



**U.S. Registered Holsteins**  
FOR MAXIMUM PROFIT

**Holstein Association USA, Inc.**

1 Holstein Place • PO Box 808 • Brattleboro, VT 05302-0808  
800.952.5200 • Fax: 802.254.8251  
www.holsteinusa.com

## The new Total Performance Index (TPI)

Dr. Tom Lawlor, HAUSA research director

Every five years, our genetic base is updated. Making now an excellent time to review past improvements and identify those areas where more emphasis may be necessary. The U.S. Holstein population has once again made very good genetic progress for production and conformation. With these most recent gains, added to our already solid genetic foundation, we have a breed with a great will to milk and the conformation to standup to its rigorous demand.

In recent years, we have worked to address some areas of concern by placing more emphasis on the health and fertility traits. So, we are pleased to see some improvement in them and, in particular, a halt to the long-term decline in fertility (DPR). However, we still have a need for even greater improvement in the health & fertility traits. The opportunity to improve these lowly heritable traits is greater now than ever before due to the introduction of genomic information.

### Genetic Progress over the last five years

Production	*** - very good improvement
Conformation	*** - very good improvement
Productive Life	* - small improvement
Daughter Pregnancy Rate	no change
Daughter Calving Ease	* - small improvement
Daughter Stillbirth	* - small improvement

Recognizing the needs, strengths, and the opportunities that we have before us, HAUSA has made a slight modification to our TPI formula. The change leads to an increase in emphasis on productive life and daughter pregnancy rate; maintains the current emphasis on udders and feet & legs; slows the increase in body size; and reduces, by a small amount, the emphasis on production. These changes coincide with the views being expressed by commercial dairy farmers throughout the U.S. and abroad. Thereby, helping to ensure that TPI continues to be the index of choice around the world.

Daughter Pregnancy Rate (DPR) measures the percent of eligible cows that become pregnant during a 21-day period. Recording starts at 50 days after freshening, thereby, providing us with a good measure of a cow's ability to return to breeding readiness and her ability to conceive. Productive Life (PL) measures the number of months-in-milk in a way that mimics the lactation curves. For example, the months surrounding the peak of production, during early lactation, receive more credit than months at the end; a third lactation receives more weight than a first lactation, etc. The trait PL is a good measure of a cow's ability to become pregnant on a routine basis, have good conformation to remain trouble-free, and produce at an acceptable level.

### New TPI Formula

$$[26(\text{PTAP}) + 16(\text{PTAF}) + 10(\text{PTAT}) - 1(\text{DF}) + 10(\text{UDC}) + 5(\text{FLC}) + 14(\text{PL}) - 5(\text{SCS}) + 10(\text{DPR}) - 2(\text{DCE}) - 1(\text{DSB})] 3.7 + 1815$$

19.4      23.0      .73      1.0      .8      .85      1.26      .13      1.0      1.0      0.9

*(The value 1815, adjusts for our periodic base change, allowing TPI values to be comparable across time)*

<u>Change in weights for the major categories</u>		
<u>Major Categories</u>	<u>Current TPI</u>	<u>New TPI</u>
Production	45%	42%
Health & Fertility	27%	33%
Conformation	28%	25%

<u>Change in individual traits</u>		
Productive Life	10%	14%
Daughter Pregnancy Rate	8%	10%
PTA Type	13%	10%
Protein	28%	26%
Fat	17%	16%

### Concurrence among indexes

USDA will also be making a change to their Net Merit \$ formula, with implementation to take place in January 2010. They describe their changes as placing less weight on components yield, SCS and calving ability and more emphasis on productive life, daughter pregnancy rate, and body size (favoring smaller cows). Coordinating formula changes with the genetic base change helps the dairy industry's educational effort and minimizes disruptions. Although the two major U.S. selection indexes, TPI and NM\$, do not need to be in complete agreement, there are benefits in having them rank animals similarly.

Below are the correlations for the current and new indexes. The current TPI and NM\$ indexes have a moderately high correlation of 0.85. If no change were made to TPI, that correlation would drop from 0.85 to 0.78. The changes being implemented by the new TPI and the new NM\$ indexes are similar in nature, maintaining our moderately high correlation (0.88). It should also be noted that the changes being made by HAUSA and USDA should not cause much confusion among breeders, as the new and current indexes are correlated by 0.97 and 0.98, for TPI and NM\$, respectively.

	<b>Current TPI</b>	<b>Current NMS</b>	<b>New NMS</b>
<b>New TPI</b>	<b>.97</b>	<b>.90</b>	<b>.88</b>
<b>Current TPI</b>	-	<b>.85</b>	<b>.78</b>
<b>Current NMS</b>	-	-	<b>.98</b>

### Analysis of the formula changes on Top 100 bull averages

Below is a table with the average value of the Top 100 bulls using the four different indexes. To qualify a bull must have a U.S. reliability of at least 85% for both production and type. The new TPI formula accomplishes several of its goals.

1. Large improvement in health and fertility traits.
  - a. The new TPI formula is superior to both the current TPI and the current NM\$ formulas.
2. The new TPI continues to identify superior conformation.
  - a. Overall type (PTAT), Udder Composite and Feet & Leg Composite are much higher with the new TPI than either NM\$ formulas.
  - b. The increase in stature will be at a slower pace with the new TPI formula than with the current TPI.

3. Although there is reduced emphasis on production, we can still expect to see continual growth in the yield traits over time.
  - a. The new TPI will emphasize production MORE than the new NM\$.
  - b. The new TPI formula results in slightly higher components than the current TPI formula.

**Top 100 bull averages using the four different indexes**

Trait	New TPI	Current TPI	New NM\$	Current NM\$
Productive Life	4.07	3.39	4.57	3.96
Daughter Pregnancy Rate	0.98	0.48	1.21	0.84
Somatic Cell Score	2.83	2.84	2.81	2.82
Daughter Calving Ease	6.20	6.32	6.18	6.22
Daughter Still Birth	6.92	7.11	6.85	6.98
PTAT	1.94	2.17	1.34	1.47
Stature	1.37	1.70	0.55	0.78
UDC	1.84	1.98	1.38	1.36
FLC	1.82	1.93	1.42	1.48
Milk	1179	1337	1112	1253
Fat	59.0	61.6	57.4	65.5
Fat %	062	.050	.065	.076
Protein	41.6	44.7	40.8	45.9
Protein %	.025	.019	.029	.032

### **Summary**

The new TPI formula accomplishes several goals.

Health & fertility traits are improved relative to the current TPI.

Production values of the new TPI are greater than the new NM\$ index.

Type traits of top animals ranked by the new TPI formula far exceed NM\$.

The newly improved TPI formula will assist breeders in identifying superior animals with the right combination of high production, good conformation, and desirable health and fertility.