

Igenity[®] Select

Lifetime Dairy \$ (LD\$) Index Case Study

KEY POINTS

- The Lifetime Dairy \$ (LD\$) index was generated by balancing traits that enhance productivity, health, and fertility.
- LD\$ prioritizes Production (44%), Health (21%), Fertility (17%), Longevity (12%), and Functional Type (6%), ensuring the identification of animals that produce more while living longer and healthier lives.
- Economic aspects were consolidated based on the criteria adopted by the USDA, and later compared with the traditional Net Merit index, to demonstrate the additional economic return that the LD\$ can deliver to breeders seeking longer living, healthier, and more fertile herds.
- LD\$ increased gains by an average of up to \$96 more than the Net Merit, focusing on health and fertility while still aiming for profitability.



INTRODUCTION

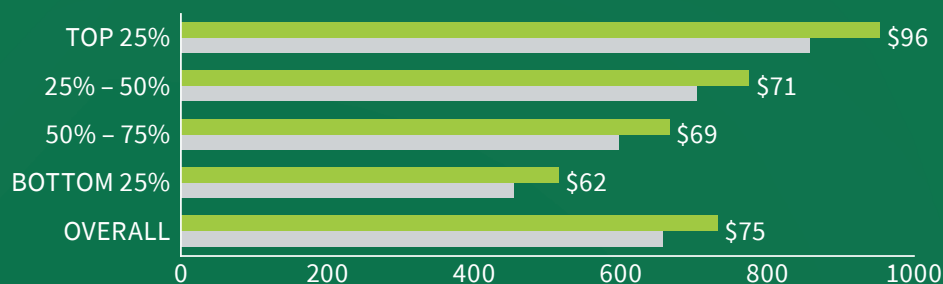
The dairy industry has evolved, requiring modern genetic tools to balance productivity, sustainability, and herd health. Traditional indices primarily focused on maximizing milk production, often at the expense of longevity and health traits (Miglior et al., 2017). The lifetime net merit index (NM\$) evaluates dairy cattle based on their genetic potential for economically significant traits, undergoing regular revisions to incorporate for anticipated future market conditions and pricing trends (Cole et al., 2021). With a different approach, focused on longevity, health, and fertility, but still heavily intensive on profitability, the Lifetime Dairy \$ (LD\$) Index was designed to optimize multiple aspects of dairy cow performance. By considering a comprehensive set of traits, LD\$ promises to improve not only short-term profitability but also the long-term sustainability of dairy operations. This case study, dividing the herd across quartiles, demonstrates how the LD\$ index works in practice, providing real-world examples that underscore its value to dairy producers.

DATA-DRIVEN RESULTS: THE POWER OF LD\$ IN IMPROVING FINANCIAL OUTCOMES

The data for this study were derived from 1,199 Holstein females, all of which were born between 2019 and 2023, on a dairy farm situated in the Midwest, United States, and analyzed using Igenity Select. Using the same economic components adopted by the USDA (Van Raden et al., 2021) for assigning values to various economically important traits in dairy cattle, the LD\$ index was applied to outline herd profitability. The herd was then divided into quartiles based on the genetic merit of the individuals, aiming to characterize different genetic levels and quantify the additional profitability each quartile contributed compared to the results presented by the NM\$ for the same group of animals.

One of the strongest arguments for using the LD\$ index is its direct impact on farm profitability, as seen in Figure 1 comparing Lifetime Dairy Dollars (LD\$) and Net Merit\$ (NM\$). Across all herd performance levels, producers using LD\$ gain more lifetime income per cow than those using traditional indices like NM\$.

Figure 1. Quartile analysis for cattle selected using Lifetime Dairy Dollars (LD\$) and Net Merit Dollars (NM\$)



The bar chart demonstrates how producers in the top 25% of herds realize an additional \$96 per cow when selecting based on LD\$ compared to NM\$. Even herds in the lower quartiles see significant financial gains, with the bottom 25% gaining \$62 per cow, indicating that LD\$ benefits operations regardless of current herd performance. Overall, an additional \$75 on average was added per animal when LD\$ was utilized in comparison to NM\$. This might represent an additional \$75,000 per generation in a 1,000-cow dairy herd, which is significant.

This clear financial improvement, shown across all herd percentiles, demonstrates that LD\$ is more than just a theoretical model; it has been proven to work effectively in real-world situations. The financial gains are primarily driven by improvements in efficiency, production longevity, and herd health—all essential components weighted within the LD\$ index. Studies have shown that selection indices focusing on a combination of production and functional traits, such as longevity and health, result in significant economic benefits. For instance, research by Chegini et al. (2018) highlights the value of selecting traits beyond just production, emphasizing that improving health and fertility traits can increase the economic lifespan of dairy cows. Additionally, a study by De Vries (2017) demonstrated that cows with higher longevity and better health traits tend to yield greater lifetime profitability, underscoring the real-world economic impact of balanced genetic selection.



BREAKING DOWN THE LD\$ INDEX: WHY IT WORKS

The LD\$ index operates by integrating traits crucial to dairy farm profitability, and its structure is key to understanding why it outperforms other selection tools. As seen in the Figure 2, LD\$ balances multiple factors that contribute to the long-term success of a dairy cow operation.

By placing considerable emphasis on production traits (44%), LD\$ ensures high milk, fat, and protein yields, which are essential for short-term profitability. However, the index also incorporates a significant 21% focus on health traits, which promotes disease resistance, reduces medical costs, and ensures cows have fewer health-related issues throughout their lives. This balance between output and sustainability is what sets LD\$ apart. Fertility (17%) and longevity (12%) are equally important contributors. Better reproductive performance results in shorter calving intervals and higher conception rates, reducing downtime and replacement needs. Longevity directly affects how many productive years a cow has, decreasing culling rates and lowering replacement costs over time.

EXPECTED IMPACT ON ECONOMICALLY IMPORTANT TRAITS THROUGH SELECTION BASED ON LD\$

The selection for economically important traits using the LD\$ index presents a powerful opportunity for dairy producers to optimize genetic gains across a wide range of traits. As genetic progress is made in production, health, and longevity traits, the overall profitability and sustainability of dairy herds will continue to improve, fulfilling the goal of long-term genetic and economic advancement in the dairy industry.

In this case study, LD\$ has demonstrated substantial genetic correlations with several key traits. As shown in Table 1, traits such as fat yield and protein yield exhibit strong positive correlations with LD\$ (0.77 and 0.66, respectively), indicating that selection for higher LD\$ is likely to yield significant improvements in milk component production. This aligns with previous research indicating that selecting economic indices that incorporate production traits results in considerable gains in milk yield and components, as demonstrated by VanRaden et al. (2021). These improvements not only enhance production efficiency but also boost the overall profitability of dairy operations.

Moreover, the negative genetic correlation with somatic cell score (SCS) (-0.25) highlights the potential for reducing mastitis incidence when selecting for LD\$, leading to healthier herds and decreased veterinary costs. This finding is consistent with reports from García-Ruiz et al. (2016), who demonstrated that economic indices incorporating health traits can drive down mastitis rates and improve udder health. In addition to production and health, productive life (PL), with a genetic correlation of 0.48, shows that selection for LD\$ enhances longevity, contributing to cows staying productive in the herd for longer periods, reducing replacement costs, and improving herd profitability over time.

Other traits such as HTH\$ (health index) and CA\$ (calving ability), with correlations of 0.39 and 0.43, respectively, underscore the multi-trait selection power of LD\$, especially focusing on health and fertility. By incorporating fertility, health, and calving traits, LD\$ supports balanced selection, ensuring that dairy herds improve holistically rather than in just one area. The relatively moderate genetic correlation for Type (0.21) suggests that while selection for LD\$ may slightly improve conformation, the primary focus of LD\$ is on traits that drive the economic returns of a dairy operation.

Figure 2. Relative emphasis for each major trait category in the Lifetime Dairy Dollars (LD\$) index

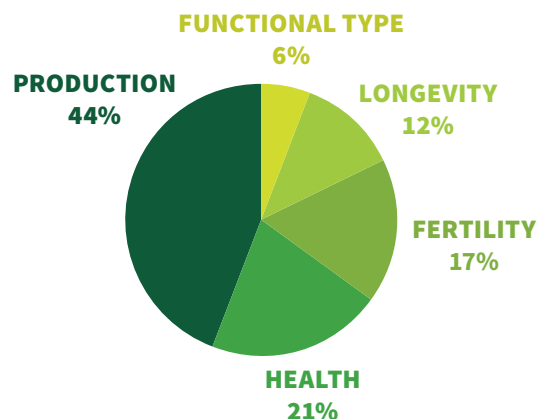


Table 1. Genetic Correlation between Lifetime Dairy Dollars (LD\$) and Key Traits

Trait	Genetic Correlation
Fat Yield	0.77
Protein Yield	0.66
Milk Yield	0.37
Somatic Cell Score	-0.25
Productive Life	0.48
HTH\$	0.39
Type	0.21
CA\$	0.43

KEY BENEFITS OF ADOPTING LD\$

Dairy producers who adopt the LD\$ index can expect to see the following improvements:

- **Increased Lifetime Milk Yield:** LD\$ ensures cows are selected for both production and durability, resulting in more milk, fat, and protein over their productive lifetimes. This lowers the per-unit cost of production, boosting overall profitability.
- **Lower Veterinary Costs:** The strong focus on health traits means cows selected with the LD\$ index are more resistant to diseases like mastitis and lameness. Fewer health problems lead to reduced veterinary costs and less disruption in production.
- **Greater Reproductive Success:** Fertility traits improve reproductive efficiency, reducing the economic impact of days open. Herds using LD\$ show higher conception rates and shorter calving intervals, resulting in a more consistent and profitable reproductive cycle.
- **Extended Longevity and Reduced Culling:** Longer-lasting cows are more cost-effective as fewer replacements are needed. LD\$ emphasizes longevity, ensuring cows stay in the herd longer, contributing more over time and lowering culling-related costs.

CONCLUSION: A PROVEN INDEX FOR DAIRY PROFITABILITY

The Lifetime Dairy \$ (LD\$) index is a proven tool that enhances dairy profitability by balancing critical traits such as production, health, fertility, and longevity. The study case results provided demonstrate visible financial benefits for producers, with all herd performance levels showing increased income when using LD\$ compared to traditional indices like NM\$. The index not only increases immediate profitability but also ensures long-term sustainability by selecting cows that can remain productive and healthy throughout their lives. Dairy producers who adopt LD\$ are expected to see significant improvements in both their short-term and long-term operations, making it an indispensable tool for modern dairy farming.

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