



Meeting Summary

NATIONAL BEEF INSTRUMENT ASSESSMENT PLAN II

Focus on Tenderness

Producing beef products that are consistent in quality is not a simple task. The beef industry has struggled with this challenge. Working with products that originate from multiple breeds and thousands of producers who use different production systems, the variability in carcasses is immense. The National Cattlemen's Beef Association brought together a group of industry professionals who represented all segments of the beef production chain as well as company representatives from the processing, retail and foodservice sectors to address this challenge. This group was given the task of developing an action plan to address the one attribute that consumers most associate with eating quality- tenderness.

How can tenderness levels be made more consistent? How should the outliers, or "tough" carcasses be identified and removed from the beef chain? The implementation of standard production practices that optimize tenderness attributes will cost money, so how will all sectors of the beef chain be compensated for their additional investment? These are just a few of the comprehensive questions that were discussed during the meeting.

Consumer economics as related to tenderness

The 1980s were a period of high beef consumption and consequent high retail prices but a drop in consumption in the 1990s led to a 30% price decrease. The low point in the demand index occurred in 1998 when it hit 50. What were some of the causes associated with this drop in beef consumption? Tenderness, flavor, consistent quality, health and nutrition, safety and competitive prices of other proteins were attributes identified as problem areas. What was the solution? Invest in technology and processes to improve beef product offerings.



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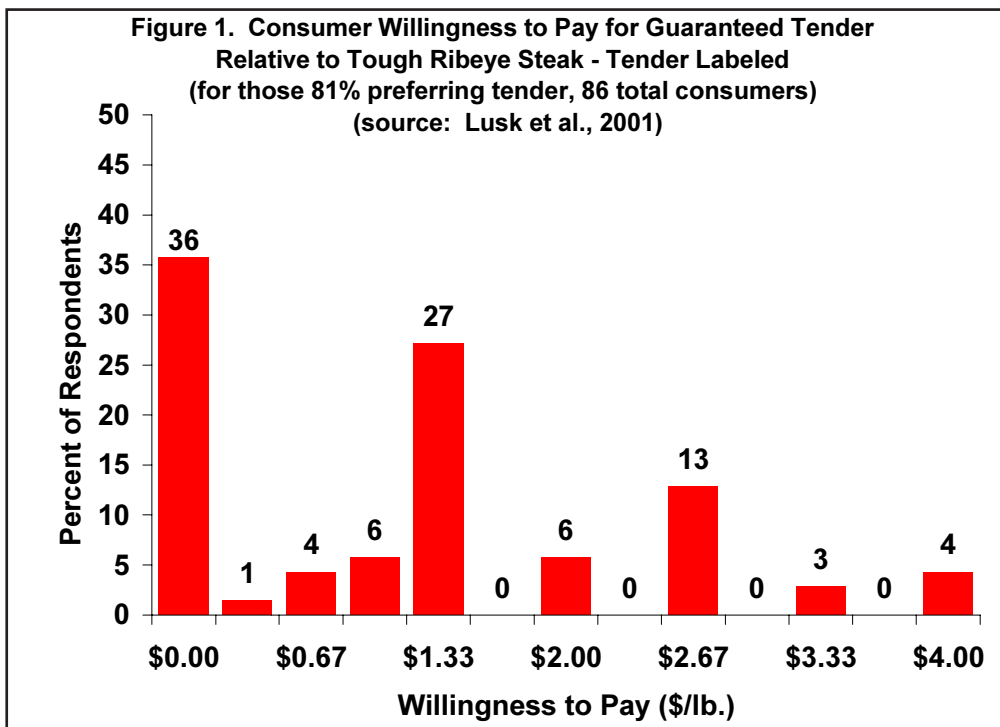
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Multiple studies have been completed recently that addressed the question, "Are consumers willing to pay more for guaranteed tender products"?



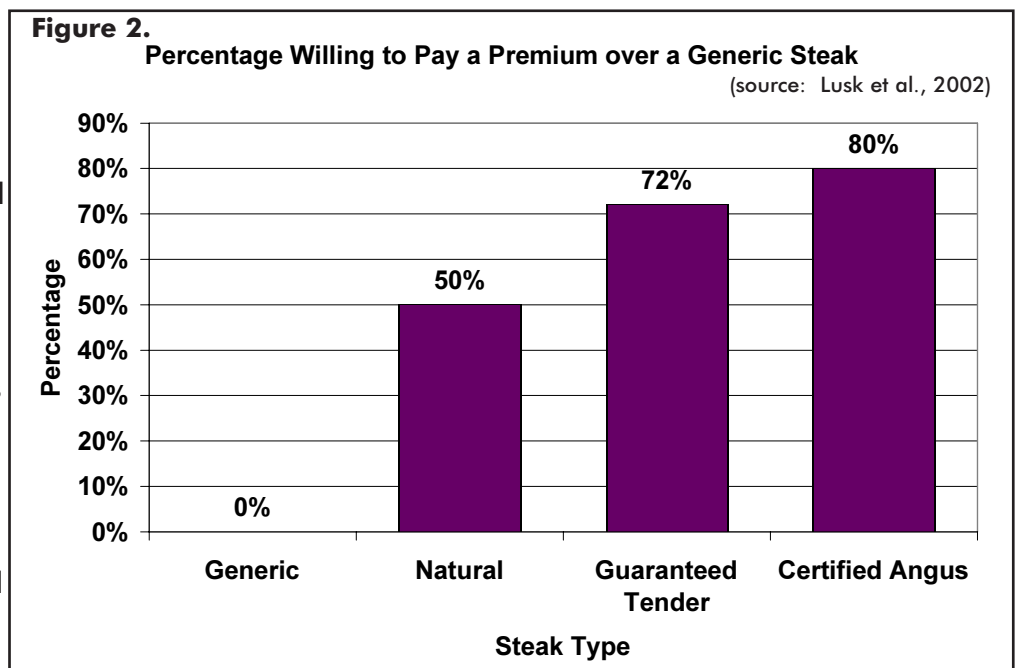
A study at Kansas State University (Figure 1) offered consumers one tough and one tender steak. Consumers could exchange one steak for the other after taste tests. When steaks were labeled as tough and tender, 81% of the consumers showed a preference for the tender steak (Lusk et al., 2001).

In another Kansas State study, consumers were able to bid on 4 steaks labeled as Generic, Natural, Guaranteed Tender, and Certified Angus Beef. 50%, 72% and 80% of consumers were willing to pay

premiums for Natural, Guaranteed Tender and Certified Angus Beef respectively (Figure 2). However, participants were not willing to pay a premium for commodity steaks.

Tenderness is not the only factor that affects consumers' beef purchases. Product brand, trust and perceptions also matter. This fact is illustrated by the number of respondents who were willing to pay a premium for Certified Angus Beef even though it did not have a tenderness guarantee (Figure 2).

A third study sponsored by NCBA and conducted with King Soopers in Denver (Shackelford et al., 2001) indicated 50% of consumers "definitely" or "probably" would pay 50¢/pound premium for guaranteed tender U.S. Select grade steaks. This study also determined that consumer ratings for like, overall satisfaction, tenderness, juiciness and flavor were all higher for guaranteed tender Select and these ratings were more highly correlated to trained sensory tenderness rating than to trained sensory juiciness or flavor ratings. Thus, consumers can detect differences in beef tenderness, a segment of consumers are willing to pay a premium for guaranteed tender Select steaks, and tenderness is the primary determinant of consumer eating satisfaction for top loin steaks.



Branded product marketing as well as numerous research studies has shown that consumers will pay for tenderness. So, if consumers are willing to pay more for guaranteed tender products, how does the beef industry produce these products and realize an economic return for their investment in quality systems?

Where do we stand today and what product attributes affect palatability?

Tenderness and flavor are equally important to consumers when characterizing a product's palatability. Tenderness variation can be affected by genetics and production and processing techniques. Flavor can be manipulated by consumers through the use of spices. Juiciness of a product also affects the palatability. This effect is controlled by consumer cooking methods.

How do we sort for tenderness today?

One way that beef products are sorted for tenderness is by type of cut. We know that middle meats (loin and rib) are generally more tender than end cuts (chuck and round). Middle meats have been considered the most tender and palatable part of the beef carcass for many years and therefore price pressure is on these cuts.

USDA Quality Grade is used as a marketing tool to differentiate between tenderness levels. Even though research has shown that the correlation between marbling and tenderness is not very high, particularly for the majority of beef that falls into the Select and Low Choice grades. Some branded programs, which are a new addition to the beef industry, use total quality systems/controlled management systems and product specifications to insure more consistent eating experiences for consumers.

Alternative processing methods for products that do not meet industry standards for acceptable tenderness include: enhancement (marination, needling, etc...), value added (cooking, further processing) and grinding.

The consensus of the group was to focus on identifying and eliminating the tough carcasses from the system. By removing the outliers, or "tough" cattle, the population as a whole would become more tender. The elimination of these tough carcasses should lead to genetic decisions

that would purge the production sector of genetic lines that are producing undesirable carcasses as well as evaluation of production practice effects on tenderness.

Tenderness Optimization Tools

As soon as a tenderness prediction technology is in place so that baseline data is available, then sources of variation and approaches for improving tenderness can be identified.

The most important factors affecting meat tenderness appear to be conditions immediately before and after slaughter. Postmortem aging time, high voltage electrical stimulation, and postmortem chilling conditions can have enormous effects on meat tenderness. High voltage electrical stimulation and 14 d postmortem aging time should be implemented to maximize the consistency in tenderness. Animal stress immediately before slaughter also can impact tenderness.

Genetics may be an important tool to use in the elimination of sires/animals that fall into the extremes for tough meat. Genetics account for about 30% of the variation in tenderness. Research studies such as the Carcass Merit Project are generating data that may help beef producers to make informed decisions on genetics that may assist in removing undesirable genetic lines from the cattle population.

A Colorado State Study (Tatum et al., 1999) demonstrated the effects of employing Palatability Critical Control Points throughout the entire chain. The critical control points outlined in this study were genetics, pre-harvest cattle management, early postmortem management, shear force verification of tenderness, calcium chloride intervention for animal exceeding the shear force criteria, and postmortem aging. By implementing production practices that optimize the tenderness potential of individual animals, variability in tenderness is reduced and the value of using these total quality systems is the reduced frequency of poor eating experiences by consumers.

The following lists of Best Production Practices are meant to serve as thought starters and not as a comprehensive list of all production practices that could be implemented as part of a Total Quality System to optimize tenderness.

Best Production Practices for Tenderness Optimization

Seedstock and Cow/Calf

- Utilize genetic lines that have been validated to produce desirable tenderness characteristics in progeny.
- Remove animals from production that produce progeny with undesirable tenderness characteristics.

Commercial Cattle Producer

- Manage available genetics to optimize tenderness without losing production efficiencies.
- Use best practices to promote animal health and reduce treatment affects on meat quality.
- Appropriate use of growth modulators.

Grower/Feeder

- Continue use of validated Excellent Health Programs.
- Keep cattle gaining on a high plain of nutrition.
- Reduce the number of short-fed cattle.
- Reduce stressful conditions for the cattle.
- If technology is available to determine the tenderness rating of an animal then, management practices to optimize yield can be put into action without negatively impacting product quality.

Processor

- Implement slice shear force to obtain baseline tenderness data and evaluate raw material suppliers for tenderness so that decisions can be made regarding what other steps may be necessary to improve tenderness. When possible, pass this information back to producers to facilitate selection for tenderness when possible.
- Minimize cattle handling stress.
- Use effective (high voltage) electrical stimulation.
- Minimize cold shortening by creating an environment in which pre-rigor chilling conditions are not severe.
- Facilitate meat aging programs for customers.
- Sample enough of the population and provide feedback to suppliers as a tool to improve the team aspect of product variation reduction.
- Use when necessary more aggressive methods to reduce toughness (enhancement, cooking, etc.).

End User Retail/Foodservice

- Put the cost of aging into pricing and evaluation models.
- Establish protocols that prohibit middle meats with less than 11 days of aging from entering the consumer supply chain.
- Provide more feedback to suppliers regarding the quality and consistency of beef purchased.
- Use simple technology such as needle tenderization to provide insurance of eating satisfaction.

System Issues that must be considered prior to implementation.

- Are all the players committed to the cause?
- Are the right value signals obvious to the players?
- What is the long-term plan for each player?
- Is the system servicing a specific customer or is the customer(s) part of the system?
- Do the system players understand the sources of variation in tenderness and are processes in place to measure and modulate?

To facilitate the use and implementation of best production practices there is much information that must be gathered and questions answered for each sector to be successful. The following lists illustrate those requirements.

Data gaps and requirements for production sectors

Seedstock

- Tenderness EPDs for bulls.
- Economic signals that communicate the message that "tough" sires are undesirable.

Cow/Calf

- Economic model that provides the justification for investment in proven "tender" genetics without sacrificing production efficiencies.
- Genetic and pre-harvest predictor of tenderness.
- Accurate post harvest identifier of tender carcasses.
- Objective criteria for improvement
- Must be able to tell the producer why the carcass was tough. What phenotype, breed etc...
- Production practices effects on the tenderness/quality of carcasses.

- Individual animal ID system that allows for improvement.
- What are the costs of the system?
 - Where? How much? How can they be lowered?
- How can cost and value sharing among all production segments be improved?
- Data sharing of post-harvest tenderness across all production sectors to initiate genetic improvement.

Stocker/Backgrounder

- Individual animal ID system.
- Established protocols for animal health, management and handling that are established/requested by customers.
- Research data on the effects of treatment for sickness on tenderness.
- Guidelines for visually culling the outliers in this production segment.

Feedlot

- Establish protocols for animal health, management and handling created/requested by customers.
- Validation of a proven tenderness prediction system is needed.
- Availability of critical management information and breakdown of dollars shared among segments.

Packer

- Technology that can accurately and repeatedly classify carcasses into tenderness groups.
- In order to effectively manage and reduce variation in tenderness, one must be able to accurately measure this trait.
- Technology should meet the following criteria:
 - Can be used on every individual.
 - Rapid in nature.
 - Non-destructive of product.
 - Compatible with current data system.
 - Should be a direct measure of tenderness at the consumer level.
- System must be able to categorize product into tenderness categories-*ie* Superior, Intermediate and Inferior.

Foodservice/Distributors

- Answers to the following questions:
 - How well do tenderness predictors for (middle meats) coordinate with the tenderness of end cuts?
 - What is correlation between tenderness predictors and consumer perceptions of tenderness?
 - Greater volume of certified tender product.
 - Integration with other segments of the beef chain.
 - Technology for rapid assessment of tenderness would allow the processor to alter market channels and possibly introduce aggressive measures to insure tenderness.

For example; "tough" product could be marketed to companies that make value added products through cooking, alternatively these products could be needle tenderized prior to sale to the end users.

Retailers

- Eliminate tough carcasses from the system.
- Alternative market channels for tough carcasses.
- Standard middle meat aging of 14 days.

Current Technology and Requirements of Systems

Technology to classify carcasses based on tenderness must be accurate, fast, durable, reasonably priced and have the ability to reflect tenderness of the various cuts after advanced aging.

Three technologies (MARC Slice Shear Force, BeefCam, Wulf Colorimeter) were recently compared in an NCBA supported study (Wheeler et al., 2002).

This study made the following conclusions: Indirect, non-invasive methods to predict meat tenderness that are based primarily on lean color are not currently sufficiently accurate to warrant their use. BeefCam did not perform well in this study. The Colorimeter performed inconsistently, appearing to be useful in Phase I, but not in Phase II, and was of little value when used within USDA Select. The direct measure of tenderness provided by Slice Shear Force results in a more accurate identification of "tender" beef carcasses than either

of the indirect technologies, BeefCam or Colorimeter, particularly for USDA Select carcasses. As tested in this study, Slice Shear Force, but not the BeefCam or Colorimeter systems, accurately identified "tender" beef. Direct methods to predict meat tenderness, such as slice shear force, are currently necessary to obtain accurate identification of beef that can be guaranteed tender.

Additional technologies and systems to predict meat tenderness are in development at various institutions and companies.

Action Plan

Working groups were formed to discuss three specific areas of concentration for research and data collection to address the many questions/issues posed during this meeting. NCBA staff members will work with these groups to facilitate initiation of projects and coordination of group initiatives.

Instrumentation Working Group

Objectives

- Review shear force values from Consumer Satisfaction Studies to determine the threshold Warner- Bratzler Shear values to be used as the initial target for instrumentation sorting of carcasses.
- Work with scientists to develop standard slice shear force protocols.
- Develop a set of performance criteria/focus for instrumentation development so that researchers have a well defined target.

Data to collect and summarize

- Implement Slice Shear Force at 2-3d postmortem in as many plants as possible to get an idea of what level of tenderness variation really exists so that sources of this variability can be identified and approaches developed to improve consistency.
- Consumer Satisfaction Studies
- Protocol Carcass Merit
- Ranch to Rail data

Research Ideas

- Set target for accuracy and repeatability of instruments.
- Standardize slice shear force protocol including cooking methods, etc. and verify all institutions get the same results.

Economics Working Group

Objective

Quantify the value/economics of implementing a tenderness verification system throughout the entire chain.

Thought starters

- Collect baseline tenderness data
- Identify Costs of Production at each sector.
- Develop a Tenderness Computer Aided Retail Decision System.
- Research the benefits of not using implants and the effects of different implant regimens on the cost of production and tenderness.

Research Ideas

- What are the costs and economic effects of changing the grading scheme to include a tenderness classification?
- Costs associated with incorporating Best Practices into a tenderness Quality Assurance program
- Need a Third Party to verify the process
- What is the cost of aging products?
- Storage costs
- Effects of aging on color during retail display
- Complete a new Customer Satisfaction Study.
- Retailers need to evaluate the price points for tender beef.

Optimum Production Practices

Working Group

Objective

Identify optimum production practices to minimize tenderness variation.

Data to collect and summarize

- Baseline tenderness data from many plants
- Colorado State Implant Study
- CSU Palatability Critical Control Points
- Carcass Merit Study
- Customer Satisfaction I & II Studies
- Production Practice papers
- Yearlings vs. Calf Fed research

Research Ideas

- Look at no-roll sector; what is tender? And what caused the non-conformity?
- What is the optimum age for various muscles and best application (case ready vs food service, etc)?

- Do Critical Control Points within a production system have an additive effect?
- Complete a white paper on production practices
 - yearling/calf fed, days on feed etc. and their effects on tenderness.
- ❖ Information distribution to end-users through FMI, AMI, NRA and the Beef Quality Assurance network.

Summary

- Consumers can detect differences in beef tenderness and some consumers are willing to pay a premium for guaranteed tender beef.
- Industry needs to begin implementing Slice Shear Force in as many plants as possible to get baseline tenderness data so that sources of variation and approaches for improving tenderness consistency can be identified.
- Development of non-invasive approaches for tenderness prediction should continue.
- The contribution of many factors to tenderness variation are still not clear.
- Slice Shear Force at 14 days postmortem should be adopted as the end point measurement of tenderness.

This is a continual improvement process and there is not one system that will work for everyone or solve all tenderness issues at once. All segments of the beef industry must work together and effectively communicate across sectors to optimize the tenderness of U.S. beef products.

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