Tackling Tenderness Through DNA

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Cotton, Inc. had a promotion slogan entitled "Cotton: The fabric of our lives." DNA, or deoxyribonucleic acid, is exactly that for all of us. It is the fabric, the strands of our lives.

How the DNA matches up determines the outcome of our mating and breeding decisions in the cattle industry. This is why full sibs produced via embryo transfer can be different. They do not necessarily share the same genetic makeup.

For years, seedstock producers have used EPDs as one of several selection tools when it comes to mating decisions. Producers have tried to balance some traits, increase other traits without adversely affecting another, and put it all into an attractive, structurally sound package. Sometimes it worked, sometimes it did not work. It always depended upon how the alleles (genes) lined up in the offspring.

Today, new tools are allowing the seedstock producer the opportunity to make selection at the genetic level. Seedstock producers in the Gelbvieh breed have been using selection at the gene level for years. This is how the polled and black allele (gene) found its way into the Gelbvieh population. Producers used a method called backcrossing to move the black and polled allele from one population of cattle to another. With the new tools, or markers, that identify the calpastatin and calpain alleles (genes), Gelbvieh producers again have the opportunity to affect genetic change. Genetic change not only within their own herd, but within the breed.

Calpain is a naturally occurring enzyme that contributes a major role in beef tenderness by weakening muscle fibers post-mortem (after death). Calpastatin blocks calpain and the role it plays in post-mortem tenderization. Therefore, it is advantageous to have ample calpain, and limited or no calpastatin present post-mortem.

There are other methods to enhance the tenderness of a beef carcass, and even other genes that affect the tenderness of a beef carcass. However, to date, the markers for calpain and calpastatin are what are available for use by seedstock producers. Gelbvieh cattle test quite well for the absence of the calpastatin alleles. Of 19 bulls tested by the American Gelbvieh Association, 52.63% would be considered homozygous for the absence of calpastatin alleles and only 10.53% would be considered homozygous for the presence of the calpastatin alleles. 89.47% were either homozygous for the absence of the calpastatin alleles or had at least one absence.

The current test for the calpain gene consists of two markers, SNP 316 and SNP 530. The test ranks the cattle based upon the frequency of the alleles at the different markers (see Table 1).

The markers are considered additive for tenderness and both are important when testing Gelbvieh cattle. Based on data from Meat Animal Research Center (MARC) in Clay Center, Neb., Gelbvieh cattle (n=40) had a shear force of 9.8 lbs., a frequency of 0.0% for the CC genotype SNP 316 and only a 34% frequency of the GG genotype SNP 530. Comparatively, Simmental cattle had a 5% frequency for the CC genotype SNP 316 and 43% frequency of the GG genotype SNP 530, with a shear force of 8.8 lbs.

It would not take a large increase in the frequency of the CC genotype SNP 316 to have a significant impact upon tenderness in the Gelbvieh breed. The Gelbvieh breed needs the calpain allele (gene) in order to make significant improvements in tenderness.

Just as Gelbvieh breeders responded to market demands by making cattle black and polled, so should the response be to improving the tenderness of Gelbvieh influenced carcasses.

There are two approaches to move the calpain allele into the Gelbvieh breed. Both involve testing cattle with the calpain markers to identify which cattle possess the calpain alleles and which do not. The first is to find the purebred Gelbvieh animal that possesses at least one C allele at the SNP 316 and maintain a G allele at SNP 530. Then using backcrossing, move the allele into the population, testing each subsequent generation for the calpain markers. The ultimate goal would be to develop a purebred animal that was CC at the SNP 316 and GG at SNP 530.

The other method is exactly what Gelbvieh breeders did when they moved the black allele into the breed. Find another breed that has the desirable genetic makeup and move the C allele into the breed. Then, utilizing backcrossing, maintain the desirable genetic frequency of the C and G alleles, eventually breeding a purebred animal that will be CC at the SNP 316 and GG and the SNP 530.

By no means should a Gelbvieh breeder single trait select. Fertility and growth pay the bills. However, consideration should be given to all traits, even those we cannot see, when making mating decisions. In a society where perception is reality, the Gelbvieh breed needs to be perceived as tackling the tenderness issue.

Rank	SNP 316	SNP 530	Genotype Score
1.	CC	GG	5
1.	CC	GA	4
3.	CC	AA	3
3.	GC	GG	3
5.	GC	GA	3
5.	GG	GG	3
8.	GG	GA	2
8.	GC	AA	2
9.	GG	AA	1