Improving the Science behind More Reliable Dairy Cattle Performance Predictions

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The improvement of dairy cattle genetics was a hot topic at the 2014 Joint Annual Meeting of American Dairy Science Association® (ADSA®), the American Society of Animal Science (ASAS), and the Canadian Society of Animal Science (CSAS) in Kansas City, MO. Hundreds of dairy and animal scientists joined together to share information discovered within the last year. Genetics is a topic of interest to many dairy producers due to the expected improved performance and economic impact from genomic evaluation improvements.

Scientists from the USDA Agricultural Research Service presented updates on the calculations and structure of genomic evaluations for dairy cattle. The Council for Dairy Cattle Breeding (CDCB), which is partially funded by AI companies and a fee assessment on genomic testing costs, played a large role in the information presented at the 2014 Joint Annual Meeting. The USDA still works closely with the CDBC in conducting research to improve the genetic evaluation predictions. The continued collection of phenotypic data is important for improvement of genomic prediction accuracy. Therefore, dairy herds providing complete data (both DHI and classification records) to CDCB pay lower fees for genomic testing, than herds that do not provide data. Information regarding this system can be found at: https://www.cdcb.us.

There has been an increase from over 45,000 to over 61,000 DNA sequence variations in the dairy cattle genome for all breeds since the spring of 2013. This increase of information allows scientists and dairy producers access to more reliable performance predictions from genomic evaluations.

Adjustments to the genomic evaluation of dairy cattle across all breeds includes counting each animal and its non-genotyped progeny instead of double counting progeny. Scientists showed that heifer genomic evaluations significantly increase the reliability of predictions of cow performance over traditional parent averages using information from US Holstein heifers, especially when considering incomplete or incorrect identification.

Some of the information gathered and analyzed from their database included more specific DNA sequences of dairy cows and heifers for fertility. Improvements in the evaluation of cows give less bias to cow evaluations and more attention to multitrait heifer and cow evaluations for conception rates. Multitrait evaluations are a way of combining milk yield and functional traits like fertility, somatic cell count, milk persistency, and calving ease to give more reliable genetic information. Selection tools such as grazing merit (GM$) gained improvements as well. For grazing dairy producers, longevity and fertility have higher importance than traditional producers, and therefore have an increase weight in the grazing merit index.

USDA and CDBC new and ongoing projects include Net Merit update, the grazing index and the genomic mating program, among others. A USDA and CDBC project of direct benefit to dairy producers was the update of lifetime net merit released in December 2014. The US lifetime net merit (NM$) has been used by commercial dairy producers as a way to select cattle based on an economic index since about 2004 with the last update in 2010. In 1971 the equivalent of net merit was predicted difference (PD$); it had a 52% emphasis on milk yield and 48% on fat. The last update of NM$ in 2010 compared to previous updates to NM$ included new traits to better describe the biology of the cow such as productive

life, daughter pregnancy rate (DPR) and more milk components. The effective change to NM$ in December was a larger weight on production traits, and lower weight on the health traits, which better reflect current and future expectations for costs vs. revenue for dairy producers. NM$ also includes two new traits – Cow Conception Rate (CCR) and Heifer Conception Rate (HCR) which are direct measures of the expected conception rate of a bull's daughters. These new traits, combined with daughter pregnancy rate should better reflect overall genetic predictions for fertility.

The emphasis on production related traits in the 2014 NM$ calculation will also change due to market changes. Emphasis on somatic cell score has decreased with the 2014 NM$ since the premium for lowering SCC is less than in 2010. The updated NM$ will include the most emphasis, 44% compared to 35% in 2010, on production yield including milk, fat, and protein. There is an expected $8 million per year value placed on these changes assuming the best case scenario.

The economic and market changes are constantly in flux. These constant changes ultimately affect the value of certain traits included in the genetic evaluation of dairy cattle. In this time of high market prices of milk and beef, geneticists are working towards the goal of helping dairy producers breed cattle that will be profitable under changing conditions in years to come.