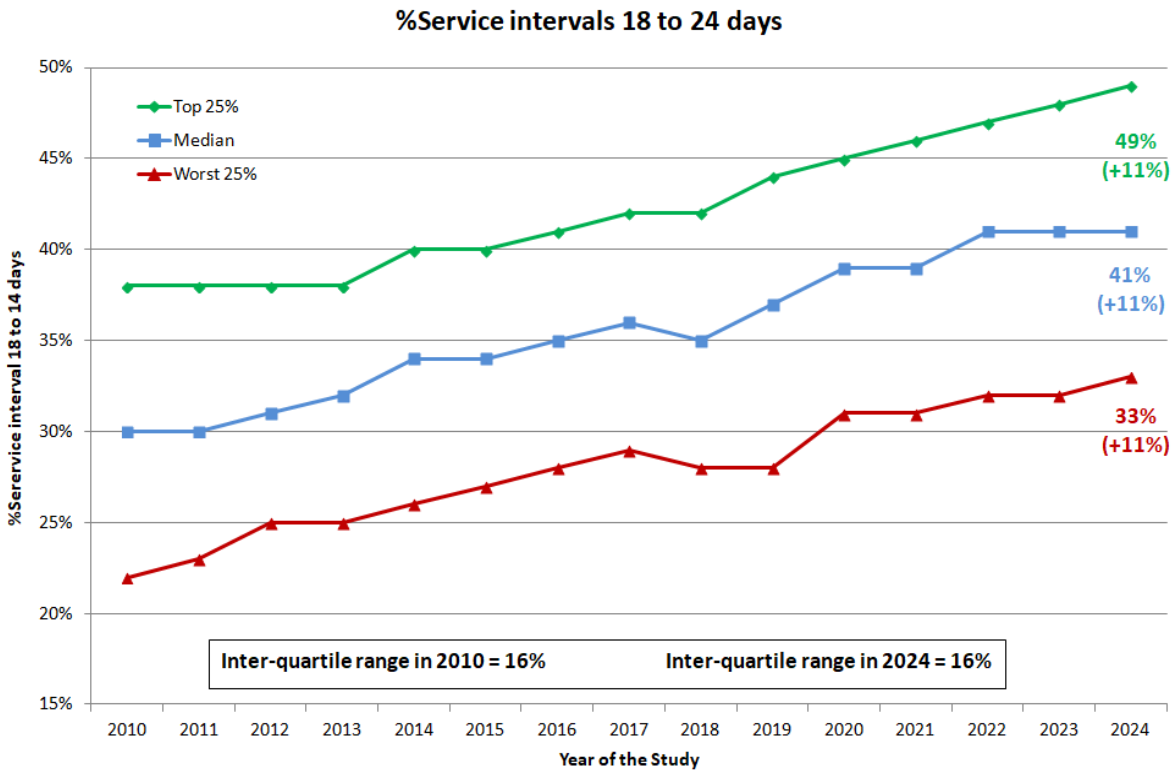
Figure 9. Percentage conceived 100 days after calving.

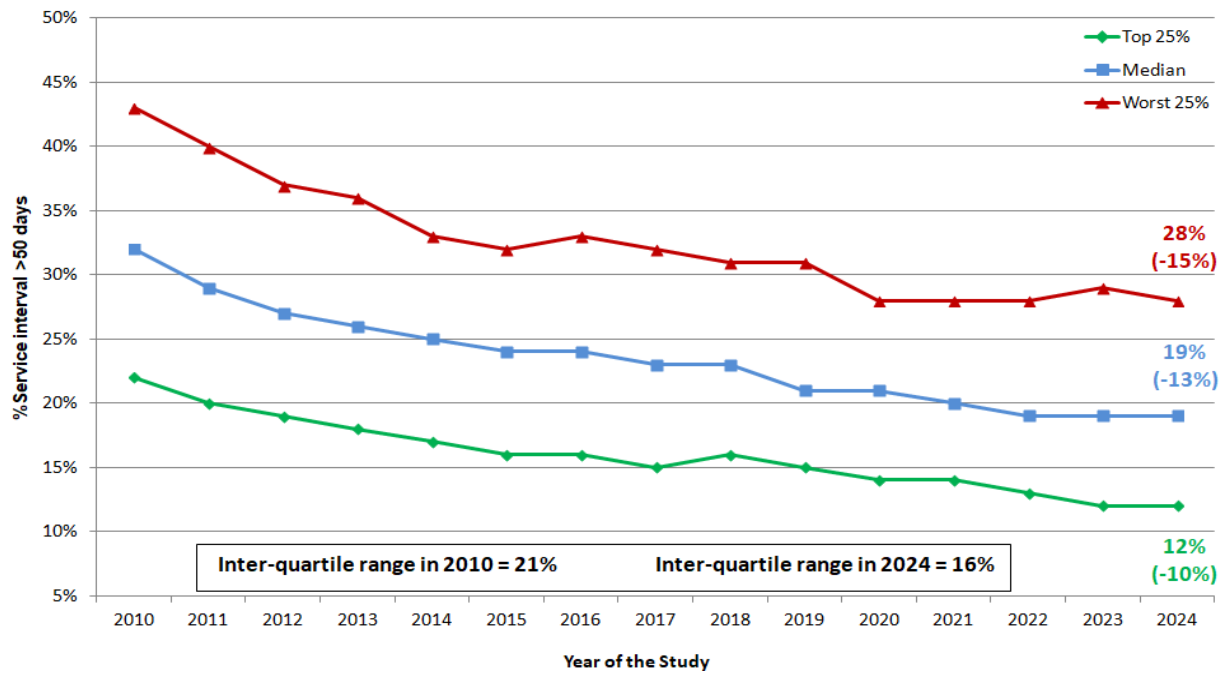**Figure 10.** Heat detection, the proportion of all repeat services that are 18-24 days after the previous service.

Figure 11. Heat detection, % service intervals that are >50 days.
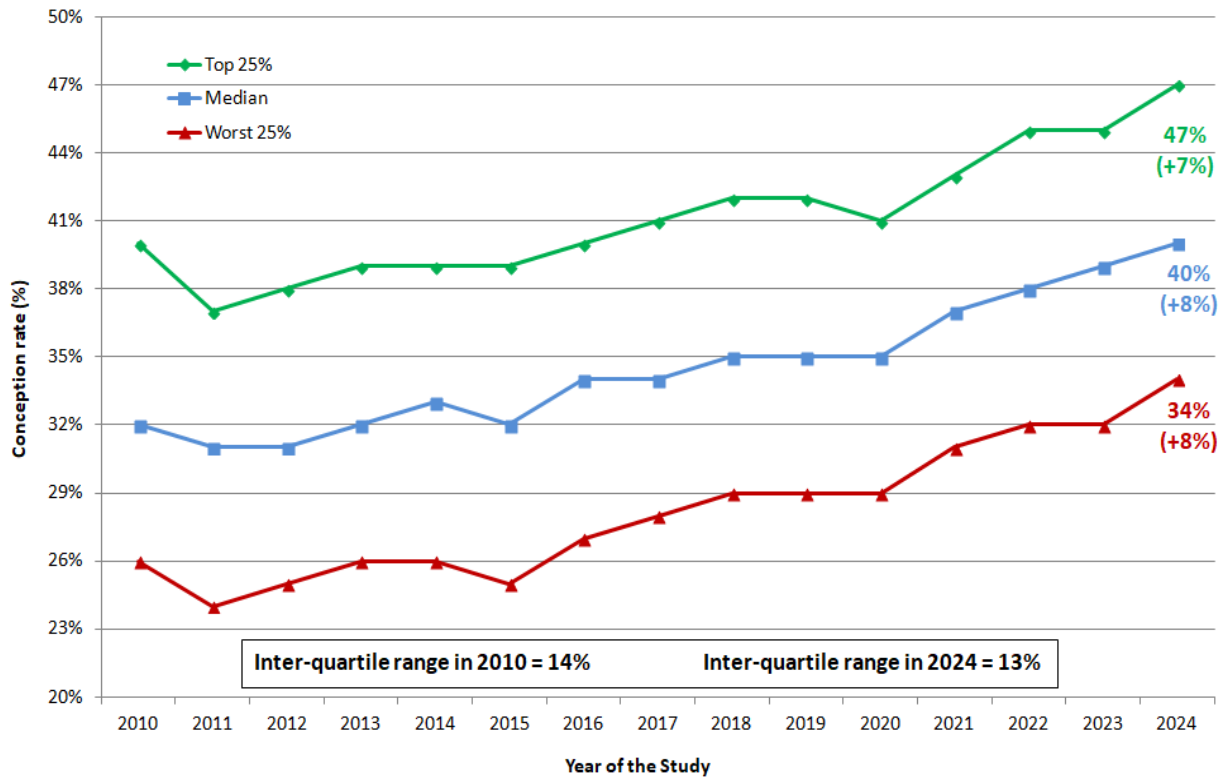
Figure 12. Conception rate (%).
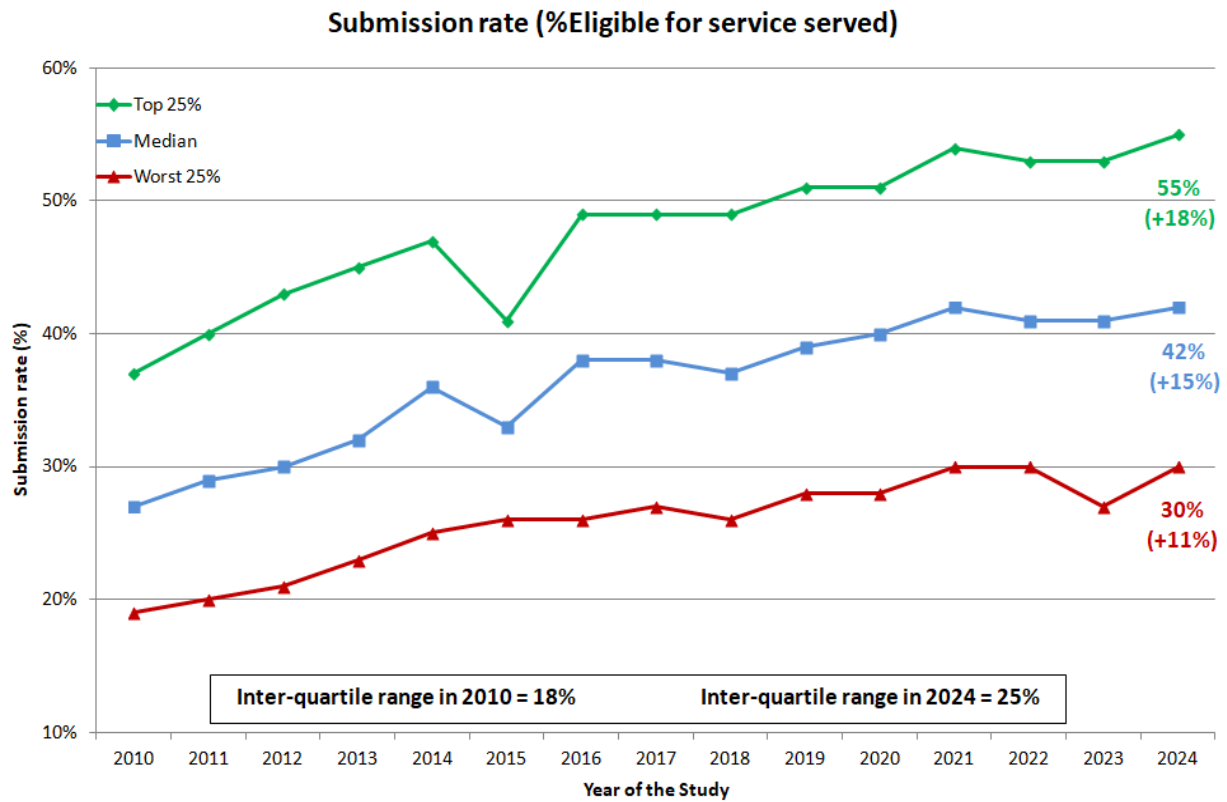
Figure 13. Submission rate, the proportion of cows eligible for service served.
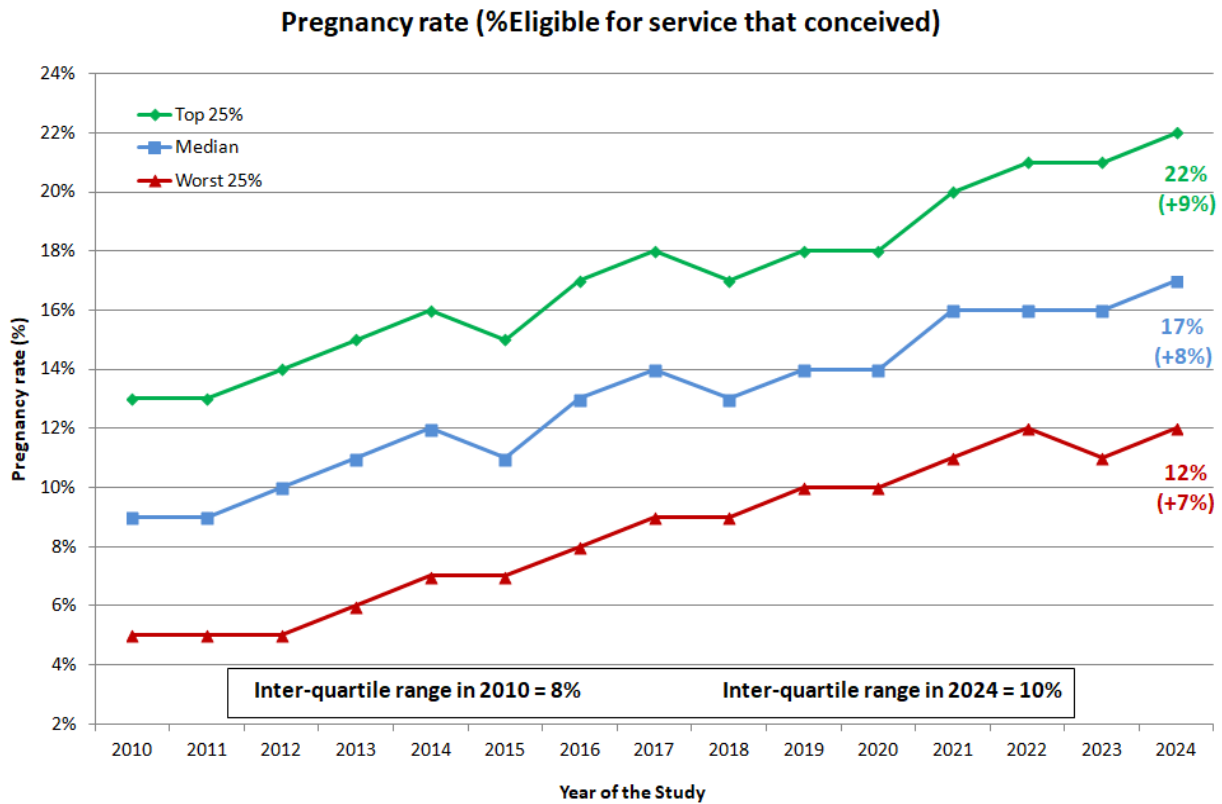

Figure 14. Pregnancy rate, the proportion of cows eligible for service that conceived.
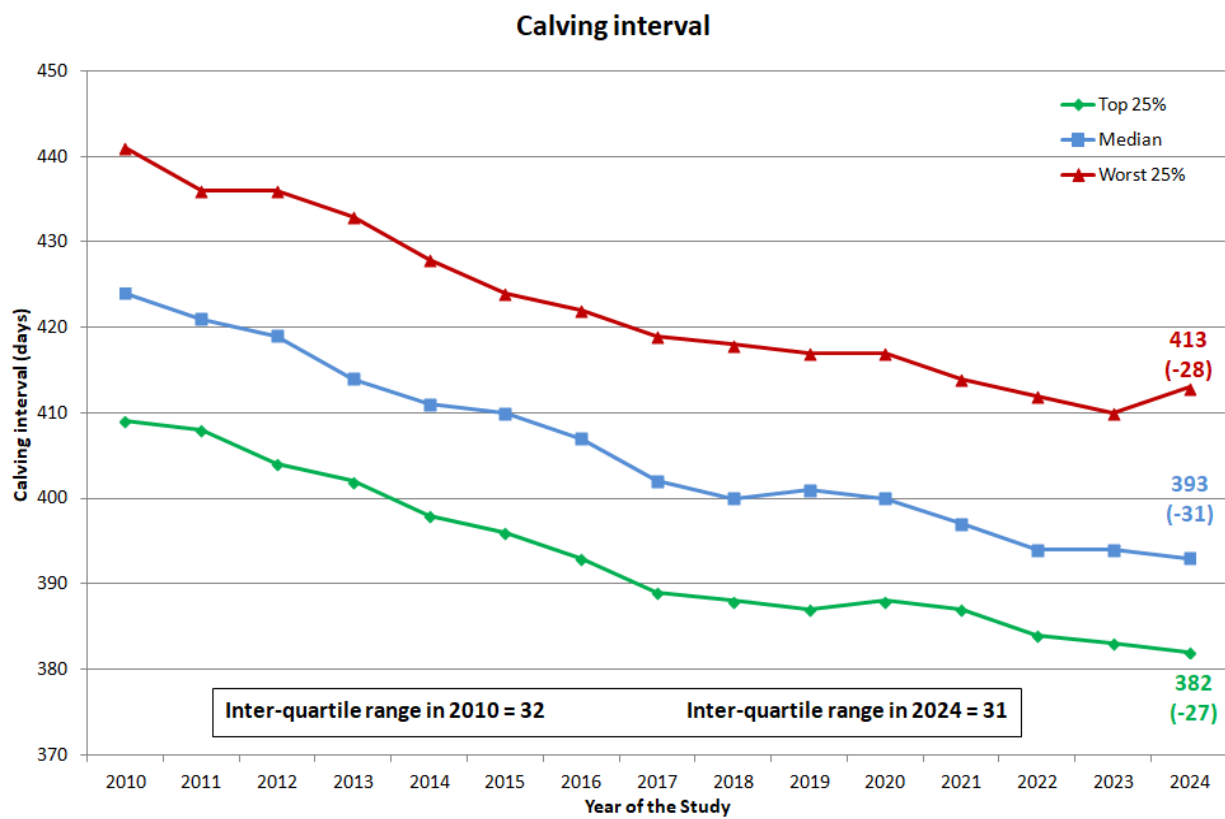
Figure 15. Calving interval (days).

3.4   Milk production

Lifetime milk/cow/day increased by 25%, albeit with fluctuations from 10.5 kg in 2010 to 13.1 kg in 2021. From 2021 to 2024, lifetime milk/cow/day notably decreased by 5% to 12.5 kg (Figure 16). Milk/cow/year increased with fluctuations from 7,665 kg in 2010 to 9,008 kg in 2021. From 2021 to 2024, milk/cow/year has notably decreased by 4% to 8,670 kg (Figure 17). Milk protein has increased from 3.27% in 2010 to 3.36% in 2024 (Table 2). Milk fat has increased from 3.96% in 2010 to 4.29% in 2024 (Table 2). Trends in milk protein and milk fat yields broadly match the trends shown by lifetime milk/cow/day and milk/cow/year, including a slight reduction from 2021 onwards (Figures 18 and 19).
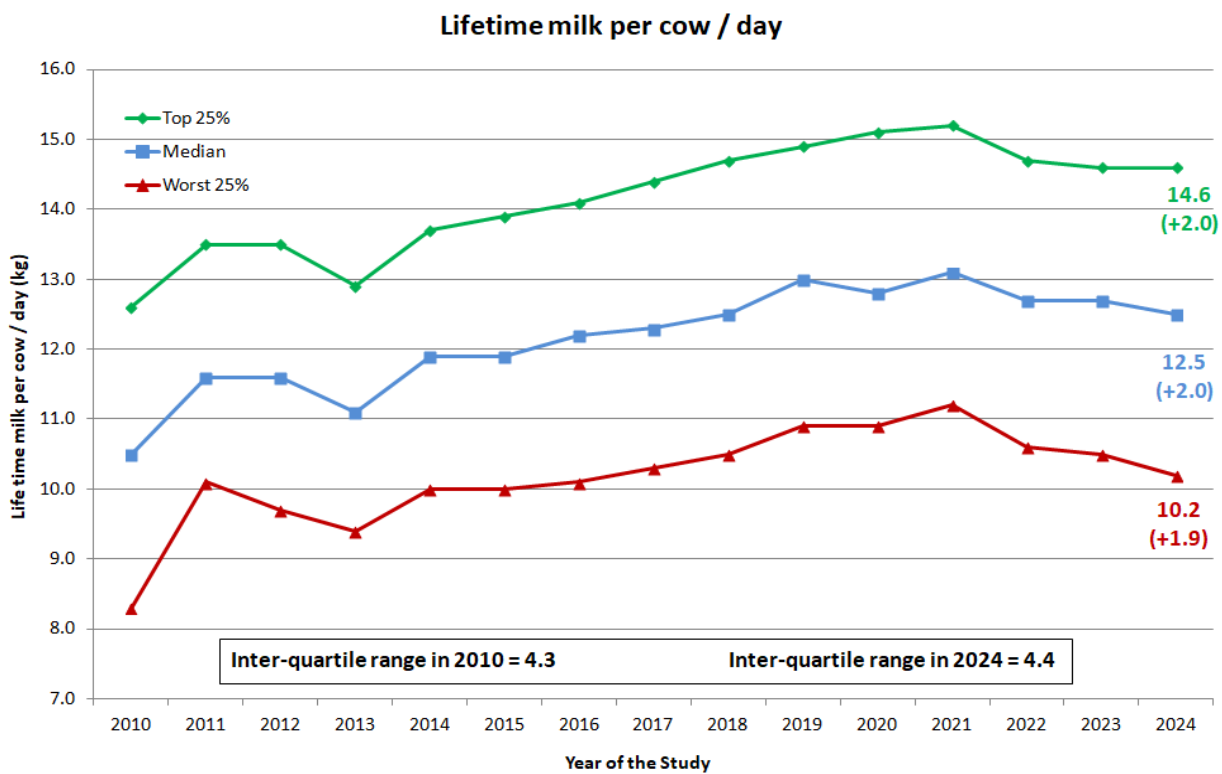

Figure 16. Lifetime milk per cow per day (kg). This includes days between birth and first calving.
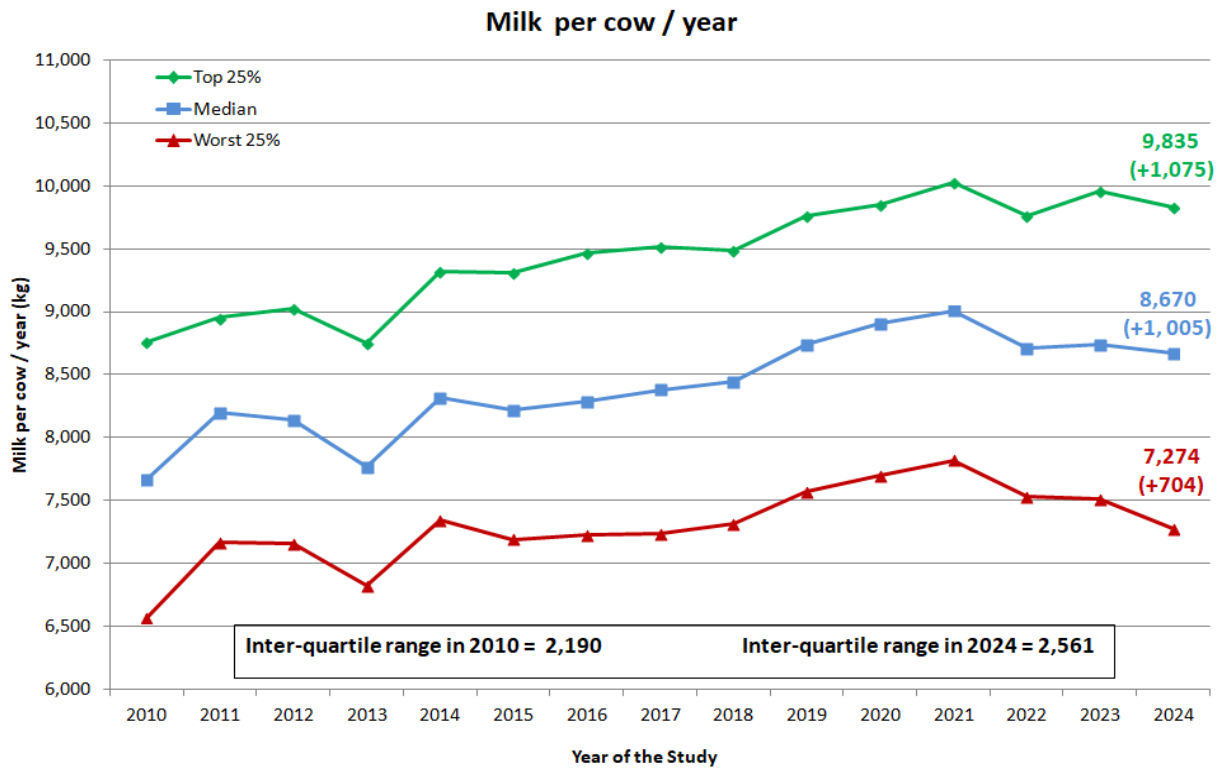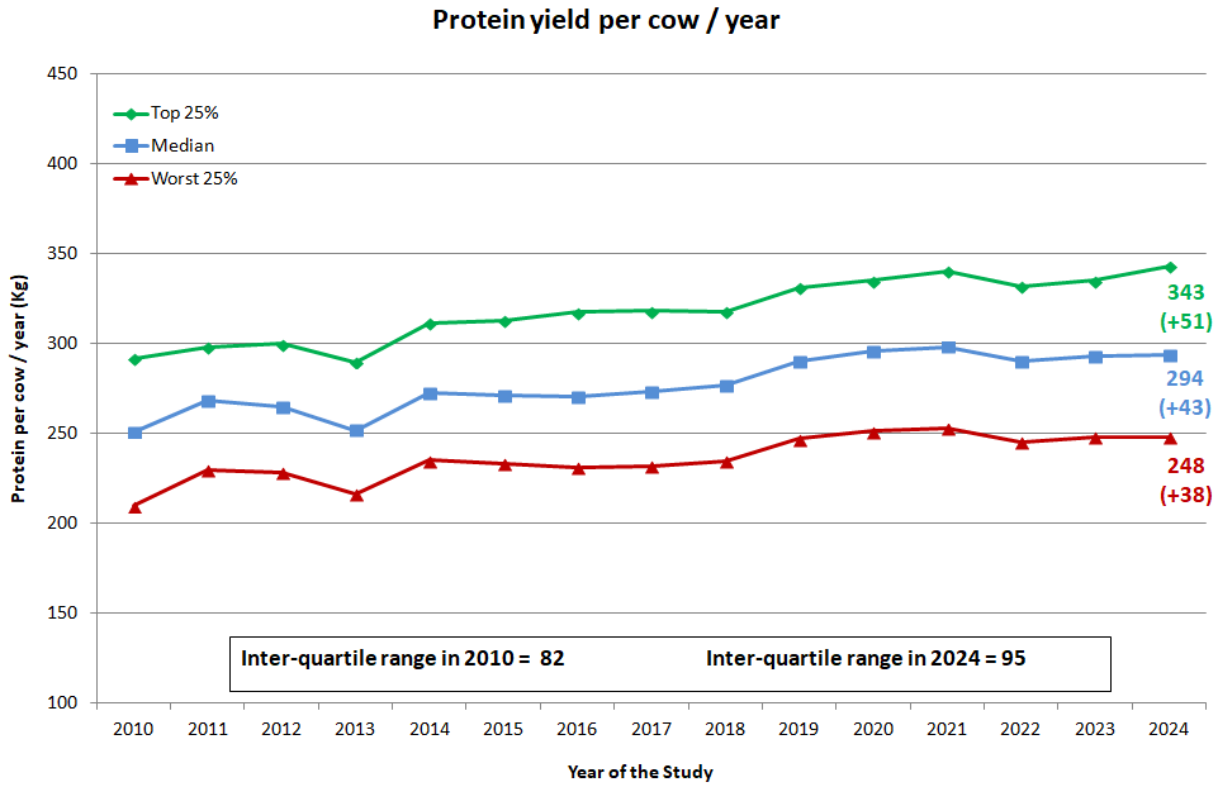
Figure 17. Milk per cow per year (kg).

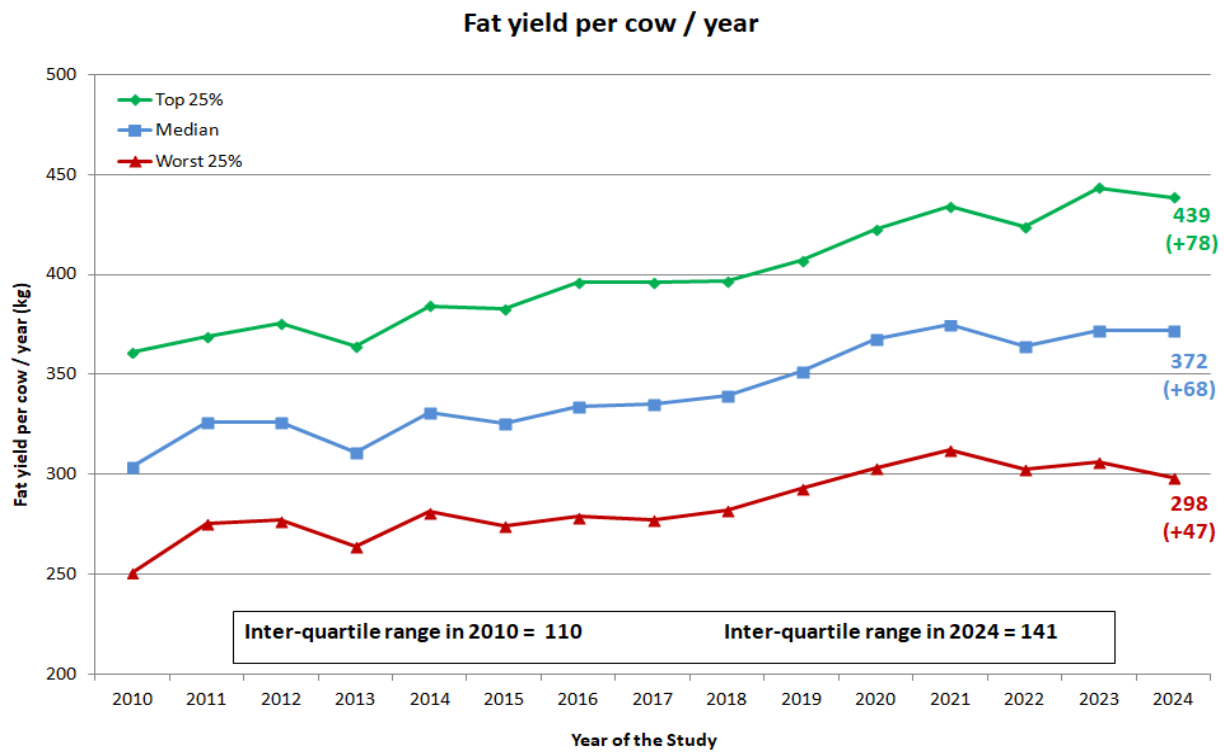**Figure 18.** Protein yield per cow per year (kg).

23

Figure 19. Fat yield per cow per year (kg).

3.5   SCC and mastitis

Average SCC decreased by 21% from 210,000 cells/ml in 2010 to 166,000 cells/ml in 2022. Over the past two years, the average SCC has slightly increased by 10,000 cells/ml to 171,000 cell/ml in 2024 (Figure 20).The proportion of recorded cows with SCC ≥200,000 cells/ml has decreased from 24% in 2010 to 16% in 2024 (Table 2). The proportion of recorded cows with SCC ≥500,000 cells/ml decreased gradually 9% in 2010 to 7% in 2024 (Table 2). The proportion of cows which were dried off without recording a SCC ≥200,000 cells/ml has increased gradually from 33% to 51%. Mastitis rates (cases per 100 cows per year) have gradually decreased from 36 in 2016 to 21 cases in 2024 (Figure 23a). The proportion of cows drying off with no mastitis cases has gradually increased from 79% in 2010 to 85% in 2024 (Figure 24).
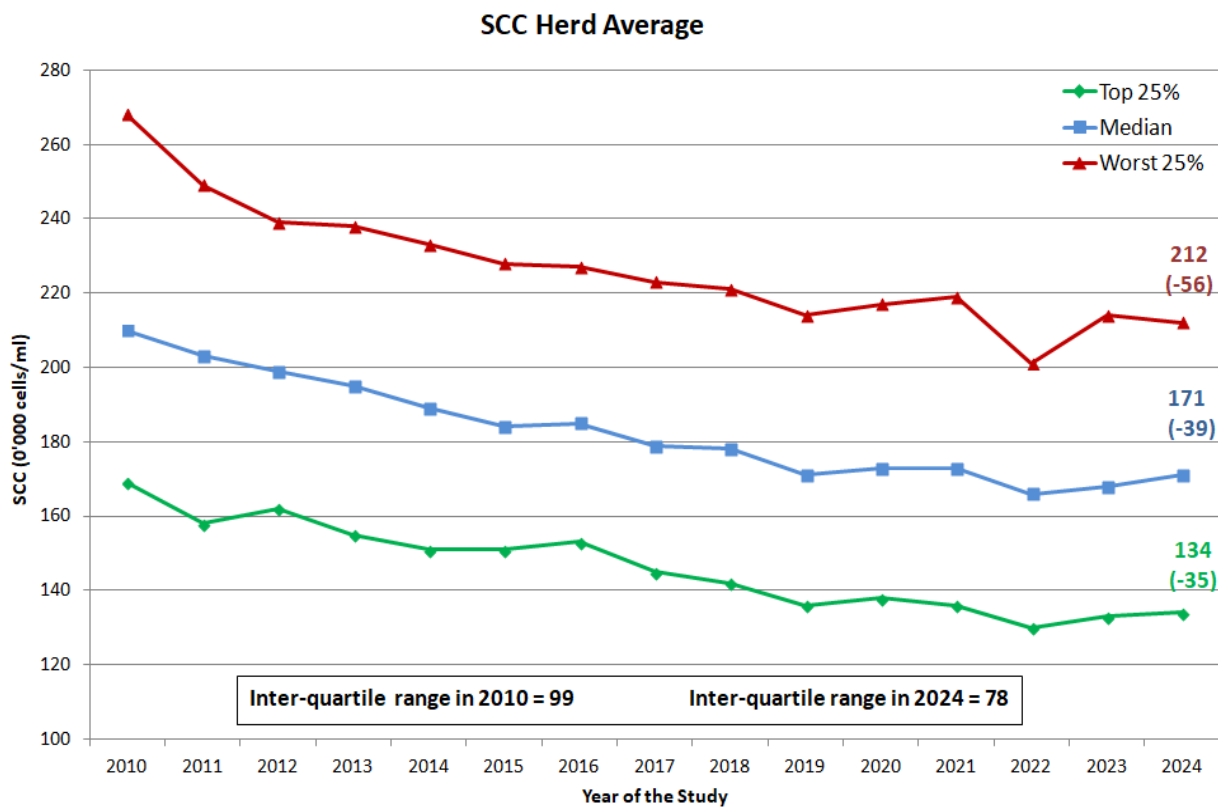
Figure 20. Herd average SCC ('000 cells/ml).
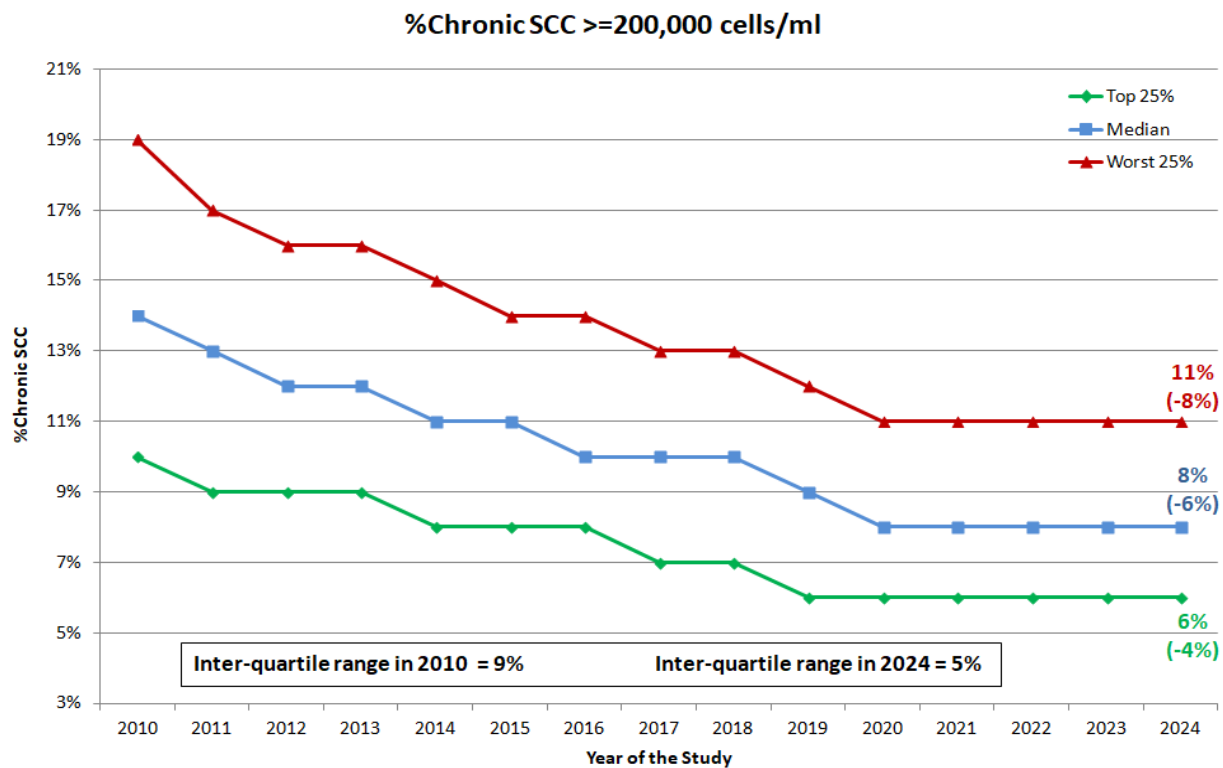
Figure 21. Percentage of milk samples originating from chronic (repeat) high SCC cows.
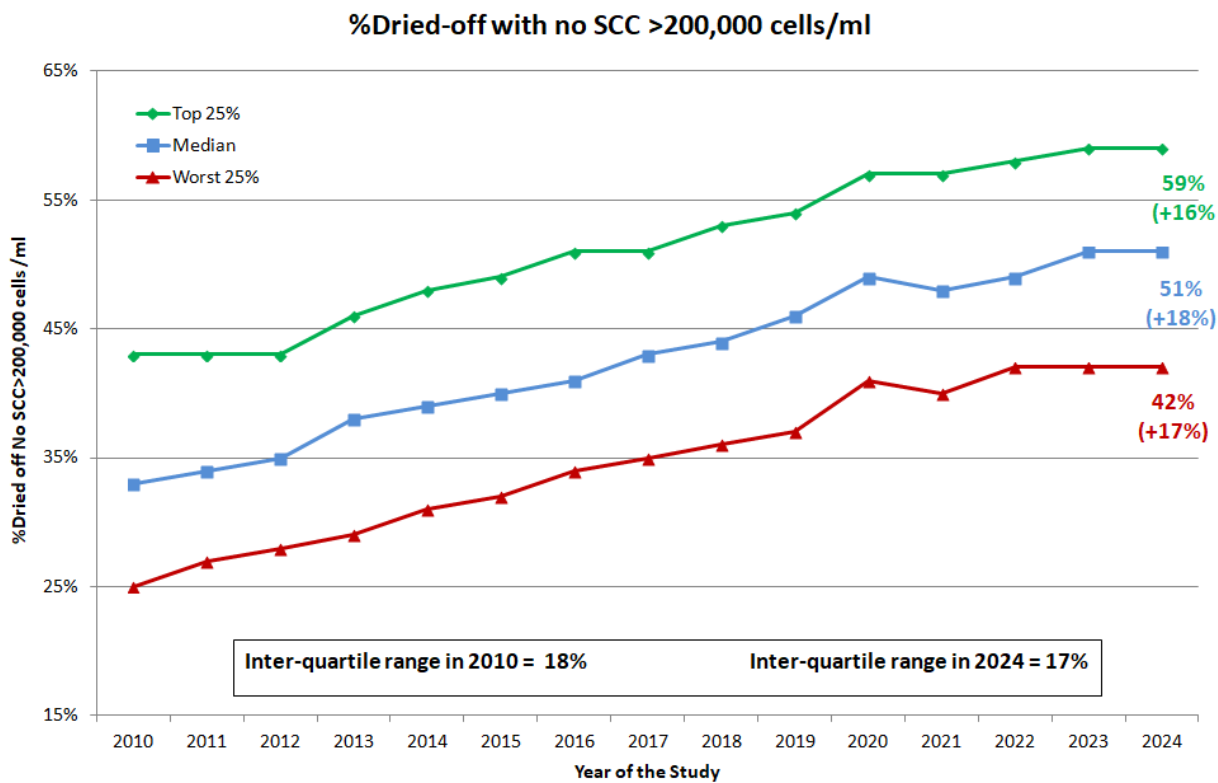
Figure 22. Percentage of cow dried-off with no SCC > 200,000 cells/ml in lactation.
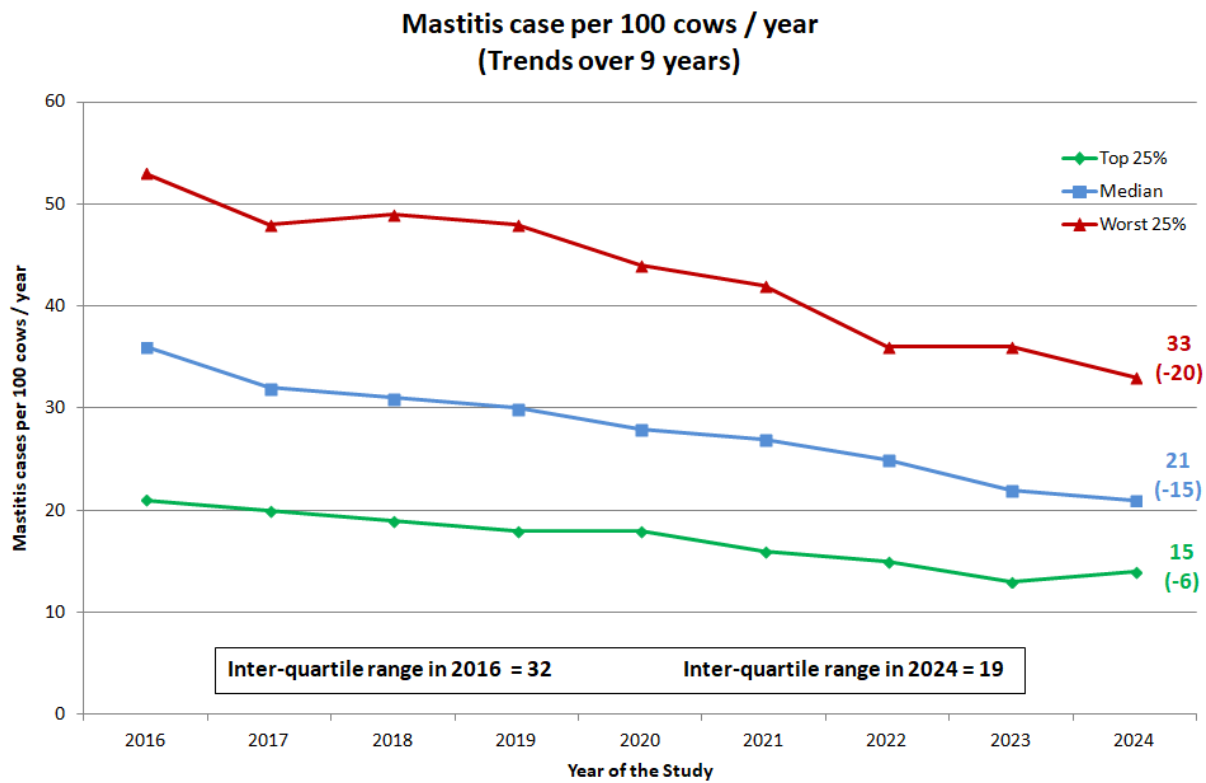
Figure 23(a). Mastitis rate (cases / 100 cows in milk / year) – mastitis groups of herds since 2016 (number of herds in each year varies between 236 and 262 herds).

Figure 23(b). Mastitis rate (cases / 100 cows in milk / year) – the same herds since 2016.

%Drying off with no Mastitis cases
(236 to 262 NMR Mastitis Herds - Trends over 9 years)

Top 25%
Median
Worst 25%

90%
(+3%)

85%
(+6%)

79%
(+8%)

Inter-quartile range in 2016 = 16%   Inter-quartile range in 2024 = 11%

Year of the Study
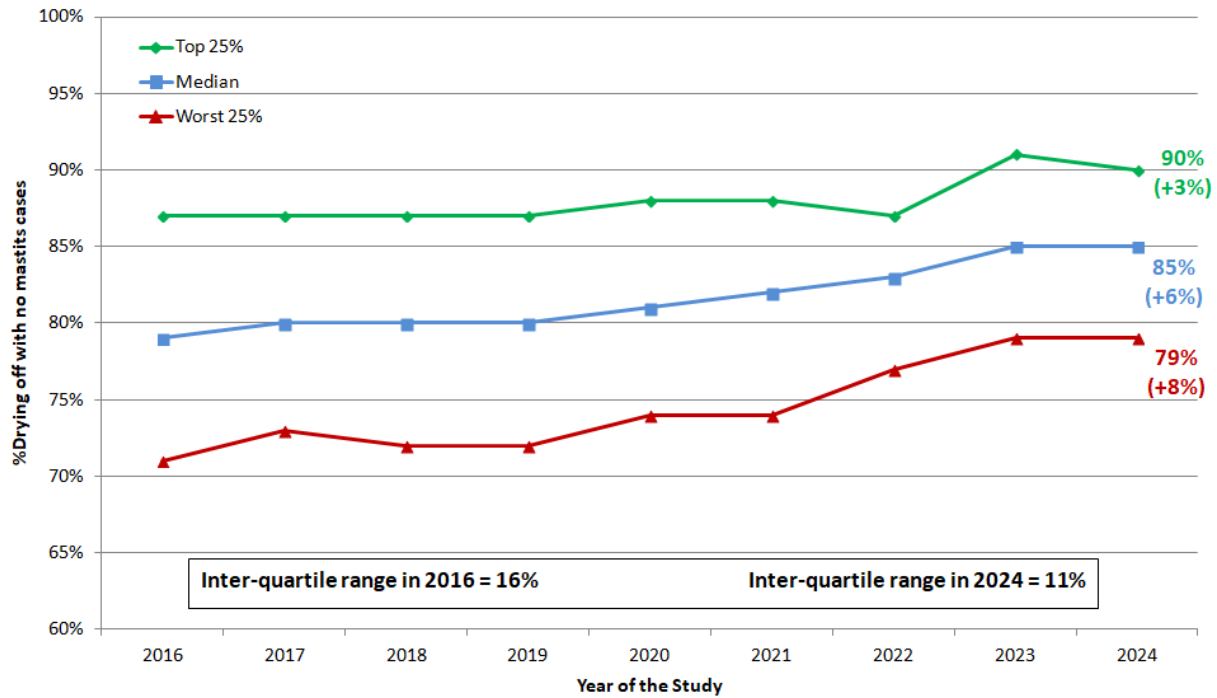
Figure 24. %Cows dried-off with no mastitis cases.

Conclusion

Fertility KPIs related to services have remained stable since 2020 but the remaining fertility related KPIs have continued to improve beyond 2020. Milk yields appear 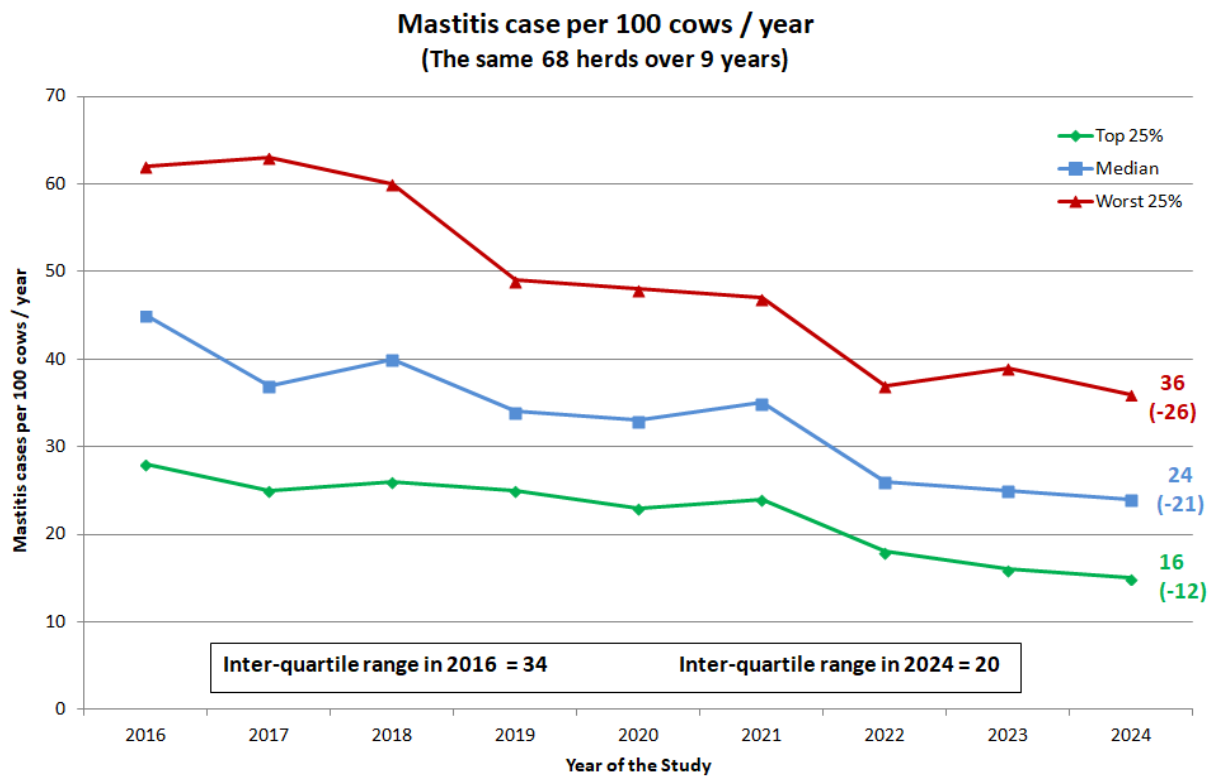to have peaked. Since 2020, milk per cow per year has decreased by 234 kg and lifetime milk per cow per day has decreased by 0.3 kg. However, fat % and protein % have continued to improve, with the result that kg of fat and protein produced per cow per year has remained more or less level since 2020. All SCC KPIs have remained stable since 2020. For example, the average SCC has plateaued at ~ 170,000 cell/ml. However, longevity KPIs have continued to worsen. Compared to 2010, cows exited the herd 261 days earlier after 218 fewer productive days in 2024. These findings suggest that KPIs related to fertility, milk composition and SCC are stable or improving, but KPIs related to milk yields and longevity are worsening.

Appendix 1. Changes in KPIs between 2010 and 2024

Since the initial study in 2010, wherever possible the same herds are kept in the sample used each year. If necessary, herds with poorly recorded fertility data and herds no longer recording were replaced with randomly selected new herds. Within the sample of the 2024 study, there remain 88 herds (18%) that have been included in all the 15 studies (2010 to 2024).

As a check to confirm that replacement of some herds and retention of others has not introduced any unexpected bias in the sample, Table Appendix 1 shows the changes observed in KPIs over 15 years (2010 vs. 2024) for the 'changing sample' of 500 each year alongside the changes seen in the 88 herds common to all 15 years. Table Appendix 1 shows similar trends in the 'common 88' herds to the trends in the 'whole 500' herd samples. Overall, these results do not suggest that significant bias has been introduced by the year-on-year partial replacement of herds in the sample.

Table Appendix 1. A comparison of the 2010 and 2024 median values within the 500-herds and 88 common herds.

Parameter Year of the study	500 herds groups		88 common herds	
	2010	2024	2010	2024
A. Culling rate	24%	28%	23%	29%
B. Culling / death rate in first 100 days of lactation	7%	5%	6%	5%
C(a). Age at exit (years)	6.6	5.8	6.7	5.7
C(b). Age at exit (days)	2,393	2,132	2,453	2,077
D. Age at exit by Lactations	3.9	3.6	4.0	3.5
E. Percentage Served by day 80	46%	60%	46%	58%
F. Percentage conceived 100 days after calving	26%	39%	26%	39%
G. Calving to 1st service interval (days)	105	79	102	82
H. Calving interval (days)	424	393	422	394
I. Age at 1st calving (months)	28.8	26.5	30.0	26.6
J. Conception rate	32%	40%	32%	40%
K. Percentage service intervals at 18-24 days	30%	41%	32%	41%
L. Percentage service intervals >50 days	32%	19%	30%	19%
M. Percentage eligible for service that served	27%	42%	28%	41%
N. Percentage eligible for service that conceived	9%	17%	10%	17%
O. Lifetime milk / cow / day (kg)	10.5	12.5	10.6	11.8
P. Milk / cow / year (kg)	7,665	8,670	8,140	8,280
Q. Average Protein%	3.27%	3.36%	3.25%	3.36%
R. Average Fat%	3.96%	4.29%	3.95%	4.34%
V. Average SCC ('000 cells/ml)	210	171	194	160
W. Percentage SCC >=200,000 cells/ml	24%	16%	22%	15%
X. Percentage SCC >500,000 cells/ml	9%	7%	8%	6%
Y. Percentage 1st recording SCC >=200,000 cells/ml	20%	16%	18%	17%
Z. Percentage chronic SCC >=200,000 cells/ml	14%	8%	12%	8%
ZA. Percentage Dry period cure (High:Low)	74%	76%	76%	78%
ZB. Percentage Dry period protection (Low:Low)	84%	86%	85%	85%
ZC. Percentage Low SCC at end of previous lactation	60%	78%	66%	78%

Appendix 2. KPI 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.

Table Appendix 2. KPI definitions.

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 80th 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 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 (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.

Parameter	Description
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.
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 ≥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 ≥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 ≥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.
Z. 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.
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 (≥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 ≥200,000 cells/ml	The percentage of all recorded milk samples that were of the "New" SCC Category, namely the first HIGH SCC (≥200,000) in a lactation following one or more low SCC samples.
ZE. Percentage Dried-off with no SCC ≥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).

Parameter	Description
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$200,000cells/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.
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.
ZI. Percentage drying off with no mastitis cases	The percentage of cows completing a lactation without recording a mastitis case.
ZJ. Mastitis rate (cases/100 cows in milk per year)	The total cow cases of mastitis recorded divided by the average population of cows in milk, represented as a % (cases/100 cows in milk).
ZK. Index mastitis case by Day 30	The percentage of cows calving during the 12 month period that recorded a mastitis case by day 30 of the lactation.
ZL. Index mastitis rate after Day 30	The incidence rate of *index* mastitis cases in cows that have passed 30 days since calving.