BCRC RESEARCH FACTS

BEEF CATTLE RESEARCH COUNCIL — RESEARCH & TECHNOLOGY DEVELOPMENT FOR THE CANADIAN BEEF INDUSTRY

Testing for Beef Tenderness

Project Title:		Project Code:	4.24
Validation of a Genetic Marker for Beef Tenderness		Completed:	*December 2006*
Researchers:			

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Background

Providing consumers with consistently tender beef, the holy grail of the beef industry, leads to satisfied customers and increased sales. However, numerous beef quality audits have demonstrated that nearly one fifth of beef is unacceptably tough.

Beef tenderness can be improved by aging, but cooler space and refrigeration costs make aging an expensive process. Genetically improving beef tenderness using conventional breeding and selection methods has been challenging. Traditionally, the only way to determine whether a sire was 'genetically tender' was to eat his progeny, but the cost and time required for these tests discouraged large scale attempts to breed for improved tenderness.

Recent advances in genomics technologies have allowed researchers to identify DNA markers associated with different beef production traits, including tenderness. This could allow the genetic merit of potential breeding stock to be evaluated earlier and more economically than progeny testing. Genes that determine how beef responds to aging are a logical place to find tenderness markers.

The calpain enzyme naturally breaks down the muscle fibres in beef during the aging process. Calpastatin is a protein that inhibits calpain. The University of Guelph previously identified a calpastatin gene marker that was associated with differences in beef tenderness. Slight changes in the DNA sequences coding for calpain or calpastatin affect how they function or interact and may affect beef tenderness. Before this genetic test could be confidently marketed to cattle breeders and producers, it needed to be validated with additional animals.

Objectives

To validate the University of Guelph calpastatin DNA marker in cattle with feedlot performance, carcass and meat quality records.

What they did

Calpastatin genotype was determined in 728 cattle from the University of Guelph research breeding herd. Carcass data and meat samples were collected from each animal. Ribeye steaks were tested for mechanical tenderness (shear force) after 7, 14 and 21 days of aging.

What they learned

As expected, aging beef increased steak tenderness. At 7 days of aging, 44% of steaks were tough, 22% were tough after 14 days and 7% were tough after 21 days.

The calpastatin genotype also affected tenderness; 37.1% (CC genotype), 42.6% (CG genotype) and 51.4% (GG genotype) of the samples were rated "tough" after 7 days of aging. Cattle with the CC genotype for this calpastatin marker produced 28% fewer tough steaks than GG cattle, confirming the University's preliminary study on this marker. The calpastatin genotype did not affect tenderness after 14 or 21 days of aging; all genotypes had similar tenderness at these aging times.

What it means

The genetic marker used in this study worked very well to identifiy animals with tender beef, but it is important to keep in mind that this is only one marker in one gene. There may be other markers within the calpastatin gene that can help predict tenderness. Several other genes affect beef tenderness, and each may have its own markers. In the future, combining all of the validated tenderness markers into a panel of DNA markers may be the most informative and user-friendly approach. These panels could be used by breeders to identify breeding stock with the genetic potential to produce tender beef, by commercial producers and feedlot operators involved in retained ownership or grid marketing programs to identify cattle that are suited for a particular market, or by packers to allocate beef and cuts to high quality product lines and identify cuts that would benefit from aging.

This calpastatin marker (called UoGCAST1) has been licensed to Merial, and now forms a part of the Igenity tenderness panel together with some calpain markers (www.igenity.com). This panel has been validated on more than 1,200 cattle from a variety of breeds. The results of the validation tests can be seen at: http://www.ansci.cornell.edu/nbcec/validation/igenity/tenderness.html.

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