

The Future of Genetic Evaluation

by Sara Gugelmeyer

Technology is constantly changing. And we are constantly adapting — from e-mail advertising to sexing embryos, technology is something that we all deal with, whether we like it or not.

One thing to like is the effect technological advances have had on genetic evaluation. A bi-continental Hereford genetic evaluation is now a reality, and a global evaluation is getting closer to a likely possibility. Also, the research continues on using DNA markers to increase the accuracy of expected progeny differences (EPDs), and it is merely a matter of time before those are commonplace.

The American Hereford Association (AHA) staff and Board members are dedicated to making sure that the breed is staying current with technology but not blindly following trends without any real benefit.

Pan-American Cattle Evaluation

In an effort to increase overseas marketing opportunities for Hereford breeders, the AHA has been working with Hereford organizations in Uruguay, Canada and Argentina to create a Pan-American Cattle Evaluation (PACE). Because of the addition of Uruguay and Argentina, the evaluation, formerly called the North American Cattle Evaluation, has been renamed.

This project has been in the works since 2004, and the first ever PACE was scheduled to be released in July. This will be the first combined genetic evaluation between continents.

AHA staff and Board members are excited about this new bi-continental evaluation because it will allow breeders to compare their cattle to a wider population. “The intent of this evaluation is to broaden the horizons for Hereford breeders between continents,” says AHA Director of Breed Improvement and Chief Operating Officer Jack Ward. “This will link the countries and expand marketing opportunities and, thus, allow for more linkage as common genetics will be used throughout North and South America. U.S. breeders could market semen to large South American herds and get bulls proven in large contemporary groups.”

AHA Director of Records Stacy Sanders points out that PACE will also allow Americans to find and sample new genetics from other countries.

Craig Huffhines, AHA chief executive officer, says, “PACE poses an immediate advantage for North American Hereford genetics in export marketing opportunities.” This is because Uruguay’s cow herd of about 3 million cows is 80% Hereford. Also, Huffhines says, Uruguay has a strong, active Hereford association, which holds weekly board meetings to discuss breed improvement. The association owns a range research station where 100-150 bulls are performance tested on grass every year.

Although there are some concerns with trade reciprocation because of health restrictions, Uruguay Hereford breeders now understand they can improve their cattle with U.S. and Canadian stock because of comparable EPDs.

All these benefits come with little to no change in their numbers, says Sanders. “The correlations are pretty high across the board, or we wouldn’t have gone ahead with the

combined evaluation. There’s no real change in any parameters, like heritabilities or adjustment factors. The only real change that we’re implementing is the addition of data from Uruguay and Argentina.”

Sanders does point out that with PACE a full multi-trait model is used, so all the traits including carcass are run at the same time. Also, genetic groupings are used. For example, Sanders explains, U.S. cattle are divided into six groups based on birth year. Sanders says, “Genetic grouping methodology is used to account for different country and temporal groups for base animals. The groups for North American base animals show a general increase over time, which is relatively consistent with genetic trends observed for the traits analyzed.”

Global Hereford Evaluation

PACE may bring us one step closer to a global Hereford evaluation. That was discussed at length at the recent World Hereford Council meeting. There the results were announced from the Global Hereford Genetic Evaluation feasibility study.

Hereford genetic groups formed in the Pan American Cattle Evaluation to account for different country and temporal groups for base animals.

Group	Country	Year range
1	U.S./Canada	≤ 1975
2	U.S.	1976-1980
3	U.S.	1981-1985
4	U.S.	1986-1990
5	U.S.	1991-1995
6	U.S.	≥ 1996
7	Uruguay	≤ 1989
8	Uruguay	1990-1999
9	Uruguay	≥ 2000
10	Argentina	≤ 1989
11	Argentina	1990-1999
12	Argentina	≥ 2000
13	Foreign	all years



The study was commissioned because of discussion at the 2004 World Hereford Conference in Australia, where several countries committed to conducting research to determine the feasibility of cross-referencing country databases and, thereby, developing methodology that would allow for country-to-country genetic evaluations, according to Huffhines.

He says David Johnston, quantitative geneticist from the Animal Genetics and Breeding Unit at the University of New England in Armidale, Australia, determined the linkage relationships of populations among 10 countries including the U.S. and Canada. He determined that the North American Hereford populations have strong genetic links to the larger Hereford population including Australia, New Zealand, Uruguay and Argentina with weaker links to the rest of the countries studied.

Now, Johnston is writing a final report on the feasibility of a global evaluation and developing a top 100-sire list for the 12 traits compared. "He will also write an education article with our help to discuss the scope, results and future application of the technology to share with each country," Huffhines says.

He adds that there are still many hurdles that must be navigated before the global evaluation becomes a reality, but those at the conference made it clear to Johnston that there is enough interest to encourage researchers to find funding for further development of the technology required.

Sanders says, "The theory has been proven to work; the thing that we are running into in the Hereford breed for making a global evaluation a reality is computing power." He says the cost of running the analyses would far exceed the benefit at this point. "You would have to be someone like NASA to be able to justify it."

Ward says, "I do believe that global evaluation is going to happen in the future. Quite frankly, the PACE is a step toward that. But as far as a time frame, I am not sure. The technology is changing on a daily basis and commercially the computing power will become more accessible."

Marker-assisted EPDs

Another advance in technology that has been a hot topic in the breed improvement sector for several years is using DNA markers to improve EPD accuracy.

In a nutshell, a combination of the animal's EPD, phenotype and DNA information is used to calculate a marker-assisted EPD, as

it's termed in the U.S., for the trait in question. The advantage is a higher accuracy prediction for the trait in young animals. Marker-assisted EPDs will allow breeders to identify and possibly eliminate animals in the lower one-third of desired traits at a younger age.

Huffhines explains, "The purpose of marker-assisted selection is to raise the accuracy of highly heritable traits on younger animals and identify differences in economically relevant traits that are extremely hard to measure such as feed efficiency or health and, thereby, provide a new confidence level in younger animals that would allow breeders to turn generations more rapidly and speed the rate of genetic progress."

Genetics companies are pushing this DNA technology, but AHA staff members say it's not something they are ready to rush into using. "What we need to assess is how they work in the Hereford breed, how they impact genetics and what amount of variation they account for in the Hereford breed," Sanders says.

The problem right now is that some markers have no variation within breeds, so testing for those markers offers no value. It also seems these markers are going to be at least somewhat breed specific, and another challenge is determining the cost-effectiveness of the information gained.

Ward explains that within the Angus breed individuals are studying DNA markers for marbling. However, he says, "There was no significant difference between looking at the markers and doing an ultrasound scan. And a DNA marker test costs anywhere from \$50 to \$100 and an ultrasound only costs \$15. The only added value is that the DNA test can be done on a calf that is only 10 days old."

At this point Ward stresses, "What our members need to understand is that we will be able to implement this fairly rapidly whenever the technology and the industry prove to us that this will add value to our EPDs. We're obviously in contact with DNA companies trying to figure out a way to get the data submitted through them to the Association for the genetic evaluation and make it usable. But, we don't want to add it to our evaluation before it makes sense to do it."

The bottom line is, in the meantime, it's important for breeders to continue to collect as much data as they possibly can. Feed intake and feed efficiency data are important, but also disposal codes, udder scores, cow weights with body condition scores and hip heights are useful.

Another way breeders can be proactive is to collect DNA samples. Sanders says, "We are

Qualifications for Gold TPR Breeder recognition

In 2000 the American Hereford Association established the Whole Herd Total Performance Records (TPR™) Program to create a more accurate database and increase the value of Hereford genetics.

Established in 2005, the Gold TPR Breeder recognition is presented to progressive Hereford breeders who have measured traits and collected and promptly submitted performance data at all levels of production, including calving weight, weaning weight, yearling weight, scrotal circumference and carcass data.

To qualify a breeder must:

- Submit herd inventory prior to the date inventory surcharge goes into effect
- Complete reporting of calving ease and reproductive status for each dam on inventory
- Complete reporting of birth weights
- Complete reporting of weaning weights
- Complete reporting of yearling weights
- Complete reporting of scrotal measurements for each bull calf with a recorded yearling weight
- Report ultrasound data on 25% or more of calf crop **HW**



not prepared to take the samples here, but if people want to pull some hair on their calves and put it in an envelope, label it with the calf's registration number and then hold on to it, down the road, we may have a need for requesting and submitting those samples to the lab and do some more work to find out exactly how those markers can be utilized."

Ward agrees, "Any kind of DNA collection on cows and/or bulls is great. When we talk about potential abnormalities or anything that might come down the pipeline involving a DNA marker, collecting as much DNA as they possibly can is a great idea."

The method by which the DNA samples are collected is not important, but the integrity of the samples is. Breeders can pull hair

or use blood cards, ear punches or whatever works best and is most convenient for them, Ward says. But, it's very important to properly identify samples with the animal's registration number and make sure that the samples aren't cross contaminated from one animal to another.

Although technology is constantly advancing, the Hereford breed is dynamically staying abreast of developing trends in genetic evaluation. The No. 1 thing breeders can do to help is by continuing to collect as much data as possible, so when new technologies are ready to implement, the Hereford breed may use those tools to continue to improve. **HW**

Whole herd reporting made it possible

The research is nearly ready to launch heifer calving rate (HCR) and survivability traits. It is expected that this fall at the American Hereford Association (AHA) Annual Meeting, HCR and survivability traits will either be released as stand alone EPDs or part of an index.

Then, they can be run as part of the January genetic analysis. Both traits are sire-driven, not individual animal analyses.

Jack Ward, AHA director of breed improvement and chief operating officer, says, "HCR gives us a better handling on fertility, which, as we found in our research projects, is perhaps the No. 1 driving force in the commercial herd."

The survivability trait will help prove Herefords' ability to sire cows that stay functional in the herd longer — a very important economically relevant trait.

AHA Director of Records Stacy Sanders stresses that the research necessary to develop these traits wouldn't have been possible without the Whole Herd Total Performance Records (TPR™) program the AHA started in 2000. "The only reason any of this is even possible is through nine years of whole herd reporting. These two traits are going to have a decent heritability and power to them because of whole herd reporting. Without it you can't develop these kinds of traits within a breed."

Ward agrees and also says continuing to collect data will allow for development of more traits. "For example," he says, "we may be able to look at evaluating an EPD for udders. Some of these things we are considering are functional, not necessarily economically relevant traits. Even though we don't have a set of stand alone EPDs for them right now, those are things that are important to us and might be incorporated in the future."

Efficiency is a buzzword in the industry right now because of high input costs, Sanders says. "If we collect more intake and efficiency data now, we can evaluate that as well. It may not be a trait in and of itself, but it may be part of an index." **HW**

