

## Breeding Slick Holstein Cattle for Superior Thermotolerance

Peter J. Hansen, Elizabeth A. Jannaman, Eliab Estrada-Cortes, Froylan Sosa, Laura M. Jensen, Serdal Dikmen, and Timothy A. Olson

Look closely at the Holstein cattle on the University of Florida Dairy Unit and you will notice some of them appear to be sporting a shorter hair coat than the rest. “Slick” cattle have a genetic mutation that causes a very short hair coat year-round. Slick cattle are better able to regulate body temperature during periods of heat stress than non-slick cattle. An example of a calf with the slick mutation is shown in Figure 1.



Figure 1. Slick-Gator Fiona

The slick trait is caused by a mutation in the prolactin receptor gene (a gene involved in milk yield). The mutation is dominant – meaning inheritance of one copy of the gene leads to the offspring having short hair. The slick mutation arose naturally in several breeds of cattle in the Caribbean basin, including the Senepol, Carora, and Criollo Limonero.

The slick mutation was introduced to the Holstein breed in Florida in the mid-1980s at Pine Valley Dairy

when Holsteins were inseminated with Senepol semen. The slick animals at the University of Florida, all of which are registered with the Holstein Association, are derived from the animals born from those matings. There are also slick Holsteins in Puerto Rico. In that case, the gene was probably introduced accidentally when cattle on the island were upgraded by crossbreeding with Holsteins.

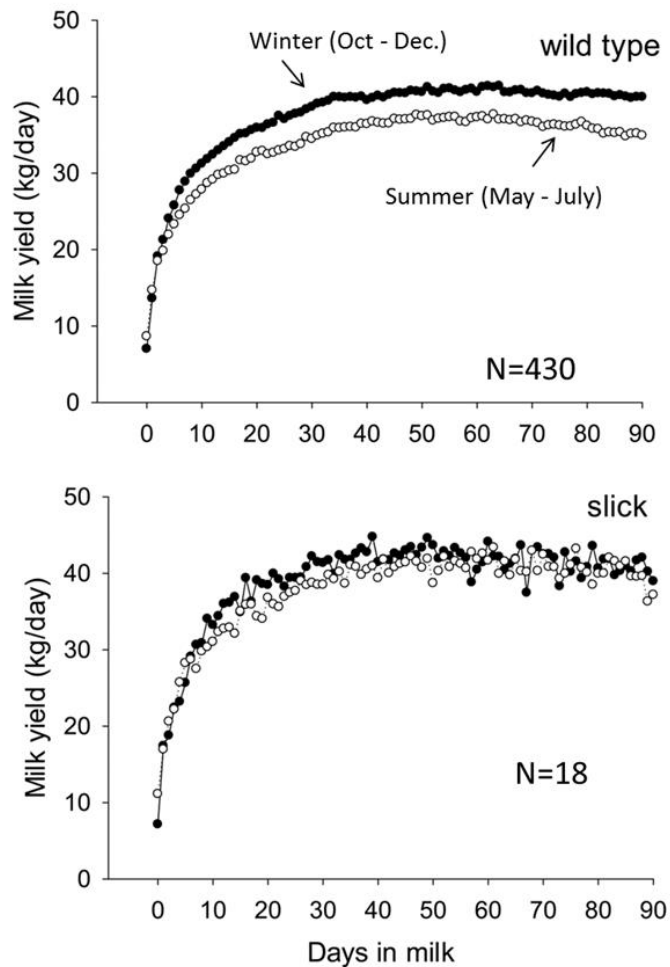


Figure 2. A comparison of summer-winter differences in milk yield during the first 90 days in milk between non-slick (wild-type) and slick Holsteins. From Dikmen et al. *J Dairy Sci.* 97:5508 (2014). • = winter o = summer

Research at the University of Florida and the University of Puerto Rico has shown that inheritance of the slick mutation minimizes the effects of heat stress on milk yield (See Figure 2). Thus, introducing the slick gene into dairy herds in hot climates may be an effective and relatively easy way to reduce the effect of heat stress on dairy cattle.

The University of Florida maintains a small herd of slick Holsteins that is being used to upgrade the genetics of slick Holsteins. The goal of the slick breeding program is to produce homozygous slick Holstein cattle (two copies of the slick allele) with high genetic merit for economically-important traits. Currently, all of the animals at the University of Florida are heterozygous –

they possess one copy of the slick allele and one copy of the non-slick allele. Half the offspring of a heterozygous animal will be slick and half will have normal hair coat when mated to a non-slick

animal. In contrast, all offspring from a homozygous slick animal will have short hair.

The breeding goal is being pursued in two phases. In phase 1 (currently underway), the objective is to raise the net merit (\$NM) of bulls carrying the slick gene to over \$800 by mating slick females to elite non-slick bulls and slick bulls to genetically-superior non-slick females. Slick calves are being produced by both artificial insemination and transfer of embryos produced in vitro. For phase 2, the objective is to produce homozygous offspring by mating slick females with high net merit to slick bulls with high net merit.

Semen from two of the heterozygous bulls produced at the University of Florida is for sale. **Slick-Gator Blanco** (551HO03574) has a genomic value for \$NM of +347 and was sold to ST Genetics. Sexed semen is currently available and over 3000 straws have been sold. **Slick-Gator Lone Ranger** (047HO01029) is pictured in Figure 3. The bull has a \$NM of +554 and is owned by the University of Florida. Over 4000 straws of Lone Ranger semen have been sold in the United States, Canada, Mexico, Honduras, Panama, Thailand, and Qatar.



Figure 3. Slick-Gator Lone Ranger (047HO01029)

Breeders and genetic organizations outside of the University of Florida have taken note of the benefits of the slick allele and are developing their own slick Holsteins. Breeders in Ohio, Wisconsin, Puerto Rico and Honduras and genetic companies in the USA, New Zealand, and Australia are breeding slick dairy animals. Semen from a homozygous slick Red Holstein bull from Puerto Rico named Simba is now available in the US and a company called Acceligen has used modern gene editing techniques to produce a slick Angus in Brazil.

The US Holstein Association has funded a research project between the University of California-Davis (Anna Denicol) and the University of Florida (Peter Hansen) to evaluate the performance of slick Holsteins in hot and cool seasons raised in six dairies in California and Florida. The first calves for this project have now been born. What this means is that more data regarding the suitability of using the slick mutation to combat heat stress will become available, helping more cattle “Keep Cool” with slick genetics!

More information on Slick-Gator Holsteins, contact Pete Hansen, [pjhansen@ufl.edu](mailto:pjhansen@ufl.edu)



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## Is the Secret Behind Lowering Bulk Tank Somatic Cell Counts, Consistency?

Izabella Toledo

For milk processing plants, low somatic cell counts extend product shelf-life and improve the flavor of dairy products. For producers, keeping low cell counts results in lower costs due to fewer treatments, more milk per cow and less wasted milk.

Lowering bulk tank somatic cell counts can be achieved independent of the type of operation or herd size. The common factor among herds with low somatic cell count is that management ensures that all employees are consistently focused on paying attention to details in order to maximize milk quality.

A number of common factors influence bulk tank somatic cell counts and should be considered in order to develop a good milk quality program.

### Milk Clean, Comfortable and Relaxed cows

Cow comfort and **consistent** attention to bedding management is essential to improve milk quality. Be sure to keep cows and udders clean and dry. A clean environment is the key to prevent environmentally caused mastitis.

**Consistent** appropriate low stress cow handling procedures, sufficient stalls, clean water and adequate feed space ensures that clean and relaxed cows are entering the milking parlor. To optimize production, cows should **consistently** have minimum stress.

### Milking Procedures

All milkers should be **consistent** with proper milking procedures at every milking. Ideally, milking procedures should include a pre-milking teat dip, with at least 30 seconds of contact time, 10 to 20 seconds of forestripping, and examination of the udder for swelling, heat, pain or milk abnormalities, and subsequent thorough drying of each teat end. Taking the time to make sure all teats are fully dry and clean before attaching the milking unit makes a big difference in the presence of environmental organisms. Plan a routine to achieve a 60 to 120 seconds prep-lag time to maximize milk let-down.

**Consistent** udder preparation before unit attachments results in reduction of the average milking time, which is related to improvements in teat

conditions and subsequent fewer bacteria on teats when units are attached, which decreases the chances of new infections. Soon after the unit's removal, **consistency** in fully covering each individual teat with a post-dipping solution is essential to prevent future infections. Remember, the ultimate goal of every milk quality program is to control mastitis by preventing the introduction of bacteria into a healthy mammary gland!

### Bulk tank bacterial culture

**Consistently** collecting bulk tank milk cultures is critical to determine what you are really "fighting" when trying to decrease bulk tank somatic cell counts. Milk bulk tank samples help producers understand if the bulk tank's high somatic cell count problem is environmental or contagious. The results will allow the development of a strategy to solve possible issues. When bulk tank culture results show a high level of contagious mastitis pathogens, try to identify infected cows by performing individual cultures on cows with high somatic cell counts, separate and treat them. When bulk tank culture results show a high level of environmental pathogens, focus on improving bedding management and pre-milking procedures.

### Infected cows

Identify high somatic cell count cows. Lactating cows with chronic infections and high somatic cell counts that do not respond to therapy (i.e., cows treated more than five times in one lactation period) should be culled. Infected cows that are being treated should be **consistently** milked last to avoid spreading of contagious organisms to healthy cows.

### Milking equipment and Parlor Cleanliness

Milking equipment should be **consistently** kept clean. Improve parlor cleanliness to minimize the bacterial load and reduce the chances of infections during the milking process. Spray with water any equipment that may get dirty during milking. It is important to make sure milking equipment is working properly. **Consistent** evaluation and replacement of damaged milking equipment parts is essential to ensure proper performance. Be sure system cleaning is done properly and **consistently**.

## Dry and Fresh Cows

**Consistently** perform dry cow therapy and provide dry cows with adequate space, ventilation and clean bedding to avoid high somatic cell counts after calving. When applied properly, dry cow antibiotic treatments are 80-90% effective in eliminating existing infections, versus treatments during lactation, which are only 30-40% effective. During dry off, after teats have been infused with antibiotics, teat sealant should be applied to seal the teat end and help prevent environmental bacteria from entering during the early dry period.

Pay special attention to the calving pen. During calving cows are under stress and both the reproductive tract and udder are exposed to the environment, increasing the chances of infection. Every cow should calve in a clean and fresh pen.

**Consistently** monitor fresh cows to make sure they don't have infections before moving them into milking groups. Milk from fresh cows generally is higher in somatic cell counts. A cell count of 300,000/mL or less within the first 5 days after calving is considered normal.

## Training Programs

A great number of dairy farms have a high turn-over rate of dairy crews, making it challenging for management to monitor individual variability during milking procedures. Implementation of training programs in order to ensure proper milking procedures and standard operating procedures for the milking crews are essential tools to improve and evaluate **consistency** among employees. This is critical to optimize both milk quantity and quality.

It is no secret that milking clean, dry and well stimulated teats is essential to produce high quality milk. When it comes to having a milk quality program at the farm, making sure everyone is on the same page will help secure that cows produce high volumes of high-quality milk, **consistently!**

Dr. Izabella Toledo is the Northeast Florida Dairy Regional Specialized Extension Agent. Reach her at [izatol@ufl.edu](mailto:izatol@ufl.edu) or (386) 294-1279.



## Dr. Charles J. Wilcox 1930 – 2019

Dr. Charles 'Charlie' J. Wilcox, 89, of Gainesville died Monday, December 16, 2019 at North Florida Regional Medical Center, Gainesville, FL. Dr. Wilcox was born on March 28, 1930, in Harrisburg, PA. Charlie was the son of Charles John and Gertrude May (Hill) Wilcox. He married Eileen Louise Armstrong, on August 27, 1955, and welcomed children Marsha Lou Wilcox Mastriforte and Douglas Edward Wilcox in 1959 and 1963,



respectively. Charlie served as a 2nd Lieutenant, U.S. Army, from 1951-53 in Korea, receiving a Bronze Star, Combat Infantry Badge and 3 Korean Campaign medals. After his release from duty, he operated a family owned

dairy farm in Charlotte, VT from 1955-56. Charlie earned his Bachelor of Science degree from the University of Vermont (1950) and his Master (1955) and PhD (1959) degrees from Rutgers University.

Dr. Wilcox was a tenured **Professor of Dairy Science at the University of Florida (1959-1995)** and Professor Emeritus until his death. He was a world-renowned consultant in the areas of bovine genetics and international agriculture. Dr. Wilcox was a prolific writer with numerous textbooks, textbook chapters, and scientific articles to his credit. During his teaching career, one of his greatest pleasures was guiding his graduate students through the rigors of the dissertation process.

Charlie is survived by his wife Eileen, and children Marsha and Douglas (Kim), as well as grandchildren: Nicole, Matthew, Samuel, Gabriel, and Kaci. A Memorial Service was held at Milam Funeral Home Chapel in Gainesville, FL on January 17th, 2020. In lieu of flowers please consider donating to The World Wildlife Fund. The obituary was published in the Gainesville Sun on January 12 and 13, 2020.



## What is the Best Way of Assessing Heat Stress in Dairy Calves in a Subtropical Environment?

Veronique Ouellet, Bethany Dado-Senn, Geoffrey Dahl and Jimena Laporta

Efficient production is a high priority for the U.S. dairy industry to accommodate food security, social concerns and environmental issues. Heat stress in dairy cows undermines production efficiency, especially in subtropical environments, as it negatively affects milk yield, composition, growth, reproduction, and carcass traits. In adult cows, the temperature-humidity index (THI) is the most commonly used environmental indicator of heat stress with thresholds set between 68 to 72 in a subtropical environment. Animal-based indicators such as rectal temperature and respiration rate are also useful indicators to identify heat stress. Although it was recently demonstrated by our research team that dairy calves directly exposed to high ambient temperatures will experience reduced feed intake, knowledge about effective methods to recognize heat stress in dairy calves is currently lacking.

To address this, we evaluated the associations between different environmental and animal-based heat stress indicators in group-housed dairy calves that were provided cooling (shade of a barn and fans, CL, n=24) and calves that were only provided shade of the barn (heat stressed, HT; n=24) at the University of Florida Dairy Unit. The two groups were exposed to high ambient temperatures from 15 to 42 days of age.

Environmental indicators (ambient temperature, humidity, and THI) and animal-based indicators (rectal temperature, respiration rate, heart rate, and skin temperature) were measured daily in the morning, afternoon and evening. In both treatments, all the tested animal-based indicators, with the exception of heart rate, showed a strong positive correlation with ambient temperature and THI. This means that, as expected, all animal-based indicators would increase with an increment of temperature or THI. Based on these results, ambient temperature or THI could be the optimal environmental indicators for the estimation of chronic heat stress in dairy calves in a subtropical environment.

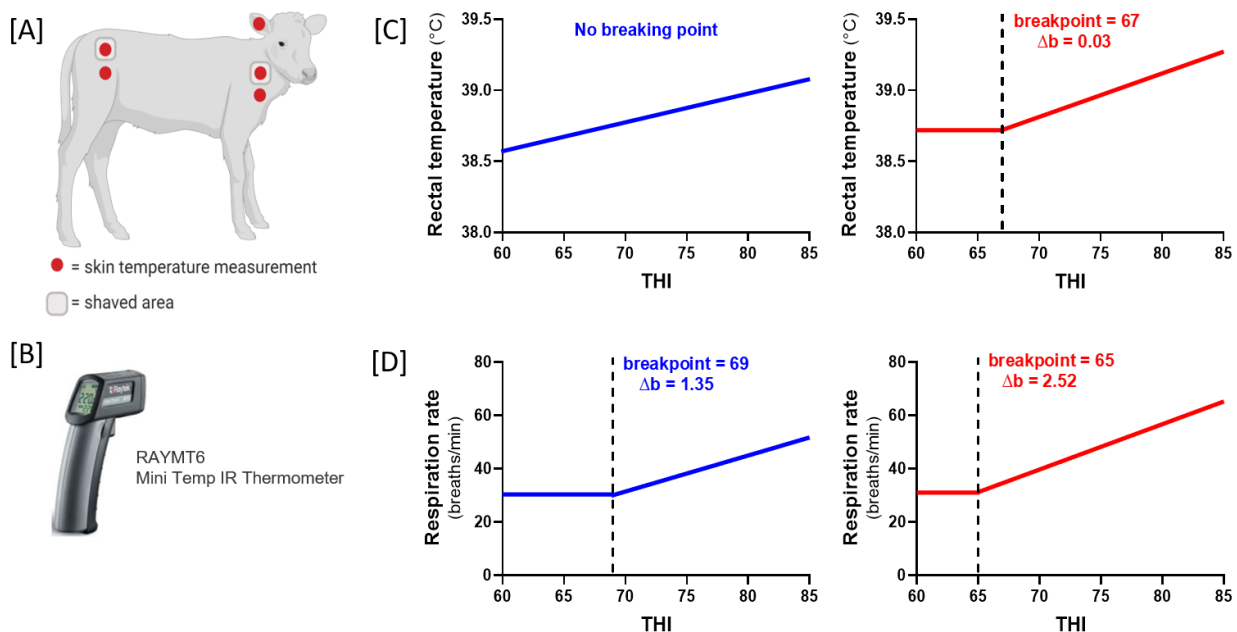


Figure 1. Non-invasive skin temperature measures [A] can be obtained using an infrared thermometer [B] either in a shaved or unshaved region of the calf. Heat stress thresholds for [C] rectal temperature (°C) and [D] respiration rate (breaths/min) depending on THI in pre-weaned dairy calves that were provided shade and fans (CL, blue) or shade (HT, red) only. Vertical dashed lines indicate thresholds at which the animal-based indicator changed significantly.  $\Delta b$  indicates the rate of increase above the threshold.

Interestingly, the thermal environment (fans and shade or only shade) did not affect the magnitude of these correlations, indicating that these indicators are equally suitable for both environments. In both treatments, the strongest observed association was between all environmental indicators and skin temperature. This suggests that skin temperature could be the most appropriate animal-based indicator of heat stress in dairy calves chronically exposed to heat stress. Skin temperature is advantageous, as it can be rapidly and non-invasively measured using an infrared thermometer (RAYMT6 Mini Temp IR Thermometer, temperature range: -20° to 932° F, cost \$ 90-120) either in a shaved or unshaved area of skin [Figure 1A, B]. When deciding on where to measure skin temperature, producers should aim for the rump or the neck, as the strongest associations were measured at these locations in both treatments.

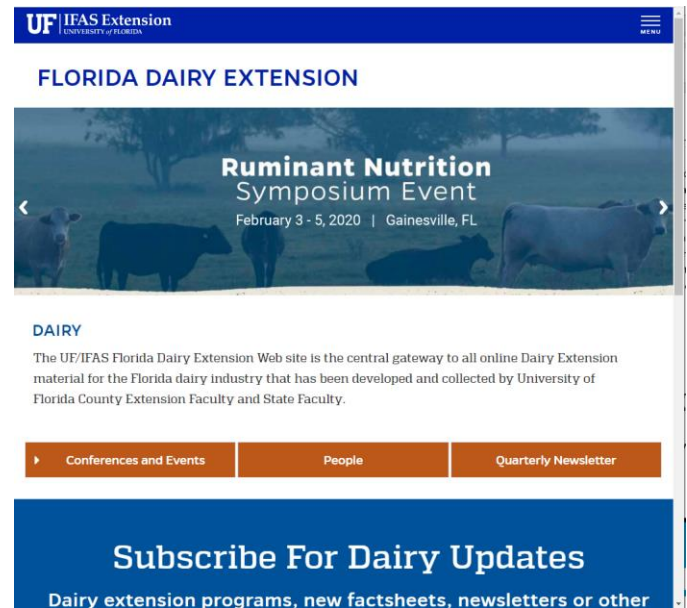
Heat stress thresholds at which rectal temperature and respiration rate started to significantly increase were also determined for both treatments. Our results suggest that rectal temperature started to increase at a THI above 67 in HT calves whereas no significant threshold was detected in CL calves [Figure 1C]. In addition, respiration rate started to significantly increase at a THI of 65 and 69 in HT and CL calves respectively [Figure 1D]. Therefore, to minimize the negative impacts associated with heat stress in pre-weaned dairy calves, producers should begin to monitor calf heat stress response at a THI of 65 when only shade is provided and of 69 when shade and fans are provided to calves. For more information contact Jimena Laporta, [jlaporta@ufl.edu](mailto:jlaporta@ufl.edu).

### Bulletin: Developing a Storm Preparedness and Response Plan for Dairies

Dr. John Bernard at the University of Georgia has published an Extension bulletin on preparing your dairy farm for a major storm. This bulletin provides information that dairy producers can use to develop an emergency preparedness plan in advance of a storm and suggestions for their potential responses following a storm. The bulletin can be found at <https://extension.uga.edu/publications/detail.html?number=b1525>. More information: John Bernard, [jbernard@uga.edu](mailto:jbernard@uga.edu), (229) 391-6856

### New Animal Sciences Dairy Extension Website Replaces [dairy.ifas.ufl.edu](http://dairy.ifas.ufl.edu)

UF/IFAS Communications has developed a new website for Dairy Extension in the Department of Animal Sciences that meets the current IFAS standards for website development. The old website [dairy.ifas.ufl.edu](http://dairy.ifas.ufl.edu), in use since 2003, used an older template and had to be replaced. Most of the information on [dairy.ifas.ufl.edu](http://dairy.ifas.ufl.edu) has been transferred to the new website at <https://animal.ifas.ufl.edu/dairy/>. For questions about the new website, call 352-392-1981 or email [webteam@ifas.ufl.edu](mailto:webteam@ifas.ufl.edu).



### Dairy Extension Agenda

- 7<sup>th</sup> Family Day at the Dairy Farm. Saturday March 28, 2020 from 9 AM to 2 PM. This is the open house for the general public at the UF Dairy Unit. <https://www.facebook.com/FamilyDayattheDairyFarm/> Contact Albert De Vries at [devries@ufl.edu](mailto:devries@ufl.edu) to help sponsor the event or for more information.



## Better Ranking of Sires on Future Profitability with Two New Genetic Selection Indexes

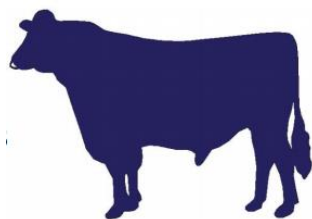
Albert De Vries and Michael Schmitt

Sire selection is an investment in the future profitability of the dairy herd. We generally identify the best sires by the highest values for an economic selection index. Such an index combines various traits that have economic value, such as milk, pregnancy rate, and health. Current USDA selection indices such as Lifetime Net Merit (LNM\$) estimate lifetime profit differences, which are accurately approximated by a linear combination of 14 traits. In these USDA indexes, every animal gets credit for 2.78 lactations of the traits expressed per lactation, such as fat and protein, independent of the sire's productive life (PL).

Differences in PL between sires are used in the LNM\$ formula as an adjustment for replacement costs only. This formulation may over- or underestimate the net revenue from traits that are expressed per lactation when the trait productive life (PL) varies between sires.

We challenged the idea that every sire gets credit for 2.78 lactations for traits that repeat every lactation. For example, if a sire has a predicted transmitting ability (PTA) of fat of +100 pounds per lactation, the sire should get credit for +100 pounds of fat for every lactation his daughters are expected to remain in the herd, which is not necessarily 2.78. This number of lactations depends on the sire's PTA of PL and is more than 2.78 lactations if his PTA of PL is greater than 0 months. Similarly, sires that have a negative PTA of PL should get credit for less than 2.78 lactations of +100 pounds each.

Selection among sires with different PTA of PL is an example of investment in mutually exclusive projects that have unequal duration. Financial investment theory says that such projects are best compared with the annualized net present value (ANPV) method when replacement occurs with technologically equal assets. This assumption means that a daughter of a sire will be replaced by another cow that is equal in all traits compared to the cow that is being replaced. However, genetic progress implies that future available replacement animals are technologically improved



assets. Asset replacement theory with improved assets results in an annualized value including genetic opportunity cost (AVOC) for each animal.

We developed the formulas for ANPV and AVOC and compared their values with the LNM\$ for 1,500 marketed Holstein sires from the December 2017 genetic evaluation. The lowest Pearson correlation coefficient was 0.980 between AVOC and NM\$, whereas the highest was 0.999 between ANPV and NM\$ among the 1,500 sires. Correlations for the top 300 sires were lower. Rank changes are in figure 1. Although we found high correlations between indexes, the 95th and 5th percentiles of individual rank changes between AVOC and LNM\$ were +131 and -163 positions, respectively, whereas these changes between ANPV and LNM\$ were +27 and -45 positions, respectively. This means that some sires change rankings a lot.

The relative emphasis of PL in the AVOC index was half of the relative emphasis in LNM\$. These results show that applying financial investment methods to value differences in genetic merit of sires changes their rankings sometimes significantly compared with the LNM\$ formulation. Rank changes were meaningful enough that the new indexes should be used in practice.

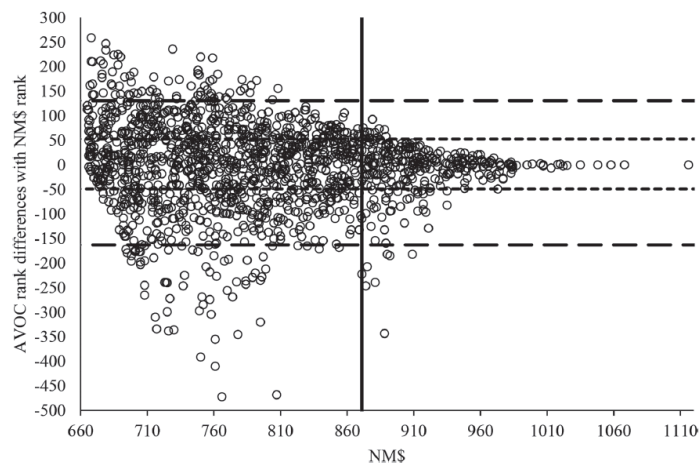


Figure 1. Lifetime net merit dollars (NM\$) rank difference from their annualized value with opportunity cost (AVOC) rank for each of 1,500 Holstein sires ordered by NM\$ for the December 2017 genetic evaluation. The top 300 NM\$ sires can be found to the right of the vertical line (NM\$ = \$871). Percentile of rank change lines are drawn at 95% (long-dash line; +131), 75% (short-dash line; +53), 25% (short-dash line; -49), and 5% (long-dash line; -163). Positive values represent a better ranking of the sire for AVOC than NM\$. Source: *Journal of Dairy Science* 102 (October 2019) pages 9060–9075.

The study was published in the October 2019 issue of Journal of Dairy Science pages 9060-9075 (<https://www.ncbi.nlm.nih.gov/pubmed/31378490>). A larger story was published in Progressive Dairy issue 18 (2019) page 66 and online at <https://www.progressivedairy.com/topics/a-i-breeding/is-it-time-to-rebuild-our-economic-selection-indexes>. The ANPV, AVOC, and LNM\$ for a list of sires using the **December 2019 genetic** evaluation is available on <http://devries.ifas.ufl.edu/info.htm>. For more information, contact Albert De Vries, [devries@ufl.edu](mailto:devries@ufl.edu)

## High Somatic Cell Counts Lead to Large Financial Losses

Albert De Vries

The dairy had lost some labor and was not able to keep up with sand bedding management. Stalls were only maintained whenever there were no other tasks that appeared to be more important. Stalls and cows were not as clean as they should. Compliance with the milking procedures had slipped too. As a result, bulk tank somatic cell count (SCC) increased from below 200,000 cells/ml to over 400,000 at times. Everybody knew that this was a problem, but the financial impact was not clear.

High bulk tank SCC is associated with several factors that result in financial losses. Perhaps the most obvious one is missed milk price premiums. Others are lower milk production per cow, more cases of clinical mastitis, reduced fertility, and more culling.

The milk buyer's quality premium program pays premiums if the monthly SCC was less than 275,000 cells/ml. The lower the SCC, the greater the premiums. The maximum premium is \$0.30 per cwt milk if the monthly SCC is less than 200,000 cells/ml. The average monthly SCC of milk shipped by the dairy is in figure 1 (black line, right axis). The monthly bulk tank SCC ranged from 236,000 to 393,000 cells/ml. The maximum premiums were never captured, but some premiums were captured in some months.

On average, \$4.94 per cow per month was missed in premiums (orange bars in figure 1, left axis). In the month with the lowest bulk tank SCC, only \$2.04 was missed per cow. In the worst month this was \$7.73.

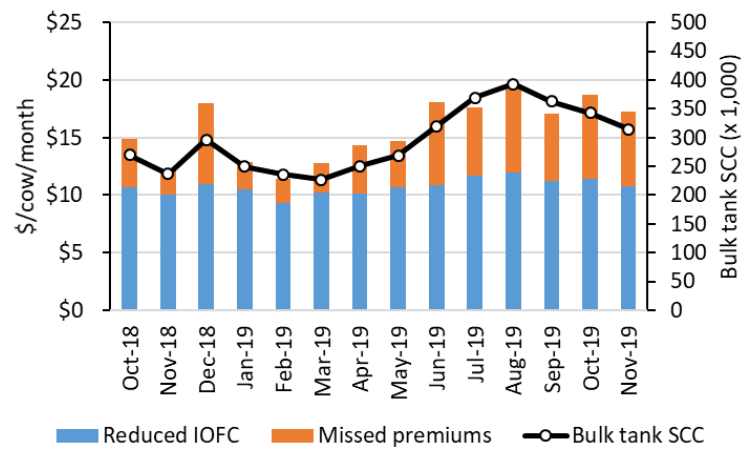


Figure 1. Bulk tank somatic cell count, missed milk price premiums and reduced milk income over feed cost at the dairy as a results of high bulk tank SCC.

Although missed premiums are straightforward to calculate, a bigger loss of high SCC is milk not made. Figure 2 shows the relationship between SCC and milk loss for individual cows. Milk losses are greater for older cows than for first lactation cows. The dairy participates in monthly milk testing through DHIA, including testing for SCC. After some math with the distribution of SCC in the herd, and the milk loss curves in figure 2, it turned out that the average milk loss was 2.29 pounds per cow per day. This loss varied from 2.15 to 2.50 pounds per cow per day, depending the bulk tank SCC.

For this analysis, the milk price was close to \$18/cwt milk on average. The average of 2.29 pounds less milk per cow per day translates to \$0.41 less milk sales per cow per day.

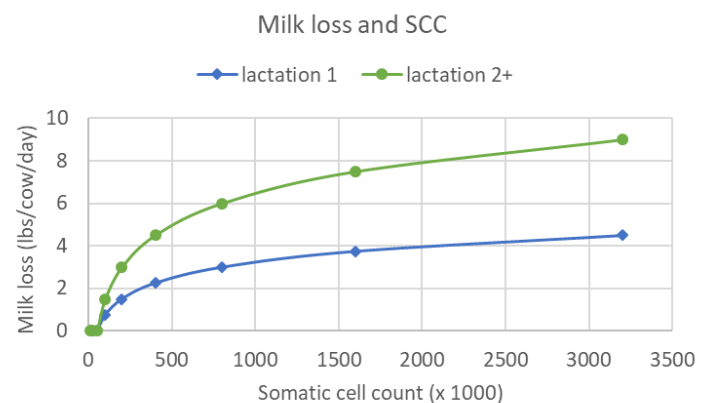


Figure 2. Milk loss and somatic cell count. The data are from the DHIA Glossary April 2014, and based on Raubertas and Shook, Journal of Dairy Science (1982) 65:419



A cow that produces less milk may eat a little less, so there are some feed savings when SCC is high. A study in the Journal of Dairy Science (2018) 101 page 9510 showed that the feed efficiency of cows with high SCC is reduced. Based on this study, one pound less milk results in approximately only 0.2 pounds less dry matter intake. Feed cost at the dairy was approximately \$13/cwt dry matter. The 2.29 pounds less milk translates to \$0.06 less feed cost per cow per day. Milk income over feed cost was reduced by \$0.35 per cow per day on average as a result of high bulk tank SCC. The average reduced income over feed cost per cow per month was \$10.76. Figure 1 shows the reduced income over feed cost per cow per month (blue bars, left axis) depending on the level of bulk tank SCC.

Total losses from missed premiums and reduced income over feed cost ranged from \$11.40 to \$19.66 per cow per month, depending on the bulk tank SCC. The average was \$15.69 per cow per month. In one year, this is \$188 less net revenue per cow. Other costs associated with high bulk tank SCC, such as costs from more clinical mastitis cases, add to the total cost of high bulk tank SCC.

The dairy learned that lack of upkeep with sand bedding management and following good milking procedures is very expensive and can make the difference in staying in business or not.

More information: Albert De Vries, [devries@ufl.edu](mailto:devries@ufl.edu)

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### Should We Use the Old Semen in the Tank?

Albert De Vries

The new sire evaluations have come out and a number of new bulls have very good evaluations. But there is some old semen left in the tank. So should we use up the old semen in the tank first? Or should we throw out the old semen and replace it with new semen? Economically, it depends. The semen in the tank is paid for, so “free” to use. New semen costs money. However, if the new semen is of enough higher genetic merit, the resulting calf may be of a genetic value that warrants buying and using new semen instead of using the old semen.

There is a break-even gain in PTA where the increase in genetic value of the calf is equal to the price of new semen. If the increase in the genetic merit is

greater than this break-even price, the better decision is to not use the old semen but buy and use new semen instead. Let’s do some math to illustrate and quantify this.

The semen in the tank has a PTA of a lifetime economic index that is \$800. This index can be Lifetime Net Merit, but also another index. We’ll assume that the economic index is a good measure of expected profitability. Assume further that it takes 3 inseminations to get a calf on the ground and we use sexed semen. There is a 90% chance of a female calf and 85% of the female calves become cows. Between the time of an insemination and the average time the genetics from a successful insemination is expressed is assumed to be 4.5 years. This includes time between the purchase of the semen and the successful insemination, the gestation length, time to raise a heifer, and the average time the cow expresses her genetic merit. This difference in time between the purchase and use of the semen, and the expression of the genetics of the cow should be discounted. Using a 5% interest rate, this means that \$1 spent on semen is worth only \$0.803 in 4.5 years in the future when this genetic merit is expressed. Now  $\$800 \times 90\% \times 85\% \times 0.803 = \$491$  which is the net present value of the PTA of the semen (compared to semen with a PTA of \$0). Further,  $\$491/\$800 = \$0.61$  which means that \$1 greater PTA of semen is worth \$0.61 at the time the semen is purchased and used (I am assuming that the value of a bull calf that may result from an insemination does not depend on the genetic merit of the semen).

The \$800 PTA semen is already paid for, so free to use. But there is an opportunity cost of not using semen with a higher PTA to make the pregnancy. How much higher would the PTA have to be in order to buy and use new semen instead?

If the semen price is \$25 per unit and it takes 3 inseminations to get a calf on the ground, then the total semen cost per calf is \$75. Because \$1 greater PTA is worth \$0.61, the PTA of the semen would need to be at least  $\$75/\$0.61 = \$122$  higher than the old semen in the tank. For the example above, that means that if the PTA of the new semen is greater than  $\$800 + \$122 = \$922$  it is economically a good idea to buy and use the new semen for \$25 per unit and not use the old semen.

The necessary gain of \$122 in PTA of the new semen does not depend on the PTA of the old semen. So we can generalize these results for sexed semen as

shown in table 1. The \$122 is in the middle of table 1. We see that the necessary gain in the PTA of the new semen is lower with cheaper semen and the fewer inseminations it takes to get a calf on the ground (better conception rates).

*Table 1. Increase in PTA of a lifetime economic index necessary to warrant buying and using new sexed semen versus using up old sexed semen.*

		semen price (90% females)									
		\$	5	\$	15	\$	25	\$	35	\$	45
#inseminations per pregnancy	1.5	\$	12	\$	37	\$	61	\$	85	\$	110
	2	\$	16	\$	49	\$	82	\$	114	\$	147
	2.5	\$	20	\$	61	\$	102	\$	142	\$	183
	3	\$	24	\$	73	\$	122	\$	171	\$	220
	3.5	\$	29	\$	86	\$	143	\$	200	\$	257
	4	\$	33	\$	98	\$	163	\$	228	\$	293

*Table 2. Increase in PTA of a lifetime economic index necessary to warrant buying and using new conventional semen versus using up old conventional semen.*

		semen price (50% females)									
		\$	5	\$	15	\$	25	\$	35	\$	45
#inseminations per pregnancy	1.5	\$	22	\$	66	\$	110	\$	154	\$	198
	2	\$	29	\$	88	\$	147	\$	205	\$	264
	2.5	\$	37	\$	110	\$	183	\$	257	\$	330
	3	\$	44	\$	132	\$	220	\$	308	\$	396
	3.5	\$	51	\$	154	\$	257	\$	359	\$	462
	4	\$	59	\$	176	\$	293	\$	410	\$	527

Table 2 is the result of the same math, except that the probability the insemination results in a female calf is now only 50% because we are using conventional semen. Again I assume that the value of the bull calves out of this semen does not depend on the PTA. With conventional semen, the increase necessary in the PTA of the new semen is greater than with sexed semen. If we had used conventional semen in the example above (3 inseminations, \$25 per unit), the new semen needs to be at least \$220 higher in PTA to warrant not using the old semen in the tank. Again cheaper semen and fewer inseminations per pregnancy need smaller increases in the PTA of the semen to make it worthwhile to not use the old semen in the tank.

These analyses show that buying new semen instead of using up the old semen may be the smart decision for your farm. More information: Albert De Vries, [devries@ufl.edu](mailto:devries@ufl.edu)

## Reducing the Genetic Lag Cost with Beef-on-Dairy

Albert De Vries

Using beef semen in dairy cattle is popular because the market value of a crossbred calf is greater than the market value of a dairy bull calf. A common premium is at least \$100 or more for a crossbred calf. Many farms will combine the use of beef semen with the use of sexed semen. A greater use of sexed semen means that more cows (and maybe heifers) are available for breeding with beef semen and the number of crossbred calves can be increased. Important factors that affect the profitability of the beef-on-dairy program are the value of calves, cost of semen, conception rates, and genetic lag.

The higher price and the lower conception rate of sexed semen take away some of the higher net revenue made with crossbred calves compared to using conventional semen. For example, using a herd budget model of a typical herd, I compared a scenario with 100% conventional semen with a scenario where only sexed and beef semen is used (a beef-on-dairy program). In this scenarios, the sexed semen is used in heifers and the first 3 breedings in first lactation cows. This supplies enough dairy heifer calves to replace culled cows at a 35% annual cow cull rate. The 100% conventional semen program also supplies just enough dairy heifer calves. I assumed crossbred calves are worth \$100 more than dairy bull calves. There are many other inputs not mentioned here. In this case, the beef-on-dairy program resulted in \$58 greater calf sales per milking cow per year, but also \$30 greater breeding costs and \$74 lower operational revenues. Operational revenues include other consequences of using sexed semen, such as increased days open. Together, the net profit before accounting for changes in genetic lag was \$14 per milking cow per year. Let's now look at the value of genetic lag.

Genetic lag is the difference between the average genetic merit in the herd and the genetic merit of the best available service sires. The current cows in the herd were sired in the past by sires that are often no longer competitive with the best sires on the sire list today. Genetic lag can therefore be thought of as an opportunity cost. It is the missed opportunity of not having the best genetics in the herd. Looking at Lifetime Net Merit (LNM\$) as an economic measure of the

profitability of a sire, data from the Council on Dairy Cattle Breeding shows that the PTA for LNM\$ now increases by more than \$70 each year for the average available service sire. Ten years ago this was an increase of no more than \$35 per year. A consequence of better sires over time is that on average heifers are genetically better than first lactation cows, which are better than second lactation cows, and so on.

One way to reduce genetic lag in the herd is to make more replacement dairy heifer calves from heifers and first lactation cows and fewer or none from older cows. This is what beef-on-dairy with use of sexed semen on the younger animals and beef semen on older cows does. In the example herd above, I used a moderate annual increase of \$50 in PTA of LNM\$ per year. The value of a reduced genetic lag is then about \$48 per milking cow per year. The total value of the beef-on-dairy program is the \$14 net profit from above + the \$48 value of reduction in genetic lag, for a total of \$62 per milking cow per year. When I used the annual increase of \$70 in PTA of LNM\$ per year, the value of the reduction in genetic lag is worth about \$67 per milking cow per year.

Although reducing the genetic lag is worth a lot, this reduction does not come immediately when the switch to a beef-on-dairy program with sexed semen is made. The figure, based on some straightforward math, makes this clear. Initially, the genetic lag of cows in the herd compared to the best available service sires is -\$482 when only conventional semen is used. The beef-on-dairy program starts in year 1 and continues for 20 years. With this program, all dairy heifer calves are made out of heifers and first lactation cows. We see that not until year 4 is there a small reduction in genetic lag of \$13 in PTA of LNM\$ and it is worth about \$8 per milking cow per year. The genetic lag eventually is reduced by \$71 in PTA of LNM\$ to -\$411 and the value of that reduction in genetic lag is about \$47 per milking cow per year. Notice however that it takes years to get there. Also notice in the figure that in the first 10 years the genetic lag is reduced fast. Dairy farmers switching to beef-on-dairy with a lot of sexed semen see a genetic progress above and beyond the improvement in genetic merit that comes from continuous genetic improvement in service sires. However, eventually this annual genetic progress slows down again and will be at the same rate as the annual improvement of the service sires. Contact Albert De Vries, [devries@ufl.edu](mailto:devries@ufl.edu)

Reduction in genetic lag and increase in profitability due to genetic lag

