Marking Tenderness

By Clint Peck, Senior Editor, Beef Magazine - 11/1/2005

Meat tenderness is an interesting trait. It's one that beef producers can't select for by simply looking at an animal. And, it can't be measured until after the animal has contributed to the next generation. To adjust for the struggle of finding and producing animals that produce tender meat, we've tried every trick in the book from slicing, dicing and pounding, to poking, smoking and soaking. And,

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To adjust for the struggle of finding and producing animals that produce tender meat, we've tried every trick in the book — from slicing, dicing and pounding, to poking, smoking and soaking. And, the long-held practice of dry-aging beef until it fell off the bone just doesn't work in today's warp-speed meat business.

Therefore, tough beef product, even when it accounts for only a small portion of our whole-muscle beef, remains a costly and contentious issue for everyone involved in putting meat on the table. Yet, tenderness has been identified among the most important characteristics in a consumer's checklist when choosing their beef cuts.

Even as much as consumers seem to value tender beef though, the marketplace hasn't found a way to blaze a trail to the tenderness money-pot. Promises of just-around-the-corner, high-tech solutions to the toughness dilemma — especially DNA marker-assisted selection — have fallen short of most beef producers' expectations.

Research into the use of genetic markers nonetheless has matured to the point where several companies now offer commercial genotyping services for marbling and tenderness

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Gene jocks gone wild?

Enter today's gene jockeys — particularly the scientists with the National Beef Cattle Evaluation Consortium (NBCEC). Faced with the growing commercialization of marker-assisted selection, and wanting to assure the technology gets used for the greater good, they collectively decided the prudent way to advance the technology was to field test it.

NBCEC scientists Dick Quaas and John Pollak, both of Cornell University, spearheaded the recently finished series of validations of DNA markers that influence tenderness. And, they say it's high time their DNA tenderness validations were made public to a large audience of American beef producers.

In fact, they're now ready to stand on a stump and proclaim — with a high degree of confidence — that genetic markers associated with increased tenderness have been discovered and validated, and their effects seem to be fairly consistent.

NBCEC's tenderness validations didn't come easy and followed the results of numerous scientists who did the marker discovery work. It involved two DNA companies, utilizing association data from five cattle breeds, DNA resources from the National Cattlemen's Beef Association carcass merit project, as well as an additional data set from a large U.S. cattle ranch.

But, before the gene jockeys break out the pom-poms, they say it's important to emphasize that their validation work should be viewed as an “independent assessment” of whether or not a genetic-marker test does what the company claims it does. Still, Pollak and Quaas are quite adamant the beef industry should look for ways to reward producers who implement marker-assisted selection to improve beef's overall quality.

“We're doing this because it's time for someone to step up and announce the scientific community believes in this tool,” Pollak says. “We're certainly past the point of just ‘finding’ genes.”

They're also adamant that the business of just finding genes is a long way from the end of the story.

“Our results show the markers we've validated are quite effective in sorting cattle for measures of shear force,” Quaas adds. Shear force using Warner-Bratzler values has long been an objective method of assessing tenderness in meat cuts.

“If you look at all the buildup to the use of DNA technology, we're talking about having maximum impact on traits where we really can't generate a lot of phenotypes,” Quaas explains. “And, tenderness certainly is one of those traits.”

OK, pony up…

Unfortunately, while Quaas and Pollak have confidence in the science, this story doesn't have a definitive conclusion. “The problem is nobody really is getting paid for tenderness,” Pollak says. “Until someone forces the issue, the economics of DNA testing, at least for tenderness, will remain up in the air.”

This makes for an interesting dilemma, he says. If the beef industry would apply available DNA marker tools and improve tenderness on a widespread basis — which can be done — the economic health of the beef cattle business in the U.S. would significantly improve.

But, the entire industry isn't making an equal investment into this technology. This leads Pollak and Quaas to suppose the initial investments into DNA tenderness marker-selection technology are going to have to come from the seedstock segment.

“At some point, if they're going to recoup investments, they'll need to convince the commercial industry there's value in buying bulls with proven tenderness traits,” Pollak says. “Unfortunately, the value of getting those genetics into commercial herds is a couple steps removed from the seedstock source.”

Pollak is convinced that for the foreseeable future, the payoff for tenderness won't trickle down from the commodity beef packing and merchandising segment.

“Unless the big packers develop a branded product of their own — as long as they're dealing primarily with commodity beef — they aren't going to genotype the animals coming into their packing houses,” he says. “The payoff will more likely come from merchandising a branded product that has incorporated tenderness traits into their supply chain and from which a way has been found to cash in on it.”

For the industry's good

Meanwhile, Pollak and Quaas hope there are enough seedstock producers who will, sooner than later, believe incorporation of proven DNA tenderness traits into their genetic packages is in the best interests of the nation's beef industry. Maybe, Pollak suggests, they'll start testing for tenderness traits, regardless of immediate payback.

“I think there's a cadre of producers out there who think, for the good of the industry, we just need to get this technology rolling,” he says. “Some of them might step forward, even without a good economic model.”

NBCEC would rather see an economic model come through the commercial producer who is part of a branded-product chain or alliance that guarantees a tenderness payback. That rancher could conceivably afford to pay more for a bull that's been tenderness “rated.”

But, Pollak cautions against cavalier application of marker-assisted selection. He's concerned some commercial cattle producers today are spending a lot of money DNA testing bulls, but with no idea what the data means or how it applies to their operation's financial success.

“They certainly can't afford to test their entire heifer crop to decide which ones to keep as replacements,” he says. “And, how do they weigh the tenderness factor with other replacement selection criteria. It's hard enough to sort out replacements without putting an additional selection layer on them.”

Back to the conundrum

Which brings us back to the conundrum. Everyone lauds the virtues and value of a tender product. And, there are many postmortem tenderness treatments, but they all come at a cost.

“With marker-assisted selection, we have a genetic solution that could substantially improve things for the beef industry, not overnight, but permanently,” Quaas says.

NBCEC scientists say producers shouldn't be intimidated by the high-tech nature of DNA testing. And, if and when the cost/return ratio begins to work in favor of marker-assisted selection, the practice will become second nature to ranchers.

In fact, Pollak compares using tenderness markers for genetic improvement to producers' efforts over the past couple of decades in converting herds to homozygous black animals.

“When they tried to turn a herd homozygous black they were working with a dominant gene but had to deal with a recessive red gene floating around the population,” he explains. “Until the calf was born they were never sure if a cow was heterozygous or homozygous for black hair coat.”

Today, with DNA testing, a rancher can know precisely which genotype they're working with.

“If I want to turn my herd completely homozygous for the beneficial tenderness markers, I'd have an entirely easier time than getting rid of the recessive red gene when I was turning my herd black through phenotypic selection,” Pollak explains.

“We've been asked a lot of questions about these DNA tests — and there's been little science-based information to base any decisions on,” Quaas says. “Now, we have a lot of information.”

“We're simply stepping forward and saying publicly these genes work — that we have confidence in the use of these tools,” Pollak adds. “Now, it's up to the industry to work on enterprising this technology into profit for the entire beef industry.”

Sorting out markers

Marker-assisted selection allows for the accurate selection of specific DNA variations that have been associated with a measurable difference or effect on complex traits.

“It is important to realize that markers for complex traits in beef cattle, such as marbling, are associated with only one of the many genes that contribute towards that trait,” says Alison Van Eenennaam, University of California-Davis Extension animal genomics and biotechnology specialist.

The presence or absence of numerous other “unmarked” genes and the production environment, she adds, determines whether an animal displays the desired phenotype (e.g. large weaning weight, increased marbling, etc.).

When making selection decisions, expected progeny differences (EPDs) should be considered, even in the presence of marker data, to estimate the breeding value of all the “unmarked” genes contributing to a given trait, Van Eenennaam adds. “Marker-assisted selection should be seen as an assistance tool, not as a replacement for, traditional selection techniques.”

Genotypes are identified by analyzing DNA collected from hair, tissue, blood, or semen samples.

Van Eenennaam says the potential benefits from marker-assisted selection are greatest for traits that:

- Have low heritability (traits with observed or measured values that are a poor predictor of breeding value).
- Are difficult or expensive to measure (disease resistance).
- Can't be ensured until after the animal has already contributed to the next generation (carcass data).
- Are currently not selected for as they are not routinely measured (tenderness).
- Are phenotypically (observed value), but not genetically, correlated with a trait you don't want to increase (e.g., a marker associated with increased marbling but not associated with genes increasing backfat thickness).

Van Eenennaam details the DNA markers for tenderness in the two commercially-available genetic tests that have been validated by the National Beef Cattle Evaluation Consortium (NBCEC).

- Igenity *Tender*GENE™ (Merial) is actually two SNP (single nucleotide polymorphism) markers (SNP 316 "C" and SNP 530 "G") in the μ-calpain gene associated with increased tenderness by the U.S. Meat Animal Research Center. The DNA variations are located at two different places in the coding region of the μ-calpain gene.
- This gene produces an enzyme that weakens muscle fibers, thus increasing tenderness during the postmortem-aging process. The 530 SNP test is currently recommended for use only in cattle without Brahman influence.
- The results from the *Tender*GENE test are being presented on a 1-5 scale with "5" being the most tender. ("CC" at the 316 SNP, and "GG" at the 530 SNP), and "1" being the least tender ("GG" at the 316 SNP, and "AA" at the 530 SNP). Validation studies by the NBCEC confirmed an association between *Tender*GENE test, results and meat tenderness in commercial cattle.
- GeneSTAR® Tenderness (Bovigen) also reports on two SNP markers, one SNP associated with the calpastatin gene which produces an enzyme that regulates μ-calpain, and the aforementioned 316 SNP of μ-calpain. The results from the GeneSTAR Tenderness test are presented as "0 to 4 stars" with 4 stars being the most tender.

A four-star animal would be homozygous for both the tender form of the calpastatin SNP, and homozygous "CC" for the 316 μ-calpain SNP. Validation studies by the NBCEC confirmed an association between GeneSTAR Tenderness test results and meat tenderness in commercial cattle.

Courtesy Beef Magazine

For the original article on Beef Magazine's Website:
http://www.beefmagazine.com/mag/beef_marking_tenderness