Greater accuracy predictors, earlier in an animal's life

Using DNA for Genetic Improvement

By Brian Bertelsen, Vice President, Field Operations

Lately there's a lot of buzz about DNA testing. A DNA test can be run from a sample of hair, blood or skin to identify single-nucleotide polymorphisms (SNP) that are located on strands of DNA. These SNP's are indicators of genes that influence different traits. Currently, DNA tests can provide results for up to eighteen different traits. These types of tests are expensive and are typically run by seedstock suppliers on registered animals.

The American Angus Association (AAA) first began incorporating DNA test results, also known as genomic information, into the calculation of Expected Progeny Differences (EPD) for carcass traits in 2009. Today, AAA incorporates DNA testing for seven different general traits listed in the table below. These are referred to as Genomic-Enhanced EPD's (GE-EPD).

AAA Genomic-Enhanced EPD's
Calving Ease (CED)
Growth (BW, WW, YW, Milk)
Residual Average Daily Gain (RADG)
Docility (Doc)
Yearling Scrotal/Height (SC, YH)
Mature Weight (MW)
Carcass (CW, Marb, RE, Fat)

Traditionally, EPD's are calculated from performance measurements of the individual animal, his/her pedigree (relatives) and the progeny of the individual. Genomic information can now be added as an additional piece of information used to determine an EPD. Plus, genomic information can be determined very early in the animal's life.

Genomics will certainly influence the numeric value of an EPD. However, they also have an impact on the accuracy value associated with each GE-EPD. Accuracy values of any EPD range from zero to one, with one being the most accurate.

High accuracy EPD's are calculated from a greater number of total records, including their own progeny and are less likely to change as more progeny records are added. Yearling bulls tend to have lower accuracy EPD's because they have no progeny.

A yearling bull's EPD's have been, and still are the best predictor of genetic merit at that point in his life, but with genomics, a yearling bull can have a more accurate EPD, even without any progeny records. For example, the improvement in accuracy for yearling weight EPD from a DNA test is similar to having up to 20 progeny records from that bull. So genomics make non-parent EPD's more reliable.

When a lot of data is reported in a bull sale catalog, including DNA test results, the important thing to remember is that EPD values are based on the most total information available. It isn't relevant to ask if DNA is more important than other data, because the EPD brings it all together.

The two primary companies offering DNA testing are Pfizer and Igenity. Each company now offers a more affordable priced test that is designed for potential replacement heifers in **commercial herds** (non-registered cattle). The Pfizer test is offered through Angus Genetics, Inc., which is a subsidiary of the AAA. Both tests are designed for Angus cattle and are priced in the range of $17-20 per head. These tests are simpler and include fewer total traits, but that is what makes them more affordable.

Most DNA tests are breed-specific because different SNP's have different frequencies, or rate of occurrence, within different breeds. In other words, one SNP might be very valuable in one breed. However, it might be almost non-existent or it might be present in almost all animals in another breed. Either way, the results really don't differentiate any animals in that breed.

In commercial herds, DNA testing can be valuable for potential replacement heifer culling decisions. It could be used to prevent selecting females with poor genetics for carcass and growth traits, for example. Heifer development costs are significant and keeping cows in production longer can reduce costs and improve profitability, so it pays to select the right replacements.

Even though carcass and growth traits are very complex, meaning they are controlled by many different genes, DNA markers, or SNP's, are now more dependable than they have been in the past. They do not account for all of the genetic difference between animals, but they are pretty dependable and they are known—an animal either has them or they don't. It's a known factor about part of the animal's total DNA makeup.

Commercial ranchers using Angus genetics might also want to test cows in their herd to determine the best from the worst. This can be valuable when culling, especially during times of drought, to know which ones to keep or cull if the herd needs to be reduced significantly.

It is now possible for commercial ranchers to test a representative sample, or cross-section, of their herds and then **market feeder cattle backed by genomic information**. This could potentially reduce some of the risk associated with purchasing value-added feeder cattle destined for a grid such as USPB's.

Another consideration is confirmation of parentage. This is different than the tests for genetic merit/value. However, SNP's are still used, but in this case, to confirm the sire of a calf produced from a multiple-sire pasture mating, for example. This does require sampling of all possible sires to have something to compare the progeny results back to. Therefore, some planning should be done early enough to sample all potential sires before any die or are culled.

Parentage confirmation is an additional cost. Igenity currently offers this type of test for an additional $10 per head. Other companies either offer this test or are developing systems to offer it in the future. Confirming parentage can offer several potential benefits. Ranchers could choose to collect samples on all calves and test only the best and/or the worst calves to try and find individual bulls that show up more often as the sire of the best/worst calves. Another benefit is to test all calves to determine if a bull produces no calves during the breeding season.

Parentage verification expenses could be further reduced if young sires are used in a single breeding pasture separate from older bulls. This would allow ranchers to "prove out" a sire in his first year or two of service through actual progeny records. Then, individual bulls that are identified as having different strengths and weaknesses could be more selectively mated with specific cows or cow families. For example, you could mate bulls that are best in marbling with the cows that tend to produce lower marbling calves.

Another exciting thing about DNA testing is that it can estimate genetic value of traits that are difficult to measure. One of the newer traits offered is **Residual Feed Intake** (RFI) or **Residual Average Daily Gain** (RADG). These are both related to the relationship between feed intake and live weight gain which together, make up feed efficiency which has a huge impact on feedlot cost of gain. "Residual" refers to the difference between a predicted (average) value and the animal's actual value. So animals with a low RFI would eat less than average at a given body weight. Likewise, animals with a high RADG would gain more than predicted at their level of feed intake.

Genetic improvement in feed efficiency could have a huge effect on profitability of beef production. It will likely still take some time to become better understood. For example, we don't yet know the true relationship between a bull's actual RFI phenotype using a concentrate diet, and the forage intake of his daughters. Some breeders, however, have chosen to invest in the necessary equipment to actually measure individual feed intake of bulls while they are being developed and calculate their actual RFI phenotype.

Other traits that are currently measured by DNA testing, but not yet included in EPD calculations include: tenderness, heifer pregnancy rate and stayability. Genomics are also used by breeders to identify genetic defects/abnormalities. Tests are also available for coat color, horned/polled and Myostatin, commonly referred to as the "double muscling" gene.

Tests are being developed and researched for new, additional traits like disease resistance, for Bovine Respiratory Dis-

ease, for example. Healthfulness of the final beef product for the consumer is another trait being considered.

A lot of genetic improvement has already been made in beef cattle over the last twenty years. Other breeds are working diligently to develop DNA tests similar to AAA. With more breeds, more SNP's and more traits available, the rate of genetic improvement in economically relevant traits could be staggering.

Genomics are not likely to replace the tools commonly used today. But rather, they complement and build upon them. Plus, they open up a realm of new traits such as feed efficiency that have been extremely difficult and costly to measure. I encourage you to visit with a **USPB Qualified Seedstock Supplier** about how they are utilizing genomics and how they can provide you with the genetics you need to succeed in marketing your cattle on the USPB value-based grids.♦
