

## **USMARC Beef Carcass Instrument Grading Systems**

Tommy Wheeler, Steven Shackelford, and Mohammad Koohmaraie  
USDA-ARS, U.S. Meat Animal Research Center, Clay Center, NE

### Evaluation of Beef Carcass Grades with Image Analysis

The USMARC beef carcass image analysis system objectively evaluates beef carcass grade factors including marbling score, adjusted preliminary yield grade, and ribeye area (Figure 1). This image analysis system can assess USDA yield grade more precisely and accurately than can be achieved by USDA graders. Furthermore, use of this image analysis system will allow for creation of additional yield grade classes beyond those that on-line USDA graders are capable of describing. Thus, use of this system would allow for more precise assessment of yield differences between carcasses (Figure 2). This system also has the ability to add objectivity to marbling score determination which should help to alleviate day-to-day and plant-to-plant differences in quality grade application. In comparison to existing systems for evaluation of carcass leanness, this system is expected to save the U.S. beef packing industry \$15 million dollars annually. Moreover, this process allows for a more accurate assessment of the value of each individual carcass. Therefore, use of this system will allow beef packers to objectively identify value differences between carcasses and compensate producers appropriately. This will facilitate a clearer line of communication between beef packers and beef producers regarding the value differences between individual animals or groups of animals. This information will allow producers to better understand the impact of their management decisions on the value of their product. In turn, this information will allow for more efficient production of cattle that excel in leanness which will improve the profitability of beef production and the competitiveness of U.S. beef in the global marketplace.

In cooperation with supervisory officials from the Standardization and Meat Grading branches of the Livestock and Seed Division of USDA-AMS, USMARC scientists collected and analyzed the necessary data to obtain AMS approval of this system for measurement of yield grade of beef carcasses. AMS has approved the USMARC beef carcass image analysis system for on-line use in determining official beef carcass yield grades. AMS is currently conducting a series of national tests to evaluate the use of this system for marbling score determination.

One of the four major U.S. beef packing companies has implemented this system, another one is in the process of implementing this system and a third company is considering implementation of this system. Additionally, one niche beef company has implemented this system. Industry wide adoption of this system will allow producers to make transparent comparison of marketing bids between packers without concern for differences between packing plants in methods to assess yield grade. The distributor of the system is E+V, Inc. ([www.eplusv.com](http://www.eplusv.com)).

### Beef Tenderness

Because of the industry's interest in sorting carcasses based on tenderness, we developed a method using slice shear force early postmortem that could very accurately predict 14 d postmortem tenderness. A few companies have used this approach very successfully. However, most of the industry concluded this approach was too expensive and they encouraged us to develop a non-invasive method that was sufficiently accurate.

Thus, we have worked for the last 12 years on development of non-invasive technology for prediction of beef tenderness. We have focused on classification of U.S. Select carcasses

because U.S. Select cuts are currently marketed at a discount relative to U.S. Choice cuts, despite the fact that cuts from many U.S. Select carcasses are very tender and consumers have shown a strong willingness to pay a premium for "Tender Select" cuts that combine superior tenderness with the leanness of Select.

We developed the reflectance spectroscopy technology for predicting tenderness (Figure 3) by first optimizing the protocol then testing it on-line in packing plants. Our first in plant test on 292 Select carcasses looked very promising. Those carcasses not predicted to be tender had 30.1% that were tough, while those carcasses predicted to be tender had only 5.5% that were tough. In order to be sure we had something that really worked, we conducted another experiment to confirm those results. Using another sample of 467 Select carcasses we found similar results. Of those carcasses not predicted to be tender, 23.2% were tough and of those predicted to be tender, only 6.8% were tough. These results convinced us that implementation of this technology should be pursued.

We contacted potentially interested industry groups and began working one-on-one with those that expressed interest to move the technology towards commercialization. We worked with an equipment supplier to develop a commercial system for on-line application to ribbed beef carcasses during carcass grading and sorting. We have validated this commercial system in four beef processing plants in cooperation with NCBA and industry partners. The system operates on-line and takes 2-3 seconds to measure each carcass. This technology will provide the industry with the ability to identify US Select and low Choice carcasses that will be more consistently tender after 14 days of aging for use in branded beef programs. On average, the system is 85 to 95% accurate at identifying carcasses with tender beef after 14 days of aging.

A number of packers have expressed interest but we don't know how quickly any of them might move toward adoption of the technology. The distributor of the system is Analytical Spectral Devices, Inc. ([www.asdi.com](http://www.asdi.com)).



Figure 1. USMARC beef carcass image analysis system for measuring yield grade and marbling score.

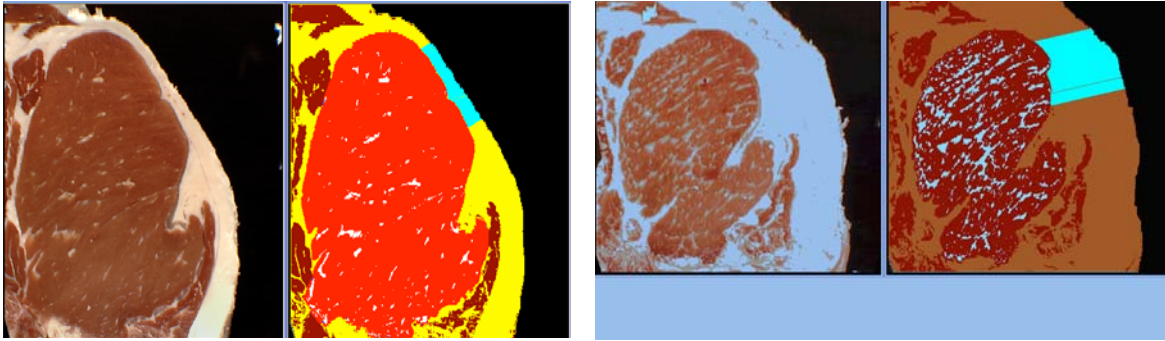


Figure 2. Results of image analysis showing the ribeye, other lean, fat, and marbling from low and high yielding carcasses.

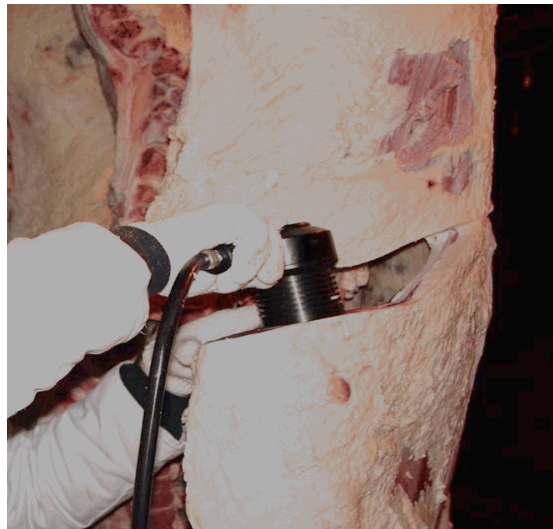


Figure 3. USMARC on-line reflectance spectroscopy system for predicting beef tenderness.