# Dairy Industry's Love Affair with Culling: Decades of Failed Mastitis Control

**Mastitis is a thief on many dairy farms. Beyond cost due to lost milk production and treatment costs, mastitis is linked to other ailments that pile on losses, including earlier than intended culling, lameness and mortality. Bill Gehm, a Partner in LR Gehm, LLC, offers a wide-ranging perspective on mastitis and focuses on a major culprit (in his opinion): alternating pulsation milking systems.**

**by Bill Gehm**

High turnover rates in milking herds raise the question: when did milk become a secondary product and beef become a primary product? The following data points raise that question:

• During the past 80 years, herd replacement rates have more than doubled — rising toward 50% on large dairies.

• Lameness and mortality have also climbed.

• Conception rates have declined for second- and later-lactation cows.

• USDA data for 2019 discloses that only 47% of United States' bulk milk shipments had a Somatic Cell Count (SCC) of under 200,000 per milliliter, suggesting that many milk cows have subclinical or clinical mastitis.

The dairy industry is facing numerous, strong headwinds, including increased calls for sustainability, reducing water usage, and addressing animal welfare. It's challenging to put a positive spin on slaughtering near half the milking herd annually. Five to ten percent of milk cows simply drop dead at the farm.

Bottom line: the factors that reduce milk cows' working lifetimes have a negative financial impact on dairy farms' balance sheets.

If you could travel back in time to the first half of the 1900s, you would enjoy replacement rates around 20% with on-farm death rates of nearly zero. Dairy cow productive lifespans were five to ten years, not two. There was little control of SCC, so virtually all milk went in the milk can or the bulk tank. The 1960's served up the Five Point Plan — creating the newly-formed National Mastitis Council as the answer to every dairyman's mastitis problem.

Those early changes reduced farm milk's SCC content, but at the expense of the cows that quickly went to slaughter. The real secret to achieving a low SCC was to sort and slaughter. It is no wonder that today there exists many milk quality labs running multi-million-dollar businesses to expedite the process of sorting out the offending cows that somehow went from producing quality milk to a mix of "cottage cheese" and milk. A broad offering of pharmaceutical and chemicals was concocted to "fix" mastitis problems. But some of those elixirs eventually gained consumers' attention, who asked what was in the milk they were serving up on little Joey's Cheerios.

The true success of the Five Point Plan and the NMC was to more than double the herd replacement rates, creating a fertile environment for sexed semen. Dairies could no longer rely on prior reproductive technologies to ensure the milking herd had a steady, adequate heifer supply. To date: mastitis hasn't been beaten. Rather, beatings have been absorbed by dairy cows and the dairy farmers' check books. Spending two years to raise a heifer and then watch her either drop dead or be converted to a Big Mac meal in less time than it took to raise her is a path to ruin, not profitability.

It is difficult to make a case for improving genetics when a cow doesn't hang around long enough to determine how good she is and then yield a few offspring. This certainly isn't the approach of the thoroughbred racehorse industry, at least not if you want to win a race.

High cull rates are a real cost impact to the dairy when milking a herd of young animals. Paul Dyk, GPA Consulting, provided insight into the financial impact of reducing cull rates in an article titled "Managing the expanding heifer population". His graph of heifer inventory as a percent of cow inventory shows a rise from 20% to 50% over the past hundred years. **Dyk estimated that reducing a 35% cull rate to 20% yields an additional $250,000/year for a herd of 1,000 milk cows with a net farm milk price of $15/hundredweight.** The math is simple: an older cow gives more milk compared to a heifer, which yields around 85% that of a mature cow. However, industry data shows that cows beyond first lactation have higher SCC, more clinical mastitis, lower conception rates and more lameness. The inability to prevent mastitis and associated afflictions drives dairies to replace profitable older cows with heifers and suffer reduced production.

Anyone who has ever milked a cow knows the real reason why the industry doesn't just "hit the easy button" and drive cull rates below 20% - mastitis. The same scourge that plagued the industry in the early 1900s thrives today. You must wonder how it is that after eighty years, there has been no true progress in making mastitis an insignificant issue and achieving cow longevity of ten or more years.

Consider the top four reasons for early culling of a cow: lameness, reproductive issues, mastitis, and low production. Published research links lameness, reproductive issues and low production to mastitis. The industry recognizes an SCC of greater than 150,000 as subclinical mastitis. Less than half the milk produced in the US has an SCC of under 150,000 suggesting over half the cows being milked have at least subclinical mastitis.

Add lameness to the mastitis stress and you certainly don't have a California Happy Cow. Overall lameness in herds may range from five percent to over thirty percent. In recent years lameness has worsened due to varied causes. However there is a relationship with mastitis. The stress on the immune system has an impact. Research from England shows that cows with mastitis tend to walk with their feet further apart. That stride creates an incorrect load on the hooves, which causes harm and lameness. The bigger concern is the financial impact. **Lameness costs on average $78 per cow/year. In a 1,000-cow dairy herd, lameness pilfers an average of $78,000 annually.**

Lameness isn't the only thief in the milking barn. Mastitis also wreaks havoc on conception rates – a huge contributor to culling cows. Difficulty in breeding often leads to a one-way ride to the hamburger factory. A published study stated, "low circulating estradiol in 30% of subclinical mastitic cows was associated with a low and delayed LH surge, leading to delayed ovulation in cows." **The understandable conclusion is: "mastitis is associated with a significant reduction in probability of conception." The negative financial impact, which is in the range of $25 per cow/year and for a 1,000-cow dairy, is another $25,000 that gets eaten away from the bottom line annually.**

The real instigator in this mess is mastitis. Mastitis-causing bacteria's forced into the udder by the milking equipment suck away profit 24/7 — like a hole in your milk tank. Clinical mastitis reduces production, adds treatment cost and all the money spent trying to prevent it. **Conservative industry cost estimates are $300 per cow per case of clinical mastitis, and another $50/cow/year in reduced production based on $15/hundred milk and a good bulk SCC level. If you have a low clinical rate that combines to a total cost of around $90/cow/year that sucks away $90,000 from a 1000 cow herd.**

Adding insult to injury is culling the offending, mastitis-riddden animals when you lose the battle. It often a nice cow that started out as a fast-milking heifer with a perfect udder and teat ends. After just one or maybe two lactations she has an uneven udder, you find you are scoring her damaged teats, and she walks with a bit of a limp. In the time it took to raise the animal she is spent, and you decide to plug another in her spot from the line up of more hopefuls. That doesn't come without a price that adds up to an average of $250/cow/year. Premature culling due to mastitis is a rather large bill that comes due for a 1,000 cow dairy to the tune of $250,000. Adding insult to injury are the cows that depart hoof up resulting in a total loss. Death loss on even better dairies is five percent with ten percent common. That five percent rate costs another $100/cow/year.

**Adding all the expenses and you arrive at $793/cow/year that you lose with a good milkng herd. Add up at your 1,000-cow dairy once a year and demanding a check for $793,000! The real situation you have is that the thief robs you every minute in small amounts – a little over $2,000 a day. This cost does not include the added land required for the extra forage, additional equipment to harvest the forage and the water required for the forage to grow.**

In many regions of the country water is becoming a scarce commodity. If the industry were to halve the cull rate, there would be a savings of 7 million acre-feet of water. In California the water savings would be approximately that consumed by the city of Los Angeles annually. Similar impacts can be made in other dry states such as Arizona. Large cities are running out of water, which will soon put dairy production in that area in a difficult position.

### Environmental considerations such as water use

Extra water to support forage growth is not the only environmental impact. Harvesting and moving the forage for those additional replacements adds over 600 million pounds of carbon to the atmosphere due to fuel required to operate equipment. Those in the world pressing for sustainability are becoming aware of these wastes.

The dairy industry in many parts of the world is under siege from governments and activists to improve sustainability. An easy way to make a large improvement is to halve replacement rates thereby reducing water waste, reducing the carbon footprint, reducing land use as well as fertilizers and herbicides. It is a win for everyone but requires meaningful progress in beating down mastitis. The past eighty years has shown that managing mastitis has driven the industry to excessive culling along with rising death rates, increased lameness and problematic conception rates. Mastitis-related problems that prematurely pull milk cows out of production are certainly not sustainable and linked to mastitis.

### Suspect milking equipment

Other industries concluded decades ago that the path to quality is not through testing and sorting good from bad, but rather starting with a good design. The core of milking equipment at the machine to teat interface has not changed in decades since introduction. The basic pulsation and liner design has continued other than liner shapes and conversion from simultaneous to alternating. The industry took a wrong turn with design eighty years ago with alternating pulsation, which happens to coincide with the rise in all the issues discussed. The original intent of alternating was to solve mastitis problems by milking front quarters at 50:50 and rear at 60:40. That different ratio was recognized as a disaster and abandoned. However alternating pulsation was retained due to a nearly universal sell job — despite research by Dr. Sybren Reitsma in 1967 showing those systems created problematic vacuum fluctuations in the claw.

In the early 1960's, a young veterinary student's research concluded that the action of a liner was forcibly shoving the non-motile bacteria up the teat canal to cause mastitis. That research effectively demonstrated that the modern pulsation/liner combination is the delivery mechanism for bacteria that causes mastitis. Dr. Derek Forbes research remained ignored; the industry has attempted to prove it wrong with disastrous results on modern dairy farms. Forbes used *Staph aureus* to prove his theory that the upward rolling pinch of a liner forcibly shoves non-motile bacteria up the teat canal and into the teat sinus.

At the 2004 NMC annual meeting, Graeme Mein, Doug Reinemann and Norm Schurring comprised a panel titled: "Milking Machines and Mastitis Risk: A Storm in a Teatcup." They tried to make the case that there is nothing to see relative to milking machines causing mastitis, even though they stated, "one third of the milk volume present in a teat sinus is pumped back up into the udder by the closing liner." This conclusion fits nicely with the Forbes' research and explains how non-motile bacteria gets into the udder. It explains why cows milked with robotic milking machines still have so much mastitis even though the machine self-cleans between each cow milked.

The milk quality industry has known for decades that a problem exists and instead of fixing the liner pinch-and-push problem, most experts stuck with a failed pulsation design and added to it multi-sided liners and reduced vacuum levels to distribute the pinching and reduce the pumping action. The intent was that the liner would never fully close below the teat canal to constantly apply vacuum to suck away the bacteria. The bacteria still gets shoved up the canal and cows on average milk slower — causing more machine-induced canal damage.

It is practical and proven that a proper pulsation and liner design can eliminate the upward-rolling, pinching action while relieving the teat tissue during a full rest phase. This can only be accomplished by segregating the vacuum and air supplies within the pulsator creating a highly efficient pulsation output that changes liner dynamics. The liner must be a round liner with a sufficiently low closure force to coordinate with the pulsation allowing it to fully close and provide a gentle massage action like compression sock worn for poor circulation. Cornell University research demonstrated that this approach virtually eliminates all new *Staph aureus* cases — thus validating the research Dr. Forbes conducted decades prior. No other technology has ever achieved a nearly 16:1 reduction in new infections.

Perhaps the circumstances the industry now finds itself in will finally motivate it to right the wrongs of the past. Technology exists to prevent the action driving mastitis infections. The TridentPulsation[tm] Milking System provides a unique pulsation output that when combined with a low closure force round liner enables the liner to fully close below the teat canal while massaging the full teat length. The result is elimination of the typical upward rolling pinch that forcibly shoves bacteria up the canal while failing to relieve the teat tissue of the milking vacuum. Experiences on commercial dairies demonstrate the fact that mastitis can be beaten, cows can be cleanly milked in under 4 minutes — allowing longevity to be substantially increased. Healthy cows with even udders producing quality milk with four to ten lactations can become a reality.

Reviews of industry studies recognize the problems created by the limitations of conventional modern milking systems. R. Bruckmaier of DeLaval, *et al.,* stated: "an impact of machine milking on the teat tissue cannot be avoided" in the journal *Animal*. Bruckmaier also stated: "The mechanical stress by the milking machine activates a cascade of cellular mechanisms that lead to an excessive keratin growth and thickening of the keratin layer. Consequently, a complete closure of the teat canal is disabled and the risk of bacterial invasion and intramammary infection increases." Additional facts included: "Raising the vacuum level from 9 to 15 inHg resulted in shorter machine-on time but also caused an increase in teat tissue thickness. Increasing the duration of the liner open phase has been shown to increase peak milk flow rate, machine strip yields and tissue thickness." This is all observable on any dairy with modern milking machines even with low vacuum levels.

You simply cannot avoid the problems of damaged teat canals, swollen teat tissue, slow milking quarters, mastitis and kicking cows. It is all baked into the cake you have been served with modern milking equipment and everyone knows it. It doesn't get more obvious that the liner comparisons at Evolution-liners.com where the various X series are compared. You can select from consistent performance, better milk-out, low-slip or gentle but you cannot get all those options in one liner. But of course, you know that, so you are forced to pick one and deal with the culling of cows that become a problem. The technology of TridentPulsation[tm] has broken the industry paradigm and proven that it is possible to milk at the vacuum level you want – 13 inHg and higher, as high as 16.5 inHg. Vacuum level is no longer a factor when properly coordinates with the correct liner such that all of the problems recognized by Bruckmaier, Cornell University, Forbes and many others are addressed. As Einstein once said, doing the same thing over and over expecting different results is insanity. It is well past time to end the insanity of slaughtering your way to quality milk.

For more information, go to the following website:
TridentPulsation.com

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## Summary of Data for Award-Winning, Low Mastitis Herd

| Test Date | Days In Test Period | Number Cows In Herd On Test Day | Test Day Averages (Milking Cows) DIM | Test Day Averages (Milking Cows) Milk | 150 Day Milk | Test Period Persist. Index | Test Day Averages (All Cows) % In Milk | Test Day Averages (All Cows) Milk | Test Day Averages (All Cows) %Fat | Test Day Averages (All Cows) %Pro | Rolling Yearly Herd Average Milk | Rolling Yearly Herd Average Fat | Rolling Yearly Herd Average Pro | Somatic Cell Count Summary % Cows SCC Score 0,1,2,3 Below 142,000 | 4 142,000 283,000 | 5 284,000 565,000 | 6 566,000 1.13 M | 7,8,9 Over 1.13 M | Avg. SCC Linear Score | Wt Avg. Actual SCC | MUN | Number Left Herd Died | Sold |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Test Dropped | 45 | 288 | 162 | 99.7 | 100.1 | 108 | 88 | 88.0 | 3.5 | 3.1 | 28467 | 1072 | 902 | 94 | 3 | | 1 | 2 | 1.1 | 92 | | 1 | 7 |
| 4-25-22 | 39 | 287 | 175 | 99.1 | 101.1 | 102 | 90 | 89.1 | 3.5 | 3.2 | 28711 | 1070 | 909 | 94 | 2 | 2 | 2 | | 1.0 | 49 | | | 8 |
| 6-14-22 | 50 | 258 | 177 | 99.6 | 103.3 | 102 | 88 | 88.1 | 3.6 | 3.1 | 28994 | 1067 | 918 | 93 | 2 | 2 | 1 | 1 | 1.0 | 60 | | | 35 |
| 7-27-22 | 43 | 248 | 180 | 90.5 | 95.9 | 94 | 86 | 77.7 | 3.5 | 3.1 | 29185 | 1070 | 922 | 95 | 2 | | 1 | 2 | 0.9 | 71 | | | 19 |
| 9-08-22 | 43 | 248 | 177 | 89.7 | 96.2 | 104 | 88 | 78.9 | 3.6 | 3.1 | 29304 | 1078 | 924 | 94 | 2 | | 2 | 1 | 0.9 | 70 | | | 19 |
| 10-20-22 | 42 | 252 | 174 | 89.8 | 95.4 | 103 | 86 | 77.3 | 4.0 | 3.3 | 29401 | 1085 | 928 | 91 | 5 | 2 | | 1 | 1.1 | 91 | | | 8 |
| 12-08-22 | 49 | 253 | 156 | 92.0 | 95.2 | 103 | 79 | 72.7 | 3.5 | 3.3 | 29780 | 1087 | 939 | 88 | 7 | 4 | 1 | 1 | 1.6 | 78 | | | 9 |
| 1-19-23 | 42 | 254 | 146 | 90.6 | 91.9 | 99 | 83 | 75.6 | 3.8 | 3.3 | 29658 | 1076 | 938 | 90 | 7 | 3 | | | 1.1 | 49 | | | 9 |
| 3-02-23 | 42 | 252 | 148 | 94.3 | 93.1 | 103 | 91 | 85.7 | 3.9 | 3.2 | 29484 | 1077 | 936 | 95 | 3 | 1 | 1 | | 1.0 | 48 | | 2 | 10 |
| Averages | 44 | 257 | 167 | 93.4 | 96.6 | 101 | 87 | 80.8 | 3.7 | 3.2 | | | | 92 | 4 | 2 | 1 | 1 | 1.1 | 65 | | 2 | 117 |

**Lofty claims are often made in the industry about herds achieving and bettering industry goals for mastitis, replacement rates and bulk SCC. The general message has been that a properly installed and maintained milking system combined with proper procedures, bedding and teat dips will lead you to a path of easy success. Despite all the bravado no one ever provides any data to back the claims. If you should ask questions, you get told how all goes well with your neighbor and how you really need to rely on your local lab to sample milk and do genetic testing. In the end the most desirable genetic traits for avoiding mastitis are those of the bull as opposed to those of the highest producing heifer with the soft very fast milking teats.**

**DHI data was obtained for a dairy herd that was a 2024 recipient of an NMC National Dairy Quality Platinum Award for achieving a consistently low bulk SCC. The DHI data for the herd of 252 milking cows shows a replacement rate of 46.4%, well above any goals you hear of and double what herds were doing a hundred years ago. The data also shows that most of the cows with a high SCC are at two or more lactations demonstrating while it is possible to achieve a low bulk SCC with heifers it is not easily accomplished with more mature cows. A check of DHI data for some university herds shows that while they claim the role of industry leaders their parlor performance is no better than your results. A university herd of 400 cows has an average SCC of 216,000 with the average for the first lactation at 88K, the 2nd at 182K and the 3rd+ at 370K. It is rather clear that the driver behind sort and slaughter is mastitis given the rapidly rising SCC trend with lactation. Death rate data for several universities is in the 7% to 10% range. You start to get the notion that when it comes to mastitis, replacement rates and bulk SCC you can at best pick two to optimize and take what you get for the remainder. There is a reason why you never get to see the top show cows at World Dairy Expo milk in the parlor – it likely is not a pretty sight. Sometimes it is just best to avoid the bathing suit part of the beauty pageant and stick with the interviews and stories.**

| Category | Trident™ | RST14ON | Others | Winner | % Change RST | % ChangeTrider |
|---|---|---|---|---|---|---|
| Milk/cow | 31.02 | 27.72 | 27.12 | Trident™ | 2.2 | 14.4 |
| Avg #/Min | 8.62 | 7.34 | 7.15 | Trident™ | 2.7 | 20.6 |
| Duration Min | 3.6 | 3.91 | 3.94 | Trident™ | -0.8 | -8.6 |
| 0-15 Sec Lbs./Min | 7.92 | 2.89 | 3.06 | Trident™ | -5.6 | 158.8 |
| 15-30 Sec Lbs./Min | 11.44 | 7.85 | 7.58 | Trident™ | 3.6 | 50.9 |
| 30-60 Sec Lbs./Min | 12.54 | 8.17 | 7.8 | Trident™ | 4.7 | 60.8 |
| Peak Flow Lbs./Min | 20.2 | 8.84 | 8.52 | Trident™ | 3.8 | 137.1 |
| 2 Min Milk Lbs. | 21.8 | 15.61 | 15.08 | Trident™ | 3.5 | 44.6 |
| 2 Min Milk % | 70.3 | 56.3 | 55.6 | Trident™ | 1.3 | 26.4 |

**Large herd data comparing TridentPulsation to published data using the RST liner on different milking systems and data for other milking systems. TridentPulsation technology is a clear winner yielding significantly higher milk flow rates and shorter milking times.**