# Finding the Tools to Achieve Longevity in Canadian Dairy Cows

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## Take Home Messages

- Dairy cow longevity is an important economic trait in that it takes more than one lactation on the average to pay for the cost of raising a replacement at about $2100 to $2400.
- Market factors such as price of heifers versus salvage value of cull cows, as well as decisions to calve all replacements affect turnover rate and cow longevity.
- Do not raise heifers unnecessary to maintain the herd.
- Genetic selection can improve herd life over time.
- Compare key herd performance factors with industry benchmarks and prepare a plan to act on the most needy areas. If benchmarks do not exist set reasonable goals.

## What is Longevity?

Usually longevity is defined as the time from first calving until a cow is culled from the herd.

With the investment in raising a herd replacement about $2,100 to $2,400, a long productive herd life is advantageous to recover the investment and return a profit to the dairy operation. Figure 1 represents the daily cash flow during a cow's life as well as the cumulated net income. According to Dr. David Galligan, Pennsylvania State University, the breakeven point usually occurs towards the end of the first lactation.

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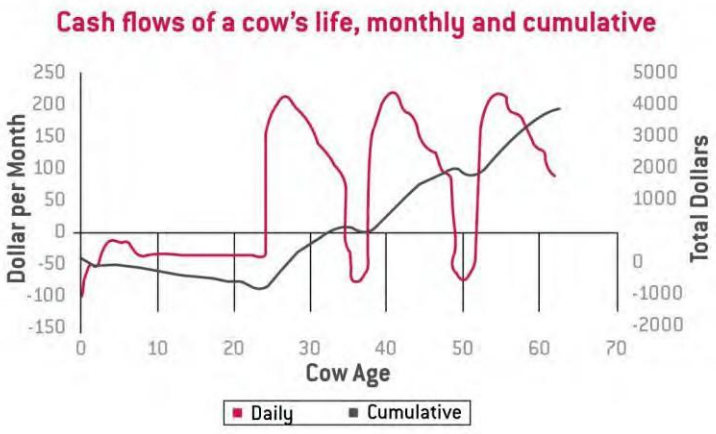



**Figure 1. Graph illustrating the cash flows of a cow's life on monthly and cumulative basis**

A cow only becomes profitable once she has progressed into the second lactation. Greater longevity = more profitable cows.

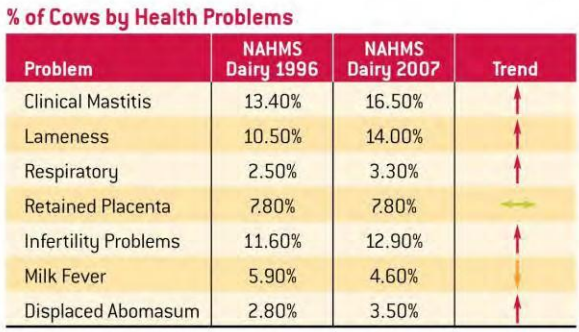
## ■ How do we Measure and What are the Benchmarks

CanWest DHI reports as the 50 percentile of DHI herds:

| | |
|---|---|
| % of herd 3 lactations plus | 37.3% |
| Average age milk cows | 4 yrs 3 months |
| Average age at first calving | 26.4 mo. |
| Average calving interval | 427 days (14 mo) |
| Average # Lactations | 1.6 |

Culling rates in Canadian milk recorded herds typically show reproductive failure as the predominant reason for culling at around 30%. This is followed by mastitis, feet and leg problems (lameness?) and low milk production.

Data from the United States and recently summarized by Bill Woodley at Shur-Gain on relative cull rates for disease problems show mastitis, infertility and lameness as the big 3 health issues in dairy herds and are proportionately increasing. At the same time culling for low production slipped from 21.4% to 16.1%.



% of Cows by Health Problems

| Problem | NAHMS Dairy 1996 | NAHMS Dairy 2007 | Trend |
|---|---|---|---|
| Clinical Mastitis | 13.40% | 16.50% | ↑ |
| Lameness | 10.50% | 14.00% | ↑ |
| Respiratory | 2.50% | 3.30% | ↑ |
| Retained Placenta | 7.80% | 7.80% | → |
| Infertility Problems | 11.60% | 12.90% | ↑ |
| Milk Fever | 5.90% | 4.60% | ↓ |
| Displaced Abomasum | 2.80% | 3.50% | ↑ |

**Figure 2. Percent of cows by health problems reported in United States dairy herds according to National Animal Health Monitoring System (NAHMS) 2007 survey. Appended from NAHMS USDA APHIS VS. Section I: Population Estimates. P.84**

Do we try to read too much into culling information? We probably do. Culling data are easy to summarize and averages can be attained in a few minutes with a calculator, but we need to use caution in drawing conclusions from these data or trends as they could be misleading.

It is common for culling data to contain 25-40% as unknown and died; often this is the largest category. This leaves a lot to be desired and casts some doubt on any conclusions one draws from culling data other than to say that reproduction, mastitis and lameness are important reasons for culling. The decision to cull a cow from a dairy herd is usually based upon multiple reasons of varying importance and sometimes the reason that gets recorded is only one of many possibilities.

That said, one interesting way of looking at culling information is by stage of lactation. Figure 3 summarizes culling data over 2 years of DHI records.

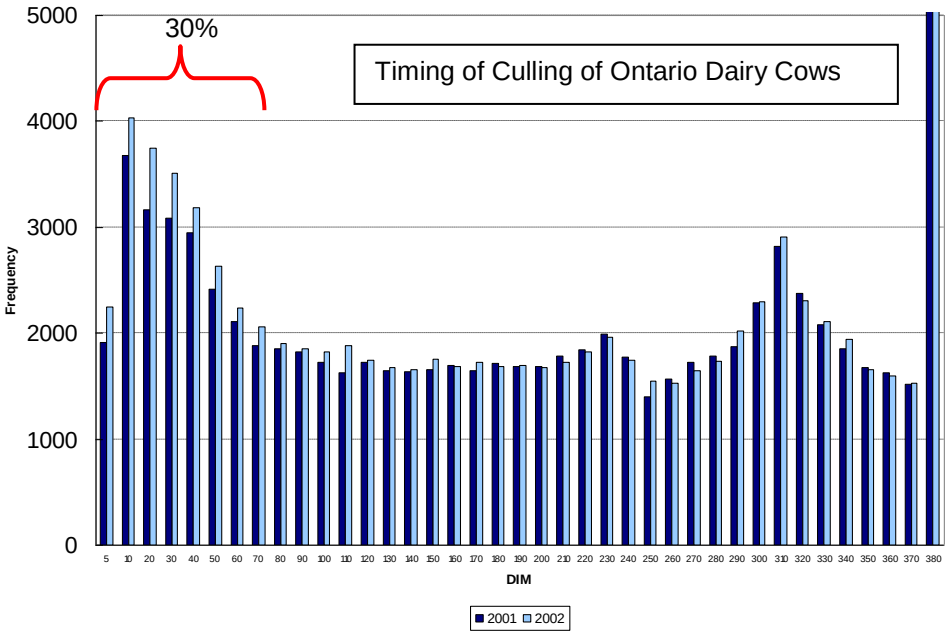



**Figure 3. Timing of culling of Ontario dairy cows on two years of DHI data.**

This summary by Dr. Dave Kelton of the University of Guelph shows that approximately 30% of culls happen in the first 60 days of lactation. These data may be helpful in looking at the causes for cow removals and strategies to manage early lactation and transition cows. Herds with the same overall culling rate may have dramatically different rates in the first 60 days in milk (DIM).

The second most common timing of culling comes at the end of lactation after 350 DIM. The most common reason for culling at that stage is reproduction, but in this data it is impossible to separate cows left open intentionally form those that were bred repeatedly and did not conceive. In a study at the University of Florida, the proportion of cows culled due to reproduction rose from 5% in the first 150 DIM to over 40% by 500 DIM (Pinedo et al. 2010).

## ■ Outcomes and Goals

Measures such as longevity, percent 3rd lactation or greater and culling rates are outcomes as a result of practices or situations in the herd. They may be useful markers and guidelines but are lacking when it comes time to decide what strategy to take to fix the problem or sometimes even if anything needs

fixing. To make these data meaningful we have to dig deeper and look at processes or measures of what is going right or wrong in a herd.

## Longevity Not Always Most Profitable

Longevity does not necessarily equal higher profit if the dairy is forced to keep cows that are broken down and unprofitable through low production, disease, mastitis or lameness.

When is longevity not a good thing? Ideally the producer should make decisions on keeping or culling cows based on profitability. In many situations where cows leave the herd for other reasons the herd may be made up of broken and unprofitable cows.

- Poor reproductive performance – not enough cows calving to maintain milk flow
- Poor calf survival – fewer replacements coming into the herd
- Late age at first calving – necessary to keep some cows longer than you should

## Market Forces

Strong export demand and strong price for replacement heifers combined with a good market for milk cows means less pressure to turn over the milking herd. With less replacements and first lactation cows coming into the herd more cows are kept in the herd longer resulting in greater longevity. This was the situation in Ontario until May of 2003.

The BSE crisis and border closures to cattle traffic meant the bottom fell out of the springer and replacement market. The advice given to producers then was to cull the herd ruthlessly and build up a younger higher quality herd. The current situation with low prices for heifers in the USA, a high Canadian dollar, and reasonable demand for cull cows in the USA means that most dairy producers are calving out all of their replacement 2 year-olds and culling heavily once cows have been milking in the herd perpetuating a higher herd turnover.

Market forces at play since 2003 indicate we should see a higher culling rate of milking cows and a lower average age than in the previous time period.

## Genetics

Genetics are an integral part of nearly every piece in the longevity puzzle; however, the only obvious measure is Herd Life. Herd Life is an often ignored

trait in our genetic evaluation system - it plays a role in the Lifetime Profit Index (LPI) calculation but only a small part. Herd Life calculation is based on how many of a bull's daughters are still in the herd at each of 5 stages of productive life after first lactation. The index 100 is the mean and one standard deviation difference is +/-5. For example, a bull ranked over 110 for Herd Life will have about 50% of his daughters lasting until 4 lactations versus only around 30% for the average (VanDoormaal, 2010).

**Table 1. Relationship of Herd Life to major groups of traits**

| **Trait** | |
|---|---|
| Low Somatic Cell Score | 35.2% |
| High Female Fertility | 24.8% |
| Easy Calving Performance | 23.7% |
| Desirable Functional Conformation | 23.7% |
| High Lactation Persistency | -10.7% |
| Body Depth | -14.4% |

Bulls tend to have "indirect herd life" calculated from relatives and related traits until their daughters are old enough to measure how long they would stay in the herd. As shown in the table above, mastitis, fertility and calving ease proof information have the greatest value in predicting daughter survival. Conformation traits especially mammary traits (28-34%) and feet and legs (21-25%) also follow expectations, but high scores for lactation persistency and body depth are actually associated with shorter herd life. The use of genomic proofs has increased the relative accuracy of these proofs so they should be nearly as useful as waiting for direct herd life proofs.

**Table 2: Example proof for herd life for Braedale Goldwyn with 30785 daughters in 5628 herds, herd life proof: 110, % rank: 98**

| | **Daughter Survival from First Calving to:** | | | | |
|---|---|---|---|---|---|
| | First Lactation | | Second Calving | Third Calving | Fourth Calving |
| | 120 DIM | 240 DIM | | | |
| No. daughters | 30785 | 28445 | 22063 | 11938 | 3944 |
| Percent survived | 97% | 95% | 87% | 68% | 48% |
| Breed average | 96% | 91% | 70% | 50% | 31% |

**Source:** Appended from Canadian Dairy Network Genetic evaluations Dec 2012: Evaluation details for functional traits
http://www.cdn.ca/query/detail_functional.php?breed=HO&country=CAN&sex=M&regnum=10705608

Note the percent survived to 2nd, 3rd and 4th calving in Braedale Goldwyn's proof compared to breed average. If you are concerned about making genetic progress for longevity and cows that stay in the herd longer, consider more emphasis on Herd Life. Of the top 20 bulls on the Top LPI Bull List of December 2012 published by Canadian Dairy Network, the average score for Herd Life was 108.5 with a range of 104 to 116 (Crackholm Fever) reflecting the influence that longevity related traits have on the LPI.

## ■ Transition Period

The transition period holds the most promise for progress to be made from analysis of calving and post calving records such as health conditions and reasons for culling. A successful transition period can result in birth of a healthy vigorous calf and successful integration of the cow into the milking string to produce milk to the maximum of her genetic potential. A poorly managed transition period will result in a weak sickly calf, and a cow that is prone to post calving health disorders such as retained placenta, metritis, acidosis, and delayed conception often results in culling from the herd.

Many transition and early lactation health problems can be related to the pre-calving period. Monitor daily intake. Avoiding overcrowding in pre freshening groups has been shown to be important. Take care in group changes and integration into new groups to minimize stressful effects of social change.

## ■ Calving and Calf Survival

Dystocia has been shown to be related to stillbirths and high incidence of diarrhea and pneumonia in calves, as well as subsequent poor health and reproduction in the mother. Selection of sires for use on heifers should emphasize calving ease and calf survival as well as daughter calving ease and daughter survival. These will not necessarily be the same sires you use on the existing milking herd and will result in more live calves and less calving problems for heifers entering the herd. Goals: 5% stillbirths with heifers and 2% with 2nd and later calving.

## ■ Heifer Management and Age at First Calving

- Raise healthy calves
- Set realistic goals for age at calving and do not allow heifers to get lost in the system
- Raising all replacements and calving them implies you will have a 40% replacement rate in your herd. At $2100 to $2500 cost to raise a heifer to 24 months of age, there may be less costly options.

- Consider breeding all heifers or the top half of the heifer crop to sexed semen.
- Consider 6K genomic testing shortly after birth to identify the best replacements, breed them to sexed semen, use the lower genetic value heifers as recipients or find a new home for them. Reducing the number of heifers raised to first calving is a net saving.

## Reproduction

Choose some herd benchmarks to monitor reproduction. Calving intervals have lengthened from 13 months to 14 months on average and reproductive failure remains one of the most popular reasons for culling. The favored overall measure of reproduction is 21day pregnancy rate (PR). The average PR in DHI herds is 13%, and is calculated as the insemination rate (heat detection) x conception rate. Recent thinking that the reproduction scene is not entirely hopeless is encouraging: Pregnancy rates of 20% and higher are achievable on an ongoing basis. To change the herd pregnancy rate you have to know and understand the insemination rate and the conception rate in a herd.

Ovsynch protocols have typically been the solution to poor heat detection however, the use of activity monitors has gained in popularity. A large field trial conducted at University of Guelph has shown that a pregnancy rate using activity monitors comparable to that attained by using Ovsynch (Neves et al, 2012). Heat detection rates of 50 to 75% can be achieved with minimal use of injectibles. Producers need to look at investing in the technology such as activity monitors versus cost per treatment with Ovsynch programs. Featured herds with exceptional reproductive success place emphasis on heat detection, by humans or activity monitors, along with varying degrees of Ovsynch. Some top reproductive herds are crossbreeding.

## Mastitis

As the allowable limit for bulk tank somatic cell count (SCC) has been reduced to 400,000 from 500,000, a higher proportion of high SCC cows will be culled. According to Dairy Farmers of Ontario statistics, 34.9% of herd tests for SCC in 2010 were over 399,000! High cell count or mastitis will become one of the more popular culling reasons in 2012. Valuable tools to use are individual cow SCC and milk sample screening for individual mastitis pathogens both offered through DHI. High SCC cows are culling candidates. Mid-range SCC cows (200-500,000) should receive attention to stop them from becoming high SCC cows.

## ■ Recording Health Traits

Dairy producers have the opportunity to better manage health traits in their herds by recording In the DHI system eight common health problems: mastitis, lameness, displaced abomasum, cystic ovarian disease, milk fever, ketosis, metritis and retained placenta. This is one of the few systems in the world whereby all health occurrences can be recorded into a central database, reports given back, and potentially generate benchmarks and genetic evaluations for health.

As most of these traits relate to transition and fresh cow health as well as lameness, we would expect more producers to take advantage of this option. As well, many veterinarians may be entering health data in their DairyComp systems which are not being included in the main DHI system. Until there is a way found to incorporate more complete health event data we are missing out on a great opportunity to track and benchmark post calving disorders.

## ■ Lameness

Lameness is rapidly becoming the number one health issue in milking cow herds according to a recent Cornell University survey, and ranks closely with mastitis and reproductive failure as a reason for cows being culled. It is an economic issue and an animal welfare concern. Many dairy producers underestimate the extent of lameness in their herds (Espejo et al. 2006). Lameness affects about 40% of the cows in dairy herds. Research in Michigan showed cows 8 times more likely to be culled if they were in the “lame group”. Lame cows had longer days to first breeding, longer days open, and more services per conception. Bicalho (2011) in field studies has related lameness to cows with low body condition in early lactation. Cows with low BCS have significantly thinner digital cushions and therefore a lower capacity to protect the corium tissue from compression by the third phalanx, leading to claw horn disruption lesions.

Diagnosing and quantifying lameness remains an imperfect practice. Lameness or locomotion scoring is inexact and open to interpretation and even if there is agreement on the scoring it does not indicate the source of the lameness.

Several years ago Sweden’s hoof trimmers and researchers adopted a hoof health scoring and reporting system based upon the trimmers reporting of lesions and conditions. This has progressed to the point of generating bull proofs for hoof health for a number of years in the Scandinavian system and more recently in the Netherlands. In Canada we now have the opportunity to capture this information at chute side with a touch screen tablet and software. This system provides excellent management information and records for the

herd owner to combat digital dermatitis and track progress of treatments of lesions. Many hoof trimmers are buying into this technology and now participate in Hoof Health Projects in BC, Alberta, Ontario and Atlantic Canada. They are leading the way to coordinate this information for health and genetic research and to provide benchmark information for their clients. If the industry wants to benefit from this technology and be able to share the data they need to buy in and support these programs.

As of November 30, 2012, 578 herds in 3 provinces had contributed trim records and DHI data to The Alberta Dairy Hoof Health Project's hoof health database, providing trim records for 80,533 individual cows. In Alberta, 50.9% of these cows had one or more of the 14 claw lesions being evaluated by hoof trimmers. In BC, 59.8% of cows trimmed had one or more lesions while, in Ontario, only 38.1% had lesions. Summaries of the information to date can be found at www.hoofhealth.ca.

## ■ Crossbreeding

Crossbreeding strategies have come to the fore in the discussions about fitness issues such as fertility and longevity. Crossbreeding trials, both controlled and field trials, were begun in the United States investigating crosses among Holsteins (HO), Jerseys, Montbeliarde, Normande and Swedish Red. A large 5 year Canadian crossbreeding project involving some Semex partners and Geno Global was carried out using imported Norwegian Red (NR) semen on purebred Holstein females with the result of 1018 female NR cross calves born in 79 herds, along with over 16,000 pure Holstein herd mates. This was a pretty extensive trial.

One benefit to the industry was that analysis was carried out using data from all crossbreeds on which there were available data and not just those in the trial.

**Table 3. 56-day Non-return rate to 1st insemination of NR and other breeds on HO females**

| Breed of Service Sire | 1st inseminations | Comparative HO Sires | Difference |
|---|---|---|---|
| Norwegian Red | 70.2% | 60.6% | +9.5% |
| Jersey | 71.1% | 57.4% | +13.7% |
| Brown Swiss | 65.1% | 61.3% | +3.8% |
| Ayrshire | 71.7% | 65.5% | +6.2% |

Resultant calvings from NRx matings on HO versus pure Holstein:

- NRx matings 93% live calves at birth versus 88% live calves. Difference: 5.6%
- With matings to 2nd+ lactation cows live births were 95% vs 94%. Difference: 1.1% Calves were smaller and the percentage of unassisted calvings was 6.3% higher

**Table 4. Reproduction and calving performance of Norwegian Red crossbred and purebred Holstein heifers.**

| | NRx | HO | Difference |
|---|---|---|---|
| Non-return rate as heifers | 81.8% | 76.6% | +5.2% |
| Unassisted calvings (1st calving) | 63.2% | 54.9% | +8.3% |
| Stillbirth rate (1st calving) | 9.2% | 14.5% | -5.3% |
| Non return rate (lactation 1) | 69.4% | 58.5% | +11.1% |
| Stillbirth rate (2nd calving) | 1.6% | 5.9% | -4.3% |

Many reproductive performance measures favour the NRx breedings and crossbred offspring. Some calving ease statistics may be due to smaller calf size but that was not the case when the crossbred cows gave birth in their first and later lactations (Schaeffer and Burnside, 2011).

In general terms the analysis of crossbred offspring (compared to pure Holstein) showed:

- Production: Lower milk volume, higher fat and protein yield
- Reproduction: Increased fertility, shorter gestation length, shorter calving to first service.
- Calving: Better ease of calving, fewer stillbirths.
- Somatic Cell Counts: No difference, although a concurrent study on immunity showed better overall immunity levels with crossbreds.
- Conformation: shorter stature and deeper udders. Scandinavian crosses had narrower rear attachments.
- Milking Speed and Temperament: No difference.

The crossbreds can compete in yield of components, traits that have been shown to only have a 2-5% benefit from heterosis. Heterosis plays a larger role and gives a bigger boost to traits such as fertility and calf survival. As well, the Scandinavian breeds have been selected for these traits for generations and may bring some advantage with them. With better fertility

and calf survival, and equal production, crossbreeding could be part of a longevity strategy.

## ■ Cow Comfort

Cow comfort is becoming recognized as an important aspect of herd management and has been the subject of a lot of applied research in recent years, thanks in large part to the efforts of the UBC group. The industry as a whole has struggled with finding objective measures of cow comfort that can be used to reliably measure herd situations and be repeatable over time. Three measures of stall comfort have been suggested, recently summarized by Dr. Rick Grant of the Miner Institute (Martinez, 2012):

- Cow Comfort Index (CCI) – proportion of cows in contact with a stall that are lying down. Calculate by: total number of cows lying in a stall divided by the total number of cows in contact with a stall (within 2-4 feet). Benchmark: 85%.
- Stall Standing Index (SSI) – proportion of cows in contact with a stall that are standing. Calculate by: total number of cows standing within a stall divided by the total number of cows lying or standing within 2-4 feet of a stall (Inverse of CCI). Benchmark: 15%
- Stall Use Index (SUI) – number of cows lying down divided by all the cows in the pen minus the cows that are eating. Benchmark: 75% or greater.

In order to obtain true benchmarks for one or all of these indices, they would need to be used on a widespread basis and recorded in some way. Then we might be able to compare CCI score for example to cow longevity in a herd. Keep in mind these are stall comfort indexes – what about all the other comfort factors affecting the cow? We still have a way to go to quantify these measures.

## ■ Precision Technology

Increasing use of precision technology in the next few years will dramatically alter how we view cow performance, fitness and health, and ultimately change cow survival and welfare in our dairy herds. The use of in-line monitoring equipment in automatic milking stalls, in-line analyzers for milk components, activity monitors and rumen sensors, and automatic body weights and body condition scores, although they come at a steep initial price, are becoming a worthwhile investment in herd knowledge. Commercial applications such as Herd Navigator, Afilab and Lely T4C, to name a few, are leading the way in turning data into useable information. The models that make sense out of this

information will be the cow management tools of the future and will definitely affect selection and culling patterns.

## ■ Summary

Greater longevity usually means higher profit per cow as the cash flow of production pays off the investment made in raising replacements. Ideally we maintain a herd of healthy productive cows, and culling is due to economic reasons, not so-called involuntary culling, although we need to recognize that market issues also affect herd turnover rates. Opportunities to better manage cow culling lie in transition cows and health issues in early lactation, reproduction and hoof health, through better use of individual cow information in these areas. Evaluate performance against existing benchmarks or if benchmarks don't exist, against reasonable goals.

We can control when cows leave the herd with commitment to tracking cows before they leave and learning the contributing factors why they leave. We need less emphasis on outcomes such as cull rates and more understanding of the key performance measures to make better economic decisions.

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