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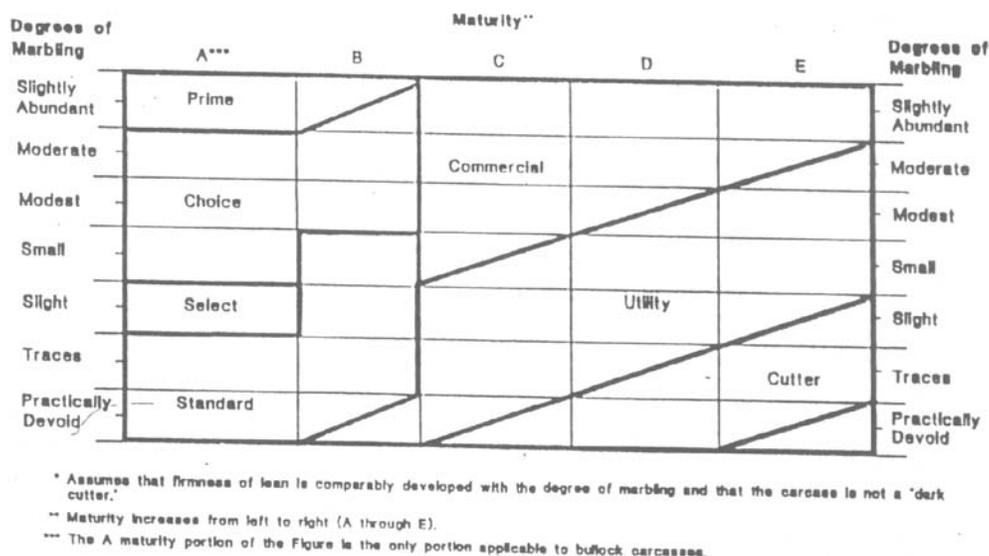
B-maturity: Factors Affecting Physiological Maturity

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INTRODUCTION:

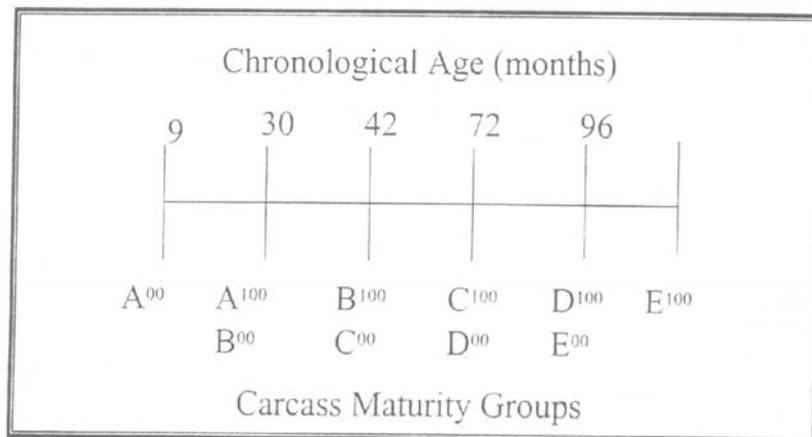
The United States Department of Agriculture (USDA) approved a change in its grading system in 1996 that became effective January 31, 1997. All carcasses with overall maturity scores of "B" (from cattle approximately 30 to 42 months of age at slaughter) and with Slight or Small degrees of marbling are excluded from the U.S. Choice and U.S. Select quality grades. In fact these carcasses will only be eligible for the U.S. Choice grade if they possess a minimum of Modest amount of marbling (Figure 1).

Figure 1 The new relationship between marbling, maturity and beef quality grades.



It is important to understand how carcass maturity scores are determined. Under the current US Quality Grading system, carcasses are segmented into one of five maturity groups based on estimates of physiological maturity. These groups are designated "A", "B", "C", "D", and "E" and can be further broken into 100 points, with 0 representing the youngest possible extreme within a group and 100 being the oldest possible within that group. It is important to notice the overlap of the A 100 with the B00, the B100 with the C00, etc. Under the current guidelines of the beef quality grading system any carcass that is assessed as A100 or B00 will be classified as A100, therefore making it eligible for quality grades that correspond to the "A" maturity grade (Figure 2).

Figure 2. The approximate chronological age with increasing physiological maturity.

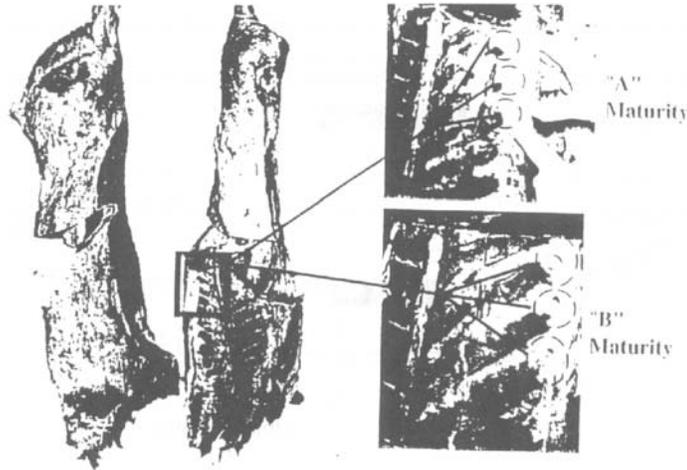


Determining the Carcass Maturity Score

The physiological maturity of a carcass is a very subjective estimate of the animal's true chronological age. Physiological maturity is assessed by evaluating the size, shape, and ossification of the bones and cartilage's -- especially the last three thoracic cartilage buttons or tips of the split chine bones of the forequarter and the color and texture of the ribeye muscle. Ossification is the hardening of cartilage into bone, a phenomenon that occurs in various areas of the skeleton as animals age. The following guidelines are set to differentiate between "A" and "B" maturity groups.

- "A" Maturity:
In young carcasses (those in the "A" maturity group), the skeletal characteristics will appear as follows:
 - (1) The cartilage on the ends of the chine bones show little or no ossification, cartilage is evident on all vertebrae of the spinal column, and the sacral vertebrae show distinct separation
 - (2) The split vertebrae usually are soft and porous and very red in color
 - (3) The rib bones have only a slight tendency toward flatness, and the color is bright cherry red.
- "B" Maturity:
In progressively more mature carcasses, the following changes occur:
 - (1) Ossification changes become evident first in the bones and cartilages of the sacral vertebrae, then in the lumbar vertebrae, and still later in the thoracic vertebrae. Also, the lean becomes darker colored and coarser textured.
 - (2) In "B" maturity carcasses the upper three thoracic buttons (See Figure 3) should have between 10% and 35% ossification (bone within the cartilage). The sacral vertebrae are completely fused, and the lumbar vertebrae are nearly completely ossified. The ribs are slightly wide and slightly flat.

Figure 3. A comparison of the ossification in the thoracic vertebrae of an "A" maturity carcass and "B" maturity carcass

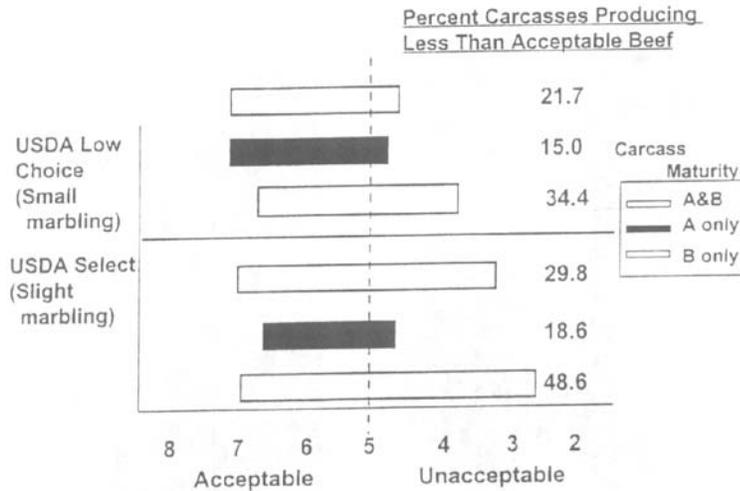


Relationship Between Carcass Maturity and Beef Tenderness

Leading into the proposed grade revision, most retailers, restaurateurs and purveyors agreed that the consistency associated with beef tenderness would be improved if the "B" maturity quality revision was accepted. According to National Cattlemen's Beef Association information more than 200 million undesirable eating experiences would be prevented as a result of the grade revision. Certainly, previous research on the relationship between carcass skeletal maturity and tenderness was taken into count when the proposed grade revision was being fleshed-out on the drawing board. Some "B" maturity carcasses in the U.S. Choice and U.S. Select quality grades do produce beef of satisfactory eating quality, but more than 40% do not - thus contributing to the inconsistency problem pointed out by beef merchandisers and consumers. In this connection, one might ask: What American consumer-product company could remain in business if part of its product line had a failure rate of 40 percent?

An accompanying chart (Figure 4) shows the results of sensory panel ratings of beef from more than 1,000 beef carcasses. When B-maturity carcasses are removed from the U.S. Choice and U.S. Select grades, quality variability is reduced (note the chart's shorter bars for A-maturity beef only) and the percentage of carcasses yielding less than acceptable beef is sharply reduced.

Figure 4. Sensory panel overall desirability ratings of "A" - and "B"-maturity beef.



Source: Texas A&M University Meat Science Department.

Variables Affected Skeletal Maturity of Beef Carcasses

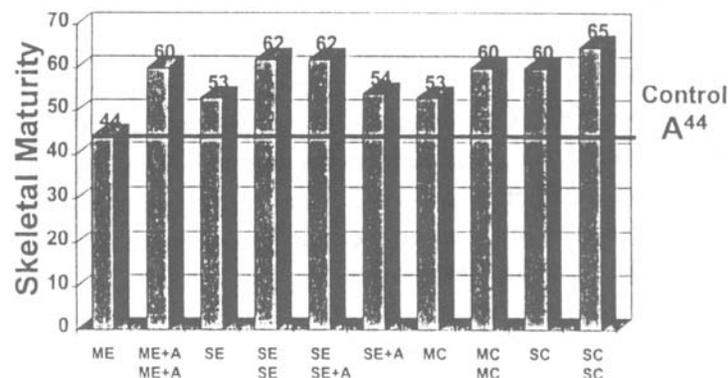
This change in the U.S. Quality Grading system has caused considerable controversy for several reasons, including the fact that the difference in carcass value of a U.S. Standard compared with a U.S. Select or Choice may be as much as \$25 to \$30/cwt. Furthermore, the relationship between carcass maturity and cooked beef tenderness may be affected by several factors other than actual age of the animal at the time of slaughter. The following list includes variables believed to influence carcass maturity:

- *Age of animal at slaughter:* Appraisals of carcass maturity are included in the USDA beef grading standards on the assumption that advancements in physiological maturity result in decreased cooked beef tenderness. Previous quality studies have indicated that substantial differences in tenderness exist between muscle samples from very youthful (A-maturity) as compared to very mature (E-maturity) carcasses (Romans et al., 1965; Walter et al., 1965; Breidenstein et al., 1968; Carpenter, 1974; Smith et al., 1982). However, research has also shown little difference in meat tenderness samples from "A- and B-maturity" carcasses (Smith et al., 1982; Miller et al, 1983; Shackelford et al., 1995; Field et al., 1996). In summary, the verdict is still out concerning the strength of correlation between maturity score (A vs. B maturity) and tenderness.
- *Gender status:* According to the latest USDA audit, the new "B-maturity" grading standard has downgraded 1.61% of the heifer carcasses compared to only 0.46% of the steer carcasses. It certainly is no surprise that a greater number of heifer carcasses are

being downgraded when compared to steer carcasses due to the fact that heifers are earlier maturing than their steer counterparts. Another factor that has certainly skewed more "B-maturity" carcasses in heifer populations is a unique production scheme referred to as the single-calf-heifer system (SCH). As described in 1985 by Taylor and his co-workers, the SCH system involves retaining surplus heifers, breeding them to produce one calf, and finishing them in a feedlot beginning shortly after parturition. The SCH system is very efficient because it combines reproduction and meat production into one system. This system results in a dramatically higher salvage value of the calved heifers relative to more mature cows and greatly reduces maintenance costs generally associated with traditional cow-calf operations. That's the good news; the bad news is that a high percentage of meat produced from this management style has less desirable shear force value and sensory ratings compared to meat from conventionally produced steers and heifers.

- *Implant status and frequency:* Results from implant trials conducted after 1989 were compiled to create the *OSU Implant Data Base*. Results were summarized to determine the impact of various implant types and schemes on beef carcass quality traits and meat tenderness. Compared to carcasses from non-implanted control animals, skeletal maturity of carcasses from implanted cattle was increased (Figure 5). In fact as implant strategy became more aggressive, the degree of increased carcass skeletal maturity became more pronounced. (General note: ME: mild estrogen implants consisting of Compudose or Ralgro; SE: strong estrogen implants consisting of Synovex, Implus, Magnum, Steer-oid or Heifer-oid; A: androgen implant consisting of Finaplix; MC: mild combination implant consisting of Revalor; and SE: strong combination implant consisting of Synovex Plus).

Figure 5. Impact of anabolic implant administration of beef carcass skeletal maturity.



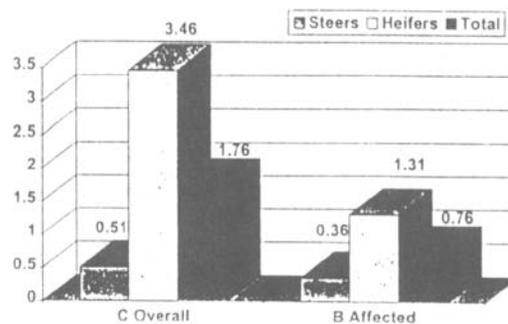
Source: OSU Implant Data Base, 1997.

"B" Maturity: Is It Impacting Our Industry?

Original USDA estimates stated that approximately 265,000 (0.94%) steer and heifer

carcasses would be downgraded to U.S. Standard in 1997. Economic losses associated with the production of advanced maturity carcass is estimated to be approximately \$60 million annually. Certainly, this did not account for potential losses associated with much of the downgraded beef from "B-maturity" carcasses which actually are very palatable. However, according to the most recent "B" maturity audit conducted by the Livestock and Meat Standardization Branch of the USDA, the new grading change has impacted approximately 0.76% (0.36% and 1.31% for steer and heifer carcasses, respectively) of the fed cattle in the U.S. (Figure 6). Surprisingly, many more "C" maturity carcasses are being found throughout the beef coolers of beef processing plants across the U.S.

Figure 6. "B" maturity carcass audit stratified by gender.



Source: USDA, February through June of 1997.

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