The Color of Tenderness

The RMS logo appears when CVS BeefCam certifies a carcass is tender.

Does BeefCam™ offer an effective means to further sort beef carcasses for projected eating quality, particularly in branded beef marketing programs?

BY TROY SMITH

Much has been said about the problem of inconsistent beef quality. For most of a decade, pundits have harped on the palatability problem, driving efforts to develop value-based marketing systems that communicate consumer preferences throughout the production chain and reward producers who satisfy those preferences.

There also has been considerable debate regarding the role of U.S. Department of Agriculture (USDA) quality grades as an indicator of eating quality. Is the relationship between quality grades and palatability strong enough to warrant significant price differences among carcasses of different quality grades?

It's been argued that the purpose of quality grades never has been to guarantee a satisfying eating experience, but to inform retailers and consumers concerning the risk of certain carcasses' delivering a poor experience.

Using USDA quality grades to sort carcasses for eating quality presents a challenge because the lion's share of U.S. fed beef represents a narrow range of quality-grade variation. Roughly 80% of production exhibits limited diversity of marbling scores, grading either USDA Select or low-Choice, and consumer dissatisfaction with the eating quality of beef generally relates to carcasses within that range.

Above: BeefCam helps channel the most palatable carcasses toward value-based marketing opportunities, but it also identifies those carcasses whose values might be improved through enhancement or further processing.

Assessing palatability

Hence came the call for an instrument grading system that, ideally, could estimate carcass yields and generate information to facilitate the sorting of carcasses from a narrow range of quality grades based on their expected palatability.

In the most basic terms, we're talking about a tool to sort the tender from the tough. But advocates of the instrument-grading concept sought reliable, accurate tools for measuring all of the factors that contribute to consumer satisfaction, while reducing production costs and waste. Meat scientists concluded, during a 1994 National Beef Instrument Assessment Planning Symposium, that visual image analysis (VIA) was a technology offering considerable promise for success.

One of the most promising applications of VIA technology is BeefCam™. Keith Belk coordinated the research at Colorado State University (CSU) that developed this carcass-palatability-assessment technique involving evaluation of color in beef ribeyes.

"Several previous studies, including work done by Duane Wulf [assistant professor of animal and range sciences at South Dakota State University (SDSU)], had shown how the colors of lean and fat were related to eating quality," Belk says. "Muscle and fat color can be used to measure several palatability traits, including the presence or absence of marbling, physiological maturity of lean, muscle pH and amounts of connective tissue within the muscle.

"Hunter Associates Laboratory Inc. (HunterLab), Reston, Va., already had developed video imaging technology to measure color. So it made sense to put it all together, in a system using color parameters derived from the surfaces of ribeyes, to use as a tool for sorting beef carcasses on the basis of expected eating quality. So we sought support from some breed groups and the

The Computer Vision System (CVS) is a two-camera arrangement capable of capturing and channeling carcass information through different software modules. It was recently approved by the U.S. Department of Agriculture (USDA) to help its graders assign more accurate yield grades.

National Cattlemen's Beef Association (NCBA) to build a prototype machine for the HunterLab BeefCam system."

Measuring color

Essentially, BeefCam is a digital video camera that takes pictures of the ribeye, feeds them into a computer and transfers real-time images to the computer screen. The images contain up to 250,000 data points, or pixels, allowing separation and measurement of different colors.

HunterLab had been in the business of measuring color for more than four decades, supplying systems to a variety of industries, including manufacturers of denim clothing. Makers of stone-washed jeans, for example, use HunterLab equipment to monitor, measure and control the degree to which the jeans are faded during

washing. Since stone-washed denim is not a solid color, the equipment allows the manufacturer to monitor, quantitatively, not only the overall color but also the degree of color uniformity, which gives the fabric a desired character.

This application is similar to what is expected of a beef-grading instrument that would sort carcasses by palatability characteristics of lean and fat. The technology is complex, but the bottom line is this: The BeefCam system quantifies color parameters of lean and fat, which are known to be correlated with palatability. It sorts the tender from the tough, identifying carcasses eligible for certification as tender. It also identifies carcasses that would benefit from enhancement or tenderization measures.

From the beginning, Belk

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—Jo Weaber

says, BeefCam's performance was encouraging, particularly since data were collected with generic software. A system containing hardware and software specifically designed for evaluating beef carcasses was developed and evaluated.

Results showed that 95%-97% of the carcasses identified as tender by BeefCam were tender. However, the prototype exhibited less accuracy in predicting toughness. Of the carcasses not selected as tender, 60%-75% actually were acceptable for tenderness.

"We're working on new software that addresses that problem," Belk says. "Still, I'd have to call the study results *encouraging*. And commercial application of BeefCam has been encouraging, too."

Helping graders

The commercialized BeefCam represents a collaboration of CSU, Smart Machine Vision (a division of HunterLab) and Research Management Systems USA Inc. (RMS). RMS has had instrument-grading systems

installed at major packing facilities since 1996. It joined with Smart Machine Vision to manufacture and to market BeefCam.

RMS's flagship technology is the Computer Vision System (CVS), a two-camera arrangement capable of capturing and channeling carcass information through different software modules. BeefCam is now one of three CVS modules used to evaluate carcass quality.

The Yield Grade Augmentation Module was developed to provide USDA graders with accurate ribeye area (REA) measurements to help assign yield grades in one-tenth increments. The third module, a Tagger Interface Console, helps packing plant taggers compare carcass quality and yield characteristics with the specifications of various beef customers and sort carcasses to the most appropriate program.

"Instrument grading technology is still new in this country," says Jo Weaber of RMS's Fort Collins, Colo., office. The company also has operations in Canada, where it began pioneering technologies for the red-meat industry.

"Currently, computer analysis (of carcasses) is being used by several U.S. beef packers. This technology has the potential to validate value-based marketing programs," Weaber adds. "Our CVS Yield Grade Augmentation Module has USDA approval and is being considered by both packers and alliance groups. I think BeefCam will be widely accepted, too."

Not a replacement

The vigor with which packers embrace BeefCam will depend upon its performance in the real world.

The first commercial application of the technology began about a year ago when Beefmaster Cattlemen LP incorporated BeefCam for the selection of product to wear their "Nolan Ryan All-Natural Tender Aged Beef" label. The Beefmaster breeders' organization had helped fund development of the technology and gained the right to use BeefCam first.

"A way to evaluate tenderness at chain speed is just what we wanted. And you can't conduct a Warner-Bratzler shear test every six seconds," says Charlie Bradbury, CEO of Beefmaster Cattlemen. "BeefCam has been extremely accurate. It correctly sorts carcasses for tenderness 95% to 98% of the time. When we do get errors, it's when carcasses selected as tough turn out to be better than predicted. It's not a big problem for us because our main focus is to identify and certify tender beef for the branded program."

In addition to providing assurance that their program delivers only satisfactory eating experiences, Bradbury says the computer vision system facilitates effective management at both ends of the industry. Carcass data, including tenderness scores, are collected and recorded instantly for feedback to producers, thus providing information to influence genetics.

In the packing plant, BeefCam helps channel the most palatable carcasses toward value-based marketing opportunities, but it also identifies those carcasses whose values might be improved through enhancement or further processing.

Belk is quick to point out that BeefCam was neither proposed nor developed as an alternative to the USDA quality-grading system. He believes it does provide additional information and helps make required time-sensitive computations at commercial packing plants' chain speeds.

"BeefCam was never intended to replace USDA graders. It augments and refines the process. It functions to measure color on-line and predict palatability," Belk adds. "It's no silver bullet, but I feel pretty good about its potential. I believe it's an effective means to further sort beef carcasses for projected eating quality, particularly in branded beef marketing programs designed to improve consumer acceptance of — and loyalty for — U.S. beef products."

What do packers think?

What do major packers have to say about visual image analysis (VIA) — BeefCam™ in particular? Rob Cannell, director of research for ConAgra Meat Co., says the technology's absolute objectivity makes it appealing. He says ConAgra has been interested for years in systems offering highly consistent, accurate measurement of carcass traits for evaluation of cutability and palatability. Only recently, however, has the technology caught up with ConAgra's expectations. From a business standpoint, systems that help U.S. Department of Agriculture (USDA) graders calculate and assign yield grades probably take priority.

"Yield grade is very important to a packer. By contrast, tenderness evaluation is something that will be pulled, rather than driven, through our operations. Processes like BeefCam are more likely to be adopted as a result of requests from our beef customers — customers wanting Select beef, but with the assurance of a satisfactory eating experience. When they come, we do want to be [in] a position to handle those requests," Cannell says.

"We're still in the testing phase. We're not using the technology routinely, but we are looking at beginning some company trials," he adds. "Of the carcasses BeefCam currently identifies as tough, a significant percentage actually are acceptable for tenderness. That remains an issue for us."

Glen Dolezal, Excel Corp., says his company uses the Research Management Systems USA Inc. (RMS) Computer Vision System to evaluate beef carcasses in six North American processing plants. He, too, is concerned about overlooking tender carcasses.

"We applaud the BeefCam effort; and, yes, we see its potential for creaming the coolers. But it hasn't been perfected as a payment tool," Dolezal offers. "So we haven't gone full-bore and included BeefCam in our systems. We're anxious to see the results of work to improve its accuracy on a higher percentage of carcasses."