

UNDERSTANDING VARIOUS TRAITS

With Genomic mapping, more information is available to make genetic selections. This information explains traits in this catalog.

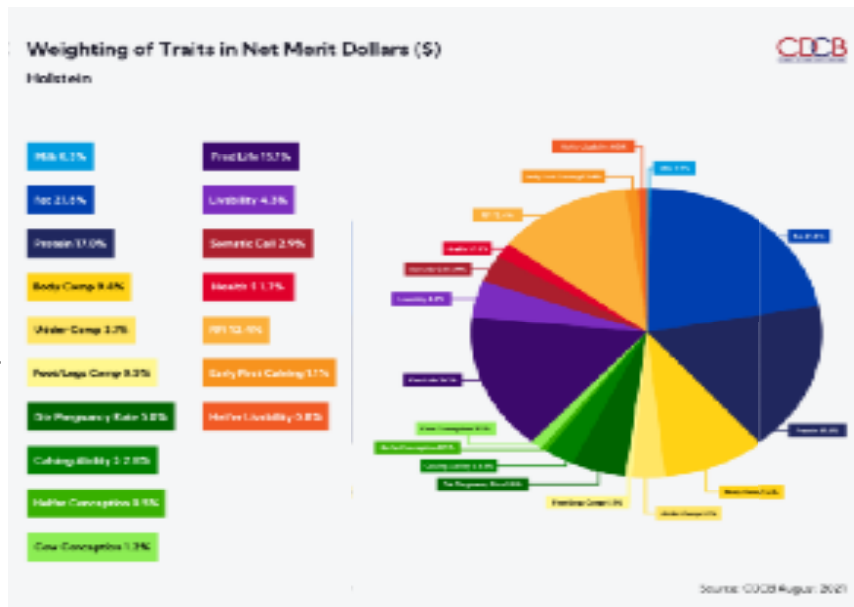
NET MERIT \$ & TPI FORMULAS

Net Merit \$

The Net Merit \$ (NM\$) index was revised with the August 2021 genetic evaluation. NM\$ now has over 40 traits. The updated NM\$ formula includes three new traits: feed saved (FSAV), heifer livability (HLIV), and early first calving (EFC).

FSAV includes the economic value of cow body weight composite (BWC) with actual feed intake data. Residual feed intake (RFI) measures the difference between actual and expected feed intake. Feed Saved (FS) combines RFI and feed intake required for maintenance.

The new formula also reflects changes in emphasis given to traits. More emphasis is on longer Productive Life and smaller Body Weight Composite.



TPI/GTPI®

The primary selection index recommended by Holstein USA is the Total Performance Index (TPI or GTPI.) TPI/GTPI is not aimed at breeding individual cows but as a tool to advance the entire genetic pool. The graph below shows the current formula used to calculate TPI/GTPI, updated April 2021.

April 2021

TPI®

$$\frac{15}{17}(PTAP) + \frac{15}{22}(PTAF) + \frac{8}{52}(FE) + \frac{8}{0.8}(PTAT) + \frac{11}{0.8}(UDC) + \frac{6}{0.8}(FLC) + \frac{5}{1.6}(PL) + \frac{2}{2.0}(HT) + \frac{3}{1.4}(LIV) - \frac{4}{0.13}(SCS) + \frac{13}{1.7}(RFI) - \frac{0.5}{0.5}(DCE) - \frac{1.5}{0.8}(DSB) - 3.9 + 2363$$

Weighting of Major Categories in TPI/GTPI Formula:

Production	46%	(Fat, Protein, BWC and FE)
Health & Fertility	28%	(SCS, PL, HT, LIV, FI, DCE and DSB)
Conformation	26%	(PTAT, UDC and FLC)

Traits included in the TPI/GTPI Formula:

PTAP = PTA Protein	HT = Health Trait Index
PTAF = PTA Fat	LIV = PTA Cow Livability
FE\$ = Feed Efficiency \$	SCS = PTA Somatic Cell Score
PTAT = PTA Type	FI = Fertility Index
UDC = Udder Composite	DCE = PTA Daughter Calving Ease
FLC = Feet & Legs Composite	DSB = PTA Daughter Stillbirth
PL = PTA Productive Life	

NET MERIT \$ VS CHEESE MERIT \$ VS GRAZING MERIT \$

Genetic indexes help dairy producers focus on a total approach to genetic improvement, rather than limiting progress by single trait selection. Every dairy operation is unique with different management environments, situations and goals. Knowing what traits are included and the weight of each trait in an index helps producers evaluate if an index matches your operation's goals.

In our information, we include four indexes:

- Total Performance Index (TPI or GTPI)
- Net Merit \$ (NM\$)
- Cheese Merit \$ (CM\$)
- Grazing Merit \$ (GM\$)

The graph indicates the traits and weighting of those traits for NM\$, CM\$ and GM\$. HTH\$ is a Health Trait Subindex that incorporates mastitis, metritis, displaced abomasum, retained placenta, ketosis, and milk fever.

Trait	NM\$	CM\$	GM\$
Milk	0.3%	-2.2%	0.3%
Fat	28.6%	27.2%	27.6%
Protein	19.6%	20.9%	18.9%
Productive Life (PL)	15.9%	15.1%	6.9%
Somatic Cell Score (SCS)	-2.8%	-3.5%	-2.8%
Body Weight Composite	-9.4%	-8.9%	-10.9%
Udder Composite (UDC)	3.4%	3.2%	3.8%
Foot & Leg Composite (FLC)	0.4%	0.4%	0.4%
Daughter Pregnancy Rate (DPR)	4.1%	3.9%	11.7%
Calving Ability \$ (CA\$)	2.9%	2.7%	2.6%
Heifer Conception Rate (HCR)	0.4%	0.4%	0.7%
Cow Conception Rate (CCR)	1.0%	0.9%	2.8%
Livability (LIV)	4.4%	4.2%	3.3%
Health Trait Subindex (HTH\$)	1.2%	1.2%	1.4%
Residual Feed Intake (RFI)	-3.8%	-3.6%	-4.2%
Early First Calving (EFC)	1.2%	1.1%	0.9%
Heifer Livability (HLIV)	0.5%	0.5%	0.4%

UNDERSTANDING VARIOUS TRAITS

WELLNESS TRAITS & DWP\$



CLARIFIDE® provides reliable assessments of genetic risk factors for economically relevant diseases in Holstein cattle for six wellness traits.

The six wellness traits are:

Dairy Wellness Traits	Label	Ave. Score*	Min.*	Max.*
Mastitis	MAST	100	77	116
Lameness	LAME	100	75	114
Metritis	MET	100	68	114
Retained Placenta	RP	100	70	117
Ketosis	KET	100	62	114
Displaced Abomasum	DA	100	70	115

* provided by CLARIFIDE® Plus

The **Dairy Wellness Profit Index™ (DWP\$®)** includes production, fertility, type, longevity, calving ability, milk quality, the dairy wellness traits, and Polled test results. Combining Wellness Traits with traits used to calculate Net Merit (NM\$), DWP\$® estimates the potential profit contribution an animal will pass along to the next generation.

The **Wellness Trait Index™ (WT\$®)** estimates the difference in expected lifetime profit associated with the risk of diseases in cows. It focuses on the six wellness traits of mastitis, lameness, metritis, retained placenta, ketosis and displaced abomasum, in addition to adding the economic value for the polled gene.

The **Calf Wellness Index™ (CW\$™)**, estimates the difference in expected lifetime profit with risk of calthood diseases and early death losses by including calf livability, calf respiratory disease and calf scours.

Calf Wellness Traits	Label	Ave. Score*	Min.*	Max.*
Calf Livability	LIV	100	66	116
Calf Scours	SCOURS	100	85	117
Calf Respiratory Disease	RES	100	83	116

* provided by CLARIFIDE® Plus

SIRE SUMMARY TERMINOLOGY

GENERAL TERMS:

PTA: Predicted Transmitting Ability

- M: Milk production in pounds
- F: Fat production in pounds
- F%: Genetic variance for transmitting fat
- P: Protein production in pounds
- P%: Genetic variance for transmitting protein
- Rel: Percent reliability of a sire's proof
- T: Type
- UDC: Udder composite Index
- FLC: Foot and leg Composite Index

EFI: Effective Future Inbreeding

An estimate based on pedigree of the level of inbreeding that the progeny of a given animal will contribute in the population if mated at random.

Beta-Casein: A1A1, A1A2 or A2A2

A major casein protein that makes up 30% of total milk protein. Studies have shown health benefits for A2.

HEALTH & FERTILITY TRAIT TERMS:

PL: Productive Life

Time a cow stays in herd as a "productive" animal. Number represents how many months (additional or fewer, if negative) of lifetime expected.

LIV: Cow Livability

A cow's ability to remain alive while in the milking herd.

DPR: Daughter Pregnancy Rate

A percentage of non-pregnant cows that become pregnant during each 21-day period. DPR considers how quickly cows come back into heat after calving and conception rate when bred. A DPR of +1.0 implies daughters of this bull are 1% more likely to become pregnant during that estrus cycle than a bull with +0.0. DPR ranges from +3.0 to -3.0.

LIV: Cow Livability

A cow's ability to remain alive while in the milking herd.

Milking Speed

Evaluated in terms of the percentage of first lactation daughters as average or fast. A value of 100 indicates average.

Milking Temperament

The expected percentage of future daughters that will be average, calm or very calm during their first lactation. A value of 100 indicates average.

Feed Efficiency

The net profit a dairy producer receives from an increase in production. Calculation: Feed Efficiency = (Dollar Value of milk produced) – (Feed costs of extra milk) – (Extra maintenance costs)

COMMON HAPLOTYPES & CALVING EASE

DEFINITIONS:

What is a haplotype?

A haplotype is a stretch of chromosome or DNA that is transmitted as a unit from one generation to the next. In our context, we are referring to a set of single-nucleotide polymorphisms (SNPs) on a single chromosome that is inherited together as a unit.

Homozygous vs. Heterozygous

Cattle have two versions of each chromosome. One chromosome was inherited from the sire and one was inherited from the dam. Homozygous and heterozygous are used to describe DNA at specific points along the chromosome. Homozygous means the DNA on each chromosome is the same. Heterozygous indicates the DNA on each chromosome is different at a specific site.

CALVING TRAIT TERMS:

SCE: Sire Calving Ease

Percentage of a bull's calves considered difficult when born to a first lactation animal.

DCE: Daughter Calving Ease

Measurement of the ability of a cow from a particular sire to calve easily.

As calving traits have been successfully improved, the August 2020 Holstein Calving Ease PTAs were adjusted. They average 2.2% for SCE and 2.7% for DCE. Most Holstein bulls will range from 1% to 4% SCE.

WHEN POLLED IS DOMINANT

Polled trait or naturally hornless is a dominant trait. The Holstein Association USA identifies Polled animals one of two ways:

PC: Tested Heterozygous Polled
PP: Tested Homozygous Polled

When a heterozygous polled bull (PC) is bred to a horned female, 50% of the offspring are Polled. When a homozygous Polled bull (PP) is bred to a horned female, 100% of the offspring are Polled. Only one parent must have the Polled gene for offspring to be Polled.

RECESSIVE HAPLOTYPES

The following codes show on a sire summary evaluation if an animal is a carrier or tested positive for a specific Haplotype. If the animal tested free, the codes will be indicated on the animal's pedigree.

TC: Tested free of Cholesterol Deficiency
HCD: Cholesterol Deficiency
TY: Tested free of Brachyspina
BY: Brachyspina
TV: Tested free of CVM
CV: CVM or Complex Vertebral Malformation
TL: Tested free of BLADS
BL: BLADS or Bovine Leukocyte Adhesion Deficiency
TD: Tested free of DUMPS
DP: DUMPS or Deficiency of the Uridine Monophosphate Synthase

HHH & RECESSIVES

USDA researchers and international collaborators identified nine haplotypes that cause embryo loss or stillbirths when homozygous. The exact genetic or biological cause of why the embryos or fetuses are not viable is unknown. These are six common Haplotypes, their frequency and source sires of the Haplotype:

Holstein Haplotype 1 (HH1) - 4.5% freq., Pawnee Farm Arlinda Chief
Holstein Haplotype 2 (HH2) - 4.5% freq., Willowholme Mark Anthony
Holstein Haplotype 3 (HH3) - 4.7% freq., Gray View Skyliner & Glendell Arlinda Chief
Holstein Haplotype 4 (HH4) - 0.7% freq., Besne Buck
Holstein Haplotype 5 (HH5) - 4.8% freq., Thronlea Texal Supreme
Holstein Haplotype 6 (HH6) - 0.5% freq., Cal-Clark Board Chairman

Recessive haplotypes appear to be normal. Those with two haplotype copies are lost as embryos or are stillborn. Their negative impact is accounted for in sire conception rate (SCR) and daughter pregnancy rate (DPR). Only when both parents are heterozygous Haplotype carriers may offspring be affected.

VARIANT RED

566HO1345 EVER-RED is a Variant Red sire and labeled as DR1. Anytime a Variant Red sire is bred to a Black, Red Carrier or Red animal, there is a 50% chance for a Red calf and 50% for a Black calf. When a Red animal is the result of using a Variant Red sire, the Red gene is transmitted to the second generation differently than with traditional Red hair color. When a true Red sire is used on a Variant Red daughter, there is a 50% chance of offspring being Red and 50% offspring will be Black.