

Total Performance Index® (TPI) – Keeping up with changing times

The primary selection index recommended by the Holstein Association USA is the Total Performance Index, more simply known as TPI. Several years ago, the Association’s Genetic Advancement Committee developed the following vision statement.

TPI is the gold standard in ranking world-wide Holstein genetics, serving as a rudder for the genetic direction of the breed. TPI represents HAUSA’s vision for feeding the world through the improvement of the domestic and international Holstein population, encompassing animals identified in the Herdbook as well as commercial Holsteins. TPI is not necessarily aimed at breeding individual cows, but rather to advance the entire genetic pool. HAUSA recognizes and encourages diversity in breeding philosophies to ensure the continual improvement of the Holstein breed globally.

These thoughts hold as true today as when they were developed. However, what has changed in recent years is the rate of genetic progress. As GAC Chairman Paul Buhr said in his 2017 National Holstein Convention address, “our genomic predictions continue to become more accurate and genetic change is occurring much quicker.” We are now in an era that requires precision breeding, where our breeding goals are more precise and our path for achieving these goals is clearly laid out. The recent changes made to the TPI formula reflect a more accurately described breeding goal as opposed to any fundamental change in direction or philosophy.

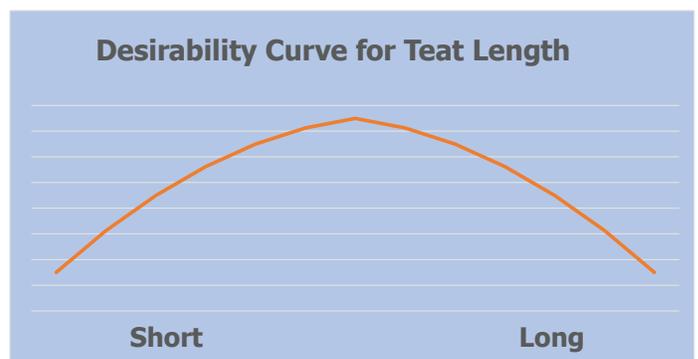
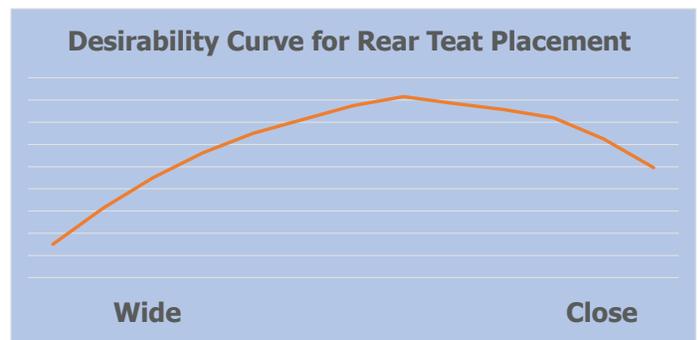
For example, in the production component of the TPI formula, we’ve placed more emphasis on butterfat, to reflect the changing dynamics in the marketing of our dairy products. And we have increased the weighting on Feed Efficiency. More confidence and therefore more emphasis is being placed upon feed efficiency because of the improvement that was made to the body composite in 2016. Every 1.0 STA increase in body size correlates with a 40-pound predicted increase in mature body weight. Starting in August 2017, we will change the name of Body Size Composite (BSC) to Body Weight Composite (BWC), as it more accurately describes what the composite is predicting. BWC looks at both the size of the cow and how

heavy she’s milking (how much extra body condition she carries). The Feed Efficiency \$ (FE) calculations will be made more current with the utilization of the economic values from the 2017 Cheese Merit \$ formula.



BY TOM LAWLOR, Ph.D.

We adjusted the Udder Composite (UDC) and Feet & Legs Composite (FLC) to improve their relationship with higher lactation averages, productive life and lifetime production of fat and protein. Our new Udder Composite continues to describe a well-formed capacious udder with strong attachment. Udders of the future will result in a lowering of the somatic cell score, continue to be trouble-free and capable of holding more milk. An added benefit is that we’ve lessened the composite’s relationship with stature. By decoupling UDC from stature, we’ve made UDC more accurate and more reflective of true udder traits. Another example of this era of precision breeding is the handling of Rear Teat Placement and Teat Length. There is a penalty for rear teats that are placed too close to one another. The same goes for teat length. Teats that are too long or too short are penalized.



Back in 2015, Holstein's Genetic Advancement Committee provided USDA's researchers with discussion and encouragement for the development of the new trait - Cow Livability. Whereas, Productive Life (PL) measures the number of Months-In-Milk, Cow Livability (LIV) measures a cow's ability to stay alive while on the farm. About 20% of cows die on the farm, instead of being sold for beef, with death losses averaging 7% per lactation. The longevity component of the TPI formula will be changed from 7% Productive Life to 4% Productive Life and 3% Cow Livability. Although both traits have a high correlation of +0.70, you do see important differences. For example, Mogul's PL is +4.3 but his LIV is -4.1. Or Numero Uno whose PL is +6.7 and his LIV is -0.6.

So, what's the overall impact from these changes?

Trait average of the top 100 Proven bulls using the new TPI formula compared to the current TPI is listed below:

The obvious advantages of the new TPI formula are:

- An improvement in the ratio of Fat to Protein...We did this by increasing Fat without any loss in Protein or pounds of Milk
- Increased production without a significant change to Productive Life.
- Adding Cow Livability will lead to higher economic returns by lowering the incidence of on-farm deaths.
- A slower rate of increase in Stature, a move which helps to control the height of our cattle.
- Daughters of the new Top 100 bulls should have a Body Weight that is consistent with the current population.
- As production increases, and body weight stays the same, the Feed Efficiency of our Breed improves.
- With improved efficiency, there is no change in Dairy Form (0.97 vs 0.95).

"Our genomic predictions continue to become more accurate and genetic change is occurring much quicker."

- R. Paul Buhr

- An added benefit of the better control of the size of our cattle is a lowering of the incidence of difficult births, with a slight improvement in the daughter's ability to deliver a calf.
- Conformation of our cattle will continue to improve from an average PTAT of +1.37.

The net result, based upon USDA calculations, is that dairy farmers using the new TPI formula will be breeding a more profitable herd of cattle.

GAC member Mark Kerndt describes the impact of the changes as follows "I don't see radical changes in the new TPI values for either bulls or females. This is important, because that means our current formula was pretty good, but as we have always done in the past, we continually

look for ways to improve our breed. The beauty of a multi-trait index, with a number of traits, is that it makes it harder to have radical shifts."

When looking at current top 200 genomic active bulls, the old UDC and FLC had a correlation of 0.36 and 0.40 with stature, respectively.

These new composites are essentially neutral as the new correlation with stature is close to zero. Breeders using high TPI bulls can now improve udders and feet & legs without making their cows taller. If a breeder wants to make their cows taller, they can select for the trait stature!

Industry feedback on the recent TPI changes has been positive and widespread. While the recent TPI changes will slightly shift the direction of future genetic progress, the key point to remember is that the rudder has been adjusted and we're headed in the right direction. Now, our task is to keep our eye on the horizon and move forward. The future of our breed - the Holstein cow – the number one breed of dairy cattle in the world, looks bright and favorable. 🐄

New TPI compared to current TPI

	Pro	Fat	Milk	FE	BWC	Stature	SCE	DCE	SCS	PL	LIV	Fert	PTAT	UDC	FLC	NM\$
New	45.6	63.9	1246	147	0.06	0.60	6.81	5.15	2.86	5.21	1.26	1.56	1.37	1.42	1.17	642
Current	45.4	59.7	1256	137	0.34	0.87	6.94	5.20	2.84	5.26	0.99	1.65	1.48	1.33	1.16	626
	same	X	same	X	X	X	X	same	same	same	X			X	same	X

The new formulas for UDC, FLC, FE and TPI can be found in the August 2017 Red Book™ and on our website at www.holsteinusa.com.