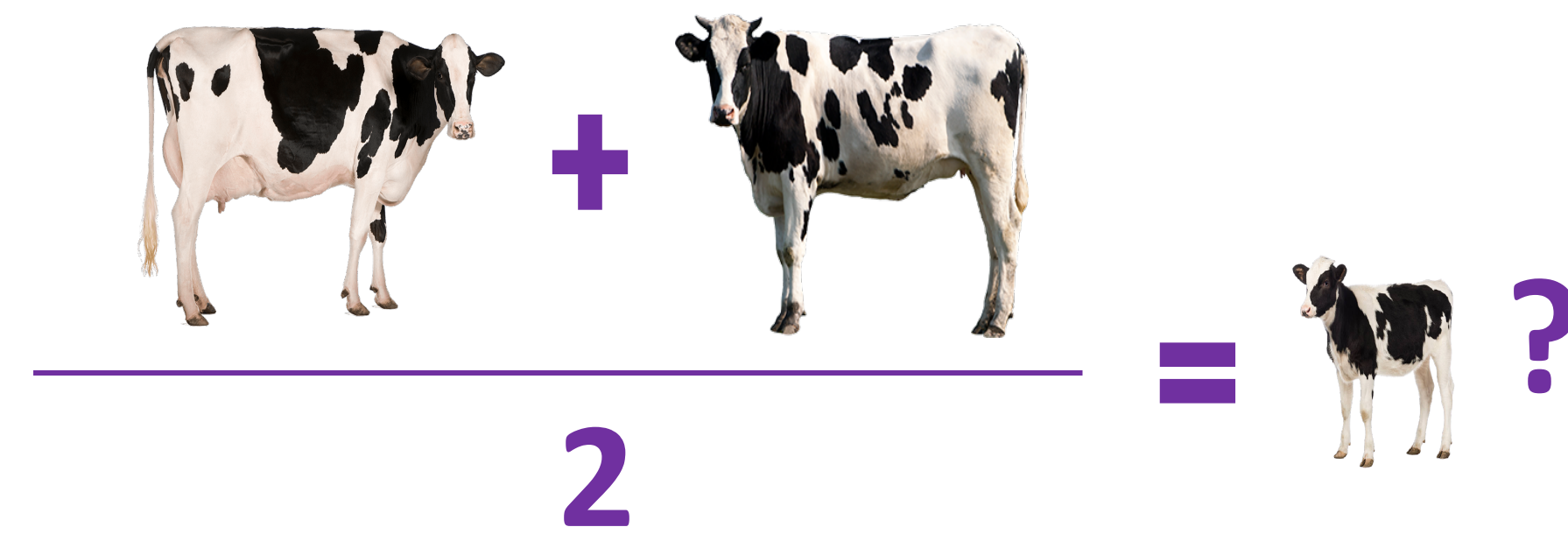


BACKGROUND

- Net merit (NM\$) is a simplified genetic evaluation of a large group of traits awarded as a numeric score to dairy cattle by the Council on Dairy Cattle Breeding. The NM\$ index incorporates economically important traits related to **animal health, production longevity, and reproductive capacity**.
- Dairy cattle breeders may use the NM\$ index to predict the lifetime profit of a cow, indicating the income an animal can generate. Many breeders make mating and culling decisions based on NM\$ scores of animals within their herds.
- The Cornell Veterinary School Teaching Dairy (VTD) herd is composed of over 200 Holstein dairy cattle with 6 genetic traits of interest: NM\$, fat (lbs.), protein (lbs.), somatic cell score, daughter pregnancy rate, and productive life. Both dam and sire NM\$ are important considerations in mating decisions.
- Expected NM\$ can be calculated by averaging sire and dam NM\$ scores, shown in the graphic below. Without requiring mating and registration of offspring, expected NM\$ provides a prediction of an offspring's NM\$ score. Breeders can use these estimates to determine optimal sire-dam pairings.

OBJECTIVES

- To visualize sire repeats and half-sister relationships in pedigrees.
- To identify if expected NM\$ of a mating pair can provide an accurate estimate for the observed NM\$ of the offspring.

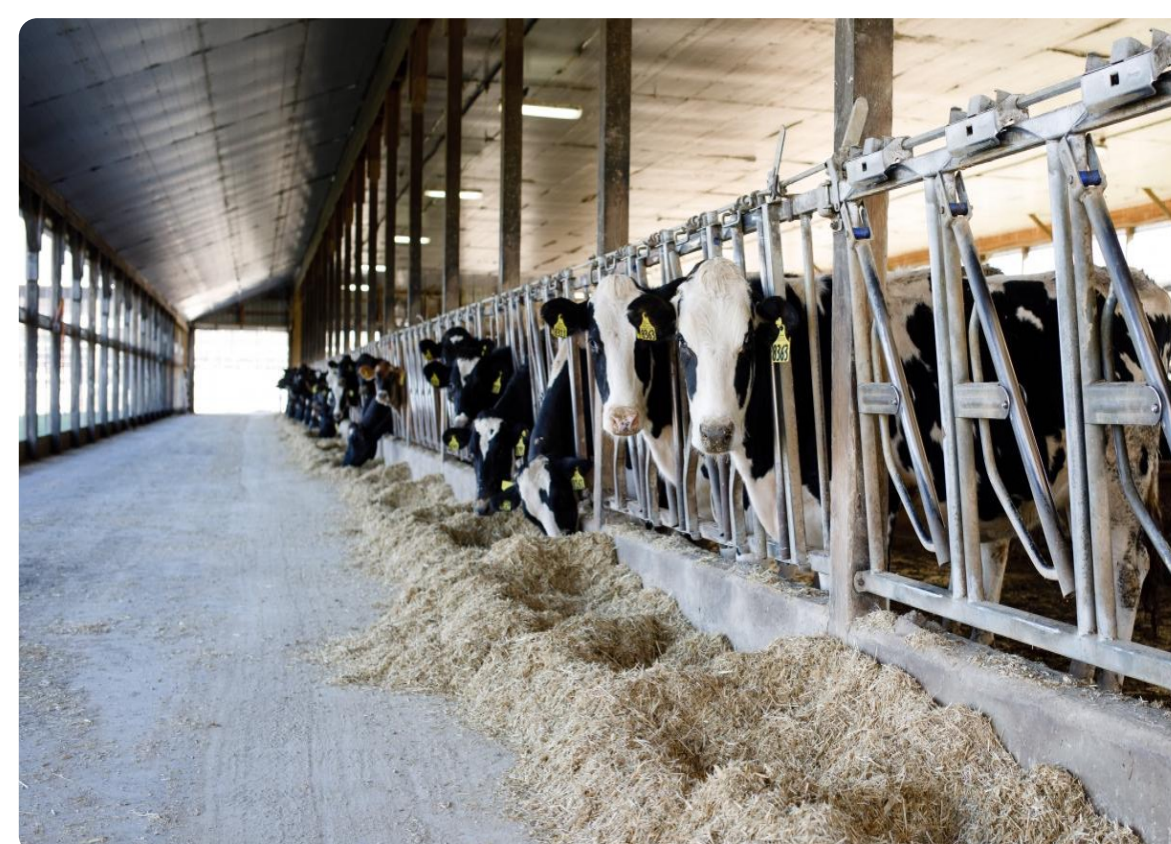


BROADER IMPACT STATEMENT

- Dairy cattle play an important role in sustainable food systems, contributing significantly to the welfare, livelihoods, and nutritional security of millions. Dairy animals increase the financial capital of families, serve as credit collateral, and play an important role in empowering women; in developing countries, dairy cattle have the potential to increase educational attainment for women and reduce gender inequalities. Milk production, however, is energy intensive and animal husbandry practices require mitigation of infectious diseases. Through genetic evaluations, **dairy cattle breeders can select for beneficial traits that reduce environmental burden and costs, enhance disease resistance, and improve food production**, addressing important issues of public concern.

METHODS

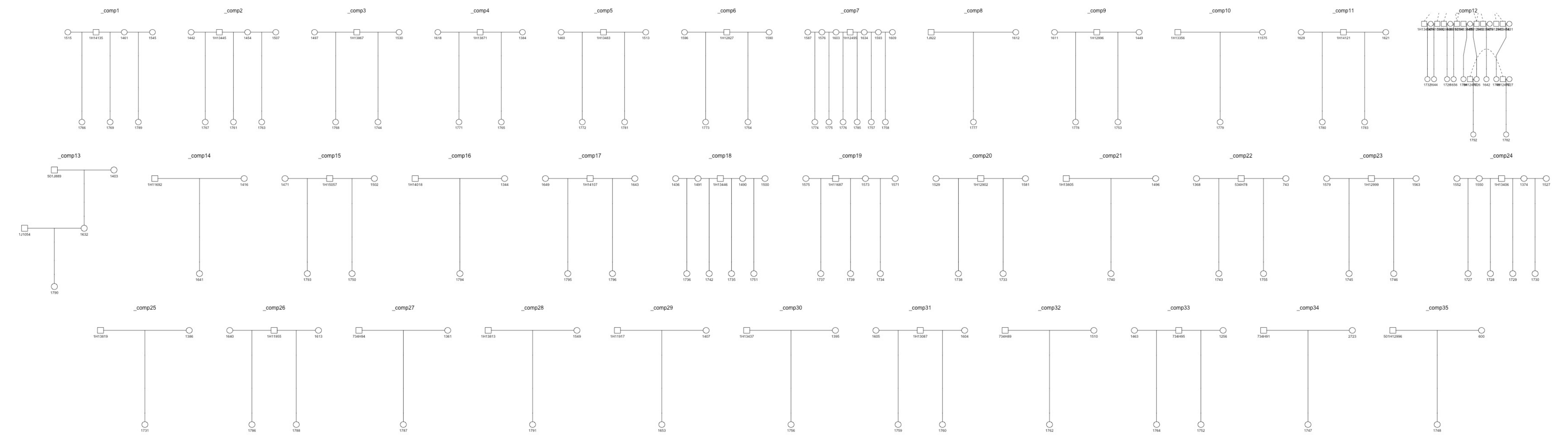
- NM\$ and breeding data were collected from VTD cattle in Feb. 2021 and compiled into pedigrees to visualize parent-daughter relationships.
- Expected NM\$ was calculated based on parent averages and compared to the observed NM\$ for that individual using linear regression.



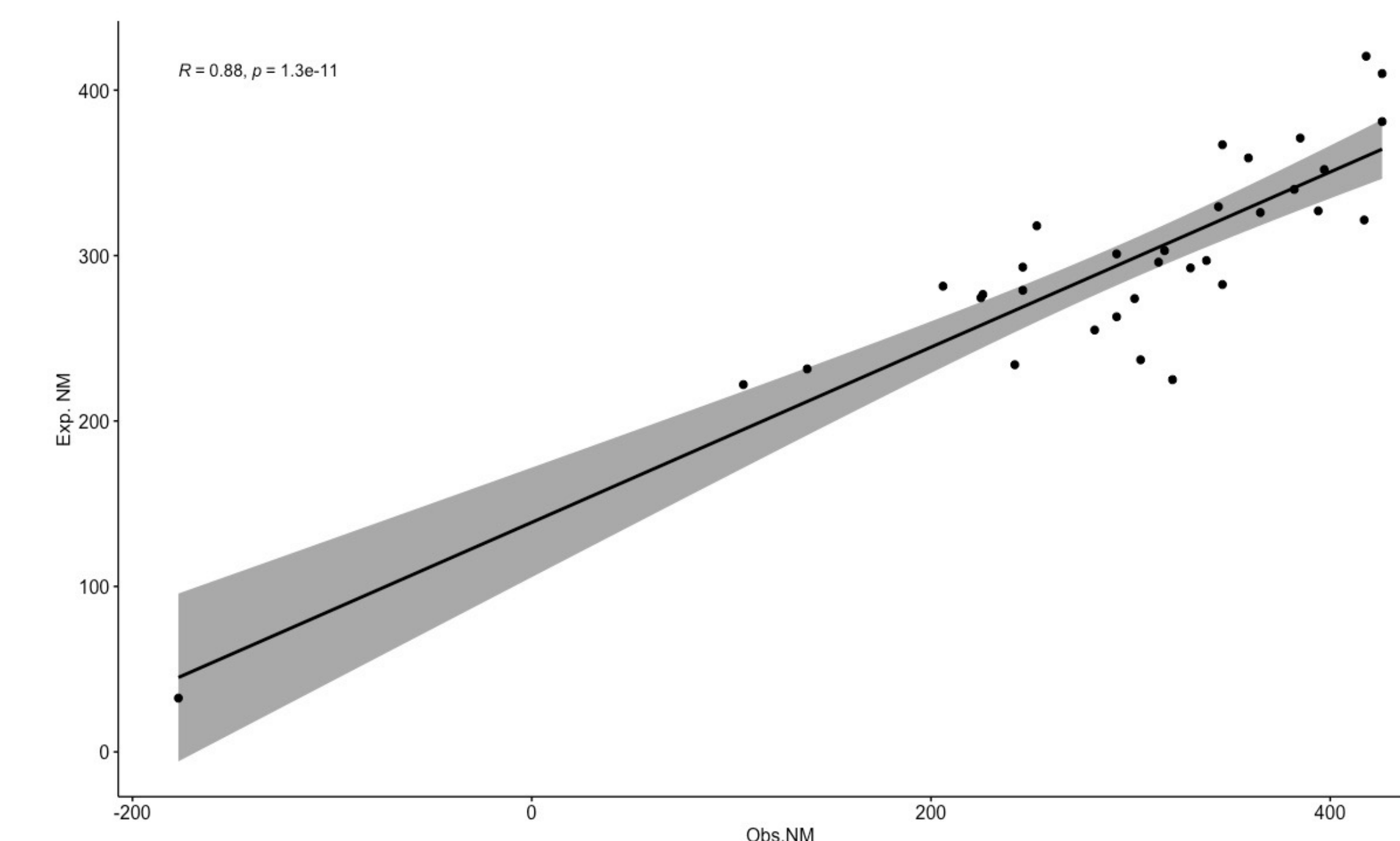
Cornell Veterinary School Teaching Dairy

RESULTS

- A pedigree was created to visualize the relationships between cows and bulls used for breeding within the VTD herd (Figure 1).
- Linear regression was used to evaluate the relationship between observed and expected NM\$ to identify if a statistical difference exists. A correlation coefficient of 0.88 was calculated with a p-value of 1.33e-11 (Figure 2), **indicating a strong, positive linear relationship**.



(Figure 1). Pedigree of the VTD herd displaying parent-daughter relationships used to calculate expected NM\$. Bulls are squares and cows are circles with lines connecting animals used to display a mating event and resulting offspring.



(Figure 2). Linear regression ($R = 0.88$, $p\text{-value} = 1.3e-11$) comparing observed NM\$ along the x-axis and expected NM\$ along the y-axis. Each point represents an animal and the shaded region shows the line's 95% confidence band.

DISCUSSION & IMPLICATIONS

- The strong correlation between observed and expected NM\$ indicates that there is not a statistical difference between the values. With this information, **breeding decisions can accurately be made by calculating the expected NM\$ for various dam-sire pairings to find optimal mates**.
- Further research can apply the methodology used in this study to other dairy farms and other genetic health traits to determine if the expected values can be used to accurately estimate offspring scores for a more detailed genetic estimation of offspring quality.

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