

Research Advances

BIF Live Animal, Carcass & End Product Committee considers environmental and genetic influences on beef tenderness.

Story & photos by **Troy Smith**, field editor



During last summer's Beef Improvement Federation (BIF) symposium in Lincoln, Neb., the Live Animal, Carcass & End Product Committee explored several research projects and the challenge represented by the diminishing number of beef research herds at land-grant universities.

Differences in tenderness

When it comes to tenderness, there are many influential factors. There are tenderness differences related to cattle breed, but there is considerable variation within a breed. Certainly, genetics have much to do with it. According to Tommy Wheeler, a scientist specializing in meat quality research, numerous gene markers associated with beef tenderness have been identified. He expects even more. However, evidence thus far suggests that the influence any single gene has on beef tenderness is small.



► Discussing cattle management influences, Tommy Wheeler said aggressive growth-implant protocols can increase beef toughness.

A researcher at the U.S. Meat Animal Research Center (USMARC) near Clay Center, Neb., Wheeler talked about sources of variation in beef tenderness. While positively correlated, Wheeler said marbling (intramuscular fat) is not a big factor. Relative amounts of connective tissue (collagen) and postmortem muscle shortening are greater influences, as is enzymatic action occurring during aging of beef. Wheeler said the influence of each can vary among different animals, but it can also vary among different muscles of the same carcass.

"There is great variation in the impact

of each trait," stated Wheeler. "Each has an impact, but it is the combined effect that really determines whether beef is more or less tender."

Discussing cattle management influences, Wheeler said aggressive growth-implant protocols can increase beef toughness. Use of beta-agonist feed additives also makes beef less tender. Wheeler said the effects have been smaller with Optaflexx® than with Zilmax®.

"Not all animals are affected the same," Wheeler added. "Not all are tough after receiving beta-agonists."

Wheeler said research has shown that tenderness variation also occurs among dark cutters — animals producing dark-colored beef as a result of experiencing a period of stress just prior to slaughter. The darkest beef was actually the most tender, while only slightly dark or "shady" beef was less tender than normal beef.

According to Wheeler, slightly dark beef often makes it into the normal product mix. Since it can be tough, it could be the cause of some less-than-satisfactory eating experiences.

The role of collagen crosslinks in beef tenderness

Beef tenderness is important to consumer satisfaction, and a connective tissue protein — collagen — is an important contributor to meat tenderness and texture. Kansas State University meat scientist John Gonzalez talked about collagen and its relationship to beef tenderness.

Gonzalez explained how collagen is abundant in beef, occurring in layers around muscles, around muscle bundles and around individual muscle fibers. Collagen appears to be responsible for up to 90% of the variation in meat tenderness.

However, it is not the total amount of collagen present, but collagen crosslinking, that affects beef tenderness. Collagen molecules are bound together through intermolecular "crosslinks" that provide structure and strength. Greater amounts of mature crosslinks are thought to be significant contributors to toughness.

"Crosslink determinants include animal age and sex, as well as muscle location within



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the carcass," said Gonzalez. "Breed may have an effect, too."

Gonzalez described research attempting to measure crosslinks, noting the need to develop more accurate methods of measurement. He said questions remain regarding the pattern of crosslinking and what effects aging has on crosslinking.

To the question of whether manipulation of collagen (through genetic selection) is the next logical target, Gonzalez said, "Probably not."

Can we select for healthfulness of beef?

Among the goals for application of genomics is to develop selection tools applicable to novel traits such as healthfulness of beef. A pair of University of Nebraska



► Lauren Schiermiester described the study, which involved Angus, Simmental and Piedmontese cattle that had been genotyped using the 50K SNP chip.

graduate students described a research project designed to evaluate the potential for developing genomic predictors for healthfulness of beef.

Lauren Schiermiester described the study, which involved Angus, Simmental and Piedmontese cattle that had been genotyped using the 50K SNP chip. Beef from these animals was evaluated for mineral and fatty-acid composition and results showed variation in the levels present exists.



► Cashley Ahlberg said the results suggest that cholesterol and protein levels, as well as minerals and fatty acids are at least partially under genetic control. Relationships between the components also exist.

In her subsequent discussion of the study's outcome, Cashley Ahlberg said the results suggest that cholesterol and protein levels, as well as minerals and fatty acids are at least partially under genetic control. Relationships between the components also exist.

"Selection for change should be possible," stated Ahlberg.

Breeding for a reduced environmental footprint

It's become popular in recent years to be environmentally conscious. Plenty of people fret about greenhouse gas emissions, for example. It seems to be human nature to attempt to fix blame on someone. The beef industry has been a frequent target, but Donagh Berry, a geneticist with the Animal Research and Innovation Centre in Ireland, says the beef industry's accusers are being unfair.

"Let's set the record straight," Berry declared. "Beef producers (worldwide) actually have achieved a 16% reduction in carbon dioxide equivalents per billion from 1977 to 2007."

Of course, beef producers can't rest on their laurels. Berry said their breeding goal should be to improve the ability of animals to make a profit in an environmentally responsible and sustainable manner. Establishing each breeder's own breeding objective is more difficult. That, said Berry, involves addressing traits that generate revenue, hold down costs of production

Role of research herds

Agricultural researchers are in a precarious position. The cost of research is growing, while government appropriations for public research are declining in many states and flat in others. According to Kansas State University Animal Science Department Head Ken Odde, even land-grant universities now rely on private sources for an ever-greater portion of revenue.

"What's happening is the privatization of our public institutions," lamented Odde, in a presentation delivered during the 2014 Beef Improvement Federation (BIF) symposium June 18-21 in Lincoln, Neb. "Private donations often come with strings attached. They may not be driven by concern for the public good, but by an agenda."



► Ken Odde said university beef cow-calf research and teaching herds have fared better than some other areas.

maintained nearly constant numbers, and 30.7% of units have decreased their numbers.

Odde said stable numbers probably are the best that can be expected in the future, with slight decreases just as likely. In his opinion, it's a sorry situation.

"Cow-calf units remain critical to answering important questions," stated Odde. "For example, we need to really understand feed efficiency in cattle. I think it's critical that we measure feed intake of cows on pasture. We could do that but we aren't."

Listing threats to the viability of university cow-calf units, Odde included land use restrictions due to urbanization, aging facilities, labor availability, plus environmental and waste management issues. Budget constraints present a major threat, forcing researchers to become increasingly dependent on self-generated funds and grants.

"We haven't been selling the public good that comes from public institutions, and I put part of the blame on institutional leaders. University presidents and regents aren't talking about it like they once did," declared Odde.

— by Troy Smith, field editor

and address social and environmental concerns.

While there has been much talk about reducing methane produced by cattle and more about improving feed efficiency, Berry would not bet the farm on either of those targets. He suggested cattle producers focus their attention on reducing days on feed,



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increasing growth rate and maintaining fertility while maintaining or improving milk production. That focus, he said, will improve profitability and reduce the industry's environmental footprint.

"Good fertility rates and good growth rates will optimize water use, and that will be a big concern in the future," explained Berry. "I'd argue that days on feed is a better measure than feed intake. It gives a better indication over the lifetime of an animal. [Fewer] days on feed and less feed per day offer huge environmental benefits."



Editor's Note: The 2014 BIF Annual Meeting & Research Symposium was hosted by the University of Nebraska-Lincoln, the U.S. Meat Animal Research Center and the Nebraska Cattlemen June 18-21 in Lincoln, Neb. The Angus Journal and LiveAuctions.tv provide comprehensive online coverage of the event at www.BIFconference.com. Visit the Archive to find the 2014 meeting's Newsroom to access summaries, proceedings, PowerPoints and audio of the sessions.