National Mastitis Council

Milk quality still pays

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Abstract

As the mailbox price premiums for producing quality milk decline globally, it is fair to wonder if there is still value in producing quality milk. While what defines "quality milk" is evolving, even for the parameters that have traditionally been used to define milk quality, research and field experience continue to confirm that the production of high quality milk continues to be a primary driver of dairy profitability.

Key words: dairy, milk quality, quality premiums, profitability

Résumé

Alors que la prime des prix dans la boîte aux lettres pour la production de lait de qualité est en déclin mondialement, il est juste de se demander s'il existe toujours un incitatif à produire du lait de qualité. Bien que la définition d'un lait de qualité évolue, même pour les paramètres qui ont été utilisés traditionnellement pour définir la qualité du lait, la recherche et l'expérience sur le terrain continuent de confirmer que la production de lait de qualité demeure un moteur de la profitabilité des fermes laitières.

What is Milk Quality?

In order to determine if milk quality still pays, we need to first define what milk quality actually encompasses. Traditionally, the production segment of the industry has taken a very narrow view to what falls under the umbrella of milk quality. For dairymen and their advisors, traditionally, milk quality has been limited to those parameters that generate a bonus or premium for the producers. In other words, the factors that contributed to an additional line item on the milk check. This has typically limited the scope of "milk quality" to somatic cell count (SCC) and bacteria counts. We might also consider freedom from residues as another mark of quality by that definition.

Consumers of dairy products have no knowledge of what a somatic cell is, nor would trying to educate them have any positive effect on dairy consumption or consumer confidence in our product. Similarly, consumers would be aghast if they knew milk contained any bacteria at all. To dairy consumers, especially in North America, foods have taken on qualities that sound more like powers. Terms like "Super Foods", "Health Foods", "Soul Foods", and even "Whole" foods are routine and carry meaning to consumers. Consumers may ask, was this food sustainably produced? Were the cows happy and well cared for? Is it healthy for my family? Is the packaging appealing and environmentally responsible? These are factors a consumer would be likely to cite as milk "qualities."

What Factors are Leading to the Erosion of Quality Premiums?

There are currently many geographic areas where traditional milk quality premiums continue to decline. The question becomes, what are the factors leading to this decline?

Firstly, because the factors that are associated with traditional milk quality premiums are completely unknown to the consuming public, no revenue to support them is derived at the retail level, unless they lead to a superior product attribute that can be marketed. This means that not only do traditional bonuses not have a direct link to consumer purchase revenue streams, but the path to marketing traditional milk quality to customers is not straightforward or clear in many cases.

Dairy processors are, by and large, operating with quality standards based on data on the impact of quality on product yield and shelf life that were done when consistently sourcing what I will term "very high" milk quality was difficult. For many years, processors operated with a milk supply that had not met even these basic quality standards. Few manufacturers have actually given thought to what is the ideal quality for their process. I believe, from discussions I have had, that it is difficult for many dairy processors to quantify the value of moving to higher standards, though many admit they do believe one exists. It will likely take some time to determine what the effects, and by default value, of this very high quality is. This is also complicated by how milk "flows" within the market. One processor recently told me "If I put both a trailer of 100,000 SCC milk in my silo and a trailer of 300,000 SCC milk in my silo, the resulting silo is not as good as 2 tankers of 200,000 SCC milk." In order to find the value in very high quality milk, processors may actually have to source nothing but that very high quality milk. As of today, that's not the typical way milk is handled and marketed.

Perhaps most importantly, there are significant global milk marketing factors at play. Firstly, there is currently a large volume of milk and milk products available on the global market, and much of it is of high quality by traditional standards. The weighted bulk-tank somatic cell count (BTSCC) in the United States has been in decline for several years, and last year reached 181,000 cells/mL.[7] Similar declining trends have been seen in other major milk sheds, such as the European Union. This means that what processors used to define as "high quality" has slowly evolved into average quality milk. This means that in the current "buyers" market, cooperatives, and processors have access to an ample supply of high quality milk.

So how does Milk Quality Pay?

It has long been known that there is a relationship between milk production and the level of somatic cells in milk. Way back in 1982, Raubertas and Shook found "Yield loss per unit increase in average log cell count was 297 + or - 44 lb (135 + or - 20 kg) in first lactation and 594 + or - 66 lb (270 + or - 30 kg) for all other lactations. These relationships were linear, indicating that loss per unit increase in actual cell count is greatest when cell count is low."[6] In fact, the effort to quantify this relationship is what led to the development of the idea of using Log score or linear score to describe somatic cell thresholds.[2]

This relationship should intuitively make sense to most of us for 2 main reasons. Firstly, there is an energy and nutrient cost to powering an immune response within the mammary gland. Because immune function has a higher priority in the partition of nutrients than lactation, the increase in somatic cells in the mammary gland comes at the price of other nutrient demands of less importance. Secondly, inflammation related to the immune response within the udder causes some varying amounts of collateral damage to the milk secretory tissues. This at some level reduces the capacity to produce milk within the gland.

Zoetis Animal Health and Compeer Financial recently released results of a study of financial records from 90 Midwest US dairies (Michigan, Minnesota, Ohio, South Dakota, and Wisconsin), with an average herd size of just over 1,000 lactating cows, over an 11-year period between 2006 and 2016. The study focused on factors that affected Net Farm Income (NFI). The review showed that average bulk-tank shipped milk SCC had a correlation of -0.14 with net farm income. For the dairies in the evaluation, the shipped milk SCC average of the herds in the top 1/3 of herds for NFI was 196,000 cells/mL, while the BTSCC average in the herds in the bottom 1/3 for NFI was 239,000 cells/mL. The overall difference in average net farm income between the herds in the top 1/3 of BTSCC and herds in the lower 1/3 for BTSCC was $115,000 USD.[3]

Additionally, the same data set indicates that for every 100,000 cells/mL change in BTSCC, per-cow production of energy corrected milk (ECM) shifted 5.5 lb (2.5 kg) per cow per day! (Figure 1).[a] What's more, the study also revealed that average bulk-tank shipped milk SCC was highly correlated with several other key metrics (Figure 2).[a]

In an unpublished evaluation of production and somatic cell data from 200 US dairy herds including 460,269 Holstein cows, Dr. Michael Overton of Elanco Animal Health found that the milk loss due to udder health challenges remains substantial, even at lower linear scores. The losses at the lower levels are greater than perhaps we have previously considered. To be included in the data set, cows had to have calved between 7/1/16 and 6/30/17, and had a record that included both milk production and somatic cell data. Separate multivariable models were built for first-lactation cows vs older cows. For each parity group, 1 model examined the linear relationship between average linear score and 305d milk and a second model evaluated the quadratic relationship between linear score and 305d milk.

Figure 3 shows the relationship between average linear score and 305-day milk production. Based on an ANOVA model that included 171,089 primiparous cows, there is a linear incremental milk loss of 380 lb (172.4 kg) in a 305-day lactation. When looking at a curvilinear relationship between change in linear score and milk loss, the incremental decline equated to an average of 327 lb (148.3 kg) in a 305-day lactation. Stated another way, for the cows and herds represented in this data set, a one-unit increase in average

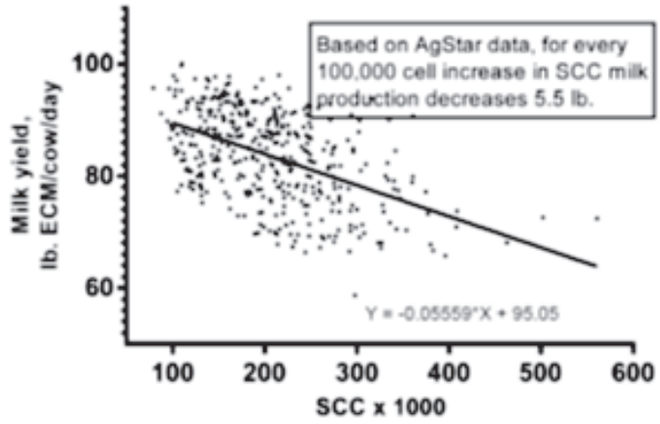


Figure 1. Change in shipped ECM/cow/day as a function of BTSCC.[a] (Figure courtesy of Dr. Michael Lormore)

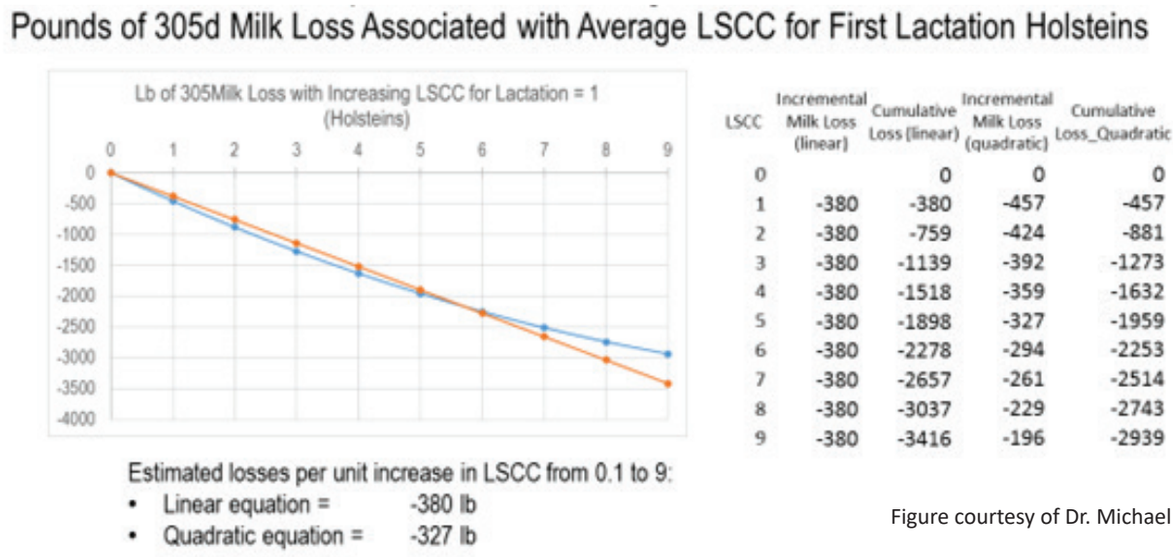
Variable	Correlation w/SCC
Death loss, %	0.44
Days open	0.31
Profitability (NFI, $/cwt ECM/day)	-0.14
21-day pregnancy risk	-0.25
ECM/cow/day, lb/day	-0.41

Figure 2. Key dairy metrics and their correlation to BTSCC levels.[a]

linear score for the lactation predicted an average decline in daily milk production of 1.07 lb (0.45 kg) in primiparous Holstein cows.[b]

The results of an ANOVA model for 246,140 multiparous Holstein cows, shown in Figure 4, indicated a linear incremental milk loss of 533 lb (241.8 kg) per unit change in average linear score in a 305-day lactation. When looking at a curvilinear relationship between change in linear score and milk loss, the incremental decline equated to 430 lb (195.0 kg) of milk in a 305-day lactation (unpublished personal communication). Stated another way, for the cows and herds represented in this data set, a one-unit increase in average linear score for the lactation predicted an average decline in daily milk production of 1.4 lb (0.63 kg) in multiparous Holstein cows.[b]

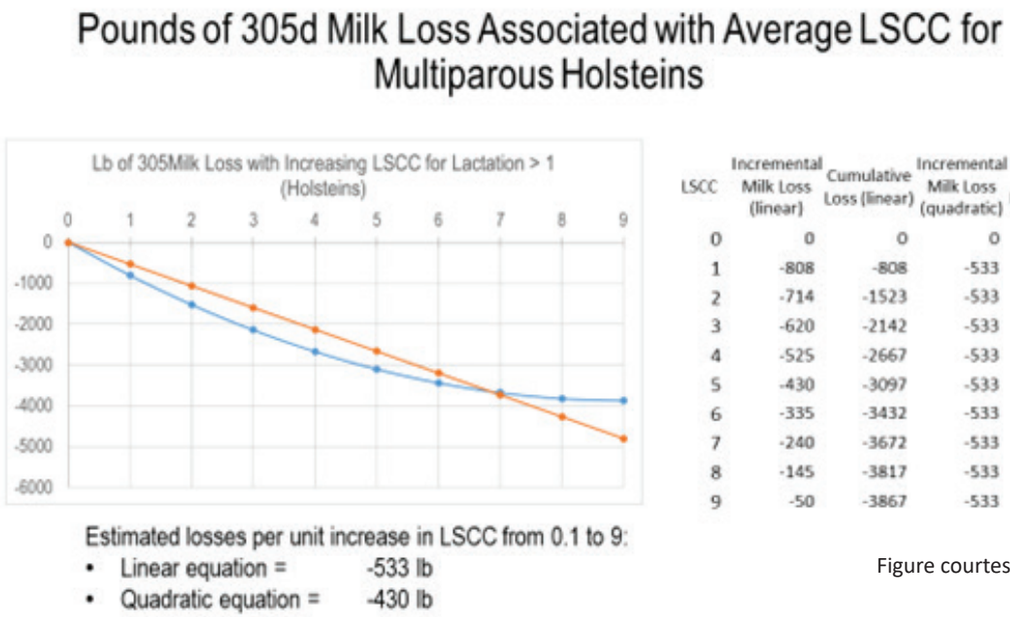
Importantly, this is not a phenomenon unique to North America. Rather, it has been described in many dairy areas globally. In a study of Irish dairy herds in 2014, Archer et al found that "A 1-unit increase in mean natural logarithm SCC over the first lactation was associated with a median decrease in first lactation and lifetime milk yield of 298 and 3,666 lb (135 and 1,663 kg), respectively." They also found that "A 75% certainty of savings of at least €199/heifer in the herd



LSCC	Incremental Milk Loss (linear)	Cumulative Loss (linear)	Incremental Milk Loss (quadratic)	Cumulative Loss_Quadratic
0		0	0	0
1	-380	-380	-457	-457
2	-380	-759	-424	-881
3	-380	-1139	-392	-1273
4	-380	-1518	-359	-1632
5	-380	-1898	-327	-1959
6	-380	-2278	-294	-2253
7	-380	-2657	-261	-2514
8	-380	-3037	-229	-2743
9	-380	-3416	-196	-2939

Figure courtesy of Dr. Michael Overton

Figure 3. Multivariate ANOVA model predicting the linear and quadratic relationships between LSCC and 305d milk production in primiparous cows.[b]



LSCC	Incremental Milk Loss (linear)	Cumulative Loss (linear)	Incremental Milk Loss (quadratic)	Cumulative Loss_Quadratic
0	0	0	0	0
1	-808	-808	-533	-533
2	-714	-1523	-533	-1065
3	-620	-2142	-533	-1598
4	-525	-2667	-533	-2131
5	-430	-3097	-533	-2664
6	-335	-3432	-533	-3196
7	-240	-3672	-533	-3729
8	-145	-3817	-533	-4262
9	-50	-3867	-533	-4795

Figure courtesy of Dr. Michael Overton

Figure 4. Multivariate ANOVA model predicting the linear and quadratic relationships between LSCC and 305d milk production in multiparous cows.[b]

	5-19 DIM	110-124 DIM	289-304 DIM
LACT 1	0.68	0.55	0.97
LACT 2	1.47	1.09	2.45
LACT 3	2.22	1.13	2.65

Figure 5. Milk losses (kg/d) per unit increase in LnSCC and by stage of lactation (days-in-milk).[4]

was detected if herd-level geometric mean SCC over the first lactation was reduced from ≥120,000 to ≤ 72,000 cells/mL".[1]

A study out of Brazil looking at over 1.5 million test day records, on over 87,000 cows, showed a relationship between linear score SCC and production that varied across lactations and stages of lactation. The paper also noted that "the association between SCC and milk production started to be evident at lower levels of SCC per mL…even among high-yielding cows".[4]

Hortet et al in a 1998 literature review of 19 research papers found that "At the lactation level, the average trend was a loss of 176 lb (80 kg) of milk in primiparous and 265 lb (120 kg) in multiparous, by each 2-fold increase of geometric mean SCC above 50,000 cells/mL.[5]

What does all of this data tell us? Firstly, it is still very clear that the milk production losses associated with elevations in SCC are real and quite large. Secondly, these production losses start at SCC levels that are lower than we had previously thought. Altogether, this means that there are significant levels of marginal milk and production efficiencies to be captured through continuing to lower SCC. Producing additional milk from our existing cows and improved production efficiencies do indeed lead to higher net farm income (NFI).

How does Managing Bacteria Counts Pay?

So what about bacteria counts in milk? How does improving bacteria counts pay? The management interventions that lead to lower SCC in shipped milk are also frequently part of the vehicle to manage bacteria counts such as Standard Plate Count (SPC), coliform counts, and Preliminary Incubation Counts (PIC).

Bacteria found in milk come from 1 of 4 places:

1. From inside the udder of the cow. This is predominantly from infections of the mammary gland.
2. From the teat skin and surface of the teat or udder floor when the unit is attached to the cow. This is based on the conditions in the environment, the cow, and by default the udder itself, are subjected to as well as the thoroughness of the teat cleaning and cow preparation prior to unit attachment.
3. From the conditions and cleanliness of the parlor itself. This predominantly is bacteria from manure inside of or on the mouthpiece of the liner, bacteria or debris sucked through a vent, and potential kick offs that result in a unit lying on the cow deck with the vacuum turned on.
4. Bacteria that are either growing within or come from the components of the milking equipment itself. This encompasses wash problems, system maintenance, milk cooling, and things like milk filter changes.

Of all the sources of bacteria listed above, many of these areas including cleaner cows, improved cow preparation practices, cleaner parlor environments, less infected quarters in the herd, less unit kick-off and liner slips, as well as better equipment maintenance are typically related to improving herd-level SCC and mastitis. Therefore, frequently making progress on BTSCC often also passively leads to improvements in many of the traditional bacteria counts in milk as well. This means that by placing emphasis and effort on continually lowering the SCC, we can often also reduce the bacteria loads in milk without significant additional cost.

Why Should We Produce Quality Milk?

Even if quality premiums do continue to erode, achieving what premiums are available in the marketplace is perhaps the only ability producers have to influence the value of their milk. Failing to maximize them leaves money "on the table" in a trying economic time. When milk prices are low, premiums become even more important to achieve, and may make the difference between making a profit and breaking even for some farms.

There are very few situations when giving less than your best effort is a winning strategy. The argument can be made that even if there was no additional monetary value to producing high quality milk, we should still be placing emphasis on milk quality. We know that bacteria counts and SCC influence things like flavor, shelf-life, moisture content, firmness, and other attributes of dairy products. In this way, milk quality has the ability to influence consumer perceptions of dairy products, and that these perceptions drive decision making, which in turn drives consumption. Producing high quality milk, at some level, likely helps drive consumption of dairy products.

Speaking from a cooperative perspective, it is likely to be a very difficult time to find a "home" for below average quality milk in the foreseeable future. While milk quality is not something many dairy processors are currently willing to pay extra for, it is certainly something they realize does differentiate milk. This means that having access to a market may be predicated on what the quality is of the product you produce. As cooperatives try to adjust supply and demand, quality may be 1 of the factors they look at. If you or your clients find themselves without a milk market, it is reasonable to ask yourself, "Who is going to want below average quality milk?"

Conclusion

While nobody can fully perceive what the future of milk quality will hold, there is little doubt that it will be economi-

cally beneficial for producers to produce and processors to source high "quality" milk! What is certain is that how that financial gain is realized will likely be different than what it was 5, 10, or 20 years ago. It is likely that in many dairy-producing regions, the value of quality may not be as a line item on the milk check in the future. Premiums likely will continue to erode, but the emergence of more designer dairy products in the market will mean that several cooperatives and processors will still value traditional milk quality. Producing quality milk will always improve the consumers' perceptions of dairy products and helps us ensure that producers continue to have the privilege to dairy. Even though not all of us may agree on what is included in milk quality, we all should be prepared to broaden our minds on what our consumer perceives as quality.

Acknowledgement

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Endnotes

[a] Lormore M. Zoetis Animal Health. Personal communication, December 2018

[b] Overton M. Elanco Animal Health. Personal communication. November 2018

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