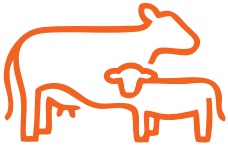


TECHNICAL BULLETIN



Building a Healthier Holstein Herd with CLARIFIDE® PLUS

Dairy producers can use CLARIFIDE Plus to select animals based on traits that affect health, performance and lifetime profit of cows and calves with a goal of a healthier, more productive herd.

Zoetis

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KEY POINTS

- Zoetis Genetics is updating Dairy Wellness Profit Index® (DWP\$®) for Holstein in April 2022. Additional traits that impact lifetime profitability are now available, and the economic values of current traits within Dairy Wellness Profit Index have been updated to be representative of current and future prices.
- DWP\$ 2022 has a standard deviation of 277DWP\$, while DWP\$ 2020 had a standard deviation of 254DWP\$. By including more traits affecting profitability, DWP\$ 2022 describes more genetic variation in profit than DWP\$ 2020.
- The 2022 formulation of DWP\$ applies increased genetic selection against residual feed intake and lameness compared to the 2020 version of DWP\$.
- The economic updates and incorporation of new traits to DWP\$ will increase DWP\$'s ability to predict potential lifetime profitability.
- Comparing the predictive capacity of DWP\$ 2022 against DWP\$ 2020, the best 25% of cows was associated with 462 more pounds of lifetime ECM and 31 USD in lifetime Income over Feed Costs per cow compared to the worst 25% of cows. These results indicate that genomically enhanced DWP\$ predictions for young calves can be used to effectively predict potential lifetime profitability.

Introduction

Selection indexes are a critical component of many breeding programs and provide a way to combine information about many traits into a single number that producers can use to rank animals and inform breeding decisions.¹ The purpose of a selection

index is to predict an animal's genetic potential for total economic merit.² Historically, selection indexes throughout the world have focused on improving production traits.³ However, this narrow selection goal contributed to a decrease in health and fertility.⁴ Improvement of phenotype recording and development

of new trait evaluations led to fertility,⁵ longevity,⁶ milk quality,⁷ and health traits⁸ becoming available to breeders. Over the last 25 years, incorporation of these non-production traits in selection indexes has grown⁹ as breeders strive to account for both incomes and expenses of an animal.

Selection indexes such as Dairy Wellness Profit Index (DWP\$), Wellness Trait Index® (WT\$®), and Calf Wellness Index™ (CW\$™) are key components of the CLARIFIDE Plus genomic test offering. Dairy producers may seek to improve their herds by genomic testing heifers and ranking them based upon DWP\$ to inform culling and breeding decisions. The dairy industry benefits from genomic technology as it results in faster genetic progress.^{10,11} As the rate of genetic progress is increased, it becomes more important that DWP\$ is correctly formulated and includes key economically important traits for the goal of lifetime profit. Dairy producers are leveraging genomic technology to increase selection intensity on their females through culling decisions very early in life and advanced reproductive technologies. With this combination of technologies and strategies, the costs for having a non-optimal selection index could be substantial.

As new traits become available, their influence on lifetime profitability is assessed and added to DWP\$ when appropriate. Therefore, Zoetis updated DWP\$ in April 2022 to incorporate new traits and update the economic values of traits previously in DWP\$.

Dairy Wellness Profit Index Updates

Dairy Wellness Profit Index is a multi-trait selection index that includes cow and calf wellness, production, fertility, functional type, longevity, livability, calving ability, and milk quality traits plus polled test results. Developed in 2016 by Zoetis Genetics and updated in 2018 and 2020, DWP\$ estimates the

potential lifetime profit an animal will contribute to the dairy operation. DWP\$ is expressed in a dollar value with higher positive numbers indicating the animal has the genetic potential to generate and transmit more profit over her lifetime.

In the Dairy Wellness Profit 2022 update, numerous changes are being implemented:

- New traits that impact lifetime profitability including early first calving and residual feed intake are included in 2022 formulation of DWP\$.
- Heifer conception rate will be replaced in the index due to the inclusion of early first calving.
- As additional traits that impact the cow's ability to stay in the herd have become available, these traits are directly accounting for the impact of fertility and disease upon longevity. This is resulting in the economic value of productive life decreasing.
- The economic values of fat, protein and milk have increased. This was done to ensure that the economic values used to develop DWP\$ are representative of current and future prices dairy farmers may experience.
- The economic values of the cow and calf wellness traits have been updated. This was done to ensure that the economic values and incidence levels used to develop DWP\$ are representative of current and future prices dairy farmers may experience.

As a result, the 2022 formulation of DWP\$ describes more genetic variation compared to the 2020 version as documented by the large standard deviation (277 vs 254DWP). By including more traits affecting profitability, DWP\$ 2022 describes more genetic variation in profit than DWP\$ 2020.

To further understand the impact of these updates to DWP\$, a side by side comparison of the emphasis placed upon

each trait in DWP\$ 2022 and DWP\$ 2020 is available in Table 1.

To assess how the use of DWP\$ 2022 would alter genetic progress of underlying traits when compared to DWP\$ 2020, the expected response to selection per standard deviation of genetic improvement of the index was estimated. In examining the response of selection between DWP\$ 2022 and DWP\$ 2020, use of DWP\$ 2022 will result in greater genetic improvement in residual feed intake and lameness. DWP\$ 2022 will maintain a similar selection response for the rest of the traits in DWP\$ (Table 2).^{1,2}

Association Between DWP\$® Predictions and Lifetime Performance

As some of the first heifers tested by Zoetis are now finishing their careers, we are now able to examine how well DWP\$ predicted lifetime profit. In order to determine if DWP\$ 2022 improves the capability to predict lifetime profitability better than DWP\$ 2020 a side by side comparison was conducted.

Five large herds (n=7,810 enrolled cows) in the United States were chosen for this study because they had: (1) genomic predictions from females born in 2011-2014, (2) recorded production, reproduction and health events to accurately estimate profit per cow (3) at least 200 animals born in 2011. Dairy Wellness Profit (DWP\$) predictions from 2012 were used to rank the 7,810 animals within herd and assign cows to percentile-based DWP\$ groups (genetic groups: Worst 25%, 26–50%, 51–75%, and Best 25%).

Herd records were used to calculate lifetime energy corrected milk and income over feed cost based on the actual performance from first freshening through when they left the herd; for cows that were still in the herd, current totals were used.

Table 1 – Defines the relative values (%) for underlying traits for Dairy Wellness Profit 2022 and Dairy Wellness Profit 2020.

Trait	DWP\$ 2022*	DWP\$ 2020*
Fat	19	18
Protein	15	16
Milk	1	1
Productive Life	5	6
Cow Livability	3	3
Somatic Cell Score	-2	-2
Residual Feed Intake	2	0
Body Size Composite	-9	-10
Udder Composite	0	0
Feet & Legs Composite	0	0
Daughter Pregnancy Rate	3	3
Calving Ability	1	2
Heifer Conception Rate	0	1
Early First Calving	1	0
Cow Conception Rate	1	1
Zoetis Mastitis	11	11
Zoetis Metritis	3	3
Zoetis Retained Placenta	1	1
Zoetis Displaced Abomasum	1	1
Zoetis Ketosis	1	<1
Zoetis Lameness	7	5
Zoetis Calf Respiratory	1	2
Zoetis Calf Scours	2	2
Zoetis Calf Livability	2	2
Zoetis Cow Respiratory	1	1
Zoetis Cystic Ovary	1	1
Zoetis Cow Abortion	5	5
Zoetis Twinning	1	1

*Sum of absolute values equals 100%.

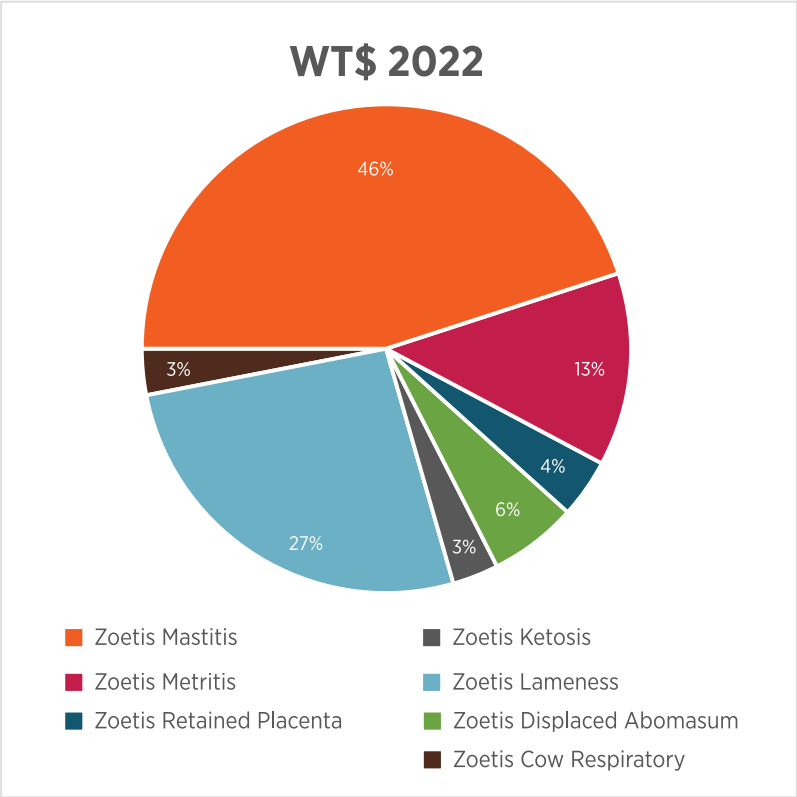


Chart 1 - Wellness Trait Index 2022

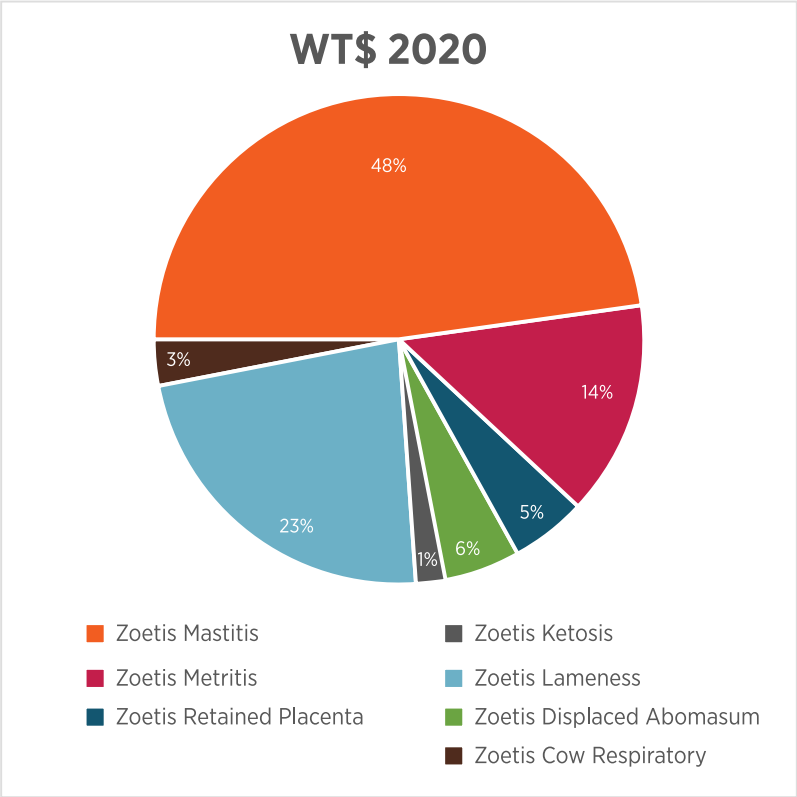


Chart 2 - Wellness Trait Index 2020

Table 3 shows that when ranked by DWP\$ 2022, the best 25% of females produced 21,998 pounds more lifetime ECM per cow than the worst 25%. This additional lifetime ECM represents \$1,474 additional Income Over Feed Cost (IOFC) per cow in the best 25% of females than the worst 25%. Table 4 shows that when ranked by DWP\$ 2020, the best 25% of females produced 21,536 pounds more lifetime ECM per cow than the worst 25%. This additional lifetime ECM represents \$1,443 additional Income Over Feed Cost (IOFC) per cow in the best 25% of females than the worst 25%. The larger difference in lifetime ECM and lifetime IOFC between the best and worst DWP\$ groups when ranked by DWP\$ 2022 indicates that DWP\$ 2022 has improved the ability to predict potential lifetime profitability when compared with DWP\$ 2020. The economic updates and the incorporation of residual feed intake and early first calving to DWP\$ 2022 are increasing DWP\$'s ability to predict potential lifetime profitability.

Use of DWP\$ under real-world conditions confirms the value of DWP\$ in helping to coordinate selection toward greater profitability. The 2022 update to DWP\$ can assist dairy producers in their goal to improve overall lifetime profitability of their dairy herd.^{12, 13}

Wellness Trait Index Update

To support selection for reduced risk of disease in dairy females, Zoetis updated the Wellness Trait Index® (WT\$®). The 2022 update to WT\$ is an update of the incidence levels and economic values of mastitis, lameness, metritis, retained placenta, displaced abomasum, ketosis, and cow respiratory disease plus polled test results. The WT\$ index directly estimates potential profit contribution

Table 2 – Expected response to selection expressed in units of the underlying trait when average DWP\$ 2022 and DWP\$ 2020 are increased by one standard deviation.

Trait	DWP\$ 2022	DWP\$ 2020
Fat (lbs)	20	20
Protein (lbs)	11	11
Milk (lbs)	219	228
Productive Life (mo.)	1.42	1.42
Cow Livability (%)	0.66	0.66
Somatic Cell Score (log)	-0.07	-0.07
Residual Feed Intake*	-5.17	0.04
Body Size Composite (pts)	-0.21	-0.22
Udder Composite (pts)	0.27	0.27
Feet & Leg Composite (pts)	0.08	0.08
Daughter Pregnancy Rate (%)	0.16	0.16
Heifer Conception Rate (%)	0.31	0.32
Early First Calving*	0.68	0.65
Cow Conception Rate (%)	0.43	0.44
Calving Ability (\$)	5.10	5.07
Zoetis Mastitis (STA)	1.54	1.70
Zoetis Metritis (STA)	1.90	1.93
Zoetis Retained Placenta (STA)	0.56	0.59
Zoetis Displaced Abomasum (STA)	1.04	1.00
Zoetis Ketosis (STA)	1.73	1.72
Zoetis Lameness (STA)	1.19	0.99
Zoetis Calf Respiratory (STA)	0.27	0.44
Zoetis Calf Scours (STA)	-0.07	-0.23
Zoetis Calf Livability (STA)	0.38	0.82
Zoetis Cow Respiratory (STA)	0.76	0.71
Zoetis Cystic Ovary (STA)	0.22	0.22
Zoetis Twinning (STA)	0.61	0.68
Zoetis Cow Abortion (STA)	0.19	0.23

*These traits were not included in DWP\$ 2020. The genetic progress is due to the relationship between these traits and traits directly selected for in DWP\$ 2020.

Table 3 – Association between lifetime performance and DWP\$ 2022 genomic ranking.

CLARIFIDE Plus DWP\$ Ranking	DWP\$ GPTA Value (\$)	Lifetime ECM (lbs.)	Lifetime IOFC per cow (\$)	Lifetime Days in Milk (days)
76-100% (Best)	618	79,263 ^a	5,194 ^a	873 ^a
51-75%	429	72,404 ^b	4,700 ^b	821 ^b
25-50%	295	66,422 ^c	4,328 ^c	763 ^c
0-25% (Worst)	90	57,265 ^d	3,720 ^d	680 ^d
Difference between Best & Worst	528	21,998	1,474	193

^{a-d} Least Squares Means within column and DWP\$ ranking with different superscripts diff (P < 0.05).

Feed costs are estimated from ECM and a fixed daily maintenance estimate and do not account for differences in body size or residual feed intake

Table 4 – Association between lifetime performance and DWP\$ 2020 genomic ranking.

CLARIFIDE Plus DWP\$ Ranking	DWP\$ GPTA Value (\$)	Lifetime ECM (lbs.)	Lifetime IOFC per cow (\$)	Lifetime Days in Milk (days)
76-100% (Best)	560	79,288 ^a	5,190 ^a	874 ^a
51-75%	393	72,861 ^b	4,728 ^b	826 ^b
25-50%	272	66,049 ^c	4,307 ^c	758 ^c
0-25% (Worst)	90	57,692 ^d	3,747 ^d	685 ^d
Difference between Best & Worst	470	21,536	1,443	189

^{a-c} Least Squares Means within column and DWP\$ ranking with different superscripts diff (P < 0.05).

Feed costs are estimated from ECM and a fixed daily maintenance estimate and do not account for differences in body size or residual feed intake

of the wellness traits for an individual animal. By including more wellness traits that affect profitability, WT\$ 2022 describes more genetic variation in profit with a standard deviation of 130WT\$.

Calf Wellness Trait Index Update

To support selection for reduced risk of disease in dairy females, the Zoetis updated Calf Wellness Trait Index® (CW\$®). The 2022 update to CW\$ is an update of the incidence levels and economic values of calf scours, calf respiratory disease, and calf livability. The CW\$ index directly estimates potential profit contribution of the calf wellness traits for an individual animal. By updating incidence levels and economic values of calf wellness traits, CW\$ 2022 describes more genetic variation in profit with a standard deviation of 61 CW\$.

Summary

The 2022 updates to Dairy Wellness Profit, Wellness Trait index, and Calf Wellness index provide an opportunity for dairy producers to continue to select for overall herd profitability. The side by side comparison of DWP\$ 2022 and DWP\$ 2020 demonstrate the ability of DWP\$ predictions to predict lifetime profit of Holstein animals. These results indicate that DWP\$ 2022 predictions for young calves can be used to predict potential lifetime profitability. Dairy Wellness Profit predictions are a useful tool for dairy producers interested in using genetics as a method to improve their overall herd profitability. Incorporating DWP\$ 2022 into breeding and culling decisions will help dairy producers create future generations of animals that have the capability for higher lifetime profit when combined with best management practices.

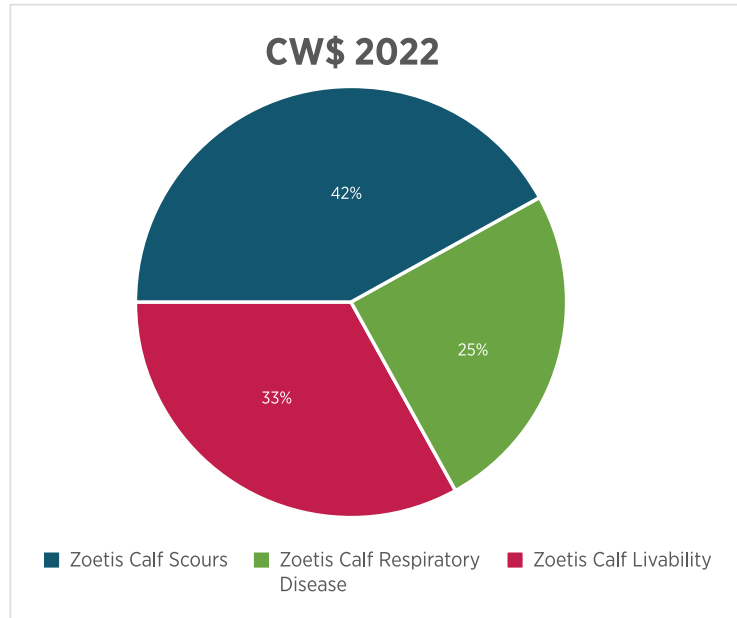


Chart 3 - Calf Wellness Trait Index 2022

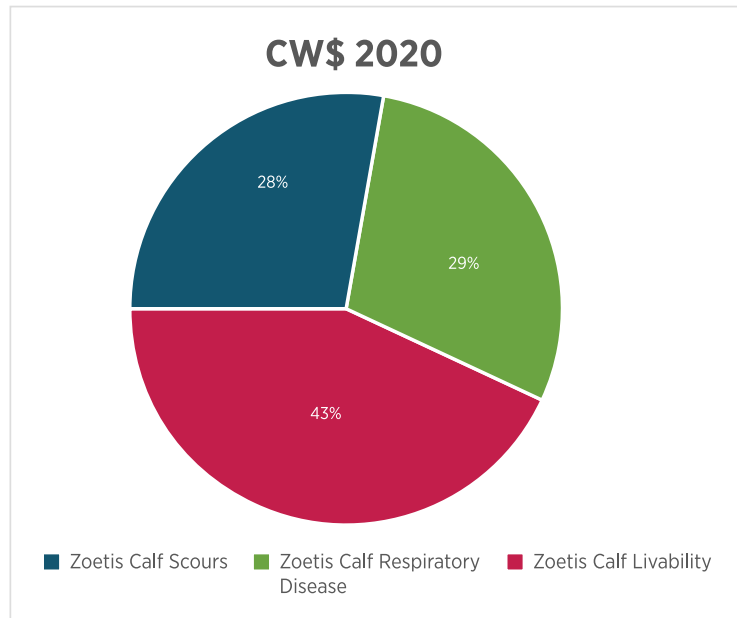


Chart 4 - Calf Wellness Trait Index 2020

References

1. Cole, JB, VanRaden, PM., J Dairy Sci, 2018 (v1.0) - Objective: Introduction Breeding Indices (p.1) Breeding indices are important tools in modern dairy cattle breeding. They provide a way to combine information about many traits into a s
2. Shook, G., *Major advances in determining appropriate selection goals*. Journal of Dairy Science, 2006. **89**(4): p. 1349-1361.
3. Byrne, TJ, et al., J Dairy Sci, 2016 (v1.0)
4. VanRaden, PM., J Dairy Sci, 2004 (v1.0)
5. VanRaden, PM., et al., J Dairy Sci, 2004 (v1.0)
6. VanRaden, PM, Wiggans, GR., J Dairy Sci, 1995 (v1.0)
7. Schutz, MM., J Dairy Sci, 1994 (v1.0)
8. Vukasinovic, J, et al., J Dairy Sci, 2017 (v2.0)
9. Miglior, F. et al., J Dairy Sci, 2005 (V1.0)
10. Hill, WG., Genetics, 2016 (v1.0) García-Ruiz, A., et al., Proc Natl Acad Sci, 2016 (v1.0)
11. Hill, WG., Genetics, 2016 (v1.0) García-Ruiz, A., et al., Proc Natl Acad Sci, 2016 (v1.0)
12. Zoetis Data on File, January 2022
13. Fessenden et al., J. Dairy Sci, 2020