

History Meets Perspective

Genetic evaluations evolve at a rapid rate, but their place in the beef industry remains steadfast.

by *Will Fiske*

Methods of genetic improvement in the beef industry substantially evolved over the past decade. The animal genetics community developed statistical models for selection of new traits, continually updated traditional trait models, introduced the era of genomics and combined these advancements through various precision selection tools. These changes in the field of animal breeding greatly improved seedstock producers' ability to accomplish breeding objectives and focus on new traits. But such change has come with a side effect of disconnect, leaving much of the industry with questions as to why this rapid change is occurring and how to best utilize the selection tools and technologies.

Beyond two-step

Expected progeny differences (EPDs) allow the comparison of animals within a specific population and are expressed in the units of measurement relative to the trait of interest. Breeders were initially introduced to EPDs as a tool derived from pedigrees, records or indicator traits, and at its foundation this has not changed. But the technology behind EPDs continues to march forward.

A new age of genetic prediction was revealed to cattlemen in the form of information derived from DNA. In the beginning, genomic information was first represented as molecular breeding values (MBVs), a separate value from EPDs. This led to a conundrum for producers attempting to find balance in the selection pressure between MBVs and EPDs. The

solution was integrating MBVs with EPDs in National Cattle Evaluation (NCE) as a correlated trait, thus creating genomic-enhanced EPDs (GE-EPDs). This process of integration was recognized as "two-step" or "multi-step."

The most recent change in genetic improvement models has been the adoption of "single-step" or "one-step." The single-step approach is a further development in how genotypic and phenotypic data are incorporated into NCE. In brief, single-step allows seamless and real-time integration methods of imputing genomic data as a proportion of the total information used to calculate GE-EPDs.

One beneficial aspect of single-step is how precisely the genetic evaluation identifies the variation in relationships by quantifying the common genes shared among animals and throughout the pedigree. Being able to better assess the degree to which animals are genetically similar or different increases the power of predicting an animal's true genetic merit. Traditionally, animal breeders accounted for the relationships between individuals with standardized values (i.e., full siblings share 50% of the same genes). However, not every animal represents the average relationship, and a degree of generality is introduced when we assume they do. In other words, DNA determines which genes each sibling inherited rather than simply assuming they share 50% in common.

Single-step excels by using the Marker Effects Model to more accurately describe the proportion of inherited genes each individual received from the parents and draw

association if the genes are favorable or unfavorable for a particular trait. Reducing bias remains a key concept for effective genetic improvement from the early stages of reporting data to the final stages of executing a genetic evaluation and providing producers with GE-EPDs.

Hereford innovation

In 2017, the American Hereford Association (AHA) made a progressive step forward when genomics was integrated into a single-step genetic evaluation using 'BOLT' software. Since that time, breeders have quickly adopted more accurate selection tools to provide the beef industry with high-value and dependable Hereford genetics. But what will the future hold?

The AHA's commitment to excellence has long been told by generations of commercial cattlemen benefiting from the profitable performance of Hereford genetics. This commitment continues in the form of forward-thinking goals to use technological innovation and cowboy ingenuity to address subjects such as the environmental impact of the U.S. beef cattle population. In many ways, this call for innovation means more of the same for Hereford breeders. Hereford breeders' dedication to accurate, comprehensive whole-herd performance reporting of phenotypes, coupled with genotypes, enabled implementation of single-step genetic evaluation. This commitment to technological evolution will drive Hereford solutions for the future of the beef business. **HW**

Editor's Note: Will Fiske is a technical service scientist for NEOGEN Genomics.