WORLD WIDE SIRES, LTD.

Description of Terms

Supporting Terminology

NAAB Code

The unique number registered with the National Association of Animal Breeders (NAAB) with which the A.I. companies use to identify semen type and sires.

Beta-Casein

Genetic variant that regulates the beta casein (main protein) in milk. Linked to how this protein breaks down in the digestive system. Can be A1A1, A1A2 or A2A2. A2A2 is the desired genotype; A2A2 is required for the production of A2 milk.

Kappa-Casein: KC

Genetic variant that is important for coagulation of the milk. Important for milk production. Can be AA, AB or BB. BB is the best variant for cheese making.

Beta-Lactoglobulin

Genetic variant that regulates the main whey protein in milk. Plays a role in how milk behaves during processing. Can be AA, AB or BB. AA is preferred for beta lactoglobulin.

Genomic Future Inbreeding: GFI

Tells us how much we believe the animal may change inbreeding in the population. Calculated by estimating the genomic relatedness of the bull to all genotyped females born in the U.S. within the last 48 months.

Haplotypes

Carrier statuses for officially recognized genetic conditions tested by a haplotype test. Haplotype tests are done by the Council on Dairy Cattle Breeding (CDCB). T stands for Tested Free, C stands for carrier.

Genetic Codes

Carrier statuses for officially recognized genetic conditions tested by a gene test. Gene tests are done by authorized laboratories and test the actual genetic variant causing the condition. Results are not from a lab, but mathematically calculated by the CDCB.

Daughter Average

Average production level for milk, fat and protein of current US milking daughters. Based on twice a day milking and a 305-day lactation, on a Mature Equivalent (ME) basis, expressed in kg.

Production

Milk / Rel %

Predicts the expected milk production of future mature daughters, in pounds, in comparison to other cows of the breed born in the same base year.

Protein

Predicts the expected milk protein production of future mature daughters, in pounds, in comparison to other cows of the breed born in the same base year.

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Production *Continued*

Protein %
Predicts the animal's genetic ability to transmit concentration of milk protein; it is expressed as percentage points in comparison to the breed base.

Fat
PTA Fat predicts the expected milkfat production of future mature daughters, in pounds, in comparison to other cows of the breed born in the same base year.

Fat %
Predicts the animal's genetic ability to transmit concentration of milkfat; it is expressed as percentage points in comparison to the breed base.

Combined Fat and Protein: CFP
The sum of PTA Fat and PTA Protein (in pounds), showing the expected genetic impact on total component production of a bull's mature daughters.

Milking Speed (MSPD) / Rel %
Predicts the average pounds of milk per minute expected of the bull's mature daughters in a herd with average management conditions using a conventional milking system. Average for Holsteins is 7 pounds per minute. Holstein bulls with a PTA of 8 are expected to have daughters that milk 8 pounds per minute and therefore milk faster than the average population.

Feed Efficiency

Feed Efficiency Index: FE$
An index that combines production, body weight composite, and residual feed intake, weighing the traits in the index by their economic benefit. Calculated by Holstein USA and is part of the TPI formula.
FE$ = (-$0.0025 x PTA Milk) + ($1.86 x PTA Fat) + ($1.75 x PTA Protein) + ($0.13 x Feed Saved)

Feed Saved: FSAV
Indicates the expected reduction of consumed feed per lactation based on evaluations for residual feed intake and body weight composite. Measured in pounds of dry matter intake. Included in the Feed Efficiency Index.

Residual Feed Intake: RFI
The difference between an animal's actual feed intake and its expected feed intake based on its size and growth compared to the breed average base. RFI is independent of the level of production. The lower the RFI value, the more efficient the animal is. Included in the Feed Efficiency Index.

Fertility and Calving

Fertility Index: FI - *Holstein*
Combines values from four measures of reproductive performance to provide one overall fertility score.
Fertility Index = 0.4*DPR + 0.4*CCR + 0.1*HCR + 0.1*EFC

Daughter Pregnancy Rate: DPR
A female fertility trait that predicts the percentage of non-pregnant cows that will become pregnant during each 21-day period compared to the breed base. A DPR of 1.0 equates to a 1% increase in pregnancy rate. Every 1.0 preditcted transmitting ability (PTA) increase in DPR correlates 4 fewer days open.

Fertility and Calving *Continued*

Cow Conception Rate: CCR

Measures the ability of lactating cows to conceive. A CCR of 1.0 equates to a 1% increase in cow conception rate.

First Service to Conception: FSC

Measures the cow's interval from first breeding to last insemination, is highly correlated with DPR and CCR but independent of the Voluntary Waiting Period. A FSC of 1.0 equates to a 1-day shorter interval between first breeding and conception. Higher values are desirable.

Heifer Conception Rate: HCR

Measures the ability of virgin heifers to conceive. An HCR of 1.0 equates to a 1% increase in heifer conception rate.

Gestation Length: GL

Expressed as the number of days greater than or less than the average gestation length for the breed. The typical range is +/-5days. In general, gestation length has decreased over time for breeds that have selected for lower calving ease (i.e. Holstein), as calving ease and gestation length are highly correlated. Gestation Length is available for all dairy breeds.

Sire Calving Ease: SCE

Predicts the tendency of bulls to produce offspring that are born easily. Expressed as % difficult births out of heifers that calf for the first time. The average for the Holstein breed is 1.77%.

Daughter Calving Ease: DCE

Predicts the tendency for daughters of bulls to calf easily. Expressed as the % of difficult births when heifers' calve for the first time. The average for the Holstein breed is 2.59.%.

Sire Stillbirth %: SSB

Predicts the tendency of bulls to produce offspring that are stillborn (dead at birth or within 48 hours of birth). Expressed as % more stillborn births compared to the base average. Average for the Holstein breed is 4.29%.

Daughter Stillbirth %: DSB

Predicts the tendency of daughters from bulls to produce offspring that are stillborn (grand offspring, dead at birth or within 48 hours of birth). Expressed as % more stillborn births compared to the base average. Average for the Holstein breed is 6.13%.

Sire Conception Rate: SCR

A male fertility trait that is NOT genetic, and is based on many breedings of a bull. An SCR of 1.0 indicates a 1% increase in conception rate when compared to average.

Conformation

Holstein Conformation Composite: HCC

A composite index that weighs 18 conformation (type) traits based on their contribution to functional balance and longevity, resulting in a single value that describes an animal's overall conformation. Calculated by Holstein USA. Higher values are better.

Type / Rel %

Conformation improvement expected from a bull's daughters compared to contemporaries.

Conformation *Continued*

Udder Composite: UDC

An index that combines several udder traits, weighting the linear traits in the index by their economic benefit.

Udder Depth 0.20	Rear Udder Width 0.19	Reat Teat Placement 0.05
Fore Udder 0.16	Udder Cleft 0.08	Teat Length 0.05
Rear Udder Height 0.23	Front Teat Placement 0.04	Stature -0.20

Unregistered Udder Index: URUI

Udder index for animals that are identified but do not qualify for registry status in the American Jersey Cattle Ancestry (AJCA) herd book. Equivalent to JUI for unregistered animals.

Jersey Udder Index™: JUI - *Jersey*

Jersey index that helps breeders select sires that produce long-lived cows with durable, good udders. Places most emphasis on udder depth followed by udder cleft. Other traits included in the index are rear udder width and height, fore udder attachment, teat placement and teat length. JUI is incorporated in JPI, the overall Jersey Performance Index.

Feet and Legs Composite: FLC

An index that combines several feet and leg traits, weighting the linear traits in the index by their economic benefit.

Feet and Legs Score 0.70	Rear Legs Side View 0.05	Stature -0.20
Rear Legs Rear View 0.20	Foot Angle 0.05	

Body Weight Composite: BWC

Index calculated by Holstein Association USA to estimate mature body weight. Combines linear traits such as stature, strength, body depth and dairy form. Also used in Feed Saved by CDCB.

Mobility: MO - *Brown Swiss & Milking Shorthorn*

Overall linear trait by Brown Swiss and Milking Shorthorn that estimates walking ability as well as structural soundness of feet and legs. Evaluates how smoothly and freely a cow moves. Scored during classification.

Production and Yield (lbs.)

Cheese Merit $: CM$

Designed for herds that produce milk for cheese. Generally, Cheese Merit combines the same traits as Net Merit. The differences are a negative economic weight on PTA Milk and increased emphasis on Protein Pounds because protein has more value in the cheese market than in other markets.

Fluid Milk $: FM$

Designed for herds that are paid on fluid milk. Generally,Fluid Merit combines the same traits as Net Merit. The difference is a positive economic weight on PTA Milk. Protein has no influence in Fluid Merit, as there is little (if any) payment for protein in fluid markets.

Grazing Merit $: GM$

Designed for pasture-based herds using intensive grazing. In Grazing Merit $, fertility receives more emphasis compared to NM$, CM$ and FM$. Production, longevity, livability and udder health also differ.

Production and Yield (lbs.) *Continued*

GrazingPRO® $: GP$®

Index by Select Sires Inc. Designed for dairy bulls that are selected to improve the profitability of intensive grass-based production systems. Key traits are daughter fertility, mobility and moderate stature, longevity, components and strong emphasis on low somatic cell score and mastitis.

Progressive Performance Ranking: PPR - *Brown Swiss & Relative for Milking Shorthorn*

Overall performance Index for the Brown Swiss and Milking Shorthorn breed. The Index has the same name but a different formula per breed. PPT for Brown Swiss includes weights for Fat and Protein, PL, Udder Composite, Mobility, DPR, Livability and Somatic Cell Score. Milking Shorthorn's PPR includes weights for milk, fat and protein as well as a select number of linear type traits.

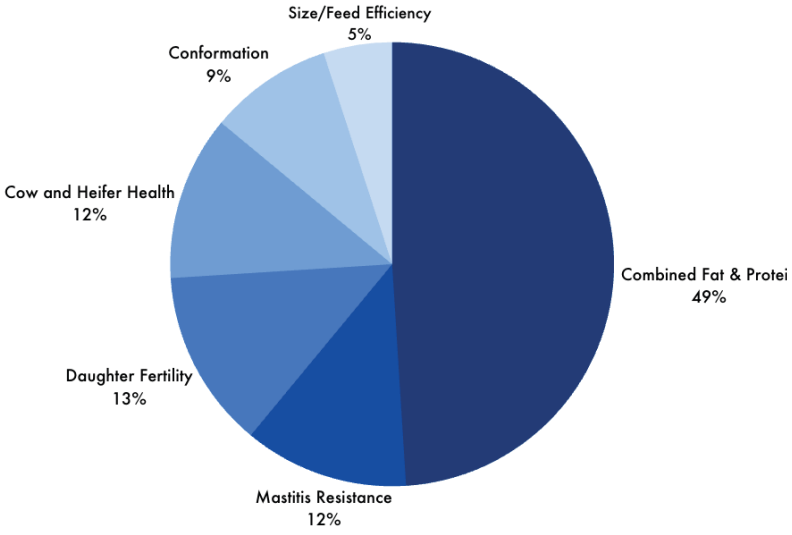
Unregistered Performance Index: URPI

Jersey performance index for animals that are identified but do not qualify for registry status in the American Jersey Cattle Ancestry (AJCA) herd book. Equivalent to JPI for unregistered animals.

Herd Health Profit Dollars®: HHP$® - *Holstein*

Designed to improve production, cow fertility, and mastitis resistance while placing strong emphasis on health traits through CDCB health trait PTAs and on shallow udders with correct teat size and placement. Allows comparisons with all active Holstein sires. Traits used in the HHP$ formula are:

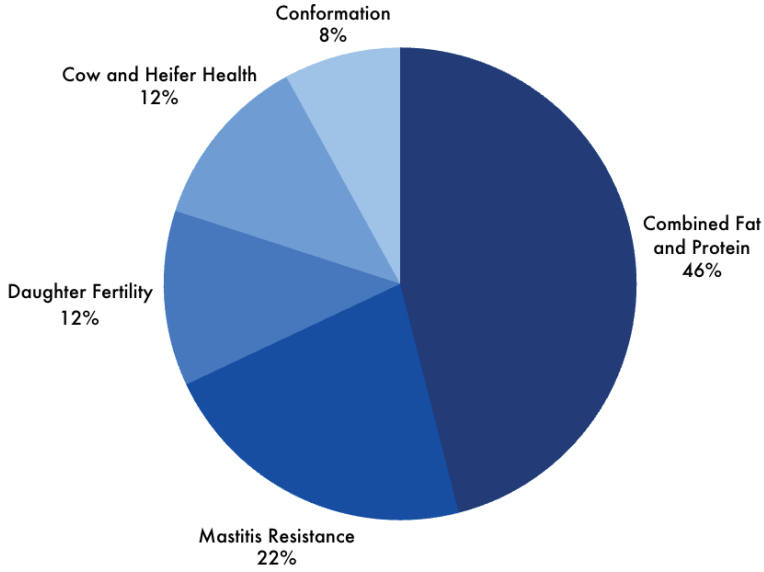
- Milk
- Combined Fat and Protein
- Mastitis Resistance
- Daughter Fertility
- Cow and Heifer Health
- Conformation
- Size/Feed Efficiency



Herd Health Profit Dollars®: HHP$® - *Jersey*

Designed to improve production, cow fertility, and mastitis resistance while placing strong emphasis on health traits through CDCB health trait PTAs. Traits used in the HHP$ formula are:

- Combined Fat and Protein
- Mastitis Resistance
- Daughter Fertility
- Cow and Heifer Health
- Conformation
- Size/Feed Efficiency



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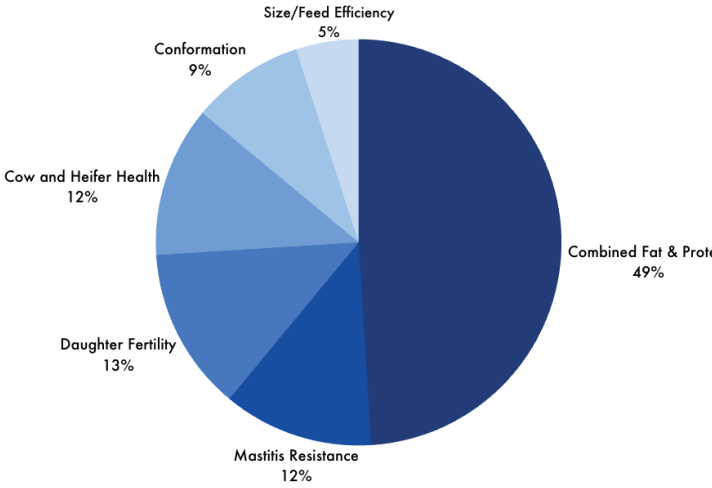
Production and Yield (lbs.) *Continued*

Total Performance Index®: TPI® - *Holstein*

This is a formula that combines type, management and production traits into one number. Very commonly used to rank bulls, TPI is the USA Holstein Association's multi trait index that ranks bulls on overall performance. TPI places more emphasis on type traits than the Net Merit formula, comparable emphasis on Fat and Protein production, and slightly lower emphasis on health traits. Traits used in the TPI formula are:

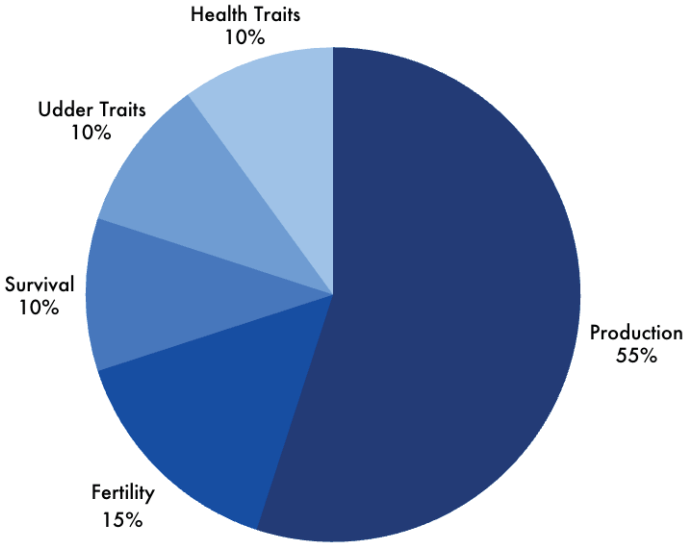
- Combined Fat and Protein
- Mastitis Resistance
- Daughter Fertility
- Cow and Heifer Health
- Calving Ability
- Conformation
- Size/Feed Efficiency
- Milk



Jersey Performance Index™: JPI™ - *Jersey*

A formula that increases production and milk component levels while moderating body weight to improve efficiency and promote longer herd life, greater fertility, and better udder health. Traits used in the JPI formula are:

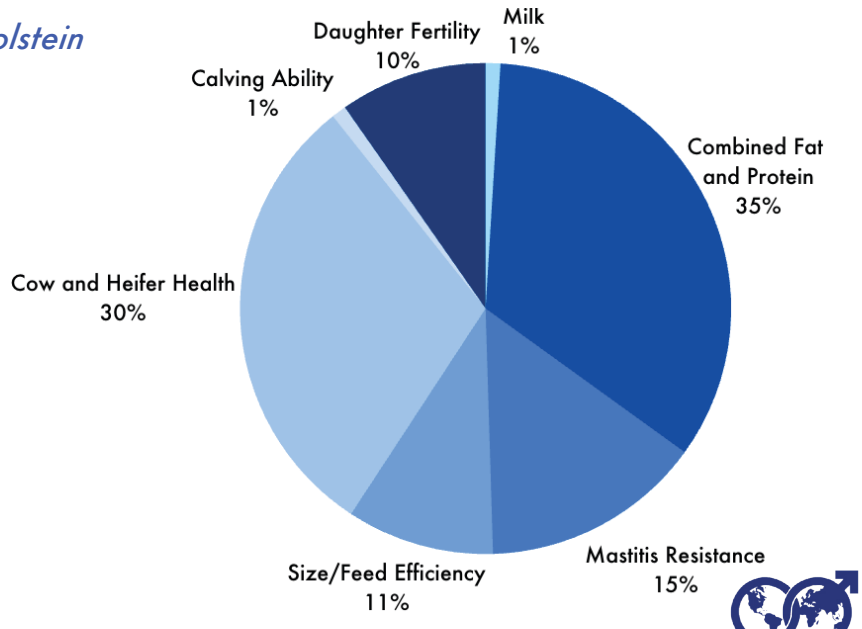
- Production
- Fertility
- Survival
- Udder Traits
- Health Traits



Dairy Wellness Profit Index®: DWP$® - *Holstein*

A multi-trait selection index that includes production, fertility, type, longevity, and the wellness traits, including Polled test results with unique formulas used for Holsteins and Jerseys. Traits used in the DWP$ formula are:

- Combined Fat and Protein
- Mastitis Resistance
- Size/Feed Efficiency
- Cow and Heifer Health
- Calving Ability
- Daughter Fertility
- Milk



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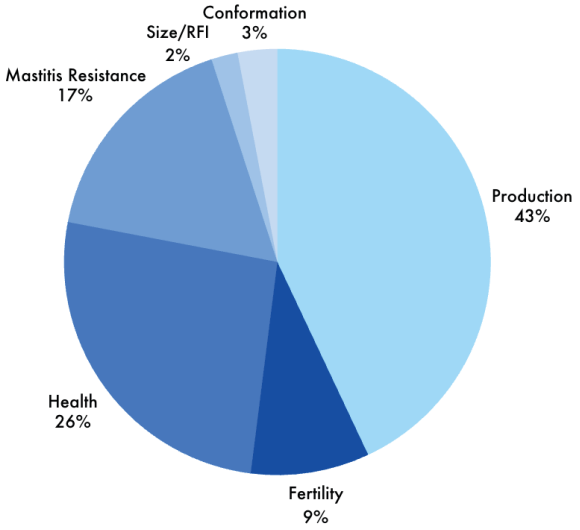
Production and Yield (lbs.) *Continued*

Dairy Wellness Profit Index®: DWP$® - *Jersey*

A multi-trait selection index that includes production, fertility, type, longevity, and the wellness traits, including Polled test results with unique formulas used for Holsteins and Jerseys. Traits used in the DWP$ formula are:

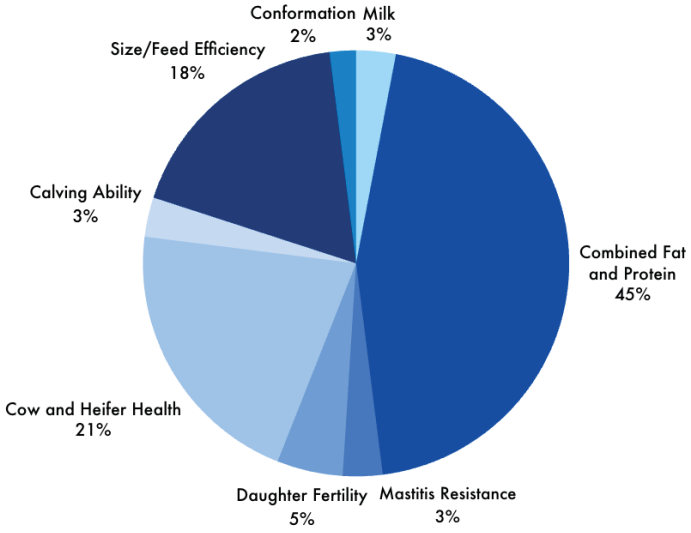
- Production
- Fertility
- Health
- Mastitis Resistance
- Size/Feed Efficiency
- Conformation



Net Merit $ (NM$) / Rel %

Economic value which combines the value of production, health, fertility and type scores. NM$ the expected lifetime profitability of a bull's average daughter as calculated by the Council on Dairy Cattle Breeding (CDCB). Traits used in the NM$ formula are:

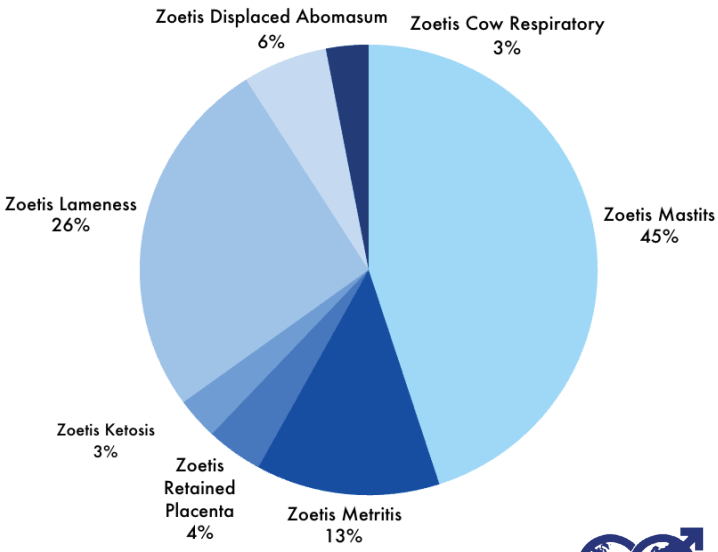
- Combined Fat and Protein
- Daughter Fertility
- Cow and Heifer Health
- Calving Ability
- Size/Feed Efficiency
- Conformation
- Milk



Wellness Trait Index™: WT$™ - *Holstein*

Places economic weights on wellness traits, directly estimating potential profit contribution of these traits for an individual animal. This multi-trait selection index focuses solely on wellness traits with unique formulas used for Holsteins and Jerseys. Traits used in the WT$ formula are:

- Mastitis
- Lameness
- Metritis
- Retained Placenta
- Displaced Abomasum
- Ketosis
- Cow Respiratory



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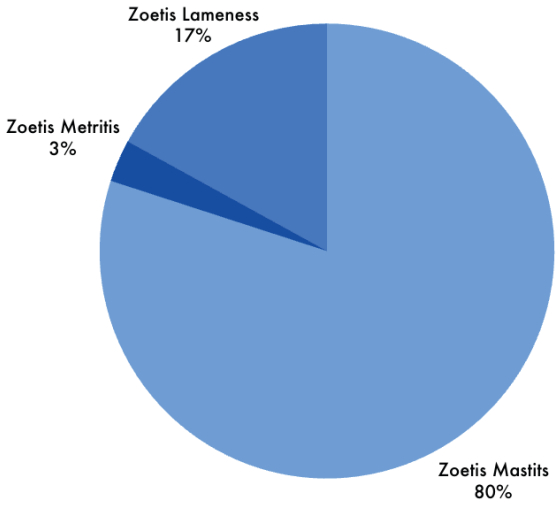
Production and Yield (lbs.) *Continued*

Wellness Trait Index™: WT$™ - *Jersey*

Places economic weights on wellness traits, directly estimating potential profit contribution of these traits for an individual animal. This multi-trait selection index focuses solely on wellness traits with unique formulas used for Holsteins and Jerseys. Traits used in the WT$ formula are:

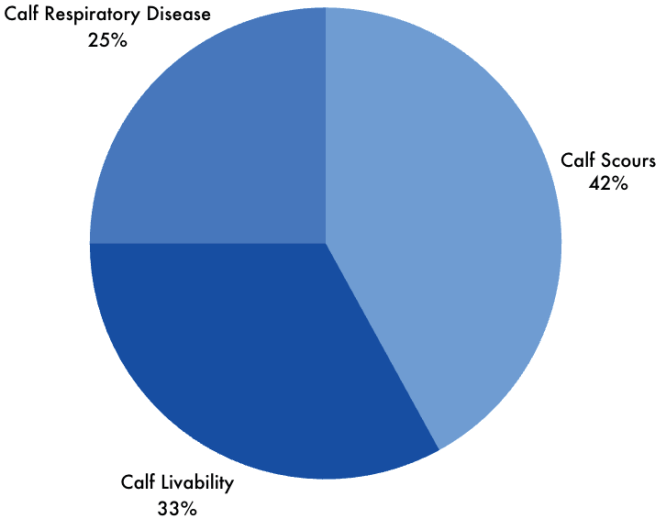
- Mastitis
- Lameness
- Metritis



Calf Wellness Index™: CW$™ - *Holsteín*

Places economic weights on calf wellness traits, directly estimating potential profit contribution of these traits for an individual animal. This multi-trait selection index focuses solely on calf wellness traits with unique formulas used for Holsteins and Jerseys. Traits used in the CW$ formula are:

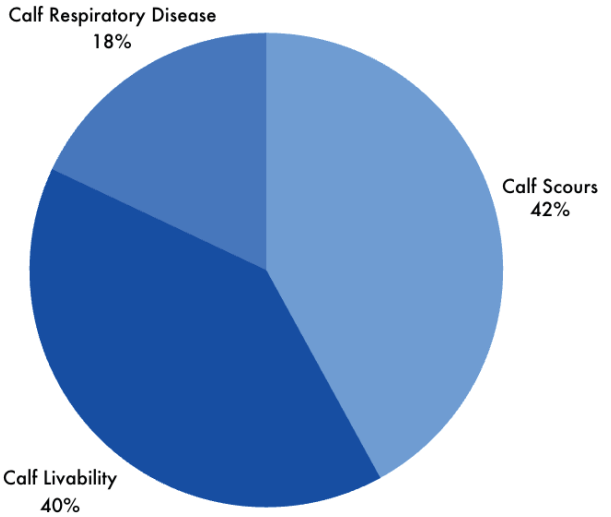
- Calf Livability
- Calf Scours (diarrhea)
- Calf Respiratory



Calf Wellness Index™: CW$™ - *Jersey*

Places economic weights on calf wellness traits, directly estimating potential profit contribution of these traits for an individual animal. This multi-trait selection index focuses solely on calf wellness traits with unique formulas used for Holsteins and Jerseys. Traits used in the CW$ formula are:

- Calf Livability
- Calf Scours (diarrhea)
- Calf Respiratory



CDCB Longevity and Health

Mastitis: MAST
Expected resistance of the bull's daughters to clinical mastitis in a herd with average management conditions. Positive values are better.

Somatic Cell Score: SCS
Expected genetic susceptibility for udder health, measured by somatic cell count. PTA < 3.0 means that daughters are expected to have less than average somatic cell counts and better udder health. Bulls with PTA SCS >3.0 are expected to have daughters with cell counts higher than breed average.

Productive Life: PL
Predicts the time that female offspring are expected to remain in milking herd before removal, death or culling, expressed as difference in months of productivity compared to the breed base.

Cow Livability: LIV
The percent of a bull's daughters above or below the average of the breed that remain alive in the herd until they can be culled and provide a source of income for the herd.

Displaced Abomasum: DA
Expected resistance of bull's daughters to displaced abomasum compared to the breed average base, expressed in percentage points. A PTA of 1% means daughters have 1% more resistance to displaced abomasum.

Hypocalcemia: MFEV
Expected resistance of bull's daughters to milk fever compared to the breed average base, expressed in percentage points. A PTA of 1% means daughters have 1% more resistance to milk fever.

Ketosis: KETO
Expected resistance of bull's daughters to ketosis compared to the breed average base, expressed in percentage points. A PTA of 1% means daughters have 1% more resistance to ketosis.

Metritis: METR
Expected resistance of bull's daughters to metritis compared to the breed average base, expressed in percentage points. A PTA of 1% means that daughters have 1% more resistance to metritis.

Retained Placenta: RETP
Expected resistance of bull's daughters to retained placenta compared to the breed average base, expressed in percentage points. A PTA of 1% means daughters have 1% more resistance to retained placenta.

Heifer Livability: HLV
Predicts the difference in daughters expected to remain alive between two days after birth and 18 months of age, expressed in percentage points from the breed base.

Resistance to Diarrhea: DIA
Expected resistance of bull's daughters to calf diarrhea compared to the breed average base, expressed in percentage points. A PTA of 1% means that daughters have 1% more resistance to calfhood diarrhea.

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CDCB Longevity and Health *Continued*

Resistance to Respiratory Disease: RSP

Expected resistance of bull's daughters to respiratory disease as calves compared to the breed average base, expressed in percentage points. A PTA of 1% means that daughters have 1% more resistance to calfhood respiratory disease.

Zoetis Wellness

Mastitis: Z MAST

Expected resistance to mastitis as calculated by Zoetis. Expressed as an STA – Standard Transmitting Ability over or under the average of 100. The range for the Zoetis wellness traits typically falls between 85-115. Higher values are more desirable and indicate the animal is more resistant to mastitis.

Lameness: Z LAME

Expected resistance to lameness as calculated by Zoetis. Expressed as an STA – Standard Transmitting Ability over or under the average of 100. The range for the Zoetis wellness traits typically falls between 85-115. Higher values are more desirable and indicate the animal is more resistant to lameness.

Cow Abortion: Z ABRT

Expected resistance for the bull's daughters to experience an abortion (involuntary pregnancy loss) after confirmed pregnant. Expressed as an STA – Standard Transmitting Ability over or under the average of 100. Higher values indicate a reduced risk of abortion and a higher capability to carry a calf safely to term.

Metritis: Z MET

Expected resistance to metritis as calculated by Zoetis. Expressed as an STA – Standard Transmitting Ability over or under the average of 100. The range for the Zoetis wellness traits typically falls between 85-115. Higher values are more desirable and indicate the animal is more resistant to metritis.

Retained Placenta: Z RP

Expected resistance to retained placenta as calculated by Zoetis. Expressed as an STA – Standard Transmitting Ability over or under the average of 100. The range for the Zoetis wellness traits typically falls between 85-115. Higher values are more desirable and indicate the animal is more resistant to retained placenta.

Displaced Abomasum: Z DA

Expected resistance to displaced abomasum as calculated by Zoetis. Expressed as an STA – Standard Transmitting Ability over or under the average of 100. The range for the Zoetis wellness traits typically falls between 85-115. Higher values are more desirable and indicate the animal is more resistant to displaced abomasum.

Cow Respiratory Diease: Z COW RD

Expected resistance to cow respiratory disease as calculated by Zoetis. Expressed as an STA – Standard Transmitting Ability over or under the average of 100. The range for the Zoetis wellness traits typically falls between 85-115. Higher values are more desirable and indicate the animal is more resistant to cow respiratory disease.

Twinning: Z TWIN

Expected resistance for the bull's daughters to conceive and deliver twins. Expressed as an STA – Standard Transmitting Ability over or under the average of 100. Higher values indicate a reduced risk of twin pregnancies (i.e. a higher probability of single births).

Zoetis Wellness *Continued*

Cystic Ovary: Z CYST
Expected resistance for the bull's daughters to producing cystic ovarian follicles during lactation. Expressed as an STA – Standard Transmitting Ability over or under the average of 100. Higher values indicate a reduction in incidence of ovarian cysts.

Ketosis: Z KET
Expected resistance to ketosis as calculated by Zoetis. Expressed as an STA – Standard Transmitting Ability over or under the average of 100. The range for the Zoetis wellness traits typically falls between 85-115. Higher values are more desirable and indicate the animal is more resistant to ketosis.

Milk Fever: Z MF
Expected resistance to milk fever as calculated by Zoetis. Expressed as an STA – Standard Transmitting Ability over or under the average of 100. The range for the Zoetis wellness traits typically falls between 85-115. Higher values are more desirable and indicate the animal is more resistant to milk fever.

Calf Respiratory Disease: Z CALF RD
Expected resistance to calfhood respiratory disease as calculated by Zoetis. Expressed as an STA – Standard Transmitting Ability over or under the average of 100. The range for the Zoetis wellness traits typically falls between 85-115. Higher values are more desirable and indicate the animal is more resistant to calfhood respiratory disease.

Calf Scours: Z CS
Expected resistance to calf scours as calculated by Zoetis. Expressed as an STA – Standard Transmitting Ability over or under the average of 100. The range for the Zoetis wellness traits typically falls between 85-115. Higher values are more desirable and indicate the animal is more resistant to calf scours.

Calf Livability: Z CLIV
Predicts the probability of the bull's daughters to survive their first year of life, measured from day 2 to day 365. Standard Transmitting Ability over or under the average of 100. Higher values are more desirable and indicate daughters have a higher chance of survival.

Milk Methane Intensity: Z MI
Predicts the amount of methane that the bull's daughters are expected to emit per unit of milk. Lower is better. Expressed as a ratio: units of methane ÷ units of milk.

Fertility Heat Resilience: Z FR
Predicts the change in conception rate at first service under heat stress. Higher means daughters are expected to be more resilient under heat stress and maintain fertility. Expressed as percentage points higher or lower first-service conception, per unit of THI above 70, compared to the average Holstein cow.

Milk Heat Resilience: Z MR
Predicts the change in daily milk yield under heat stress. Higher means daughters are expected to be more resilient under heat stress and maintain production.Expressed as pounds of milk per day more or less, per unit of THI above 70, compared to the average Holstein cow.