Improving The Quality, Consistency, Competitiveness And Market-Share Of Fed-Beef

The Final Report Of The Third Blueprint For Total Quality Management In The Fed-Beef (Slaughter Steer/Heifer) Industry

National Beef Quality Audit—2000

Conducted By:

Colorado State University

Texas A&M University

Oklahoma State University

West Texas A&M University

For The:
National Cattlemen's Beef Association

Funded By The:
Cattlemen's Beef Promotion and Research Board

This project was funded by beef producers through their $1-per-head checkoff and was for the Cattlemen's Beef Board by Colorado State University.

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I. EXECUTIVE SUMMARY

RESULTS OF THE NATIONAL BEEF QUALITY AUDIT—2000: In Phase I (Questionnaire Results), 518 Seedstock Generators reported that Changes They Had Made Since 1991 were: (1) Improved genetics (using performance), (2) Changed injection-site location, (3) Improved genetics (using physical traits), (4) Increased record-keeping, (5) Improved genetics (using carcass traits), (6) Improved genetics (using ultrasound), (7) Improved handling practices, (8) Collected carcass data, (9) Changed vaccination program, and (10) Maintained health/ management data, and that Results of Past NBQAs had "Strong Impact" (21.2%), "Moderate Impact" (54.0%) or "Weak Impact" (24.8%) on changes they had made. Cow/Calf Producers (N=1,424) reported that Changes They Had Made Since 1991 were: (1) Changed injection-site location, (2) Improved genetics (using performance), (3) Improved genetics (using physical traits), (4) Increased record-keeping, (5) Improved handling practices, (6) Increased individual animal identification, (7) Changed vaccination program, (8) Improved genetics (using carcass traits), (9) Changed preconditioning program, and (10) Maintained health/management data, and that Results Of Past NBQAs had "Strong Impact" (17.3%), "Moderate Impact" (59.7%) or "Weak Impact" (23.0%) on changes they had made. Stockers/Backgrounders (N=407) reported that Changes They Had Made Since 1991 were: (1) Changed injection-site location, (2) Changed genetic type(s) of cattle, (3) Improved handling practices, (4) Increased record-keeping, (5) Changed vaccination program, (6) Maintained health/management data, (7) Increased worker/employee awareness, (8) Provided incentive for preconditioning, (9) Provided incentive for genetic superiority, and (10) Collected and used carcass data, and that Results of Past NBQAs had "Strong Impact" (14.0%), "Moderate Impact" (59.5%) or "Weak Impact" (26.5%) on changes they have made. Feedlot Operators (N=262) reported that Changes They Had Made Since 1991 were: (1) Changed injection-site location, (2) Changed genetic type(s) of cattle, (3) Collected and used carcass data, (4) Improved handling practices, (5) Increased record-keeping, (6) Increased worker/employee awareness, (7) Changed implant strategy, (8) Provided incentive for preconditioning, (9) Maintained health/management data, and (10) Increased individual animal identification, and that Results Of Past NBQAs had "Strong Impact" (47.7%), "Moderate Impact" (40.5%) or "Weak Impact" (11.8%) on changes they had made.

In Phase I (Questionnaire Results), 29 Packers reported that the Greatest Improvements Made Since 1991 were in reducing the incidence of these quality defects or nonconformities: (1) Presence of injection-site lesions, (2) Carcass weights too light, (3) Reduced Quality Grade/ tenderness due to implants, (4) Inadequate muscling, (5) Too small ribeyes, (6) Hide damage due to parasites, (7) Carcass condemnations, (8) Excess fat cover, (9) Presence of bruises on carcasses, and (10) Hide damage due to brands, and that Results Of Past NBQAs had "Strong Impact" (6.9%), "Moderate Impact" (55.2%) or "Weak Impact" (37.9%) on those improvements. Purveyors (N=37) reported that the Greatest Improvements Made Since 1991 were in reducing the incidence of these quality defects or nonconformities: (1) Presence of bruises on cuts, (2) Injection-site lesions, (3) Excess fat cover, (4) Inadequate overall palatability, (5) Low cutability, (6) Inadequate flavor, (7) Lack of uniformity in cuts, (8) Inadequate tenderness, (9) Insufficient marbling, and (10) Inadequate juiciness, and that Results Of Past NBQAs had "Strong Impact" (6.9%), "Moderate Impact" (55.2%) or "Weak Impact" (37.9%) on those improvements. Retailers (N=44) reported that the Greatest Improvements Made Since 1991 were in reducing the incidence of these quality defects or nonconformities: (1) Excess fat cover, (2) Presence of

bruises on cuts, (3) Injection-site lesions, (4) Low cutability, (5) Lack of uniformity of cuts, (6) Inadequate muscling, (7) Excess seam fat, (8) Inadequate overall palatability, (9 tie) Cut weights too light, and (9 tie) Inadequate tenderness, and that Results Of Past NBQAs had "Strong Impact" (10.3%), "Moderate Impact" (82.1%) or "Weak Impact" (7.7%) on those improvements. Restaurateurs (N=32) reported that the Greatest Improvements Made Since 1991 were in reducing the incidence of these quality defects or nonconformities: (1 tie) Presence of bruises on cuts, (1 tie) Injection-site lesions, (3) Excess fat cover, (4 tie) Inadequate overall palatability, (4 tie) Inadequate flavor, (4 tie) Inadequate tenderness, (7) Lack of uniformity in cuts, (8) Inadequate juiciness, (9) Inadequate muscling, (10 tie) Cut weights too light and (10 tie) Insufficient marbling, and that Results Of Past NBQAs had "Strong Impact" (11.5%), "Moderate Impact" (76.9%) or "Weak Impact" (11.5%) on those improvements. Aggregated responses for Results Of Past NBQAs on the Greatest Improvements Made Since 1991 indicated "Strong Impact" by 17% of producers, 7% of packers and 10% of end-users (wholesalers/retailers), "Moderate Impact" by 60% of producers, 55% of packers and 72% of end-users (wholesalers/ retailers), or "Weak Impact" by 23% of producers, 38% of packers and 18% of end-users (wholesalers/retailers).

In Phase I (Questionnaire Results), all Producers combined identified the Greatest Quality Challenges as: (1) Inadequate tenderness, (2) Lack of uniformity in live cattle, (3) Insufficient marbling/USDA Quality Grade too low, (4) Too frequent injection-site lesions, (5) Inadequate flavor, (6) Low cutability, (7) Excess fat cover, (8) Carcass weights too heavy, (9) Inadequate muscling, and (10) Presence of bruises on carcasses. Packers identified the Greatest Quality Challenges as: (1) Lack of uniformity in live cattle, (2) Carcass weights too heavy, (3) Excess fat cover, (4) Inadequate tenderness, (5) Insufficient marbling/USDA Quality Grade Too Low, (6) Reduced USDA Quality Grade/tenderness due to implants, (7) Assuring food safety, (8) Low cutability, (9) Presence of bruises on carcasses, and (10) Too high (numerically) USDA Yield Grades. End-Users (Wholesalers/Retailers) identified the Greatest Quality Challenges as: (1) Insufficient marbling, (2 tie) Lack of uniformity in cuts, (2 tie) Inadequate tenderness, (4) Excess fat cover, (5) Inadequate flavor, (6) Too heavy cut weights, (7) Too large ribeyes, (8) Low cutability, (9) Inadequate juiciness, and (10) Inadequate overall palatability.

In Phase II of the National Beef Quality Audit—2000, researchers audited 30 packing plants, geographically distributed throughout the U.S., collecting data on the harvest floor from 43,415 cattle/carcasses for brands, horns, manure, hide color, bruises and condemnations. Percentages of brands on cattle, by number, were 49.3% none, 46.2% one, 4.0% two and 0.4% three; cattle with horns was 22.7% and without horns was 77.3%. Manure was present on the body of 81.5% of cattle and absent on the body of 18.5% of cattle; the 81.5% of cattle that had manure present on their body was comprised of 20.1% with manure in only one location and 60.5% with manure in several (multiple) locations. Manure was present around the tail-base and rectum of 33.4% of cattle, on the topline of 24.5% of cattle, on the side of 36.0% of cattle, on the belly of 65.3% of cattle and on the legs of 64.4% of cattle.

Predominant hide color of cattle evaluated was 45.1% black, 31.0% red, 8.0% yellow, 5.7% black and white (Holstein-Friesian), 4.0% grey, 3.2% white, 1.7% brown and 1.3% brindle. Carcasses with no bruises were 53.3% of those evaluated while those with one, two, three, four or more than four bruises, respectively, represented 30.9%, 11.4%, 3.5%, 0.8% or 0.1% of those

evaluated. Of all bruises detected on carcasses 14.9% were on the round, 25.9% were on the loin, 19.4% were on the rib, 28.2% were on the chuck and 11.6% were on the thin cuts (flank, plate, brisket). Severity was "critical/extreme" for 2.6%, 5.1%, 6.7%, 3.9% and 4.0%, respectively, of the bruises detected on rounds, loins, ribs, chucks and thin cuts while those that were "minor" accounted for 83.0%, 70.0%, 73.6% and 71.1%, respectively of the bruises detected on rounds, loins, ribs, chucks and thin cuts. Condemnation rates were 30.3% for liver, 13.8% for lungs, 11.6% for tripe, 6.2% for heads, 7.0% for tongues, and 0.1% for carcasses. A fetus was present in 1.2% of carcasses (approximately 3.8% of carcasses from female cattle). Of livers condemned, 44.8% were due to abscesses, 21.7% were due to flukes and 33.6% were due to other reasons (including contamination during evisceration).

In the 30 packing plants, researchers collected data from 9,396 carcasses; traits evaluated included carcass weight, gender, breed type, Quality Grade and Quality Grade factors (marbling scores were assigned by USDA officials; all other factors were assigned by university personnel), Yield Grade and Yield Grade factors (adjusted fat thickness was assigned by USDA officials; all other factors were measured or assigned by university personnel), dark cutters, blood splash, yellow fat and callused ribeyes. Carcass weight distribution was 0.7% less than 550 pounds, 6.6% 550 to 650 pounds, 27.1% 650 to 750 pounds, 40.1% 750 to 850 pounds, 21.7% 850 to 950 pounds and 3.9% greater than 950 pounds. Gender of carcasses was 67.9% steer, 31.8% heifer and 0.3% bullock. Breed type of carcasses was 90.1% native, 6.9% dairy and 3.0% *Bos indicus* influenced (greater than 4-inch hump). Mean values for Quality Grade factors were Small^{23} for marbling, A^{66} for skeletal maturity, A^{65} for lean maturity, A^{66} for overall maturity and Select^{85} for Quality Grade. Marbling score distribution was 2.3% Slightly Abundant or higher, 4.8% Moderate, 13.1% Modest, 33.3% Small, 43.3% Slight and 3.4% Traces. Overall carcass maturity was 96.6% "A," 2.5% "B" and 0.9% "C" or older. Quality Grade distribution was 2.0% Prime, 17.3% Upper Two-Thirds Choice, 31.8% Low Choice, 42.3% Select and 6.5% Standard and hardboned. Ribeye Area (square inches) distribution was 1.4% less than 10, 6.5% 10 to 10.9, 17.9% 11 to 11.9, 24.2% 12 to 12.9, 22.2% 13 to 13.9, 14.6% 14 to 14.9, 7.6% 15 to 15.9 and 5.3% 16 or larger. Fat thickness (inches) distribution was 4.9% less than .20, 13.9% .20 to .29, 15.9% .30 to .39, 18.4% .40 to .49, 16.2% .50 to .59, 15.8% .60 to .69, 6.3% .70 to .79, 4.4% .80 to .89, 2.0% .90 to .99 and 2.3% 1.00 or thicker. Mean values for Yield Grade factors were 0.49 inches for adjusted fat thickness, 787 pounds for carcass weight, 13.1 square inches for ribeye area, 2.35% for kidney/pelvic/heart fat and 3.0 for Yield Grade. Yield Grade distribution was 4.2% Yield Grade 1A, 8.0% Yield Grade 1B, 15.3% Yield Grade 2A, 22.1% Yield Grade 2B, 22.1% Yield Grade 3A, 16.5% Yield Grade 3B, 7.4% Yield Grade 4A, 3.0% Yield Grade 4B and 1.3% Yield Grade 5. Carcasses with yellow fat, blood splash and callused ribeyes occurred at a frequency of 0.4%, 0.5% and 0.0%, respectively. Carcasses with dark cutter discounts of one-third grade, one-half grade, two-thirds grade and a full grade occurred at a frequency of 1.0%, 0.6%, 0.4% and 0.3%, respectively; 2.3% of all carcasses evaluated in this study were discounted for dark cutting beef.

Comparative data for Quality Grades and Yield Grades from the 1991, 1995 and 2000 National Beef Quality Audits and USDA Annual Summaries revealed that for 1974, 1987, 1991, 1995 and 2000, respectively, percentages of carcasses grading: (a) Prime were 6.6, 2.0, 1.4, 2.1 and 3.0; (b) Choice were 68.0, 60.7, 54.2, 53.9 and 52.4; (c) Select were 21.3, 1.5, 12.5, 29.5 and 36.1, while; (d) ungraded/no-roll were 4.1, 35.8, 31.9, 14.5 and 8.5. Comparison of USDA

Annual Summary data for FY-2000 as compared to data from the National Beef Quality Audit—2000, respectively, for steer/heifer carcasses indicated that 3.0% vs. 2.0% graded Prime, 52.4% vs. 49.1% graded Choice, 36.1% vs. 42.3% graded Select while ungraded/no-roll were 8.5% vs. 6.6% and that 9.8% vs. 12.3% were Yield Grade 1, 40.7% vs. 37.4% were Yield Grade 2, 35.5% vs. 38.6% were Yield Grade 3, 1.8% vs. 10.4% were Yield Grade 4 and 0.2% vs. 1.3% were Yield Grade 5 (according to the USDA Annual Summary, 12.0% of steer/heifer carcasses were not Yield Graded). According to USDA Annual Summaries, fiscal year trends (1993 through 2000), total numbers of "Certified" carcasses (by USDA Marketing & Regulatory Programs) increased from approximately 850,000 to about 3,500,000 under all "Schedules" approved by USDA, and total numbers of "Certified" carcasses with Modest-minus or higher marbling scores increased from about 1,000,000 in 1994 to approximately 2,600,000 in 2000.

From questionnaires returned by 29 packers as a part of Phase I of the National Beef Quality Audit—2000: (a) Percentages of carcasses in their plants weighing less than 400 pounds, 400 to 600 pounds, 600 to 800 pounds, 800 to 1,000 pounds and more than 1,000 pounds were 0.2, 3.7, 58.2, 36.9 and 0.9, respectively; (b) Percentages of their carcasses by Quality Grade were 3.6 for Prime, 17.2 for Upper Two-Thirds Choice, 39.5 for Low Choice, 33.5 for Select and 2.5 for Standard; (c) Percentages of their carcasses by Yield Grade were 12.5 for Yield Grade 1, 41.9 for Yield Grade 2, 40.8 for Yield Grade 3, 3.4 for Yield Grade 4 and 0.6 for Yield Grade 5; (d) Percentages of their carcasses that were B-maturity, hardboned, with callused ribeyes, dark cutters or with blood splash were 1.3, 1.5, 0.1, 1.0 or 0.4, respectively; (e) Average number of "Branded Beef' programs per packer was 4.5; of those, 33.2%, 40.4%, 95.0% or 71.9% programs had specifications for breed, hide color, marbling or Yield Grade, respectively. From questionnaires answered as a part of Phase I of the National Beef Quality Audit—2000: (a) Purveyor (N=37) purchases of beef by Quality Grade were 3.6% Prime, 42.7% Upper Two-Thirds Choice, 17.9% Low Choice, 22.4% Select and 3.0% Standard; (b) Retailer (N=44) purchases of beef by Quality Grade were 1.8% Prime, 34.2% Upper Two-Thirds Choice, 19.7% Low Choice, 35.0% Select and 1.0% Standard, and; (c) Restaurateur (N=32) purchases of beef by Quality Grade were 20.6% Prime, 51.3% Upper Two-Thirds Choice, 25.5% Low Choice, 24.2% Select and 0.0% Standard.

In Phase III of the National Beef Quality Audit—2000, one goal of the Strategy Workshop (to capitalize upon knowledge gained in this endeavor) was characterized as "Improving The Quality, Consistency, Competitiveness And Market-Share Of Fed-Beef." Economic assessment of quality losses per slaughter steer/heifer was made and consensus was achieved; it was agreed-upon that the beef industry was losing—through Quality Problems/Defects/ Shortcomings/Shortfalls/Nonconformities—$100.10 for every steer/heifer harvested in 2000. Amounts lost were $50.96 due to Waste, $24.45 because of Taste, $18.23 due to Management and $6.46 because of Weight.

Included among items in the "Success Story" for the National Beef Quality Audit—2000 were: (a) 86.3% of steers/heifers were appropriately branded or not hot-iron branded. (b) 96.2% of steers/heifers were free of excess mud. (c) 77.3% of steers/heifers were polled or dehorned. (d) 88.4% of steer/heifer carcasses were free of major and critical bruises. (e) 93.5% of steer/heifer carcasses graded U.S. Select or better. (f) 88.3% of steer/heifer carcasses had Yield Grades of 3 or better. (g) 97.5% of top sirloin butts were free of injection-site lesions (up

from a low of 78.7%). (h) 100% of federally inspected packing facilities had implemented a HACCP approach to food safety. (i) 85% of fed cattle were harvested in plants that are using multiple-hurdle decontamination systems. (j) 47 states had a Beef Quality Assurance program. (k) 52 USDA certified/process-verified beef programs had been developed. (l) _-inch trim beef was the industry standard.

According to participants in the Strategy Workshop of the National Beef Quality Audit—2000, the "Top Ten Quality Challenges" for the fed-beef industry are: (1) Low overall uniformity and consistency of cattle, carcasses and cuts. (2) Inappropriate carcass size and weight. (3) Inadequate tenderness of beef. (4) Insufficient marbling. (5) Reduced Quality Grade/tenderness due to implants. (6) Excess external fat cover. (7) Inappropriate USDA Quality Grade mix. (8) Too much hide damage due to brands. (9) Too frequent and severe bruises. (10) Too frequent liver condemnations.

Participants in the Strategy Workshop of the National Beef Quality Audit—2000 agreed that those in the fed beef industry should make "A Commitment To Never-Ending Improvement" that stated the following: "I am a member of the U.S. beef industry and because I am committed to the role I play as a producer of safe, nutritious and wholesome food for myself, my family and humanity, I promise to: (a) Continually seek to learn more about my business and my industry so that my family can prosper, that opportunities can be created for others, and that better products can be made available to the world's consumers. (b) Collect, share and use meaningful information that affects the value and quality of beef. (c) Seek opportunities to improve relationships with others in the production, processing and marketing of cattle, beef and beef by-products. (d) Train and retrain myself and my employees in the principles and procedures of Beef Quality Assurance. (e) Be a good steward of the natural resources, the animals and the products under my care."

"Strategies" for improving the quality of beef from fed steers/heifers are: (1) Assist producers with use of selection and management techniques to produce cattle that fit customer expectations for marbling, red meat yield, weight and other value-determining attributes. (2) Assist producers with the process of collecting and analyzing data and sharing and utilizing information. (3) Enhance an already commendable record in regards to the production of safe, nutritious and wholesome beef. (4) Assure delivery of predictable and uniform lots of cattle by more correctly managing implants, nutrition, horns, castration, sorting and health programs while refining selection strategies to meet specific market windows. (5) Assure that the needs of case-ready product marketing efforts can be met by improving the yield, consistency and palatability characteristics of beef. (6) Implement new production technologies only after carefully considering the consumer demand-perception, economic, environment and animal welfare consequences. (7) Encourage continued use of cattle-marketing systems that identify, categorize and assign price to product attributes that affect consumer satisfaction by appropriately rewarding and discounting performance. (8) Identify breeding, management and sorting systems that optimize production, palatability, cutability and profitability. (9) Encourage post-harvest product enhancement technologies to assure the delivery of suitably tender and flavorful products to consumers while simultaneously managing the pre-harvest production process to achieve the same objectives.

"Tactics" for improving the quality of beef from fed steers/heifers are: (1) Develop and implement a voluntary, industry-driven, standardized electronic individual animal identification system that is tied to a seamless system of transmitting information up and down the production, processing and distribution chain. (2) Merchandize and purchase only those seedstock that are accompanied by objective performance information relative to economically important traits (production and end-product). (3) Eliminate side brands. (4) Eliminate horns via selection or early dehorning. (5) Castrate early. (6) Match implant strategies to cattle types to optimize product quality with economic returns. (7) Develop management/production practices to reduce variation in weight and cut sizes within a lot. (8) Utilize health management and nutrition protocols that contribute to improved quality attributes. (9) Match a vast majority of the fed cattle to carcass weight targets of 650-850 pounds. (10) Handle and transport cattle in a safe and humane manner. (11) Train 100% of beef and dairy producers, veterinarians, transport providers and others with an impact on cattle, in Beef Quality Assurance principles and procedures as well as humane handling practices. (12) Move all injections to the neck region and eliminate intramuscular injections. (13) Reduce immediately those genetic and management practices that contribute to production of USDA Standards, Yield Grade 4s and 5s, dark cutters and non-conforming carcass weights and cut sizes. (14) Change the Quality Grade and Yield Grade mix to 6% Prime, 27% Upper Two-Thirds Choice, 32% Low Choice and 35% Select, and to 15% Yield Grade 1, 26% Yield Grade 2A, 27% Yield Grade 2B, 24% Yield Grade 3A and 8% Yield Grade 3B. (15) Participate in partnerships and coordinated market chains to foster communications and the delivery of products that meet consumer demands. (16) Continue to support and encourage development of branded beef product concepts and value-added, further processed beef items.

"Goals, By 2005" for improving the quality of beef from fed steers/heifers are: (1) Eliminate USDA Standards. (2) Eliminate Yield Grades 4 and 5. (3) Eliminate injection-site lesions from whole-muscle cuts including the chuck. (4) Eliminate side branded hides. (5) Reduce horns to less than 5% of the fed cattle supply. (6) Develop and implement a standardized electronic individual animal identification system. (7) Develop an information system that allows each producer to conduct a quality audit for his/her own herd. (8) Assure that 100% of seedstock animals are accompanied by meaningful genetic data (EPDs, etc.) for production and end-product traits. (9) Assure that 100% of cattlemen complete BQA training. (10) Eliminate major and critical bruises that result in a devaluation of subprimals. (11) Improve the transportation (handling and equipment) of cattle. (12) Improve continually the eating quality of beef.

Research Goals identified by participants in the Strategy Workshop of the National Beef Quality Audit—2000 are: (1) Better understanding the influence of calfhood and lifetime management on the quality of beef. Specifically, how does stress at various points of a calf's life affect its ability to deposit marbling? (2) What are the levels of stress caused by dehorning at various life-stages versus the improvement in bruise prevention that results from dehorning? (3) How can we sort/implant/manage/re-sort cattle of unknown genetics to achieve uniformity targets in cut size for retail and hotel/restaurant/institutional end-users? (4) Better understand how to interpret feedlot and endproduct data at the cow/calf and seedstock levels. (5) Better understand how automation at the packing and processing sectors will affect desired characteristics of cattle and carcasses. (6) Better understand and communicate the role of each

production sector on the wholesomeness, nutritional value and quality of beef. (7) Develop carcass and cattle specifications for weight, muscling, fat and marbling based on case-ready fabrication requirements, rather than trying to fit current cattle to a case-ready approach. (8) What are the tenderness implications of injection-site lesions in the lower round (as a follow-up to the top-butt research).

II. EXPERIMENTAL DESIGN

TITLE: NATIONAL BEEF QUALITY AUDIT—2000

GOAL: To conduct, as a sequel to the National Beef Quality Audits of 1991 and 1995, a quality* audit of slaughter cattle, their carcasses and their dress-off/offal items for the U.S. beef industry, in 2000, establishing baselines for present quality shortfalls and identifying targets for desired quality levels by the year 2010. (*In the context in which it will be used in this document, "quality" includes all factors affecting value/desirability of slaughter cattle, their carcasses and their dress-off/offal items).

OBJECTIVES:

(a) To obtain information, via use of questionnaires, related to adjustments that seedstock generators, cow/calf producers, stockers/backgrounders and cattle feeders have made in management practices since 1991 resulting from benchmarking of quality challenges in the National Beef Quality Audits of 1991 and 1995.

(b) To identify, via use of questionnaires, the top-ten beef quality challenges of seedstock generators, cow/calf producers, stockers/backgrounders, feeders, packers, purveyors, restaurateurs, and supermarket operators.

(c) To characterize and quantify, numerically and monetarily, quality challenges in U.S. slaughter cattle, their carcasses and their dress-off/offal items via a substantive national audit in 30 U.S. beef packing plants.

(d) To compare results of the 1991 and 1995 Audits to those of the 2000 Audit to determine the extent to which changes have been made in, and by, the U.S. beef industry in response to the challenges and opportunities for change that were made evident by the original National Beef Quality Audit—1991 and the subsequent National Beef Quality Audit—1995.

(e) To determine, via a Strategy Workshop which old (1991, 1995), and which new (2000), strategies to pursue, goals to try to achieve, problems to solve, opportunities to capitalize-upon and nonconformities to correct—and, to ascertain probable successes in each of these endeavors.

RATIONALE: The rationale for the National Beef Quality Audit—2000 is as it was in the 1991 and 1995 National Beef Quality Audits….The U.S. cattle industry cannot expect improvements in prices for its products/byproducts when "quality" doesn't warrant such increases. W. Edwards Deming said "Industry cannot manage its quality problems until it can measure them." The beef industry must characterize its quality challenges because one or a combination of these could result in its downfall unless the root-causes can be identified so the quality problems can be corrected. The beef industry must correct its quality defects to assure that every customer who purchases cattle, beef byproducts or beef products as well as every consumer who eats beef or beef products will be satisfied with their purchase.

In 1991, the National Cattlemen's Association decided that the beef industry needed to conduct a "quality audit," to determine where it was in 1991 and to decide where it should be by the year 2001. That audit was completed, and since then, the industry has had 9 years in which to change. The National Beef Quality Audit—1995 assessed the extent of changes that occurred relative to correcting deficiencies and reducing quality concerns compared to the benchmark study (NBQA—1991) and allowed for mid-course corrections relative to improving the consistency and competitiveness of fed beef.

THE NEED FOR A NATIONAL BEEF QUALITY AUDIT:

Rod Bowling (Monfort, Inc.), in 1987, compared "thickly muscled" vs. "thinly muscled" steers and determined that there was a difference in Muscle-To-Bone Ratio worth $99.96 per head.

The NCA/Texas A&M University/Swift and Company Study, in 1988, identified differences in value associated with increased USDA Quality Grade (or position within Quality Grade) across the range of U.S. Standard to U.S. Prime of $185 per head.

In 1989, Rod Bowling (Monfort, Inc.) assessed quality of slaughter cattle and provided estimates of quality shortfalls in monetary terms. He reported a "Production-Potential Shortfall" of $107.32 per slaughter steer/heifer, attributing $10.57 of the shortfall to Management Defects (condemnations, bruises, insect damage, dark cutters, injection-site lesions, hot-iron brands, etc.), $19.95 to Quality Deficiencies (too few Prime and Choice carcasses; too many Select and "No Roll" carcasses), and $76.80 to Yield Problems (too few Yield Grade 1 and Yield Grade 2 carcasses; too many carcasses in Yield Grade 3 and Yield Grade 4).

The Value-Based Marketing Task Force of the National Cattlemen's Association, in their report entitled "War On Fat" in 1990, determined that the average amount of Excess Fat on each slaughter steer/heifer was 88 pounds and that the value of that excess fat was $97.00 per head.

Chuck Lambert (National Cattlemen's Association), in 1990, identified $5.037 billion ($192.36 per head) in "Lost Opportunities In Beef Production" due to quality defects in slaughter steers/heifers, of which $0.180 billion was due to Hot-Iron Branding, $0.304 billion was for Outlier Cattle, $4.410 billion was for Excess Fat, and $0.143 billion was for Management Losses.

At the 1991 Annual Convention of the National Cattlemen's Association, Gary C. Smith (Colorado State University) said, "The beef industry leaves $200 per head on the table with every slaughter steer/heifer it harvests because of correctable quality defects; those quality shortfalls include Hide Damage ($15/head), Improper Management Practices ($20/head), Muscling Problems ($20/head), Palatability Deficiencies ($30/head), Too Little Marbling ($30/head) and Excessive Fatness ($85/head). I don't know if the $200 figure is correct, but we need to know where we are in 1991 so we can know where we should be in 2001. A national beef quality audit could put more precise figures on the costs of these errors, giving cattlemen incentive to clean-up their programs and avoid these mistakes."

Obviously, there was sufficient precedent for conducting a national beef quality audit in 1991, to determine exactly how much the quality problems in slaughter steers/heifers were costing the U.S. beef industry. Documentation existed in 1991 for estimates of quality defect/shortfall/ inadequacy losses of $97.00 per head for excess fat alone, to $99.96 per head for inadequate muscling alone, to $185 per head for inadequate Quality Grade alone—when singular "quality defects, shortfalls or inadequacies" were considered. Estimates of such losses, when a multiplicity of "quality defects, shortfalls or inadequacies" were considered, ranged from $107.32 per head, or $196.36 per head, to $200 per head. Admittedly, most of the monetary estimates of potential "Quality Losses" made by these scientists were—at best—educated guesses; none had been verified, authenticated or tested. In 1991, the beef industry needed to conduct a national beef quality audit.

RESULTS OF THE NATIONAL BEEF QUALITY AUDIT—1991: In Phase I (Face-To-Face-Interviews), those queried found greatest fault with beef's inconsistency, excessive fatness, unreliable palatability, and high price. The "Top-Ten Concerns About The Quality Of Beef" for retailers/purveyors/restaurateurs were: (1) Excess External Fat, (2) Too Frequent Injection-Site Blemishes, (3) Too Large Ribeyes/Loineyes; Too Much Beef Per Box, (4) Excess Seam Fat, (5) Lack of Uniformity, (6) Low Overall Cutability, (7) Too Many Dark Cutters, (8) Low Overall Palatability, (9) Excess Bruise Damage, and (10) Insufficient Marbling. The "Top-Ten Concerns About The Quality Of Beef" for packers were: (1) Excess Hide Problems, (2) Too Frequent Injection-Site Blemishes, (3) Excessive Carcass Weights, (4) Excess Bruise Damage, (5) Reduced Quality Due To Use Of Growth Implants, (6) Too Many Liver Condemnations, (7) Insufficient U.S. Choice, (8) Too Many Overfat Carcasses--Carcasses of Yield Grades 4 and 5, (9) Lack of Uniformity, and (10) Too Many Dark Cutters.

In Phase II (Packing Plant Audits), slaughter-floor data revealed: (a) Brand Incidence was 45%, (b) Presence Of Horns was 31%, (c) Excessive Mud Incidence was 7%, (d) Liver, Tripe And Entire-Viscera Condemnations were 19.00%, 3.50% and 0.07%, respectively, (e) Head and Tongue Condemnations were 1.1% and 2.7%, respectively, (f) Pregnancy occurred in 0.93% of heifers, and (g) Bruise Incidence was 16.8%, 15.7%, 25.5% and 2.3%, respectively, on chucks, ribs, loins and rounds. Cooler data revealed: (a) Bullock Incidence was 1.1%, (b) Carcass Maturity was 93.0% A, 6.7% B and 0.3% C, (c) Marbling Score Incidence included 0.3% Practically Devoid and 5.8% Traces, (d) Dark-Cutter Discount Incidence included 3.4% one-third grade discount, 1.2% two-thirds grade discount and 0.5% one full grade discount, (e) Blood-Splash Incidence was 0.7%, (f) USDA Quality Grade Incidence included 7.6% Standard and 0.5% Commercial/Utility/Cutter/ Canner, (g) Carcass Weight Incidence included 3.9% less than 600 pounds and 6.9% more than 900

pounds, (h) Fat Thickness Incidence included 2.2% less than 0.20 inch and 19.6% greater than 0.79 inch, (i) Ribeye Area Incidence included 9.9% less than 11.0 square inches and 10.3% greater than 14.9 square inches, and (j) USDA Yield Grade Incidence included 10.0% Yield Grade 1, 13.6% Yield Grade 4 and 2.9% Yield Grade 5.

In Phase III (Strategy Workshop), the ultimate goal, in capitalizing upon knowledge gained from this endeavor, was characterized as "Improving The Consistency and Competitiveness Of Fed-Beef." Economic assessment of quality losses per slaughter steer/heifer was made and consensus was achieved; it was agreed-upon that the beef industry was losing--through Quality Problems/ Defects/Shortcomings/Shortfalls--$279.82 for every slaughter steer/heifer harvested in the U.S. during 1991. Amounts lost were $219.25 due to Waste, $28.81 because of Taste, $27.26 due to Management and $4.50 because of Weight. Participants/guests at the Strategy Workshop determined that the ten best Strategies for "Improving The Consistency and Competitiveness of Fed-Beef" were these: (1) Encourage Quarter-Inch Fat Trim As The New "Commodity" Fat-Trim Specification For Beef Primals/Subprimals; (2) Change Live-To-Carcass Price Logic From Dressing Percentage To Red Meat Yield; (3) Keep The "Heat" On Communicating Cutability To Retailers and Packers By Improving Understanding Of The Value Of Closer-Trimmed Beef; (4) Go After, And Correct, Management Practices That Create Non-Conformity; (5) Eliminate Biological Types Of Cattle (Not Breeds per se) That Fail To Conform; (6) Institute Quality-Based Marketing; (7) Identify Outlier-Values For Specific Carcass Traits; (8) Design And Conduct The Strategic Alliance Field-Studies; (9) Use The National Beef Carcass Data Collection Program To Identify Superior Seedstock; and (10) Repeat The National Beef Quality Audit At Periodic Intervals To Assess Progress And Identify New Opportunities For Improvements In Consistency And Competitiveness Of Fed-Beef.

RESULTS OF THE NATIONAL BEEF QUALITY AUDIT—1995: In Phase I (Face-To-Face Interviews) those questioned confirmed that the industry had addressed many of the top-of-mind concerns since the 1991 NBQA, but that many new challenges had also emerged. The positive side of story included: (a) Purveyors, in 1991, ranked injection-site lesions and bruise damage as their No. 2 and No. 4 concerns, respectively; by 1995, those two defects dropped to No. 10 and out-of-the-Top-Ten, respectively. (b) Retailers, in 1991, ranked excessive external fat and injection-site lesions as their No. 1 and No. 3 concerns, respectively; by 1995, those two defects dropped to No. 9 and No. 10, respectively. (c) Restaurateurs, in 1991, ranked excessive seam fat and excessively large ribeyes as their No. 3 and No. 4, concerns, respectively; in 1995, neither of those concerns were among the top-ten quality concerns. (d) Packers, in 1991, listed injection-site lesions as their No. 2 concern; in 1995, that defect did not appear in their list of Top-Ten quality concerns. The negative side of the story was that purveyors, retailers, restaurateurs and packers, in 1995, found new and pressing quality concerns not mentioned in the 1991 audit; these were: (1) Beef's insufficient flavor, low overall palatability and lack of uniformity. (2) Beef's price was too high for the value received. (3) Hide damage from mud and manure occurred too frequently. (4) Problems with USDA Quality-Grade mix as well as heavier cattle and/or cuts.

In the National Beef Quality Audit—1995, the "Top-Ten Concerns About The Quality Of Beef" for retailers/purveyors/restaurateurs were: (1) Low Overall Uniformity And Consistency, (2) Inadequate Tenderness, (3) Low Overall Palatability, (4) Excessive External Fat, (5) Beef's Price Is Too High For The Value Received, (6) Insufficient Flavor, (7) Excessive Weights Of Cuts And

Boxes Of Cuts, (8) Inappropriate USDA Quality Grade Mix, (9) Incidence Of Injection-Site Lesions Is Too High, and (10) Low Overall Cutability. The "Top-Ten Concerns About The Quality Of Beef" for packers were: (1) Lack Of Uniformity And Predictability Of Live Cattle, (2) Liver Condemnation Rate Is Too High, (3) Too Frequent Hide Damage Due To Mud/Manure, (4 tie) Too Frequent Bruise Damage, (4 tie) Too Many Dark Cutters, (4 tie) Excessive External Fat, (7) Cattle Of Too Heavy Weight, (8) Inadequate Marbling, (9 tie) Too Frequent Hide Damage Due To Hot-Iron Brands, and (9 tie) Beef's Price Is Too High For The Value Received.

In Phase II (Packing Plant Audits), slaughter-floor data revealed: (a) Brand Incidence was higher (52.3%) in 1995 than in 1991 (45.0%), (b) Presence Of Horns (32.2%) was about the same as in 1991 (31.1%), (c) Excessive Mud Incidence, in 1995, was lower (5.1%) than in 1991 (6.8%), (d) Liver, Lungs And Tripe Condemnations at 22.2%, 5.0% and 11.0% in 1995 were higher, the same, and dramatically higher, respectively, than in 1991, at 19.2%, 5.1% and 3.5%, (e) Head And Tongue Condemnations, at 0.9% and 3.8%, respectively, in 1995 were not substantively different from those (1.1% and 2.7%) in 1991; and (f) Bruises (1 or more) were much higher (48.4%) in 1995 than in 1991 (39.2%). Cooler data revealed: (a) USDA and NBQA data for percentages of carcasses in Yield Grades 1 and 2 indicated that slaughter steers/heifers had become leaner and more muscular. In 1974, 30% of slaughter steers/heifers were in Yield Grades 1 and 2; comparable percentages in 1991 and 1995 were 44% and 58%, respectively. (b) USDA and NBQA data for percentages of slaughter steers/heifers that graded Choice and Prime revealed a substantial drop from 1974 (75%), through 1991 (55%), to 1995 (48%). (c) USDA and NBQA data revealed that from 1974 to 1995, carcass weight had increased 69 pounds, fat thickness decreased 0.15 inches, ribeye area increased by 1.0 square inch and kidney/pelvic/heart fat percentage decreased 0.9 percentage points. (d) NBQA data indicated that from 1991 to 1995, carcass weight decreased 12 pounds, fat thickness decreased 0.12 inches, ribeye area decreased 0.1 square inch, kidney/pelvic/heart fat percentage decreased 0.1 percentage point and USDA Yield Grade improved by 0.34 YG units. (e) Dark-cutting beef carcasses decreased from 1991 (5.0%) to 1995 (2.7%), (f) In 1995 vs. 1991, 1.3% vs. 2.3% graded Prime, 11.4% vs. 17.1% were in Upper Two-Thirds Choice, 35.6% vs. 35.6% were in Lower One-Third Choice, 46.7% vs. 36.9% graded Select, and 4.6% vs. 7.6% graded Standard, and (g) In 1995 vs. 1991, carcass weight was 747.9 lb vs. 759.9 lb, fat thickness was 0.47 inches vs. 0.59 inches, ribeye area was 12.8 square inches vs. 12.9 square inches and Yield Grade was 2.82 vs. 3.16, respectively.

In Phase III (Strategy Workshop), the ultimate goal, in capitalizing upon knowledge gained from this endeavor, was characterized as "Improving The Quality, Consistency, Competitiveness And Market-Share Of Beef: A Blueprint For Total Quality Management In The Beef Industry." Economic assessment of quality losses per slaughter steer/heifer harvested was made and consensus was achieved; it was agreed-upon that the beef industry was losing—through Quality Problems/Defects/ Shortcomings/Shortfalls--$137.82 for every slaughter steer/heifer harvested in the U.S. during 1995. Amounts lost were $47.76 due to Waste, $38.30 because of Taste, $47.10 due to Management and $4.66 because of Weight. Participants/guests at the Strategy Workshop determined that the ten best Strategies for "Improving The Quality, Consistency, Competitiveness And Market-Share Of Beef" were these: (1) Assist Producers With Use Of Selection And Management Techniques To Produce Cattle That Fit Customer Expectations For Marbling, Red Meat Yield And Weight. (2) Establish Close-Trimmed Beef (1/4-inch or less) As The Industry Standard. (3) Develop A Cattle Identification System That Facilitates Data Collection And

Information Feedback, And Reduces Reliance On Hot-Iron Branding. (4) Encourage Development Of Cattle-Pricing Systems That Accurately Identify And Reward Production Of Cattle With Zero Defects. (5) Encourage Development Of Cattle-Pricing Systems That Identify, Categorize And Price Product Attributes That Affect Consumer Satisfaction. (6) Continue To Discover, Develop And Apply Technology To Enhance The Quality Of Beef. (7) Identify Breeding Systems That Optimize Production, Palatability And Profitability. (8) Identify Procedures To Facilitate Improved Customer Satisfaction And Loyalty To The Beef Eating Experience.

Response to release of the Final Reports of both the National Beef Quality Audit—1991 and the National Beef Quality Audit—1995 was overwhelming. People from every sector of the U.S. beef industry have studied the results of NBQA—1991 and NBQA—1995 and many used those findings to improve the quality of their cattle. Substantial progress in improving slaughter steer/heifer quality was made after the release of 1991 and 1995 Audit results and further progress should ensue after the NBQA—2000 results become public. The NBQA—1991 recommended that producers evaluate their herd health and genetic management programs; eliminate non-conforming cattle from their cow herds; analyze their management practices, transportation procedures and handling systems; and, encourage the flow of information from the packing plant, back to the ranch. That way, everyone involved in fed cattle production could make improved decisions and produce better beef. The NBQA—1995 recommended that producers identify and manage genetic lines that may be used to produce cattle with increased ability to deposit marbling and with maximum red meat yield; pay attention to management practices (remove horns, improve parasite control); eliminate intramuscular injections; improve transportation and handling techniques to reduce bruises and dark cutters; measure, on a repeated basis, those traits that impact value of cattle, beef and byproducts; and, eliminate genetic and management systems that erode the tenderness, juiciness and flavor of beef.

NCA issued a challenge on behalf of the fed-beef industry at the conclusion of the National Beef Quality Audit--1991, as follows: "Repeat National Beef Quality Audit—With non-conformities in the beef industry costing it up to $279.82 per slaughter steer/heifer harvested, every sector of the beef industry should become involved in eliminating problems relating to its respective area of responsibility. This should be a joint effort, and one that deserves immediate and long-term attention. And, now that the National Beef Quality Audit—1991 has given the beef industry a measuring stick, the industry can—and should—monitor its progress." A second National Beef Quality Audit (in 1995) was conducted five years after the first one (NCBA—1991) to determine the degree of progress the industry had made toward delivering a consistent, competitive product to consumers. Now, it was imperative that a third National Beef Quality Audit (in 2000) be conducted to let the industry again assess its standing.

METHODOLOGY: The methodology used for this quality Audit consisted of effort conducted in three phases:

Phase I. A series of questionnaires answered by representatives of every sector of the beef industry quantified producer changes in management practices and identified the Top-Ten quality concerns as well as sought to quantify changes in the incidence and importance of quality defects in U.S. slaughter cattle, their carcasses and dress-off/offal items during the period of 1991 to 2000.

Phase II. A substantive national audit was conducted in May through November of calendar year 2000—in 30 U.S. beef packing plants, which characterized and quantified, numerically and monetarily, quality defects in slaughter cattle, their carcasses and dress-off/offal items. A "snapshot" depiction of quality defects in a set of packing plants chosen to represent over 70% of the Federally Inspected Slaughter (FIS), and demographically selected to represent the entire U.S. slaughter steer/heifer industry was accomplished. In addition, information was solicited from the major beef packers and from AMS-USDA regarding percentages of carcasses by carcass weight, Quality Grade and Yield Grade. These data were compared to data gathered from our "snapshot," in-plant, cooler audits.

Phase III. A Strategy Workshop was convened to identify strategies and tactics needed to reduce incidence of, or eliminate, specific defects, and to determine which strategies to pursue, tactics to use, targets to shoot-at, goals to try to achieve, problems to solve, opportunities to capitalize-upon and nonconformities to correct--and to ascertain probable successes in each of these endeavors.

PROTOCOL:

Phase I. With the assistance and at the direction of Dr. Gary Cowman, Renee Lloyd and Chad Vorthmann, we developed, distributed, accumulated and analyzed questionnaires designed to obtain information related to adjustments made in management practices by seedstock generators, cow/calf producers, stockers/backgrounders and cattle feeders. These producers were asked to identify those management practices that they changed, since 1991, resulting from benchmarking of quality challenges in the National Beef Quality Audits of 1991 and 1995. Of additional interest was their opinion of the impact that results of past NBQAs had on the changes they had made.

Packers, purveyors, retailers and restaurateurs were asked to respond to questionnaires regarding the greatest improvements made since 1991 in reducing the incidence of quality defects or nonconformities and the impact that results of past NBQAs had on those improvements. In addition, packers described characteristics (weight, Quality Grade, Yield Grade and defects/ nonconformities) of their carcasses and decontamination technologies. Purveyors, retailers and restaurateurs answered questions about Quality Grades of beef they purchase and length of aging time for beef.

Phase II. A large national audit was necessary to achieve the mission of this phase of the study. Packing plants (N=30) were chosen to represent over 70% of the Federally Inspected Slaughter across the geographic and demographic regions of the U.S. Data were collected during May through November of calendar year 2000. In order to maximize efficiency, plants were divided into four groups and were evaluated by personnel from the four universities--Colorado State University, West Texas A&M University, Texas A&M University and Oklahoma State University. Data for carcass-weight, gender, Quality-Grade, and Yield-Grade groups obtained from packing plant records were compared to data that we collected during these in-plant audits.

Colorado State University		West Texas A&M University	
ConAgra, Greeley	E	Excel, Plainview	E
Excel, Fort Morgan	A	Excel, Friona	A
IBP, Lexington	G	IBP, Amarillo	F
IBP, Boise	B	ConAgra, Cactus	B
IBP, Pasco	D	Excel, Dodge City	G
Washington Beef, Sunnyside	D	ConAgra, Garden City	D
Harris, Selma	E	IBP, Garden City	D
E.A. Miller, Hyrum	B	Shamrock, Vernon	C

Texas A&M University		Oklahoma State University	
Sam Kane, Corpus Christi	G	Murco, Plainwell	C
Sun Land, Tolleson	A	ConAgra, Grand Island	A
IBP, Dakota City	B	IBP, Emporia	A
IBP, Denison	D	Taylor, Wyalusing	E
IBP, West Point	F	Moyer, Souderton	E
Nebraska Beef, Omaha	D	IBP, Joslin	G
PM Beef, Windom	B	Packerland, Green Bay (I)	G
		Packerland, Green Bay (II)	G

Letters (A through G) indicate the month in which the audit of that plant was conducted (to cover the May through November period, optimizing proportions of calf vs. yearling slaughter cattle). On single trips, if two plants were audited they had a common letter.

Arrayed by university and month, the schedule of Audits were as follows:

Code	Month	CSU	WTAMU	TAMU	OSU	Code
A	May	Excel, FM	Excel, Friona	Sun Land, Tolleson	IBP, Emporia ConAgra, Grand Island	A
B	June	IBP, Boise Miller, Hyrum	ConAgra, Cactus	IBP, Dakota City PM, Windom	None	B
C	July	None	Shamrock, Vernon	None	IBP, Joslin Murco, Plainwell	C
D	August	IBP, Pasco Wash., Sunnyside	ConAgra, G. City IBP, G. City	IBP, Denison Nebraska, Omaha	None	D
E	Sept.	None	Excel, Plainview	None	Taylor, Wyalusing Moyer, Souderton	E
F	Oct.	ConAgra, Greeley Harris, Selma	IBP, Amarillo	IBP, West Point	None	F
G	Nov.	IBP, Lexington	Excel, Dodge City	Sam Kane, C. Christi	Packerland, G. Bay (I) Packerland, G. Bay (II)	G

Information was obtained on the slaughter floor and in the cooler of each packing plant. Data were collected by live cattle lot number for 50% of all cattle on the slaughter floor and for 10% of all chilled carcasses in the cooler during the applicable time-period spent in that plant. Slaughter data were collected as animals progressed along the slaughter chain and specific data on disposition of head, offals, and carcass were not necessarily correlated--i.e., were not always from the same individual animals. Information was collected regarding brands, horns, manure, hide color, bruises and condemnations. Cooler data were collected on the grading chain and included fat thickness; ribeye area; kidney, pelvic and heart fat percentage; hot carcass weight; USDA marbling score; USDA maturity score; and lean color. From this information, USDA Yield Grade and Quality Grade were determined.

Data-collecting teams were comprised of six people. Three trained people, with the assistance of LSD, AMS, USDA personnel, were responsible for obtaining Yield Grade, Quality Grade and other carcass data, two people were assigned to the slaughter floor to evaluate slaughtering/dressing, carcass, and offal defects and one person was assigned to work in the stunning/exsanguination area (to observe horns, brands, mud and other physical characteristics of cattle). To assure that teams from the three cooperating universities were consistent in their evaluations, a training session was conducted at the IBP plant in Amarillo, TX during the period of May 15-19, 2000. At least one representative of each of the four cooperating universities was present during the training session.

Data were analyzed by personnel at Texas A&M University to determine factors affecting quality and/or value and the relative impact of each type of quality defect. In addition, the frequency of the quality defects was determined. Frequency also was determined for combinations of categories. These estimates are presented in a national format. Seasonal variation was taken into account by spacing collection trips.

Phase III. As the data in Phases I and II were being collected and assembled, and as specific quality-improvement opportunities were identified that would benefit from more thorough analysis/evaluation, we contacted individuals from the private and public sectors (this group included packers, purveyors, university scientists, veterinarians, stockers/backgrounders, affiliated industry personnel, association employees, restaurateurs, government officials, cattle feeders, seedstock generators, etc.) and invited them to participate in a Strategy Workshop to discuss these issues.

Data obtained from Phase II of this study were used to help determine the causes of the quality defects. From these findings, recommendations for reducing the quality problems were made. From Phases I and II, combined, we were able to identify, characterize and quantify the "quality defects" and the "costs for nonconformance" for slaughter steers/heifers, their carcasses and their dress-off/offal items. When all of the data was collected, assembled, summarized and analyzed (preliminarily), a Strategy Workshop was convened (at the Dallas/Fort Worth Airport). At the Strategy Workshop, responses to the questionnaires (Phase I); results of assessments of cattle on harvest floors (hide on), assessments of carcasses and offal on the harvest floor and assessments of carcasses in coolers (Phase II); costs (losses per steer/heifer) for quality defects/nonconformities identified by the National Beef Quality Audit—2000, directives to cattlemen, “Top Ten Quality

Concerns" for the U.S. Fed Beef Supply, what the U.S. beef industry is doing well, and Strategies/ Tactics for "Improving Quality, Consistency, Competitiveness And Market Share Of The U.S. Fed Beef Supply" were determined.

III. RESULTS OF THE NATIONAL BEEF QUALITY AUDIT—2000; PROCEEDINGS OF THE STRATEGY WORKSHOP

RELEVANCE OF NATIONAL BEEF QUALITY AUDITS TO THE BEEF INDUSTRY

Chuck P. Schroeder
National Cattlemen's Beef Association

On our Nebraska Hereford cattle ranch, back in 1955, we used to measure performance traits related to weight (nobody "liked" to keep records but they were important to our business). A lot of things have changed over the past 45 years—we measure more and we keep more records. Our arsenal now contains a lot of weapons; those weapons, properly targeted and appropriately deployed, can keep us competitive. And, now, in 2001, we are only at the brink of knowing what we need to measure to remain profitable.

After 20 years of declining demand, any fool could see where the beef industry was heading. Now, after seven straight quarters of increased demand for beef—and $80/cwt. fed cattle—things are looking better.

This week, the world's largest poultry producer (Tyson) offered more than $4 billion to enter the beef business, to buy the world's largest beef producer (IBP) so they could claim ownership of a substantial quantity of the most popular protein (beef).

There is excitement in the beef industry today—and this places even more importance on what you are doing here this week at the Strategy Workshop for the National Beef Quality Audit—2000. If we don't take advantage of becoming customer-oriented, we'll just be one more generation that missed the opportunity. The food business climate is one of impatient consumers and aggressive marketers.

What you will decide here, this week, will identify many of the directions that the beef industry will take during the next few years. We look forward to a good meeting and we anxiously await the decisions of the Strategy Workshop and the findings of the National Beef Quality Audit—2000.

COMPARISON OF RESULTS OF THE NATIONAL BEEF QUALITY AUDITS CONDUCTED IN 1991 AND 1995

G.C. Smith
Colorado State University

National or international Audits that provide assessments of quality and/or safety of beef and veal have been conducted since 1991. All of the Audits listed in Table 1 were funded by the Cattlemen's Beef Board. Except for the International Beef Quality—1994 (administered by U.S. Meat Export Federation), all of the Audits listed in Table 1 were administered by the Beef Quality Assurance Advisory Board of the National Cattlemen's Beef Association.

The first National Beef Quality Audit was conducted in 1991 and was in response to a series of events that occurred in 1989 through early 1991: (a) Schuh/Johnson Report (1989), which concluded that because the price of beef (relative to that of alternative meats) and real (inflation-adjusted) consumer incomes had accounted for 97% of the decline (from 1978 to 1988) in beef demand, beef production costs had to be reduced. (b) Ron Ward Analysis (1990), which concluded that because the price of beef was responsible for 93% of beef's loss of market-share, the cost of producing beef had to be reduced. (c) Lambert's Report On Comparative Prices Per Serving (1991), which demonstrated that comparative average U.S. cost per serving for beef was 32%, 184% and 212% higher than for pork, turkey and chicken, respectively. (d) Lambert's Lost Opportunities In Beef Production (1991), which suggested that beef could be priced lower at the consumer level if cattlemen recaptured the $11.999 billion of lost economic opportunities each year because, in part, of hot-iron branding, carcass/offal condemnations, bruises, injection-site lesions, abscesses, too light/too heavy carcasses, carcasses grading lower than U.S. Select, dark-cutting beef, carcasses of Yield Grades 4 and 5, excess fat due to over-finishing of cattle and excess fat because of inappropriate decision-making at the time of marketing.

Results of the National Beef Quality Audit—1991 identified as the most important actions needed by those in the beef industry to improve the consistency and competitiveness of fed-beef: (1) Attack Waste, (2) Enhance Taste, (3) Improve Management and (4) Control Weight. The costs to the U.S. beef industry of nonconformities in these items are included in Table 2.

Between the time of the release of results of the National Beef Quality Audit—1991 and the time of the Strategy Workshop of the National Beef Quality Audit—1995, it became increasingly evident that a "Mid-Course Correction" was needed in the "amount of waste" (trimmable fat) that could be removed from cattle/carcasses without negatively affecting productivity, reproductive capacity and quality—especially as "quality" relates to the amount of marbling. The "Mid-Course Correction" was described in the Final Report of the National Beef Quality Audit—1995 by saying: (a) In the first Audit, we overestimated the amount of fat that we will ever be able to remove from high quality cattle and carcasses. (b) Expected returns from removing excess fat ($189.78 in NBQA—1991) were so much of the total ($279.82) that could, potentially, be recovered, that producers became obsessed with removing excess fat from their

cattle. (c) As a result, producers didn't work to correct any of the taste, management or weight problems; and, consequentially, little or no progress in the U.S. beef industry was being made on things—little things, they thought—like brands and bruises and tough steaks that are too big. (d) Attempting to achieve "zero fat" is unrealistic; production practices and palatability concerns both dictate that some fat is necessary. (e) At the Strategy Workshop for the NBQA—1995, "Attack Waste" baseline targets were set at 16.5% of carcass weight as fat, 15.0% of carcass weight as bone, and 68.5% of carcass weight as red meat. (f) Using NBQA—1995 data, average carcass weight was 747.9 pounds with 20.4% (152.57 pounds) of total trimmable fat; at a new target of 16.5% fat (123.4 pounds), there would be 29.17 pounds of excess fat worth $27.42 ($1.07 per pound carcass value minus $0.13 per pound fat-credit value). (g) Target Yield Grades at the 16.5/15.0/68.5, fat/bone/red meat endpoint are: 2.1 for Select, 1.8 for Low Choice, 1.6 for Upper Two-Thirds Choice and 1.2 for Prime.

A comparison of results for the NBQA—1991 and the NBQA—1995, using the logic and prices of the 1991 NBQA, yielded the results illustrated in Table 3.

Results described in Table 3 reveal that those in the beef industry had accomplished improvements in Waste and Weight, but not in Taste or Management, in the four years between these two Audits. The net effect of changes made in improving the consistency and competitiveness of the fed-beef supply was $3.23 for each steer/heifer harvested in the U.S. (Table 3). When the effect of the Mid-Course Correction and new (1995) logic and prices were used to compute quality losses and when nomenclature was changed ("Attack Waste" became "Increase Red Meat Yield" and "Enhance Taste" became "Enhance Taste And Tenderness"), the results of the National Beef Quality Audit—1995 (Table 4) revealed that the potential for improvement of quality of fed-beef was $137.82 per steer/heifer.

In both the 1991 and 1995 National Beef Quality Audits, computations of value losses were usually objective but sometimes subjective. Assessments of quality losses due to management errors (branding, bruising, failure to dehorn, failure to prevent damage from parasites and disease that result in condemnations, etc.) were quantifiable; so were problems resulting from genetic or production management mistakes that resulted in carcass nonconformities (bullock, B maturity, dark-cutter, blood splash, U.S. Standard, too light/too heavy carcasses, excessively fat carcasses, carcasses with too small/too large ribeyes). Occurrences of those quality defects were determined using results obtained during Phase II activities of the Audits and the cost of each defect was determined by experts in the field. Examples of how such quality losses were computed in the National Beef Quality Audits of 1991 and 1995 are presented in Tables 5 and 6, respectively.

Other cost estimates, though, were made by experts who were not able to depend on traits quantified by the Audit results; examples of those were the "best estimates" of Robert Koeppen (The Blueside Companies) for losses in hide value due to the effects of mud, urine, feces, insects and parasites and that of Dr. Brad Morgan (Texas A&M University; Colorado State University; Oklahoma State University) for losses due to palatability deficiencies. For example, Dr. Morgan's logic in 1991 for the value loss associated with toughness was made by contacting retailers and food-service operators to determine incidences of refunds to patrons who complained about toughness of beef plus the occurrence of *Bos indicus* influenced cattle in the

slaughter mixes of packers who provided such data to him; results of his assessment in the National Beef Quality Audit—1991 are presented in Table 7. In 1995, Dr. Morgan used his estimates from NBQA—1991 plus results of the National Beef Tenderness Survey (Morgan *et al*., 1991) and of the National Beef Tenderness Conference (National Cattlemen's Association, 1994) to determine "How much does beef toughness cost?" (Table 8).

Suffice it to say, though, that the estimates of the value of quality losses in slaughter steers/heifers was made in the most scientific way that was possible. And, for "Enhance Taste" or "Enhance Taste And Tenderness" in the 1991 and 1995 National Beef Quality Audits, cooler assessments performed in Phase II of each of those Audits were used to quantify the costs of failure to produce carcasses of the desired USDA Quality Grade mixes. The manner in which such losses were calculated in the National Beef Quality Audit—1995 is illustrated in Table 9.

During Face-To-Face Interviews (Phase I) of the National Beef Quality Audits of 1991 and 1995, the top-ten producer-controllable concerns about beef quality were ascertained. Opinions of purveyors, restaurateurs and retailers were aggregated (Table 10) while those of packers were not (Table 11). From 1991 to 1995: (a) Excess external fat dropped from 1st to 4th, (b) Injection-site lesions dropped from 2nd to 9th, (c) Excess weight/box dropped from 3rd to 7th, (d) Excess seam went off the list, (e) Low overall cutability dropped from 6th to 10th, (f) Dark cutters went off the list, and (g) Bruise damage went off the list—based on the composite of opinions of purveyors, restaurateurs and retailers (Table 10). Those end-users: (a) Increased the rank of low uniformity and consistency (from 5th, up to 1st), (b) Increased the rank of low overall palatability (from 8th, up to 3rd) and (c) Replaced old (1991) quality concerns with new ones—inadequate tenderness (2nd), price too high for value received (5th), insufficient flavor (6th) and inappropriate Quality Grade mix (8th).

From 1991 to 1995: (a) Hide problems (as a general category) dropped from 1st to 3rd and tied-for-9th (as specific concerns for mud/manure and brands), (b) Injection-site lesions went off the list, (c) Excessive weights (as carcasses) dropped from 3rd to 7th (as cattle), (d) Reduced quality due to use of implants went off the list and (e) Bruise damage and insufficient marbling did not change—based on the opinions of packers (Table 11). Packers: (a) Increased the rank of lack of uniformity (from 9th, up to 1st), (b) Increased the rank of excessive external fat (from 8th as Too Many Yield Grades 4 and 5, to tied for 4th as Excessive External Fat), (c) Increased the rank of liver condemnations (from 6th, to 2nd), (d) Increased the rank of dark cutters (from 10th, to tied for 4th) and (e) Added "Beef's price is too high for the value received" to their list.

During the Strategy Workshop of the National Beef Quality Audit—1991, guests/participants identified the "Top Fifteen Quality Concerns Of The Beef Industry" as: (1) Low overall uniformity of beef, (2) Excessive external fat, (3) Low overall uniformity of live cattle, (4) Price too high for the value received, (5) Excessive seam fat, (6) Low overall palatability, (7) Inadequate tenderness, (8) Low overall cutability, (9) Insufficient marbling, (10) Too frequent hide problems, (11) Too high incidence of injection-site lesions, (12) Excessive weights of cuts and boxes of cuts, (13) Excessive live/carcass weights, (14) Inadequate understanding of the value of closer-trimmed beef, and (15) Too large ribeyes/loin eyes. During the Strategy Workshop of the National Beef Quality Audit—1995, the response/reaction/ consensus panel identified the "Top Ten Quality Concerns of The Beef Industry" as: (1) Low

overall uniformity and consistency, (2) Low overall palatability, (3) Insufficient marbling, (4) Inadequate tenderness, (5) Excessive external, seam and beef-trim fat, (6) Excessive weights of cuts and boxes of cuts, (7) Too high incidence of injection-site lesions, (8) Beef's price is too high for the value received, (9) Excessive live and carcass weights, and (10) Too frequent hide problems.

Participants at the Strategy Workshop of the National Beef Quality Audit—1991 determined that the ten best Strategies for "Improving The Consistency And Competitiveness of Fed-Beef" were these: (1) Encourage Quarter-Inch As The New "Commodity" Fat-Trim Specification For Beef Primals/Subprimals; (2) Change Live-To-Carcass Price Logic—From The Present "Dressing Percentage" (Untrimmed Carcass Weight divided by Live Weight times 100) To A New "Red Meat Yield" (Weight Of Carcass Trimmed To Quarter-Inch Fat Trim divided by Live Weight times 100); (3) Keep The "Heat" On Communicating Cutability To Retailers And Packers By Improving Understanding Of The Value Of Closer-Trimmed Beef; (4) Go After, And Correct, Management Practices That Create Nonconformity; (5) Eliminate Biological Types Of Cattle (Not Breeds *per se*) That Fail To Conform; (6) Institute Quality-Based Marketing; (7) Identify Outlier-Values (Ribeye, Too Large Or Too Small; Marbling, Too Low; Weight, Too Heavy Or Too Light; Etc.) For Carcass Traits To Facilitate Meeting Of Targeted Outcomes; (8) Design And Conduct The Strategic Alliance Field Studies ("Partnering Between Cow/Calf Producers, Feeders, Packers, Retailers and Purveyors As Demonstrations Of Functional Integration Based On Total Quality Management Principles—A Proposal Approved In Principle By The NCA Industry Information Committee); (9) Use The National Beef Carcass Data Collection Program (Plus DNA Fingerprinting And Determination Of Shear Force Requirements) To Identify Superior Seedstock; and (10) Repeat The National Beef Quality Audit At Periodic Intervals To Assess Progress And Identify New Opportunities For Improvements In Consistency And Competitiveness Of Beef.

Members of the Response/Reaction/Consensus Panel—at the Strategy Workshop of the National Beef Quality Audit—1995 decided that the eight best Strategies for Improving The Quality, Consistency, Competitiveness And Market-Share Of Beef were: (1) Assist Producers To Use Selection And Management Techniques To Produce Cattle That Fit Customer Expectations For Marbling, Red Meat Yield And Weight; (2) Establish Close-Trimmed Beef As The Industry Standard; (3) Develop A Cattle Identification System That Facilitates Data Collection And Information Feedback, And That Reduces Reliance On Hot-Iron Branding; (4) Encourage Development Of Cattle Pricing Systems That Accurately Identify And Reward Production Of Cattle With Zero Defects; (5) Encourage Development Of Cattle Pricing Systems That Identify, Categorize And Price Product Attributes That Affect Consumer Satisfaction; (6) Continue To Discover, Develop And Apply Technology To Enhance The Quality Of Beef; (7) Identify Breeding Systems That Optimize Production, Palatability and Profitability; and (8) Identify Procedures To Facilitate Improved Customer Satisfaction And Loyalty To The Beef Eating Experience. The Response/Reaction/Consensus Panel at the Strategy Workshop of the National Beef Quality Audit—1995 also identified thirteen Tactics for "Improving The Quality, Consistency, Competitiveness And Market Share Of Beef," but Tactics were not identified as a part of the National Beef Quality Audit—1991.

Table 1. National or international audits that provide assessments of quality and/or safety of U.S. beef.

National Injection-Site Audits—annually since 1991
National Beef Quality Audits—1991, 1995, 2000
Strategic Alliance Field Study—1993
National Market Cow and Bull Audits—1994, 1999
National Veal Quality Audit—1998
International Beef Quality Audit—1994

Table 2. Improving the consistency and competitiveness of fed-beef.

(1) Attack Waste:	Excessive External Fat	$ 219.25
	Excessive Seam Fat	
	Overall Cutability	
	Value of Close-Trimmed Beef	
(2) Enhance Taste:	Overall Palatability	28.81
	Tenderness	
	Insufficient Marbling	
(3) Improve Management:	Injection-Site Lesions	27.26
	Hide Problems	
	Implant Practices	
	Bruises	
	Liver Abscesses	
	Dark Cutters	
(4) Control Weight:	Excessive Live/Carcass Weight	4.50
	Excessive Weight/Box	
	Ribeye/Loineye Size	
		$ 279.82

SOURCE: National Beef Quality Audit—1991.

Table 3. Comparison of results of the NBQA—1991 and the NBQA—1995 using NBQA—1991 prices and logic.

	NBQA—1991	NBQA--1995
Attack Waste	$ 219.25	$ 203.38
Enhance Taste	28.81	36.10
Improve Management	27.26	32.98
Control Weight	4.50	4.13
TOTAL	$ 279.82	$ 276.59
1995 vs. 1991 Gain	$ 3.23	

Table 4. Improving the quality, consistency, competitiveness and market-share of fed-beef from slaughter steers/heifers.

Increase Red Meat Yield	$ 47.76
Enhance Taste And Tenderness	38.30
Improve Tenderness	47.10
Control Weight	4.66
TOTAL	$ 137.82

SOURCE: National Beef Quality Audit—1995

Table 5. Computation of value losses from carcass defects based upon results of Face-To-Face Interviews of packers.

	Percent Occurrence	Value	Discount
Grubs	.25	$ 40.00	$ 2,650,000
Back bruises	2.97	33.85	26,641,642
Loin bruises	1.56	17.86	7,383,324
Shoulder bruises	.36	3.55	338,670
Blood splash	.11	146.00	4,255,900
Dark cutters	.93	146.00	35,981,700
Abscesses	.02	65.00	344,500
Calluses	.02	115.00	609,500
Yellow fat	.06	146.00	2,321,400
Total loss (for the 26.5 million steers/heifers harvested)			$ 80,526,636
Loss per head for carcass defects			$ 3.04

SOURCE: National Beef Quality Audit—1991

Table 6. Quality losses due to management errors.

	NBQA—1991	NBQA—1995	NBQA—1995
	1991 logic and prices	1991 logic and prices	1995 logic and prices
Hide defects	$ 16.88	$ 24.30	$ 24.30
Carcass pathology	1.35	1.23	0.46
Offal condemnation	0.91	1.14	3.44
Injection-site lesions	1.74	1.03	7.05
Bruises	1.00	1.34	4.03
Dark cutters	5.00	2.70	6.08
Grubs, blood-splash, yellow fat, Callus	0.38	1.24	1.74
Loss per head	$ 27.26	$ 32.98	$ 47.10

SOURCE: National Beef Quality Audit—1991; National Beef Quality Audit—1995.

Table 7. How much does beef toughness cost?

Refunds, lost sales	$ 72,600,000
Bos indicus carcass discounts	2,650,000
Total loss (for the 26.5 million steers/ heifers harvested)	$ 75,250,000
Loss per head for toughness =	$2.84

SOURCE: National Beef Quality Audit—1991.

Table 8. Economic estimates associated with beef toughness.

	Sector	Complaints %	Cost/head	Total cost
NBQA—1991	Retail	0.6	$ 2.84	$ 75.25 millio
NBQA—1995	Retail	0.8	3.23	91.60 millio
NBQA—1995	Food Service	3.2	12.05	342.20 millio
NBQA—1995	Overall	1.7	$ 7.64	$217.0 million

SOURCE: National Beef Quality Audit—1995.

Table 9. Three estimates of economic losses incurred because of inadequate marbling/USDA Quality Grade, using information from Phase II of the National Beef Quality Audit (SOURCE: National Beef Quality Audit—1995).

Basis	NBQA—1991[a] 1991 logic and prices[c]	NBQA—1995[a] 1991 logic and prices[c]	NBQA—1995[b] 1995 logic and prices[d]
Eliminate U.S. Standards	$ 10.26	$ 13.18	$ 9.05
Use Low Choice as par	60.75	46.78	50.91
Quality Grade consensus	21.68	25.11	28.41

[a]The Quality Grade Consensus is based on the desired USDA mix agreed upon at the Strategy Workshop of NBQA—1991 (7% Prime, 24% Upper Two-Thirds Choice, 40% Low Choice, 29% Select).

[b]The Quality Grade Consensus is based on the desired USDA mix agreed upon at the Strategy Workshop of NBQA—1995 (7% Prime, 21% Upper Two-Thirds Choice, 34% Low Choice, 38% Select)

[c]The 1991 prices per cwt. of carcasses used to calculate the economic losses were $120 for Prime, $115 for Upper Two-Thirds Choice, $112 for Low Choice, $103 for Select, $96 for Standard and $85 for hardboned.

[d]The 1995 prices per cwt. of carcasses used to calculate the economic losses were $127 for Prime, $119 for Upper Two-Thirds Choice, $112 for Low Choice, $100 for Select, $91 for Standard and $77 for hardboned.

Table 10. Top-Ten producer-controllable concerns about the quality of beef based on Face-To-Face Interviews of purveyors, restaurateurs and retailers.

Composite of opinions of purveyors, restaurateurs and retailers NBQA—1991	Composite of opinions of purveyors, restaurateurs and retailers NBQA—1995
(1) Excess external fat	(1) Low overall uniformity and consistency
(2) Injection-site lesions	(2) Inadequate tenderness
(3) Ribeye/loineye; Weight/box	(3) Low overall palatability
(4) Excess seam fat	(4) Excessive external fat
(5) Lack of uniformity and consistency	(5) Price too high for value received
(6) Low overall cutability	(6) Insufficient flavor
(7) Dark cutters	(7) Excessive weights of cuts and boxes of cuts
(8) Low overall palatability	(8) Inappropriate Quality Grade mix
(9) Bruise damage	(9) Too high incidence of injection-site lesions
(10) Insufficient marbling	(10) Low overall cutability

SOURCE: National Beef Quality Audit—1991; National Beef Quality Audit—1995.

Table 11. Top-Ten producer-controllable concerns about the quality of beef based upon Face-To-Face Interviews of packers.

Opinions of packers NBQA—1991	Opinions of packers NBQA—1995
(1) Hide problems	(1) Lack of uniformity/predictability of cattle
(2) Injection-site lesions	(2) Too high rate of liver condemnations
(3) Excessive carcass weights	(3) Too frequent hide damage due to mud/manure
(4) Bruise damage	(4 tie) Too frequent bruise damage
(5) Reduced quality due to use of implants	(4 tie) Too many dark cutters
	(4 tie) Excessive external fat
(6) Liver condemnations	(7) Cattle of too heavy weight
(7) Insufficient U.S. Choice	(8) Inadequate marbling
(8) Too many Yield Grades 4 and 5	(9 tie) Too frequent hide damage due to hot-iron brands
(9) Lack of uniformity and consistency	(9 tie) Beef's price is too high for the value received
(10) Dark cutters	

SOURCE: National Beef Quality Audit—1991; National Beef Quality Audit—1995.

RELEVANCE OF RESULTS OF THE NATIONAL BEEF QUALITY AUDITS, CONDUCTED IN 1991 AND 1995, TO THE U.S. BEEF INDUSTRY

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We, at Excel, believe that the National Beef Quality Audits (NBQA) of 1991 and 1995 have had a "large" to "moderate-plus" impact on reducing beef quality defect incidence in the industry. The problem remains that not all producers read these audit reports and many that do may or may not implement the recommendations provided. Therefore, the question is "How do you motivate people to implement National Beef Quality Audit findings?" What follows are Excel's perceptions of how the various aspects (Waste, Taste, Management, Weight) of quality nonconformance, identified by the NBQA-1991 and NBQA-1995, have been addressed by producers.

WASTE-$47.76 per head. In the 1995 NBQA, 57% of the lost opportunities associated with waste in the beef industry were due to excess fat production (external, seam, and lean trim fat). There is excess fat production, in the fed steer/heifer population, that occurs as excess external fat, seam fat, internal fat and fat in beef trimmings. Four years after the NBQA-1991 Strategy Workshop, professionals decided that the bar had been set too high for fat reduction and that the net effect could negatively impact both cattle (for production/reproduction reasons) and carcasses (quality grade/eating satisfaction). Accordingly, in the NBQA-1995, the amount of trimmable fat considered acceptable was changed from 0% trimmable fat (NBQA-1991) to a new standard of 16.5% trimmable carcass fat (plus 20% fat in beef trimmings). Unfortunately, 16.5% trimmable fat translates to a targeted Yield Grade of 1.8 and that is still too lofty a goal. A target of Yield Grade 2.5 would better serve the entirety of the beef industry. At a Yield Grade 2 target, the industry could strive for a bell-shaped curve, a normal distribution, of carcasses centered at Yield Grade 2.5 with corresponding percentages of 25% YG 1s, 25% YG 2As, 25% YG 2Bs and 25% YG 3As. There is no question that carcasses of Yield Grades 3B, 4, and 5 must go! Our reasoning for recommending that a target of Yield Grade 2.5, rather than 1.8, be used as the standard in NBQA-2000 is based upon: (a) current industry Yield Grade average (2.5 is realistic and attainable, 1.8 is not), (b) popularity of closely trimmed beef (YG 2 or better is most economical), and (c) management practices designed to attain an average Yield Grade of 1.8 with the genetics available (volume) puts too much negative pressure on marbling at a time when higher-grading carcasses are needed for premium U.S. Choice branded beef programs.

Producers have paid too little attention to extremes in muscling. Although NBQA-1995 recommended that the acceptable range in ribeye area of carcasses should be from 11 to 14 square inches, tremendous variability still exists in muscularity among carcasses.

TASTE-$38.30 per head. Approximately 74% of the quality losses associated with taste were attributed to insufficient marbling. The actual Quality Grade consist in the 1995 NBQA was 1% Prime, 11% upper two-thirds Choice, 36% low Choice, 47% Select, and 5% Standard and lower. The ideal consist, based upon input from retail, food service, and exporter sectors, was identified as 7% Prime, 21% upper two-thirds Choice, 34% low Choice, 38% Select, and 0% Standard and lower.

The shortcomings evident in the 1995 NBQA for Quality Grade mix are the result of the industry response to the directive to Reduce Waste, by reducing cattle/carcass fatness, which has resulted in reduced marbling deposition (largely because of changes in feeding management and cattle types). Quality nonconformance in palatability (tenderness, flavor and juiciness), highlighted in NBQA-1995, has been addressed in the packing sector by movement toward "Branded Beef" programs. The shortcoming is that cattle are still too variable (in carcass traits and eating satisfaction of beef cuts) to fulfill the needs for Branded Beef. Moreover, there has been limited use of technology to improve the palatability of beef that does not meet the specifications for Branded Beef programs. There are presently (as of December 14, 2000) 52 USDA Certified or Process-Verified programs. Branded beef programs should deliver on promises to consumers. Over half (51%) of the current branded beef programs require Prime, upper two-thirds Choice, or—at the least—the upper half of Low Choice. There is hope, as we move to the future, that value-added and ready-to-eat beef products will use technologies to reduce the present variability in eating satisfaction for carcasses in the lower Quality Grades.

MANAGEMENT-$47.10 per head. Hide defects (hot-iron branding, insect damage, and staining) were the primary economic loss ($24.30/head) cited for cattle management in 1995. Secondary management inefficiencies were attributed to injection-site lesions ($7.05/head), dark cutters ($6.08/head), bruises ($4.03/head), and offal condemnations ($3.44/head). Shortcomings associated with these deficiencies are reduced through better education of producers, but it is still an industry problem and packers are unable to assemble large enough numbers of defect-free hides, because of fragmented production of them, to obtain premiums from tanners. The incidence of injection-site lesions has been reduced by industry-wide education and bruise incidence has decreased by packer identification of select suppliers. Unfortunately, though, little decrease has occurred in "dark cutters," probably because it is a seasonal anomaly that is exacerbated by aggressive management, on the part of producers, to increase leanness. Little improvement has been made in reducing offal condemnations because of aggressive production management and extended time-on feed. Of greatest concern are bruises and injection-site lesions because there is no room in the industry for No. 2 products!

WEIGHT-$4.66 per head. The NBQA-1995 recommended a desirable carcass weight range of 600 to 850 pounds. Unfortunately, the industry still accepts carcasses weighing 550 to 950 pounds and cattle/carcass weights continue to climb in the industry.

In summary: (a) NBQA-1995 asked for a shift in Quality Grade consist to the upper side; little progress has occurred. (b) Some management aspects have certainly improved (e.g., injection-site lesions, bruises), while others have not (e.g., offal condemnations). (c) Weight problems continue to exist; hot carcass weight increased from 746 pounds in 1994 to 767 pounds in 2000. Increased weight leads to crushed boxes, and excessive box/cut weights are a major customer complaint. Percentage of steers in the harvest mix decreased from 60% in 1994, to 53.6% in 2000; so, explanation for weight increases cannot be gender-based. (d) Based upon results of the Strategic Alliance Field Study in 1994, it is important to set industry targets that are realistic relative to their attainment. (e) Aggressive implanting of steers/heifers results in lack of uniformity of live cattle, heavy carcass weights, and insufficient marbling. (f) The greatest improvements resulting from industry response to the National Beef Quality Audits have been in reduced injection-site lesions,

fewer light-weight carcasses, improved locations of hide brands on cattle, and fewer bruises on carcasses. (g) The industry has made the least improvement as a result of the National Beef Quality Audits in increasing marbling, reducing the incidence of carcasses that are too heavy, improving uniformity, reducing hide damage due to mud/manure, and reducing the incidence of condemned livers. (h) National Beef Quality Audits have had a "moderate-plus" to "high" impact on improvements made in the quality and consistency of U.S. fed-beef over the past ten years. However, care must be taken to ensure that, as we set targets for cutability, the targets must be realistic and not lead to detrimental effects on other traits that are important, like marbling.

PRODUCER, PACKER, PURVEYOR, RETAILER AND RESTAURATEUR RESPONSES TO QUESTIONNAIRES; RESULTS OF PHASE I OF THE NATIONAL BEEF QUALITY AUDIT—2000

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In the 1991 and 1995 National Beef Quality Audits, Face-To-Face Interviews were conducted with Packers, Purveyors, Retailers, and Restaurateurs to identify their "Concerns About The Quality Of Beef" while Producers were not interviewed. In order to determine the "Changes They Had Made Since 1991," the "Impacts That Past NBQAs Had On Such Changes" and the "Greatest Quality Challenges," Producers were queried by use of questionnaires in Phase I of the National Beef Quality Audit—2000. To identify the "Greatest Improvements Made Since 1991," the "Impacts That Past NBQAs Had On Such Changes" and the "Greatest Quality Challenges," Packers, Purveyors, Retailers and Restaurateurs were also queried by use of questionnaires in Phase I of the National Beef Quality Audit—2000. Face-To-Face Interviews, while beneficial in obtaining more complete information and in determining the intent of the respondents' comments, were replaced with use of questionnaires in order to obtain input from those involved in the production sector and from more of those in the packing, purveying and retailing sectors. Results from the questionnaires represent the perceptions of those responding to the survey.

Producer Questionnaires

Questionnaires were developed for Seedstock Generators, Cow-Calf Producers, Stockers/ Backgrounders and Feedlot Operators. Questionnaires were sent to 52 state quality assurance coordinators for dissemination to individual Producers within each state.

Completed questionnaires were received from 21 states, including Alabama, Arkansas, California, Colorado, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Michigan, Nebraska, Nevada, New Mexico, North Dakota, Ohio, Oklahoma, Pennsylvania, South Dakota, Texas and Wyoming. In total, 2,611 completed questionnaires (Seedstock Generators=518; Cow-Calf Producers=1,424; Stockers/Backgrounders=407; Feedlot Operators=262) had been received for analysis at the time of the Strategy Workshop.

In response to a question asking them to identify, from a list of such challenges, the top five "Greatest Quality Challenges" facing the beef industry, results are presented by sector in Tables 1 through 4. Across all four production sectors, the aggregated results for the top five "Greatest Quality Challenges" for the beef industry were: (1) inadequate tenderness of beef, (2) lack of uniformity in live cattle, (3) insufficient marbling/low Quality Grades, (4) presence of injection-site lesions, and (5) inadequate flavor (Table 5).

Producers were also asked to respond to the "Changes They Had Made Since 1991" (all Producers) in their genetic or management programs, "Changes They Had Been Asked To Make By Their Buyers" (Seedstock Generators) and/or "Changes They Had Requested Of Their Suppliers" (Cow/Calf Producers; Stockers/Backgrounders; Feedlot Operators). Results of responses to these questions, by each production sector of the industry, are presented in Tables 6 through 13. A majority of Producers, 82.6%, indicated that those who buy their cattle have had a "strong" or "moderate" impact on changes they have made since 1991 (Table 14). A majority of Producers, 77% also indicated that results of the past National Beef Quality Audits have had a "strong" or "moderate" impact on changes made since 1991 (Table 15).

Packer Questionnaires

Questionnaires (N=36) were sent to all Packers with plants that were audited in Phase II as well as to corporate representatives for those packing companies with more than one plant in the Audit. Twenty-nine completed questionnaires were received from Packers.

The consist of carcasses and use of specific food safety interventions, based on Packer responses, are presented in Tables 16 and 17, respectively. Results of responses to questions asking them to identify, from a list of such challenges, the top five "Greatest Quality Challenges" presently facing the beef industry plus those for which the industry has made the greatest improvement or least improvement since 1991, are presented in Tables 18, 19 and 20.

The top five "Greatest Quality Challenges" for beef industry were: (1) lack of uniformity in live cattle, (2) carcass weights too heavy, (3) excess fat cover, (4) inadequate tenderness and (5) insufficient marbling/Quality Grades too low (Table 18). Packers believed the greatest improvements in quality since 1991 were reductions in: (1) injection-site lesions, (2) lightweight carcasses, (3) Quality Grade/tenderness decreases due to implants, (4) inadequately muscled carcasses, and (5) ribeyes that are too small (Table 19). Packers believed the least improvements in quality since 1991 were failure to: (1) improve uniformity of live cattle, (2) keep carcasses from being too heavy in weight, (3) keep Yield Grades from being too high, (4) reduce hide damage due to parasites, and (5) prevent Quality Grade/tenderness decreases due to implants (Table 20). Approximately 62% of respondents indicated that results of the 1991 and 1995 National Beef Quality Audits have had a "strong" or "moderate" impact on changes made since 1991 (Table 21).

Purveyor, Retailer And Restaurateur Questionnaires

Questionnaires were sent to Purveyors identified by the North American Meat Processors Association (n=227), the top 100 Retailers identified by Progressive Grocer (n=315), and to American cuisine and steakhouse restaurants listed on state restaurant association web pages

(n=367). Completed questionnaires had been received from 37 Purveyors, 44 Retailers and 32 Restaurateurs at the time of the Strategy Workshop.

The consist of product used by the respondents and the reasons for "Returned Product" are presented in Tables 22 through 24. Respondents were also asked to identify (from a given list) the leading special concerns/desires of their customers/consumers (Table 25). "Greatest Quality Challenges," identified by Purveyors, Retailers and Restaurateurs were: (1) insufficient marbling, (2) lack of uniformity in cuts, (3) excess fat cover, (4) cut weights too heavy, and (5) too large ribeyes (Table 26). Purveyors, Retailers and Restaurateurs were also asked to identify the "Greatest Quality Challenges" for which the industry has made the greatest (Table 27) or least (Table 28) improvement since 1991. Approximately 81% of respondents indicated that results of the 1991 and 1995 National Beef Quality Audits have had a "strong" or "moderate" impact on changes made since 1991 (Table 29).

Top Ten "Greatest Quality Challenges" ranked according to aggregated responses of Purveyors, Retailers, and Restaurateurs are presented in Table 30. Excess external fat, too large cuts, low uniformity, low cutability and low palatability are "Greatest Quality Challenges" that were included among the top ten challenges for the beef industry in 1991, 1995, and now, in 2000.

Percentages of weighted (by sector) responses, by sector of the industry, identifying a "strong," "moderate" or "weak" impact of past National Beef Quality Audits on the "Changes Made Since 1991" in beef quality are presented in Table 31. Across all sectors of the beef industry, 73% of respondents believed that the results of previous National Beef Quality Audits have had a "strong" or "moderate" impact on "Changes Made Since 1991" in beef quality. Results of Phase I of the National Beef Quality Audit—2000 suggest that much of the value of conducting quality audits is educational—increasing awareness of people in each sector of their role and responsibility in improving the quality, consistency, competitiveness and market-share of beef.

Table 1. Top 20 "Greatest Quality Challenges," identified by Seedstock Generators, ranked by percentage of responses weighted by production size.

	Percentage of responses
(1) Lack Of Uniformity In Cattle	15.54
(2) Inadequate Tenderness Of Beef	14.50
(3) Insufficient Marbling/Low Quality Grades	12.23
(4) Presence Of Injection-Site Lesions	8.10
(5) Inadequate Flavor Of Beef	8.03
(6) Inadequate Muscling	6.22
(7) Low Cutability	5.66
(8) Excess Condition/Fat Cover	5.19
(9) Carcass Weights Too Heavy	4.76
(10)Yield Grades Too High	4.29
(11) Reduced Quality Grade/Tenderness Due To Implants	3.07
(12) Presence Of Bruises On Carcasses	2.82
(13) Carcass Condemnations	2.09
(14) Too Small Ribeyes	1.99
(15) Carcass Weights Too Light	1.57
(16) Hide Damage Due To Brands	1.03
(17) Liver Condemnations	0.80
(18) Hide Damage Due To Parasites	0.77
(19) Too Large Ribeyes	0.75
(20) Hide Damage Due To Mud/Manure	0.33

Table 2. Top 20 "Greatest Quality Challenges," identified by Cow-Calf Producers, ranked by percentage of responses weighted by production size.

	Percentage of responses
(1) Lack Of Uniformity In Cattle	15.46
(2) Inadequate Tenderness Of Beef	14.56
(3) Presence Of Injection-Site Lesions	12.10
(4) Insufficient Marbling/Low Quality Grades	11.40
(5) Inadequate Flavor Of Beef	8.57
(6) Presence Of Bruises On Carcasses	5.29
(7) Low Cutability	4.56
(8) Excess Condition/Fat Cover	4.43
(9) Inadequate Muscling	4.36
(10) Carcass Condemnations	3.26
(11) Yield Grades Too High	3.03
(12) Reduced Quality Grade/Tenderness Due To Implants	2.83
(13) Carcass Weights Too Heavy	2.73
(14) Hide Damage Due To Brands	1.61
(15) Too Small Ribeyes	1.45
(16) Carcass Weights Too Light	1.21
(17) Hide Damage Due To Parasites	0.88
(18) Liver Condemnations	0.87
(19) Too Large Ribeyes	0.56
(20) Hide Damage Due To Mud/Manure	0.54

Table 3. Top 20 "Greatest Quality Challenges," identified by Stockers/ Backgrounders, ranked by percentage of responses weighted by production size.

	Percentage of responses
(1) Inadequate Tenderness Of Beef	14.71
(2) Insufficient Marbling/Low Quality Grades	11.91
(3) Lack of Uniformity In Cattle	11.71
(4) Presence Of Injection-Site Lesions	10.72
(5) Inadequate Flavor Of Beef	8.52
(6) Low Cutability	5.83
(7) Excess Condition/Fat Cover	5.38
(8) Carcass Weights Too Heavy	5.13
(9) Presence Of Bruises On Carcasses	4.84
(10) Yield Grades Too High	3.79
(11) Inadequate Muscling	3.74
(12) Reduced Quality Grade/Tenderness Due To Implants	3.54
(13) Carcass Condemnations	2.74
(14) Hide Damage Due To Brands	1.74
(15) Liver Condemnations	1.35
(16) Carcass Weights Too Light	1.30
(17) Too Small Ribeyes	1.00
(18) Too Large Ribeyes	0.90
(19) Hide Damage Due To Parasites	0.60
(20) Hide Damage Due To Mud/Manure	0.45

Table 4. Top 20 "Greatest Quality Challenges," identified by Feedlot Operators, ranked by percentage of responses weighted by production size.

	Percentage of responses
(1) Lack Of Uniformity In Cattle	14.87
(2) Inadequate Tenderness Of Beef	14.15
(3) Insufficient Marbling/Low Quality Grades	10.58
(4) Carcass Weights Too Heavy	8.13
(5) Inadequate Flavor Of Beef	7.01
(6) Presence Of Injection-Site Lesions	6.83
(7) Reduced Quality Grade/Tenderness Due To Implants	5.36
(8) Low Cutability	5.09
(9) Inadequate Muscling	4.38
(10 tie) Presence Of Bruises On Carcasses	3.57
(10 tie) Excess Condition/Fat Cover	3.57
(12) Yield Grades Too High	3.13
(13) Carcass Condemnations	2.72
(14) Liver Condemnations	2.01
(15) Hide Damage Due To Brands	1.96
(16) Too Large Ribeyes	1.83
(17) Hide Damage Due To Mud/Manure	1.74
(18) Carcass Weights Too Light	1.65
(19) Too Small Ribeyes	0.89
(20) Hide Damage Due To Parasites	0.54

Table 5. Top 20 "Greatest Quality Challenges," ranked according to aggregated responses by those in all four production sectors.

	Rank
Inadequate Tenderness Of Beef	1
Lack Of Uniformity In Cattle	2
Insufficient Marbling/Low Quality Grades	3
Presence Of Injection-Site Lesions	4
Inadequate Flavor Of Beef	5
Low Cutability	6
Excess Condition/Fat Cover	7
Carcass Weights Too Heavy	8
Inadequate Muscling	9
Presence Of Bruises On Carcasses	10
Reduced Quality Grade/Tenderness Due To Implants	11
Yield Grades Too High	12
Carcass Condemnations	13
Hide Damage Due To Brands	14
Liver Condemnations	15
Too Small Ribeyes	16
Carcass Weights Too Light	17
Too Large Ribeyes	18
Hide Damage Due To Parasites	19
Hide Damage Due To Mud/Manure	20

Table 6. Top 15 "Changes They Had Made Since 1991," identified by Seedstock Generators, ranked by percentage of responses weighted by production size.

	Percentage of responses
(1) Improved Genetics (Using Performance Traits)	16.99
(2) Changed Injection-Site Location	11.69
(3) Improved Genetics (Using Physical Traits)	11.36
(4) Increased Record-Keeping	9.39
(5) Improved Genetics (Using Carcass Traits)	8.01
(6) Improved Genetics (Using Ultrasound)	6.39
(7) Improved Handling Practices	5.09
(8) Collected Carcass Data	5.06
(9) Changed Vaccination Program	4.35
(10) Maintained Health/Management Data	4.31
(11) Changed Preconditioning Program	3.83
(12) Increased Individual Animal Identification	3.42
(13) Used Genetic Data	3.27
(14) Increased Worker/Employee Awareness	2.77
(15) Joined An Alliance/Supply Chain	1.99

Table 7. Top 15 "Changes They Had Made Since 1991," by Cow-Calf Producers, ranked by percentage of responses weighted by production size.

	Percentage of responses
(1) Changed Injection-Site Location	15.36
(2) Improved Genetics (Using Performance Traits)	14.57
(3) Improved Genetics (Using Physical Traits)	10.56
(4) Increased Record-Keeping	10.22
(5) Improved Handling Practices	6.99
(6) Increased Individual Animal Identification	6.09
(7) Changed Vaccination Program	5.82
(8 tie) Improved Genetics (Using Carcass Traits)	4.93
(8 tie) Changed Preconditioning Program	4.93
(10) Maintained Health/Management Data	4.09
(11) Collected Carcass Data	3.97
(12) Increased Worker/Employee Awareness	3.91
(13) Changed Implant Strategy	2.50
(14) Improved Genetics (Using Ultrasound)	1.77
(15) Joined An Alliance/Supply Chain	1.61

Table 8. Top 15 "Changes They Had Been Asked To Make By Their Buyers," by Seedstock Generators, ranked by percentage of responses weighted by production size.

	Percentage of responses
(1) Improved Genetics (Using Performance Traits)	19.57
(2) Improved Genetics (Using Physical Traits)	14.35
(3) Improved Genetics (Using Carcass Traits)	10.92
(4) Improved Genetics (Using Ultrasound)	9.01
(5) Collected Carcass Data	6.91
(6) Increased Record-Keeping	6.75
(7) Maintained Health/Management Data	5.98
(8) Used Genetic Data	4.84
(9) Changed Injection-Site Location	4.07
(10) Increased Individual Animal Identification	3.85
(11) Changed Preconditioning Program	3.53
(12) Changed Vaccination Program	3.15
(13) Improved Handling Practices	3.12
(14) Joined An Alliance/Supply Chain	1.81
(15) Improved Handling Practices	0.76

Table 9. Top 15 "Changes They Had Requested Of Their Suppliers," by Cow-Calf Producers, ranked by percentage of responses weighted by production size.

	Percentage of responses
(1) Improved Genetics (Using Performance Traits)	18.02
(2) Improved Genetics (Using Physical Traits)	12.55
(3) Improved Genetics (Using Carcass Traits)	11.92
(4) Improved Genetics (Using Ultrasound)	7.43
(5) Collected Carcass Data	6.73
(6) Maintained Health/Management Data	6.57
(7) Increased Record-Keeping	5.78
(8) Changed Injection-Site Location	5.05
(9) Increased Individual Animal Identification	4.38
(10) Changed Vaccination Program	4.17
(11) Used Genetic Data	4.10
(12) Improved Handling Practices	3.93
(13) Changed Preconditioning Program	3.47
(14) Improved Transportation Practices	1.83
(15) Increased Worker/Employee Awareness	1.54

Table 10. Top 14 "Changes They Had Made Since 1991," by Stockers/Backgrounders, ranked by percentage of responses weighted by production size.

	Percentage of responses
(1) Changed Injection-Site Location	15.41
(2) Changed The Genetic Type(s) Of Cattle	13.53
(3) Improved Handling Practices	10.26
(4) Increased Record-Keeping	8.73
(5) Changed Vaccination Program	8.38
(6) Maintained Health/Management Data	6.94
(7) Increased Worker/Employee Awareness	6.72
(8) Provided Incentive For Preconditioned Calves	6.37
(9) Provided Incentive For Genetically Superior Calves	5.72
(10) Collect And Use Carcass Data	5.41
(11) Increased Individual Animal Identification	5.02
(12) Changed Implant Strategy	3.67
(13) Improved Transportation Practices	2.62
(14) Fed Supplemental Vitamin E For Caselife Extension	1.22

Table 11. Top 14 "Changes They Had Made Since 1991," by Feedlot Operators ranked by percentage of responses weighted by production size.

	Percentage of responses
(1) Changed Injection-Site Location	13.72
(2) Changed The Genetic Type(s) Of Cattle	12.00
(3) Collect And Use Carcass Data	11.91
(4) Improved Handling Practices	9.15
(5) Increased Record-Keeping	8.46
(6) Increased Worker/Employee Awareness	8.37
(7) Changed Implant Strategy	7.94
(8) Provided Incentive For Preconditioned Calves	6.65
(9) Maintained Health/Management Data	5.91
(10) Increased Individual Animal Identification	4.70
(11) Provided Incentive For Genetically Superior Calves	4.45
(12) Changed Vaccination Program	4.14
(13 tie) Improved Transportation Practices	1.29
(13 tie) Fed Supplemental Vitamin E For Caselife Extension	1.29

Table 12. Top 14 "Changes They Had Requested Of Their Suppliers," by Stockers/Backgrounders, ranked by percentage of responses weighted by production size.

	Percentage of responses
(1) Changed The Genetic Type(s) Of Cattle	14.83
(2) Changed Vaccination Program	10.65
(3) Provided Incentive For Preconditioned Calves	10.16
(4) Improved Handling Practices	9.97
(5) Provided Incentive For Genetically Superior Calves	8.85
(6) Maintained Health/Management Data	8.66
(7) Changed Injection-Site Location	8.47
(8) Improved Transportation Practices	7.04
(9) Increased Record-Keeping	5.30
(10) Increased Individual Animal Identification	4.92
(11) Collect And Use Carcass Data	3.99
(12) Increased Worker/Employee Awareness	3.68
(13) Changed Implant Strategy	2.06
(14) Fed Supplemental Vitamin E For Caselife Extension	1.43

Table 13. Top 14 "Changes They Had Requested Of Their Suppliers," by Feedlot Operators, ranked by percentage of responses weighted by production size.

	Percentage of responses
(1) Changed The Genetic Type(s) Of Cattle	15.15
(2) Changed Vaccination Program	11.21
(3) Improved Handling Practices	10.73
(4) Provided Incentive For Preconditioned Calves	9.00
(5) Changed Injection-Site Location	8.84
(6) Maintained Health/Management Data	8.79
(7) Improved Transportation Practices	7.92
(8) Increased Record-Keeping	6.31
(9) Provided Incentive For Genetically Superior Calves	5.98
(10) Collect And Use Carcass Data	4.85
(11) Increased Worker/Employee Awareness	4.42
(12) Increased Individual Animal Identification	3.67
(13) Changed Implant Strategy	2.43
(14) Fed Supplemental Vitamin E For Caselife Extension	0.70

Table 14. Percentage of weighted (by production size) responses, by production sector of the industry, identifying a "strong," "moderate" or "weak" impact of those who buy cattle on the "Changes Made Since 1991."

Sector	Strong Impact %	Moderate Impact %	Weak Impact %
Seedstock Generators	30.08	54.35	15.57
Cow-Calf Producers	26.93	55.51	17.56
Stockers/Backgrounders	26.28	58.97	14.74
Feedlot Operators	51.63	38.60	9.77
All Sectors	27.05	55.55	17.40

Table 15. Percentage of weighted (by production size) responses, by production sector of the industry, identifying a "strong," "moderate" or "weak" impact of past National Beef Quality Audits on the "Changes Made Since 1991."

Sector	Strong Impact %	Moderate Impact %	Weak Impact %
Seedstock Generators	21.22	53.99	24.79
Cow-Calf Producers	17.27	59.74	23.00
Stockers/ Backgrounders	13.99	59.50	26.51
Feedlot Operators	47.68	40.51	11.81
All Sectors	17.33	59.67	23.01

Table 16. Mean, standard deviation, minimum and maximum values for percentages of the consist of carcasses, based on Packer responses, weighted by the number of plants operated.

	Mean	SD	Min	Max
Hot Carcass Weight (lb)				
Less than 400				
400-600				
600-800				
800-1000				
More than 1000				
Quality Grade				
Prime				
Upper 2/3 Choice				
Lower 1/3 Choice				
Select				
Standard				
B-Maturity				
Hardboned				
Yield Grade				
Yield Grade 1				
Yield Grade 2				
Yield Grade 3				
Yield Grade 4				
Yield Grade 5				
Other Characteristics				
Callused Ribeye				
Dark Cutter				
Blood Splash				
Branded Beef Programs				
Number of Branded Beef Programs				
Programs with Breed Specification				
Programs with Marbling Specification				
Programs with Hide Color Specification				
Programs with Yield Grade Specification				

Table 17. Packing companies, based on Packer responses, using specific food safety interventions.

	Packers Using the Intervention (%)
Steam Vacuum	100.00
Pre-evisceration Wash	86.21
Steam Pasteurization	82.76
Acid Wash or Rinse	75.86
Hot Water (>165ºF) Wash	34.48

Table 18. Top 23 "Greatest Quality Challenges," identified by Packers, ranked by percentage of responses weighted by number of plants operated.

	Percentage of responses
(1) Lack of Uniformity In Live Cattle	17.73
(2) Carcass Weights Too High	17.02
(3) Excess Fat Cover	12.14
(4 tie) Inadequate Tenderness	7.80
(4 tie) Insufficient Marbling/Quality Grades Too Low	7.80
(4 tie) Reduced Quality Grade/Tenderness Due To Implants	7.80
(7) Food Safety	7.09
(8) Low Cutability	4.96
(9) Presence Of Bruises On Carcasses	2.84
(10 tie) Yield Grades Too High	2.13
(10 tie) Presence Of Injection-Site Lesions	2.13
(12 tie) Liver Condemnations	1.42
(12 tie) Hide Damage Due To Brands	1.42
(13 tie) Hide Damage Due To Mud/Manure	0.71
(13 tie) Presence Of Horns	0.71
(13 tie) Carcass Condemnations	0.71
(13 tie) Hide Damage Due To Parasites	0.71
(13 tie) Carcass Weights Too Light	0.71
(13 tie) Too Small Ribeyes	0.71
(13 tie) Inadequate Muscling	0.71
(13 tie) Inadequate Flavor	0.71
(13 tie) *E. coli* O157:H7 Carriers	0.71
(13 tie) Lack Of Uniformity In The Grading Service	0.71

Table 19. Top 10 "Greatest Quality Challenges," identified by Packers, for which the industry has made the greatest improvement since 1991, ranked by percentage of responses weighted by the number of plants operated.

	Percentage of responses
(1) Presence Of Injection-Site Lesions	18.71
(2) Carcass Weights Too Light	15.83
(3) Reduced Quality Grade/Tenderness Due To Implants	8.63
(4 tie) Inadequate Muscling	7.91
(4 tie) Too Small Ribeyes	7.91
(6) Hide Damage Due To Parasites	6.47
(7 tie) Carcass Condemnations	5.76
(7 tie) Excess Fat Cover	5.76
(7 tie) Presence Of Bruises On Carcasses	5.76
(10) Hide Damage Due To Brands	4.32

Table 20. Top 10 "Greatest Quality Challenges," identified by Packers, for which the industry has made the least improvement since 1991, ranked by percentage of responses weighted by the number of plants operated.

	Percentage of responses
(1) Lack Of Uniformity In Live Cattle	14.18
(2) Carcass Weights Too Heavy	13.48
(3) Yield Grades Too High	12.06
(4) Hide Damage Due To Parasites	10.64
(5) Insufficient Marbling/Quality Grades Too Low	9.22
(6 tie) Inadequate Tenderness	8.51
(6 tie) Liver Condemnations	8.51
(8 tie) Hide Damage Due To Brands	4.26
(8 tie) Hide Damage Due To Mud/Manure	4.26
(10) Reduced Quality Grade/Tenderness Due To Implants	2.84

Table 21. Percentage of weighted (by number of plants operated) responses of Packers identifying a "strong," "moderate" or "weak" impact of past National Beef Quality Audits on the "Changes Made Since 1991" in beef quality.

Strong Impact %	Moderate Impact %	Weak Impact %
6.90	55.17	37.93

Table 22. Percentages of beef purchases by Quality Grade and aging time as well as number of Branded Beef products handled, based on responses of Purveyors, Retailers and Restaurateurs.

	Purveyor	Retailer	Restaurateur
Quality Grade Purchases*			
Prime	3.6	1.8	20.6
Upper 2/3 Choice	42.7	34.2	51.3
Lower 1/3 Choice	17.9	19.7	25.5
Select	22.4	35.0	24.2
Standard	3.0	1.0	0.0
Aging Time (days)*			
Less than 7	2.7	11.6	27.6
7 to 14	27.0	41.9	10.3
14 to 21	54.1	37.2	44.8
More than 21	16.2	9.3	17.2
Branded Beef Programs			
Number	4.0	2.5	2.3

*Columns do not necessarily sum to 100 because of partial/incomplete answers on some questionnaires.

Table 23. Percentages of product generated, ground beef identified by primal-cut origin, and "Returned Product" based on responses of Purveyors, Retailers and Restaurateurs.

	0-20%	20-40%	40-60%	60-80%	80-100%
Product Generated					
Purveyor					
-----Steaks	0.00	14.29	20.00	34.29	31.43
-----Further Processed Products	77.14	8.57	2.86	5.71	5.71
-----Ground Beef	53.13	21.88	15.63	6.25	3.13
Retailer					
-----Steaks	0.00	6.82	31.82	34.09	27.27
-----Further Processed Products	69.44	22.22	5.56	2.78	0.00
-----Ground Beef	53.66	31.71	7.32	4.88	2.44
Restaurateur					
-----Steaks	7.41	18.52	11.11	22.22	40.74
-----Further Processed Products	75.00	10.00	10.00	5.00	0.00
-----Ground Beef	52.00	16.00	12.00	8.00	12.00
Ground Beef Identified by Primal-Cut Origin					
Purveyor--Now	51.61	19.35	12.90	6.45	9.68
Purveyor--Then	70.00	13.33	13.33	0.00	3.33
Retailer--Now	26.83	19.51	7.32	17.07	29.27
Retailer--Then	37.50	30.00	17.50	2.50	12.50
Restaurateur--Now	29.17	12.50	16.67	8.33	33.33
Restaurateur--Then	75.00	10.00	10.00	5.00	0.00
Returned Products					
Purveyor					
-----Tenderness	91.43	5.71	2.86	0.00	0.00
-----Juiciness	90.91	6.06	3.03	0.00	0.00
-----Flavor	93.94	0.00	3.03	0.00	3.03
Retailer					
-----Tenderness	81.40	2.33	2.33	6.98	6.98
-----Juiciness	95.00	2.50	0.00	2.50	0.00
-----Flavor	92.50	5.00	2.50	0.00	0.00
Restaurateur					
-----Tenderness	78.57	3.57	10.71	7.14	0.00
-----Juiciness	82.61	8.70	4.35	0.00	4.35
-----Flavor	72.00	16.00	4.00	4.00	4.00

Table 24. Reasons for "Returned Product," by percentages,* based on responses of Purveyors, Retailers and Restaurateurs.

	Purveyor	Retailer	Restaurateur
Excess Fat Cover	13.22	7.25	22.67
Inadequate Tenderness	9.92		18.67
Too Large Ribeye	4.96	6.22	
Inadequate Flavor	4.13		13.33
Bruises	3.31	13.99	
Excess Seam Fat	2.48	5.18	1.33
Cut Weights Too Heavy	1.65	11.40	
Insufficient Marbling	1.65	0.52	
Inadequate Juiciness	1.65		8.00
Inadequate Muscling	0.83	4.15	
Cut Weights Too Light	0.83	10.88	1.33
Lack of Uniformity In Cuts		13.47	2.67
Injection-Site Lesions		21.24	
Too Small Ribeyes		5.70	
Inadequate Overall Palatability			1.33

*Columns do not necessarily sum to 100 because of partial/incomplete answers on some questionnaires.

Table 25. Special concerns/desires of customers/consumers by percentages, based on responses of Purveyors, Retailers and Restaurateurs.

	Purveyor	Retailer	Restaurateur
E. coli O157:H7	20.30	21.14	20.18
Salmonella	15.04	10.82	14.04
Hormone Residues	13.53	13.40	17.54
Antibiotic Residues	13.53	13.92	14.04
Listeria monocytogenes	12.03	11.34	7.89
Desire For Traceback	9.02	4.12	7.89
Desire For Natural Products	6.02	7.22	3.51
Desire For Organic Products	4.51	5.67	3.51
Concerns About Animal Welfare	3.76	7.22	7.89
Concerns About Environment	2.26	5.15	3.51

Table 26. "Greatest Quality Challenges," identified by Purveyors, Retailers, and Restaurateurs, by percentage of responses.

	Purveyor	Retailer	Restaurateur
Insufficient Marbling	13.89	13.02	11.03
Lack Of Uniformity In Cuts	13.19	13.02	9.56
Excess Fat Cover	11.11	7.81	10.29
Cut Weights Too Heavy	10.42	8.34	4.41
Too Large Ribeyes	10.42	3.65	6.62
Low Cutability	9.72	2.60	7.35
Inadequate Tenderness	9.03	14.59	13.23
Excess Seam Fat	4.86	2.08	5.15
Bruises	4.17	3.13	1.47
Inadequate Flavor	4.17	13.02	10.29
Inadequate Overall Palatability	3.47	7.81	3.68
Inadequate Juiciness	2.78	6.25	9.56
Inadequate Muscling	1.39	0.00	1.47
Cut Weights Too Light	0.69	0.52	2.94
Too Small Ribeyes	0.69	1.56	2.21
Injection-Site Lesions	0.00	2.60	0.74

Table 27. "Greatest Quality Challenges" for which the industry has made the greatest improvement since 1991 identified by Purveyors, Retailers and Restaurateurs, by percentages of responses.

	Purveyor	Retailer	Restaurateur
Bruises	12.40	13.54	12.15
Injection-Site Lesions	10.95	12.50	12.15
Excess Fat Cover	10.95	15.10	9.35
Inadequate Overall Palatability	8.76	4.69	8.41
Low Cutability	8.03	10.95	3.74
Inadequate Flavor	7.30	1.56	8.41
Lack Of Uniformity In Cuts	6.57	9.90	7.48
Inadequate Tenderness	6.57	4.17	8.41
Insufficient Marbling	5.84	2.60	4.67
Inadequate Juiciness	5.84	1.56	6.54
Excess Seam Fat	4.38	6.77	0.93
Inadequate Muscling	4.38	7.81	5.61
Cut Weights Too Light	3.65	4.17	4.67
Cut Weights Too Heavy	2.19	2.08	3.74
Too Small Ribeyes	2.19	1.04	1.87
Too Large Ribeyes	0.00	1.56	1.87

Table 28. "Greatest Quality Challenges" for which the industry has made the least improvement since 1991, identified by Purveyors, Retailers, and Restaurateurs, by percentage of responses.

	Purveyor	Retailer	Restaurateur
Lack Of Uniformity In Cuts	12.00	11.80	6.59
Insufficient Marbling	12.00	9.94	12.09
Cut Weights Too Heavy	11.20	7.45	5.49
Excess Fat Cover	10.40	5.59	12.09
Low Cutability	9.60	1.24	8.79
Inadequate Flavor	9.60	10.56	7.69
Inadequate Tenderness	7.20	14.30	8.79
Too Large Ribeyes	6.40	3.73	9.89
Inadequate Overall Palatability	6.40	11.18	3.30
Excess Seam Fat	4.80	7.45	7.69
Inadequate Juiciness	3.20	7.45	5.49
Bruises	2.40	3.73	3.30
Cut Weights Too Light	2.40	1.86	1.10
Inadequate Muscling	2.40	1.86	4.40
Injection-Site Lesions	0.00	1.86	1.10
Too Small Ribeyes	0.00	0.00	2.20

Table 29. Percentage of responses, by sector of the industry, identifying a "strong," "moderate" or "weak" impact of past National Beef Quality Audits on the "Changes Made Since 1991" in beef quality.

Sector	Strong Impact %	Moderate Impact %	Weak Impact %
Purveyors	6.9	55.2	37.9
Retailers	10.3	82.0	7.7
Restaurateurs	11.5	77.0	11.5
All Sectors	9.5	71.8	18.7

Table 30. Top 10 "Greatest Quality Challenges" ranked according to aggregated responses of Purveyors, Retailers, and Restaurateurs.

	Rank
Insufficient Marbling	1
Lack Of Uniformity In Cuts	2 tie
Inadequate Tenderness	2 tie
Excess Fat Cover	4
Inadequate Flavor	5
Cut Weights Too Heavy	6
Too Large Ribeyes	7
Low Cutability	8
Inadequate Juiciness	9
Inadequate Overall Palatability	10

Table 31. Percentages of weighted (by sector) responses, by sector of the industry, identifying a "strong," "moderate" or "weak" impact of past National Beef Quality Audits on the "Changes Made Since 1991" in beef quality.

		Strong Impact %	Moderate Impact %	Weak Impact %
Producers		17	60	23
Packers		7	55	38
Purveyors, Retailers and Restaurateurs		10	72	18
All Responses	Actual	17	60	23
	Average	11	63	26

HARVEST-FLOOR AUDITS;
RESULTS OF PHASE II OF THE NATIONAL BEEF QUALITY AUDIT—2000

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Background

The first portion of Phase II of the NBQA–2000 was the collection of harvest floor data. Information collected on the harvest floor was segmented into three categories: hide-on, bruise, and condemnation. Data collected while the hide was still on the animal included primary hide color (black, red, yellow, grey, white, brown, brindle, or "Holstein"), percent saturation of hide color (100%, 85%, 84-51%, or roan), mud/manure location (none, legs, belly, side, topline, or combination), mud/manure amount (none, small, moderate, large, or extreme), presence/absence of mud/manure in the tail region, presence/absence of horns, size of horns (<1", 1-5", or >5"), and presence/absence, location (shoulder, side, butt) and size of brands. Data collected with the hide removed included the presence/absence, location and severity of bruises (average minor ≈ 0.66 lb. of trim to remove the bruise; average major ≈ 1.5 lb. of trim to remove the bruise; average critical ≈ 3.2 lb. of trim to remove the bruise; extreme ≈ greater than 5.0 lb. of trim to remove the bruise), and the incidence of contamination, injection sites, and grubs. Heads, tongues, livers, lungs, tripe, and carcasses were evaluated for incidence of condemnation and corresponding reasoning for condemnation. In addition, the incidence of fetuses was recorded.

All observations were collected by highly trained personnel from Colorado State University, Oklahoma State University, West Texas A&M University, and Texas A&M University. Thirty plants were audited, beginning in May 2000 and concluding in November 2000. University teams audited each plant for the equivalent of one day's production. Fifty percent of each lot for each shift was audited in each plant, resulting in a total sample size of 43,415 and 43,595 carcasses for hide-on and bruise evaluations, respectively. For condemnation data, approximately ten percent of each lot for each shift was audited in each plant, resulting in a total sample size of 8,588.

Results

Cattle were classified according to predominant hide color and pattern before hide removal. Data indicate that 45.1% of the fed-beef population had black as the predominant hide color, 31.0% were red and 8.0% were yellow (Figure 1). "Holstein" was the fourth most predominant color classification at 5.7%, which corresponds very closely to the 6.9% dairy type carcasses reported in the cooler section. Also, cattle were evaluated for color pattern before hide removal to differentiate solid colored cattle (Figure 2). Data indicate that 32.0% of the fed-beef population were solid black in color while an additional 11.7% were predominantly black with a

white face (i.e., black baldy). Solid red cattle were 16.6% of the cattle evaluated and 12.5% were predominantly red with a white face (like that of Hereford).

Figure 3 shows the distribution of mud/manure amounts. Of the cattle evaluated for mud/manure coverage, 18% had none, 55.8% had a small amount, and 23.0% had a moderate amount while 3.8% had a large or extreme amount. Location of mud/manure was highly variable as 61.0% (complete data not shown) of the cattle had mud/manure coverage in multiple locations. Of the multiple locations, 25.3% of the cattle had mud/manure on both the legs and belly, 8.5% had mud/manure on their legs, belly, and side, and 18.8% had mud/manure coverage over their entire hide (Figure 4). Of the single locations, 8.9% and 8.1% of the cattle had mud/manure only on their legs or belly, respectively. Mud/manure was absent in the tail region (around the anus) of 66.6% of the cattle.

The frequency of cattle without horns was 77.3%, which was an increase from the 68.9% and 67.8% reported in 1991 and 1995, respectively (Figure 5). Of the cattle with horns, 10.1% were less than 1 in., 75.5% were between 1 to 5 in., and 14.4% had horn lengths greater than 5 in.

Figure 6 shows the distribution of brands by location. Close to half of the cattle did not have any brands (49.3%), which was a slight increase from 1995. The percentage of butt brands decreased slightly from 1995 (36.3% versus 38.7%), but was still much higher than the 29.9% observed in 1991. The percentage of side brands decreased 3.1 percentage points from 1995 to a level comparable to 1991. The percentage of cattle with multiple brands was 4.4%, which was lower than the 6.2% reported in 1995 (Figure 7). Table 1 shows the mean brand sizes by location for the previous and current audits. Mean brand sizes for NBQA–2000 were smaller than those reported in 1995, but slightly larger those reported in 1991.

The frequency distribution for the occurrence of bruises is displayed in Figure 8. A majority of the carcasses (53.3%) had no bruise, which was slightly higher than the 51.6% observed in 1995. The percentages of carcasses with bruises were almost identical to the values reported in 1995 within each numerical category. Of the carcasses with bruises, 14.9%, 25.9%, 19.4%, 28.2%, and 11.6% were located in the round, loin, rib, chuck, and brisket/flank/plate, respectively. The percentage of bruises occurring in the loin decreased dramatically from the 41.1% reported in 1995. The percentage of bruises occurring in the round more than doubled from the 7.2% in 1995, and there was a much greater incidence of bruising in the brisket/flank/plate area. Previous audits evaluated only the brisket area for bruising, whereas the current audit also included the flank and plate areas. The severity of bruising within each location is shown in Figure 10. The vast majority of the bruises reported in the round, loin, rib, chuck, and brisket/ flank/plate were minor (83.0%, 70.0%, 73.6%, 76.6%, and 71.1%, respectively). Major and critical/extreme bruises had incidence rates of 16.9%, 30.0%, 26.3%, 23.0%, and 25.3% in the round, loin, rib, chuck, and brisket/flank/plate, respectively. Major and critical bruises occurred at much higher incidence rates in 1995 (48.7% for the round, 51.9% for the loin, 61.1% for the rib, and 56.5% for the chuck) indicating a decrease in the incidence rates of severe bruises in 2000.

Percentage offal condemnation and fetal incidences are displayed in Figure 11. Condemnation rates for livers and lungs increased 8.1 and 8.8 percentage points, respectively, from the 1995

audit (30.3% versus 22.2% for livers; 13.8% versus 5.0% for lungs). Furthermore, there was an increase in the condemnation rates for heads and tongues from 1995 (6.2% versus 0.9% for heads; 7.0% versus 3.8% for tongues). Figure 12 shows the breakout of visceral condemnations by cause. Of the condemned livers, 44.8% were condemned for abscesses, 21.7% for flukes, and 33.6% for other reasons such as contamination. A vast majority of heads (83.0%) and tongues (73.0%) were condemned for other or "unspecified" reasons. NBQA–2000 visceral condemnation data included contamination as a cause for condemnation, which was not the case in previous audits. Removal of the contamination component would reduce the condemnation rate in each category, however, it is expected that condemnation rates would still be higher than were reported in the 1991 and 1995 audits. Carcass and tripe condemnation rates, and fetus incidences were similar to the previous audits.

Table 1. Mean brand sizes by location for the three quality audits

Location	NBQA 1991	NBQA 1995	NBQA 2000
Butt	4" X 4"	6" X 6"	5" X 5"
Side	7" X 7"	10" X 10"	9" X 9"
Shoulder	5" X 5"	7" X 7"	6" X 6"

Figure 1. Frequency distribution of cattle by predominant hide color -- NBQA-2000

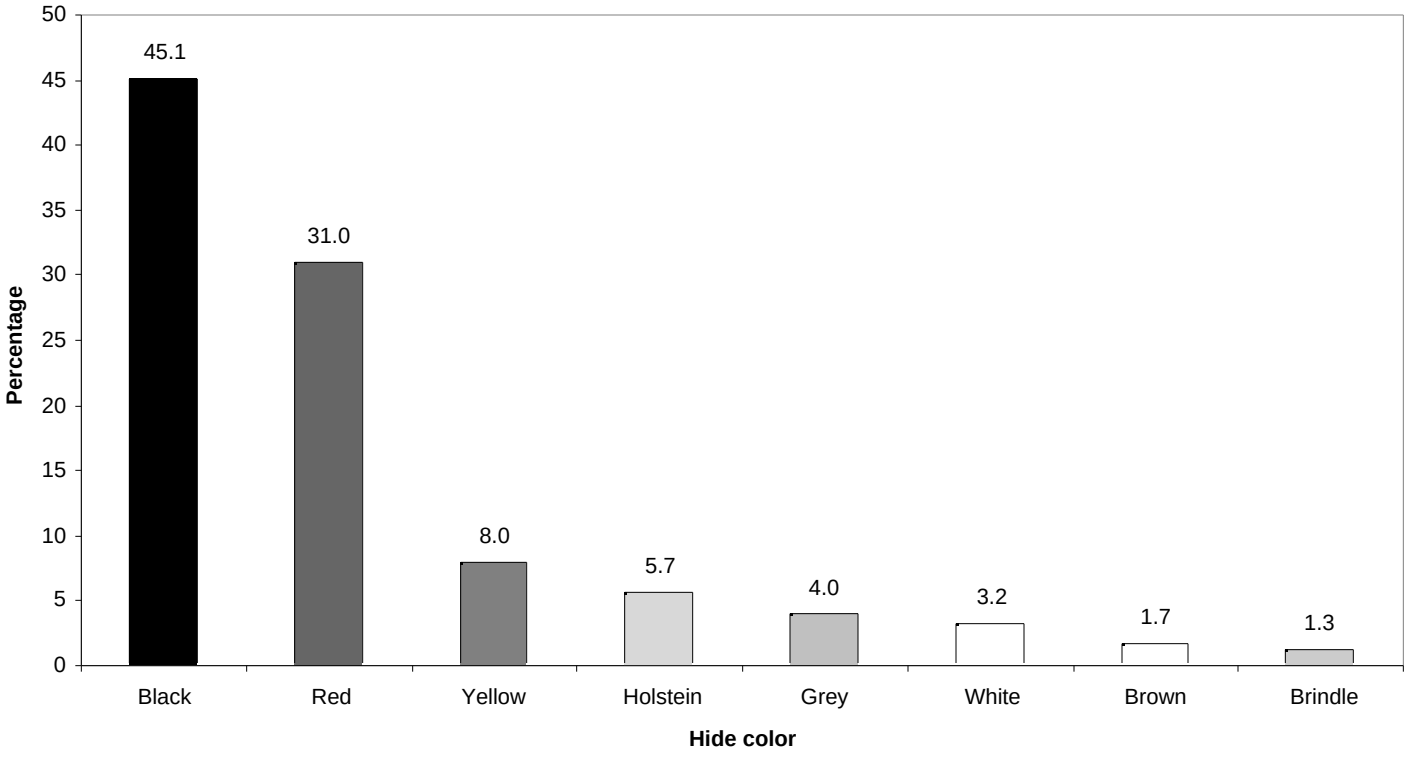


Figure 2. Frequency distribution of cattle by predominant hide color and pattern -- NBQA-2000

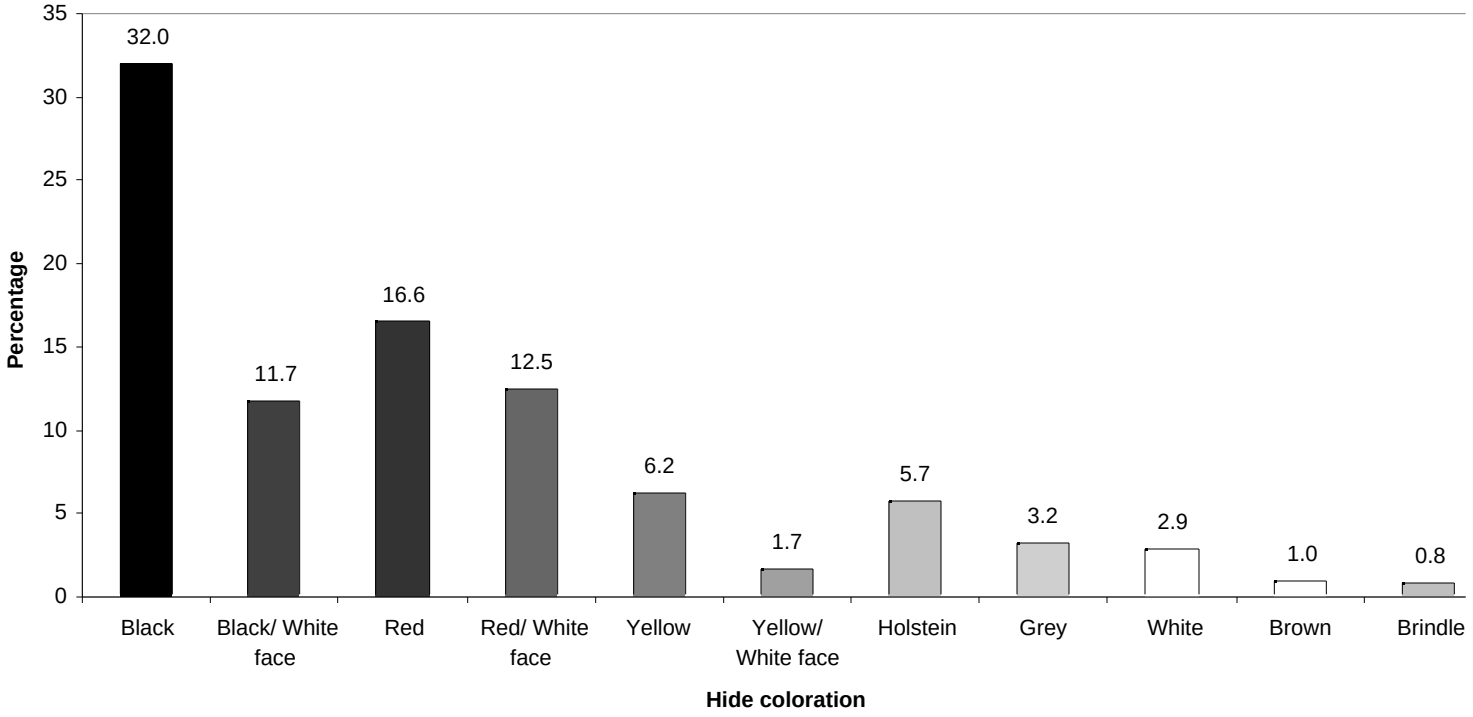


Figure 3. Frequency distribution of mud/manure amount -- NBQA-2000

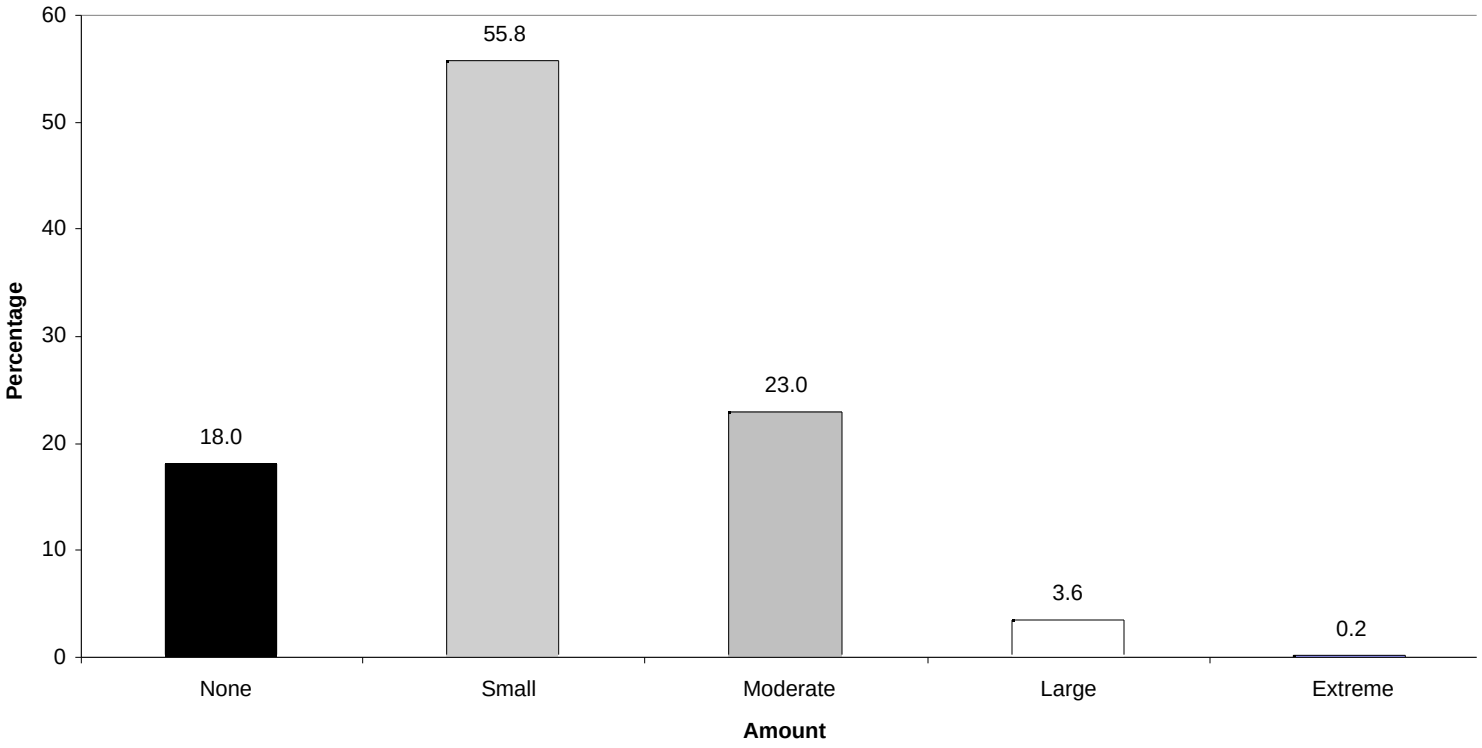


Figure 4. Frequency distribution of mud/manure by location -- NBQA-2000

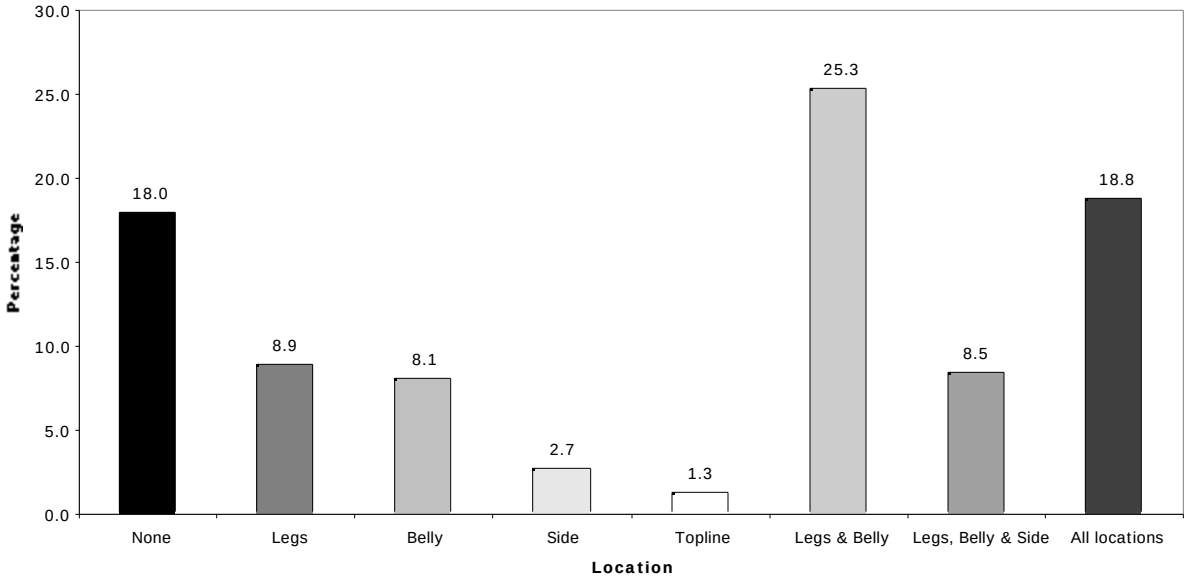


Figure 5. Frequency of cattle with or without horns -- NBQA-1991, NBQA-1995, NBQA-2000

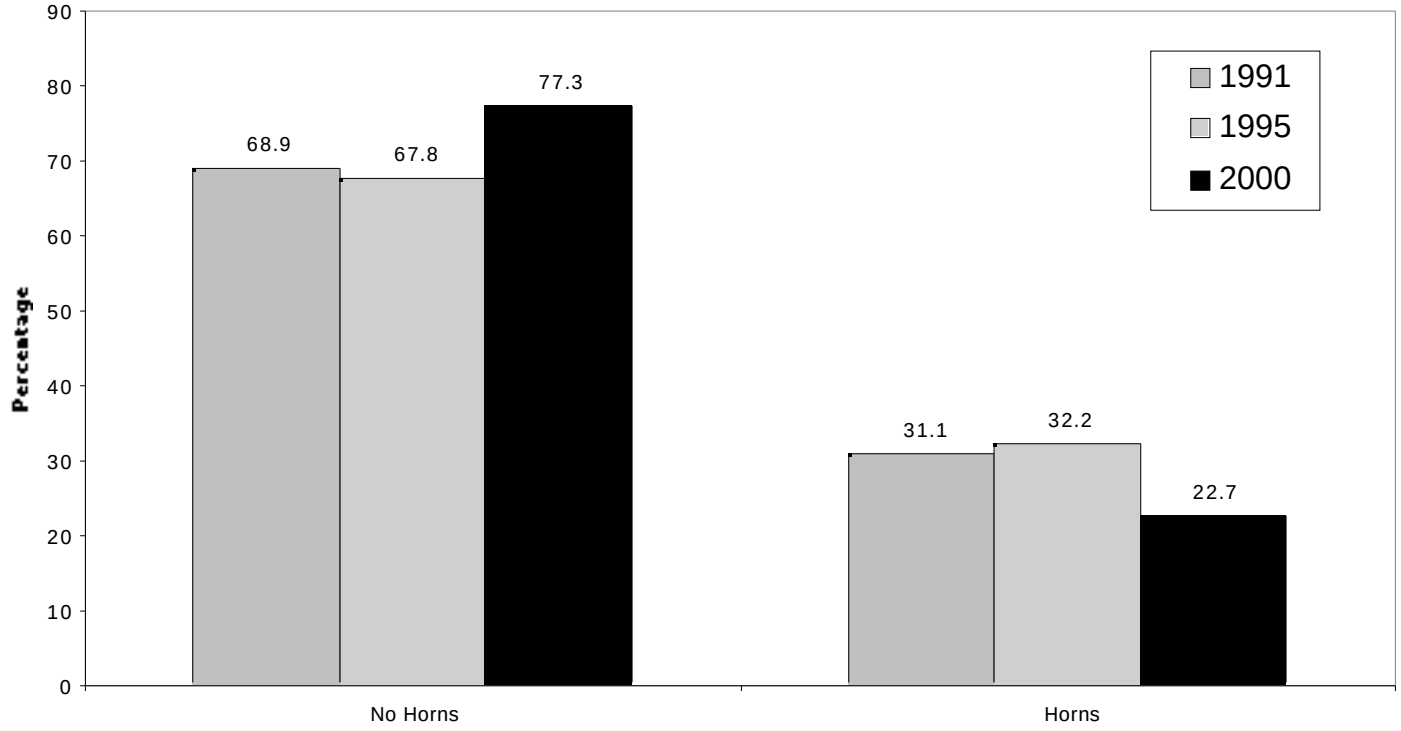


Figure 6. Frequency distribution of brands by location -- NBQA-1991, NBQA-1995, NBQA-2000

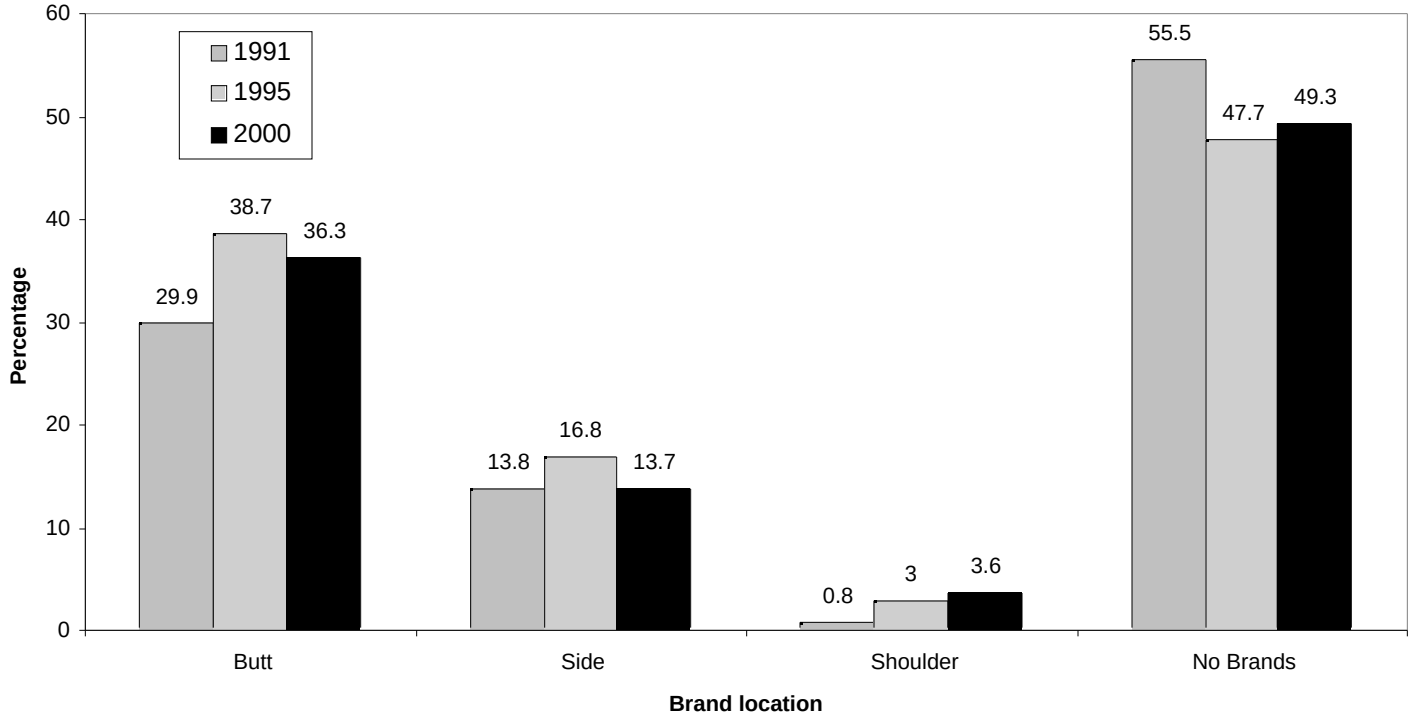


Figure 7. Frequency distribution of brands by occurrence -- NBQA-2000

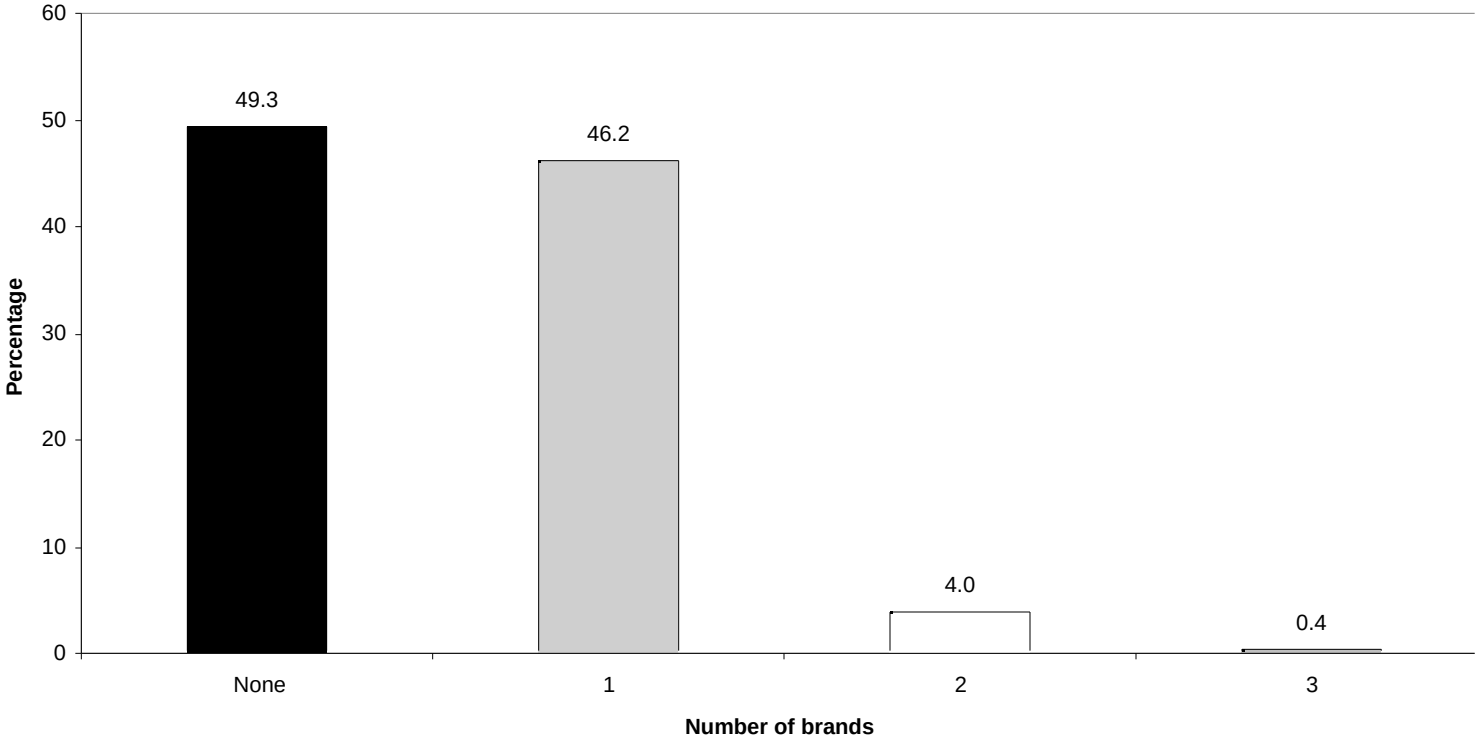


Figure 8. Frequency distribution of bruises by occurrence -- NBQA-1995, NBQA-2000

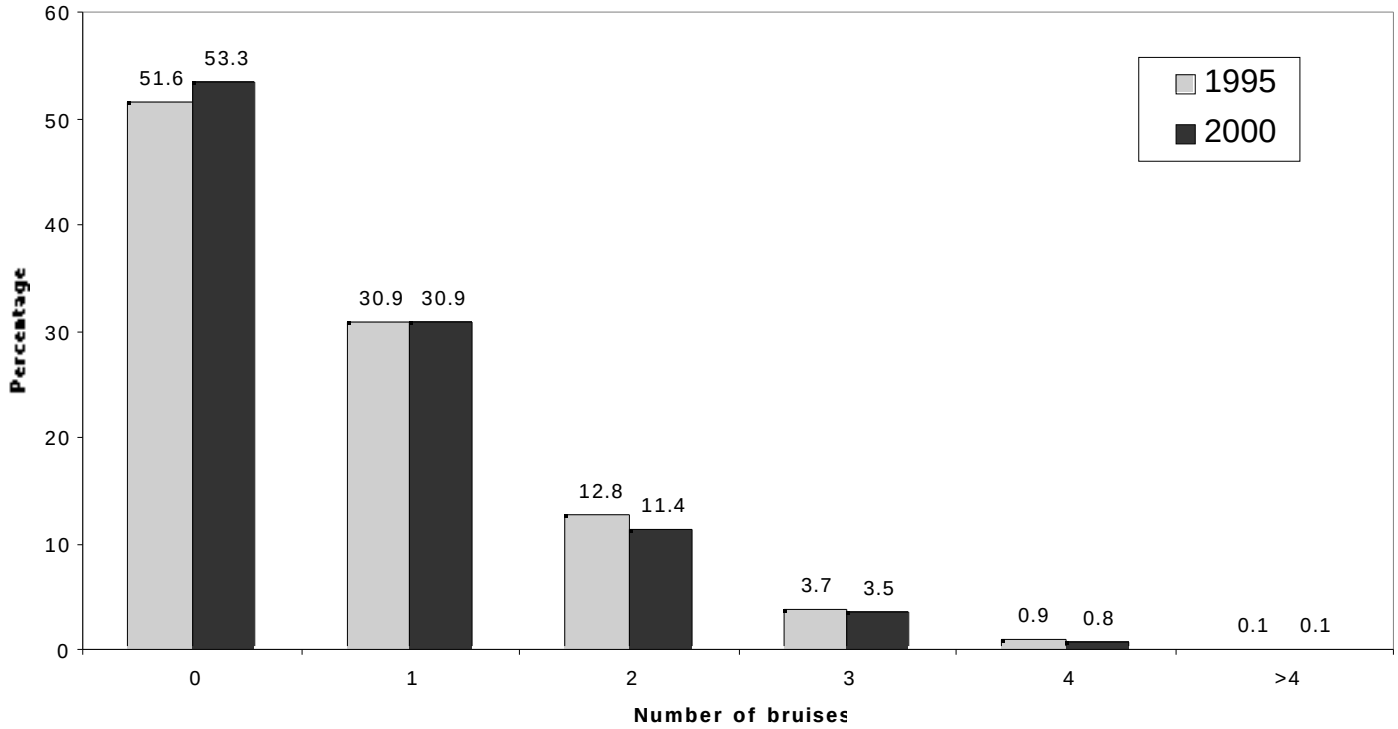


Figure 9. Frequency distribution of bruises by location -- NBQA-1995, NBQA-2000

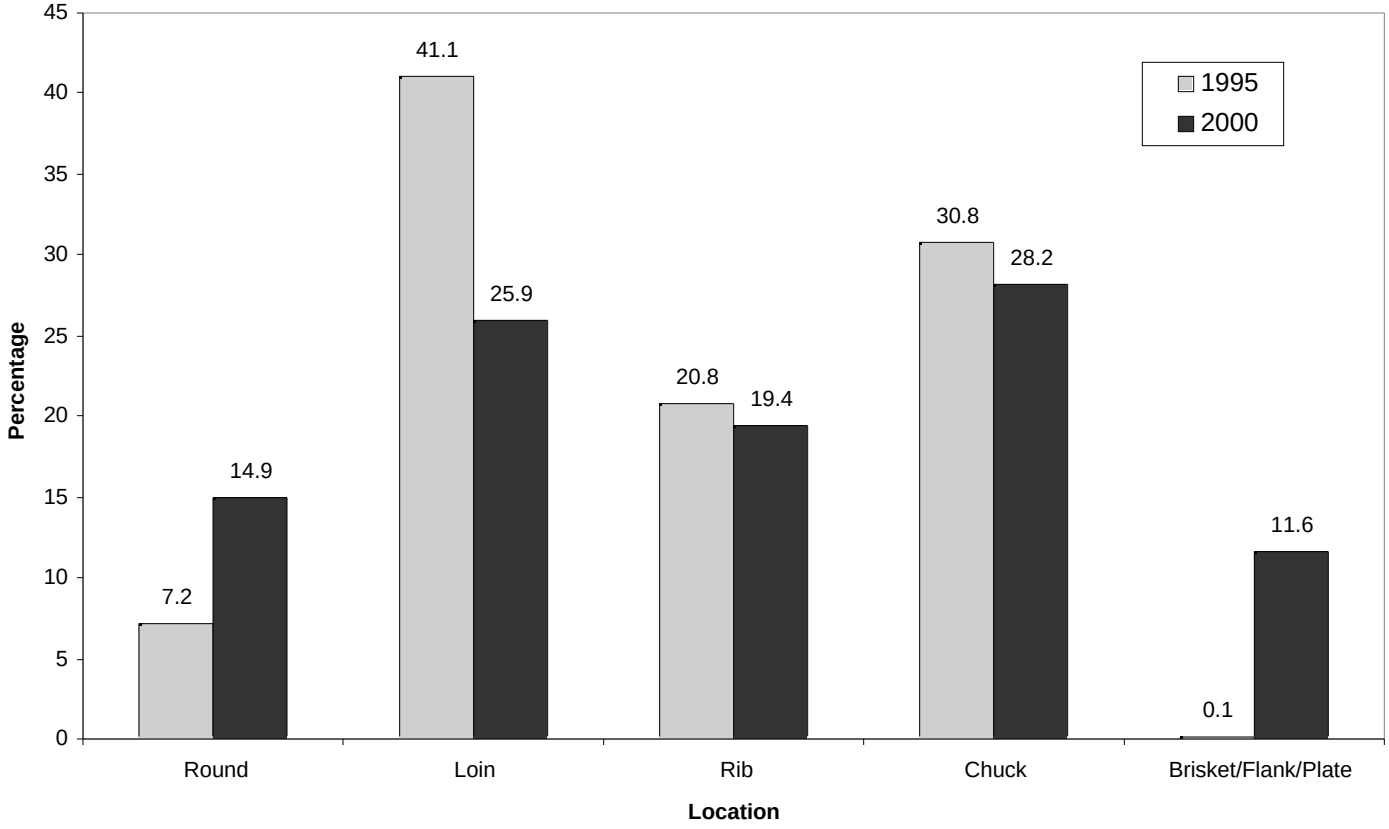


Figure 10. Frequency distribution of bruise severity within location -- NBQA-2000

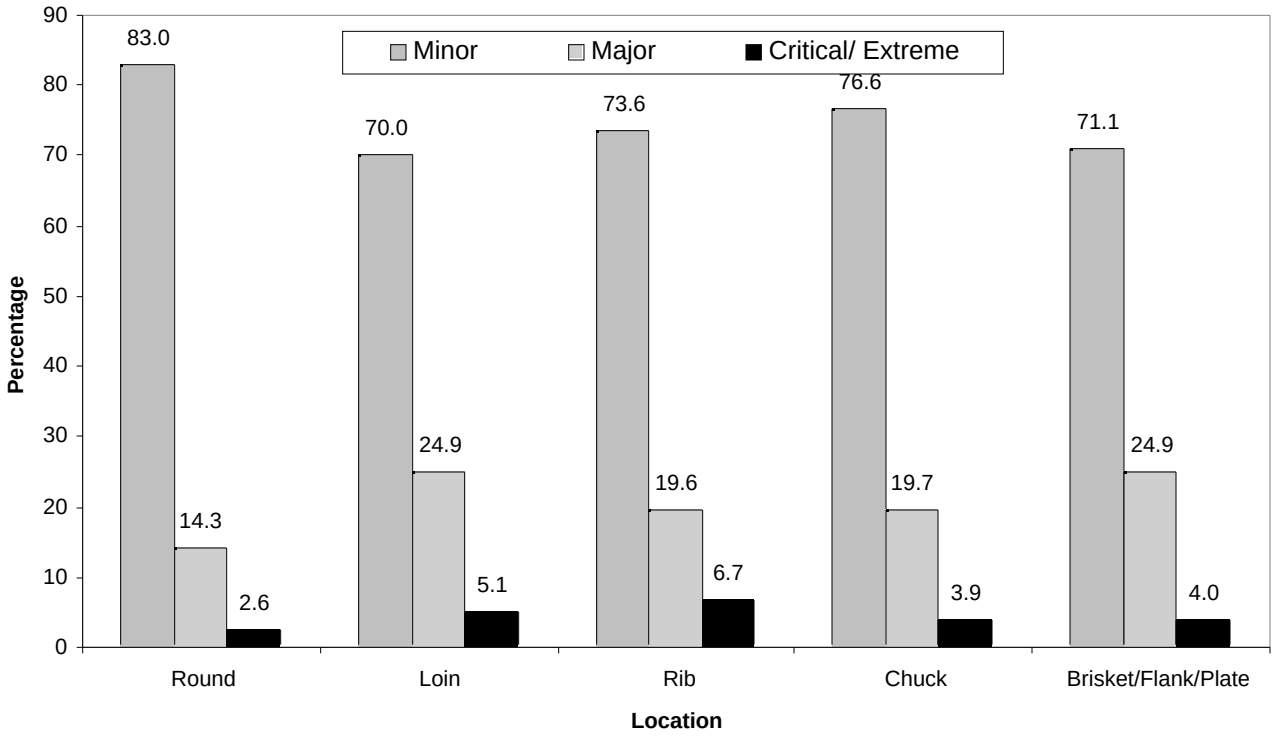


Figure 11. Frequency distribution of offal and caracss condemnations, and incidence of fetuses -- NBQA-1991, NBQA-1995, NBQA-2000

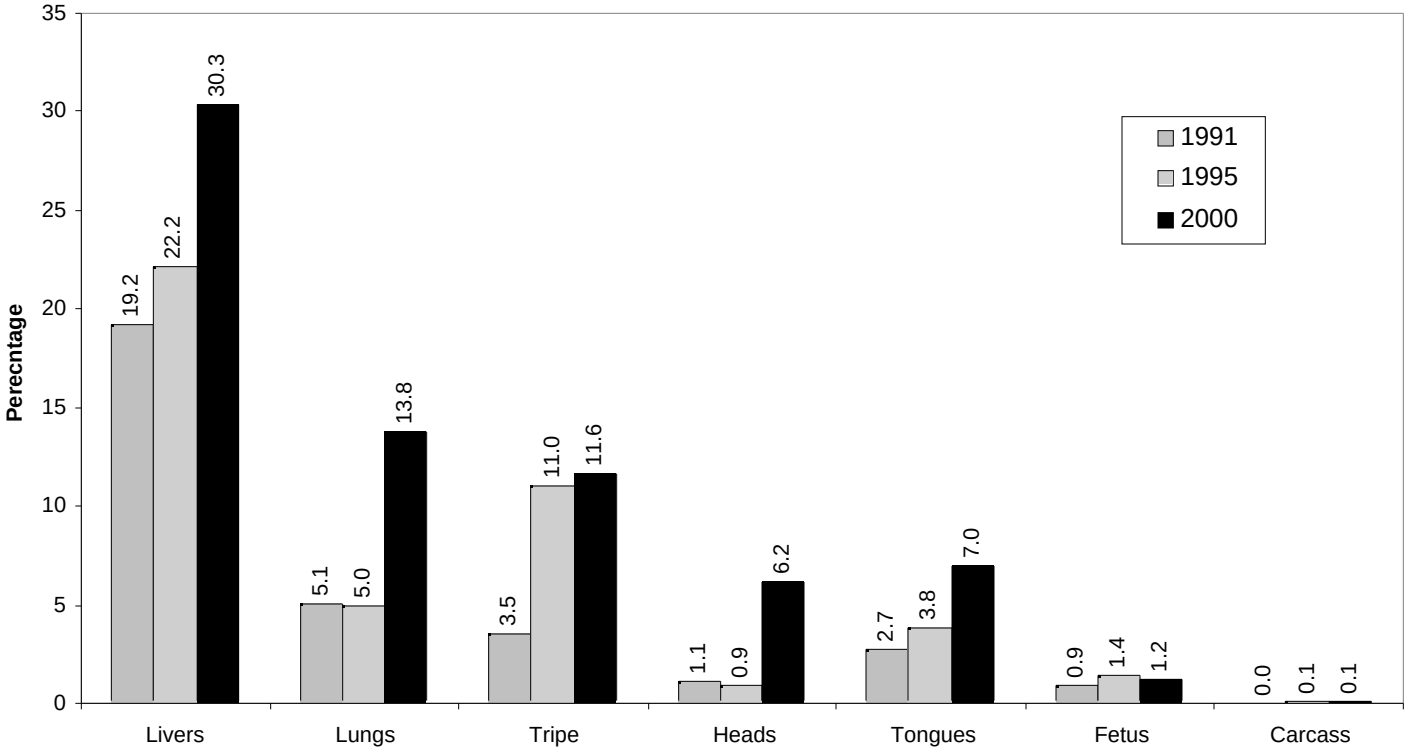
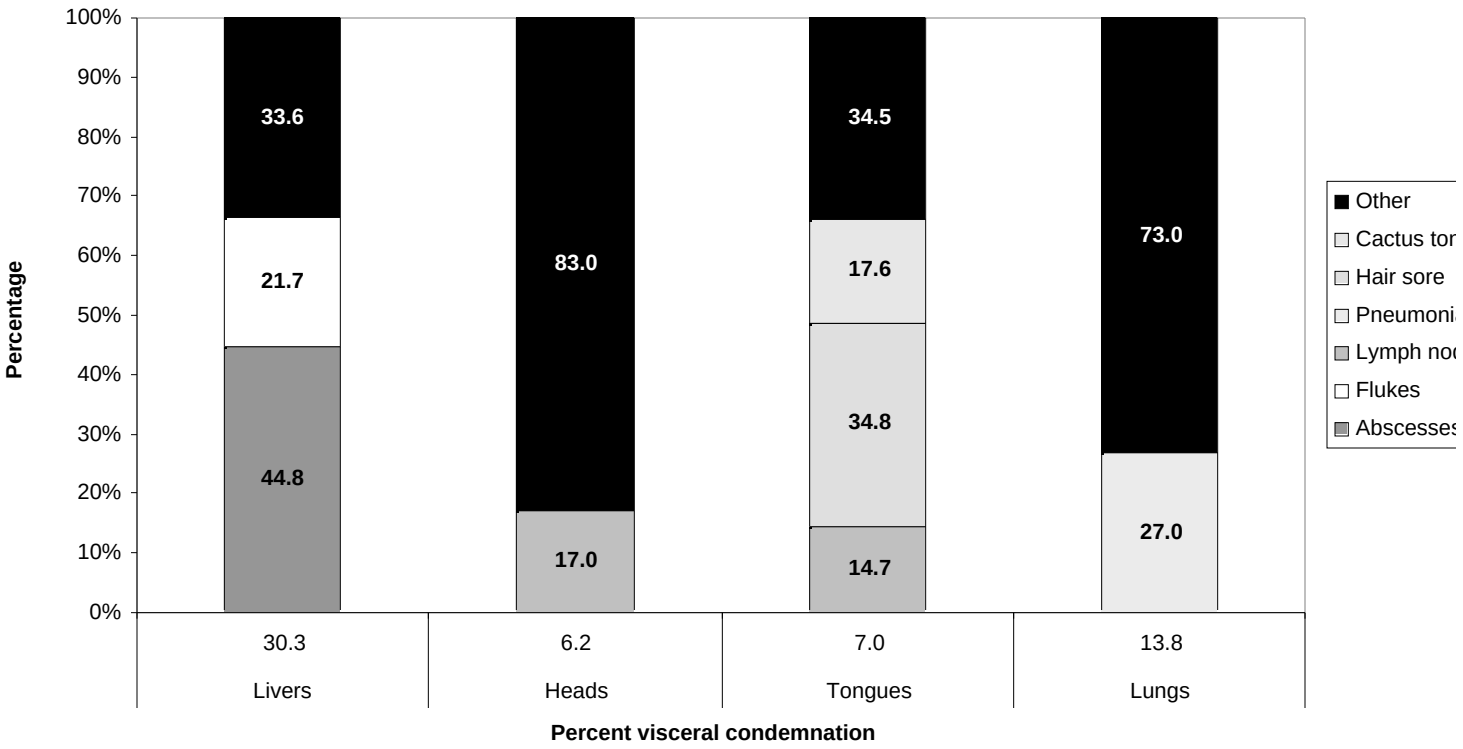


Figure 12. Breakout of condemnations by cause -- NBQA-2000



INCIDENCE OF INJECTION-SITE LESIONS IN FED-BEEF TOP SIRLOIN BUTTS

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Introduction

Results of the National Beef Quality Audit–1995 (Smith *et al*., 1995) revealed that 30-40% of purveyors, retailers, and packers believed the frequency of injection-site lesions had decreased since a similar audit in 1991. Even with such improvement, purveyors and retailers still ranked this defect in the top ten challenges of fed steers and heifers. Pharmaceuticals are commonly administered to cattle at various stages of their lives (Taylor and Field, 1999). If injections are given intramuscularly, in the anatomical region between the hooks and pins, tissue damage occurs (Dexter et al., 1992). Injection-site lesions are seldom detected at packing plants because damage is concealed within the muscles and subcutaneous fat. Unless top sirloin butts are further processed by packers (including removal of subcutaneous fat and separation of the *biceps femoris* from the *gluteus medius*), injection-site damage will normally be exposed at retailer or purveyor establishments during portioning of the primal cuts.

Dexter *et al*. (1994) reported that activities of the National Cattlemen's Association (subsequently National Cattlemen's Beef Association, NCBA) Quality Assurance Advisory Board led to a reduction in the incidence of injection-site lesions from 21.3% (July 1991) to 10.9% (March 1993). George *et al*. (1996) reported that continuation of these efforts did not result in a reduction in injection-site lesion incidence from July 1993 (10.9%) to July 1995 (10.2%). Since July 1995, 15 audits have been conducted to determine the impact of beef quality assurance efforts of cattlemen's organizations on the incidence of injection-site lesions in the top sirloin butts of fed steers and heifers. This paper is a sequel to those by Dexter *et al*. (1994) and George *et al*. (1996) and continues the reporting of results of national audits of incidence of injection-site lesions in top sirloin butts from fed steers and heifers using data collected from November 1995 through July 2000.

Materials and Methods

General Protocol. In order to obtain ongoing assessments of the incidence/severity of injection-site lesions in top sirloin butts on a national scale, data were collected from individual steak-cutting plants located nationwide. Audits in each of four plants were conducted in November 1995; in each of March, July, and November of 1996, 1997, 1998, and 1999; and in March and July of 2000. Facilities audited were selected according to (1) U.S. geographic location and (2) quantities of top sirloin butts processed at that location. In order to ensure that adequate quantities of top sirloin butts were evaluated, two shifts (8-9 h) were audited at each plant visited during each audit period. Audit procedures were identical to those described by Dexter *et al*. (1994).

At each of the audited facilities, all steak cutters were provided verbal instructions concerning the audit process and were shown how the affected tissue (injection-site lesion) appeared in top sirloin butts/steaks. Instructions also were provided regarding actions to take when questionable tissue was discovered, with the proper course of action being to hold the product for evaluation by the investigator before excision of the tissue. As each individual top sirloin butt was portioned into individual steaks, injection-site damage that was exposed was excised from all affected steaks. The excised damaged tissue was subsequently classified using a 5-point classification system as described by Dexter *et al*. (1994) and weighed (to the nearest g).

Statistical Analysis. Data representing percentage incidence of injection-site lesions were analyzed using the Frequency Procedure of SAS (SAS, 1998). Differences between incidence values associated with the 15 audit time periods were determined by calculating the chi-square statistic. Means for lesion weight were computed and analysis of variance was conducted using the GLM procedures of SAS (1998). Least significant differences were used to identify statistical differences among mean lesion weights when AOV demonstrated an effect of the audit period and/or lesion type ($\alpha = 0.05$).

Results and Discussion

The average incidence of injection-site lesions during the audit period of November 1995 was 11.40%, which was higher numerically than the 10.19% incidence reported by George *et al*. (1996) for the audit period of July 1995. The average weight of injection-site lesions excised from affected top sirloin butts during the November 1995 audit was 192.5 g, which also was numerically higher than the 152.8 g lesion weight found in July 1995 (George *et al*., 1995).

Over the entire 15 audit periods included in this report, incidence of injection site lesions decreased (Table 1) from a high of 11.40% in the first audit period (November 1995) to a low of 2.06% in the last audit period (July 2000). The decline in numerical injection-site lesion incidence was continuous, with each subsequent incidence lower ($P < 0.05$) than the preceding audit incidence, over the 15 audit periods with the exception of: (a) the July 1996 to November 1996 audit periods, where the incidence did not change, (b) the July 1997 to November 1997 audit periods, where the incidence did not change, (c) the March 1998 to July 1998 to November 1998 audit periods, where incidence of injection site lesions peaked ($P < 0.05$) for one audit period and then returned to previous levels in the following audit period, (d) the November 1998 to March 1999 audit periods, where the incidence did not change, and (e) the November 1999 to March 2000 audit periods, where the incidence did not change. The incidence of injection-site lesions in fed steer and heifer top sirloin butts was lower than incidences reported by Van Donkersgoed *et al*. (1997 and 1998); in those two studies, the incidences of lesions in Canadian fed beef top sirloin butts were 18.8% and 13.3% in the fall of 1996 and in the spring of 1997, respectively. Reduced incidence of injection-site lesions from November 1995 to July 2000 correspond to the downward trend reported by Dexter *et al*. (1994); in that study, lesion incidence declined over the six audit periods between July 1991 to March 1993. During the period covered by the report of George et al. (1996), no decrease in injection-site lesion incidence occurred over seven audit periods from July 1993 to July 1995. Across the entirety of the period covered by successive reports of Dexter *et al*. (1994), then George *et al*. (1996) and

now this study, the decrease in incidence of injection site lesions has decreased by 19.2 percentage points suggesting that producers have changed injection practices in response to efforts of the National Cattlemen's Beef Association and state beef quality assurance programs. Those efforts have increased awareness of the problem and resulted in revised production practices (e.g., moving injection-sites to the neck region), and thus have resulted in reduced incidence of lesions in top sirloin butts caused by intramuscular injections. Even with such decline of incidence in top sirloin butts in past years, the beef industry must remain cautious and the education must continue to develop as the incidence of injection-site lesions in fed steer and heifer rounds was 11.3% in the 2000 audit (n = 7,436).

Average weight of trim per lesion (Table 1) resulting from the presence of injection-site lesions generally increased from 192.5 g in November 1995 to a peak in July 1997 of 435.8 g; mean trim loss has sporadically declined since July 1997 and was 249.8 g in July 2000. The increase in weight of injection-site lesion trim between November 1995 and July 2000 was not consistent with the findings of Dexter *et al*. (1994), who found that mean weight of trim loss per lesion declined from July 1991 to March 1993, but was consistent with the findings of George *et al.* (1996) who found that mean lesion trim weight increased from July 1993 to July 1995. The spike in mean lesion excision weights in 1997 coincide with the report of George *et al*. (1996) demonstrating toughening of muscle up to 7.62 cm away from the core of injection-site lesions and suggests that a short-term change in excision procedures for lesions may have been initiated by purveyors.

Over the entire 15 audit period (November 1995 to July 2000), incidence of lesions classified as "cystic" (encapsulated lesion containing fluid) and "woody callus" (older lesion that is characterized by infiltration with organized connective tissue and fat) did not change ($P > 0.05$; Table 2). Incidence of lesions classified as "nodular" (lesion with nodules, the central foci of necrosis, surrounded by granulomatous inflammation) and "mineralized" (lesion containing mineralized remnants of muscle cells) decreased ($P < 0.05$), while the incidence of lesions classified as "clear" (older lesion that primarily contains clear connective tissue) increased ($P < 0.05$). Overall, 84% of the lesions examined between November 1995 and July 2000 were classified as "older" lesions (either "woody callus" or "clear").

Mean lesion weight by type and audit period are presented in Table 3. The mass of tissue surrounding injection-site lesions that was excised by purveyors during portioning increased ($P < 0.05$) from November 1995 through July 2000 for "clear" and "woody callus" lesions but not for other classes of lesions. Mean weights of "cystic", "nodular", and "mineralized" lesions did not increase when comparing audits of November 1995 vs. July 2000, but excised weights of "nodular" lesions increased ($P < 0.05$) to a peak value of 470.5 g in July 1997 and weights of excised "mineralized" lesions increased ($P < 0.05$) to a peak value of 482.3 g in November 1998.

Summary

Damaged beef muscle tissue resulting from intramuscular injections of animal-health products represents a "quality control" problem and an economic loss to the beef industry. Fifteen individual and sequential national audits of injection-site lesions in beef top sirloin butts have been conducted at the steak provisioner/cutting level between November 1995 and July

2000. The national incidence of injection-site lesions in top sirloin butts (n = 240,080) decreased ($P < 0.05$) between November 1995 (11.4%) and July 2000 (2.1%). From November 1995 to July 1997, mean injection-site lesion weight, across all lesion classes, increased ($P < 0.05$) from 192.5 g to 435.8 g, respectively; mean lesion weight subsequently decreased ($P < 0.05$) to 249.8 g in July 2000, but was still heavier ($P < 0.05$) than in November 1995. Results of these audits indicate that producers have changed injection practices in response to efforts of the National Cattlemen's Beef Association and state beef quality assurance programs. Analyses of results for lesion classes, partitioning lesions according to chronological stages of the healing process suggested that the majority of lesions were induced at times which coincide with cow-calf, stocker, or early finishing-period stages of cattle production.

Implications

Injection-site lesions have caused enormous economic loss to the U.S. beef industry and have been a serious quality assurance problem. Reductions in lesion incidence in top sirloin butts from U.S. fed steer and heifers for the period of November 1995 through July 2000 -- from 11.4% to 2.1%, respectively, -- generated an approximate net savings of $2.15 per steer or heifer slaughtered, which equates to an industry-wide savings of $76,078,100, based on the projected 30.31 million steers and heifers to be harvested in 2000.

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Table 1. Summary of injection-site damage (incidence and weight of lesions) in beef top sirloin butts for fifteen audits.

Audit Period	Packer Locations[a]	Steak Cutter Locations[b]	Number of Subrimals Evaluated	Incidence of Lesions[c] (%)	Average weight[d] of trim per lesion ± SE (g)
November 1995	IA, IL, KS, NE, TX, UT	AR, CO, IL, TN, WA	19,814	11.40[e]	192.5[k] ± 3.1
March 1996	CO, IL, KS, NE, TX, UT	AR, CA, CO, IL, TN	19,935	10.29[f]	211.1[j] ± 3.7
July 1996	AZ, CO, KS, NE, TX, WI	AR, CA, IL, TN	19,197	8.51[g]	212.2[j] ± 3.7
November 1996	KS, NE, TX, UT	AR, CA, IL, TN	21,617	9.03[g]	231.2[i] ± 4.2
March 1997	CO, KS, NE, TX,	AR, CA, IL, TN	19,065	7.48[h]	227.7[i] ± 4.6
July 1997	KS, NE	CA, IL, TN	11,088	5.61[i]	435.8[e] ± 12.9
November 1997	AZ, CO, IL, KS, NE, TX, UT, WI	CA, IL, TN, TX	14,644	5.59[i]	284.4[f] ± 7.2
March 1998	CO, KS, NE, UT	CA, IL, TX	12,927	4.75[j]	161.1[l] ± 6.1
July 1998	AZ, KS, NE, PA, TX	CA, TN, TX	8,693	6.07[i]	229.3[i] ± 6.2
November 1998	KS, NE, TX	CA, IL, TN, TX	8,044	4.43[j]	201.0[jk] ± 6.8
March 1999	CA, ID, KS, NE	CA, IL, TN, TX	16,237	4.64[j]	278.2[fg] ± 6.6
July 1999	KS, NE, TX	CA, IL, TN, TX	16,466	3.40[k]	210.7[jk] ± 4.7
November 1999	KS, NE, NY, TX	IL, TN, TX	10,772	2.67[l]	261.7[gh] ± 7.5
March 2000	KS, NE, TX	CA, IL, TN, TX	21,126	3.02[l]	229.4[i] ± 7.9
July 2000	CO, KS, NE, TX	CA, IL, TN, TX	20,455	2.06[m]	249.8[h] ± 9.3

[a] Packer-location origin of top sirloin butts.
[b] Steak-cutting facilities at which top sirloin butts were evaluated.
[c] Percentage of top sirloin butts that had an injection-site lesion.
[d] Average weight per lesion after excision.
[e,f,g,h,i,j,k,lm] Values,

Table 2. Percentage incidence (of lesions excised) of injection-site lesions stratified by five types of lesion classification.

	Lesion Classification				
Audit Period	**Cystic[a]**	**Nodular[b]**	**Mineralized[c]**	**Clear[d]**	**Woody Callus[e]**
November 1995	0.75^{ghi}	28.34^{f}	0.13^{gh}	46.06^{kl}	24.71^{l}
March 1996	0.59^{ghi}	17.02^{h}	0.00^{h}	49.39^{jk}	33.01^{hi}
July 1996	0.31^{i}	25.95^{f}	0.00^{h}	43.64^{l}	30.11^{ij}
November 1996	0.56^{ghi}	25.87^{f}	0.51^{f}	45.44^{kl}	27.61^{jk}
March 1997	0.35^{hi}	19.20^{g}	0.49^{f}	53.33^{i}	26.63^{kl}
July 1997	1.13^{fg}	21.86^{g}	0.48^{fg}	49.84^{ijk}	26.69^{jkl}
November 1997	0.73^{ghi}	16.85^{h}	0.85^{f}	45.79^{kl}	35.78^{gh}
March 1998	2.61^{f}	12.87^{hi}	0.65^{f}	52.77^{ij}	31.11^{hij}
July 1998	0.57^{ghi}	11.17^{ij}	0.76^{f}	49.62^{ijk}	37.88^{fg}
November 1998	1.40^{fg}	14.89^{hi}	0.84^{f}	57.58^{g}	25.28^{kl}
March 1999	0.93^{gh}	9.15^{jk}	0.00^{h}	49.34^{jk}	40.58^{fg}
July 1999	0.36^{ghi}	7.14^{kl}	0.00^{h}	48.93^{jk}	43.57^{f}
November 1999	0.69^{ghi}	4.51^{lm}	0.00^{h}	53.82^{h}	40.97^{fg}
March 2000	0.47^{ghi}	5.64^{lm}	0.31^{fg}	54.08^{g}	39.50^{fg}
July 2000	0.24^{i}	4.03^{m}	0.00^{h}	72.75^{f}	22.99^{l}

[a] Cystic = Encapsulated lesion containing fluid.

[b] Nodular = Lesion with nodules, the central foci of necrosis, surrounded by granulomatous inflammation.

[c] Mineralized = Lesion that contains mineralized remnants of muscle cells.

[d] Clear = Older lesion that contains primarily clear connective tissue.

[e] Woody Callus = Older lesion characterized by infiltration with organized connective tissue and fat.

[f, g, h, i, j, k, l, m] Percentages, within a column, lacking a common superscript letter differ ($P < 0.05$).

Table 3. Mean (± SE) weight (g) per injection-site lesion stratified by five types of lesion classification.

Audit Period	Lesion Classification				
	Cystic[a]	Nodular[b]	Mineralized[c]	Clear[d]	Woody Callus[e]
November 1995	$346.4^{fg} \pm 55.6$	$146.4^{jk} \pm 3.8$	$94.7^{hi} \pm 25.0$	$116.2^{o} \pm 3.7$	$223.7^{jk} \pm 8.3$
March 1996	$358.7^{fg} \pm 76.6$	$177.0^{j} \pm 5.6$	-	$143.6^{mn} \pm 3.2$	$216.8^{k} \pm 9.5$
July 1996	$266.6^{g} \pm 106.6$	$168.6^{jk} \pm 5.5$	-	$147.7^{lmn} \pm 4.4$	$221.8^{jk} \pm 8.9$
November 1996	$291.2^{g} \pm 77.5$	$189.6^{ij} \pm 6.6$	$81.3^{i} \pm 24.5$	$150.5^{klmn} \pm 5.0$	267.6^{hi} 10.3
March 1997	$218.2^{g} \pm 48.0$	$186.6^{ij} \pm 8.0$	$188.4^{ghi} \pm 27.3$	$159.3^{jklm} \pm 4.6$	$240.9^{ij} \pm 13.1$
July 1997	$291.9^{g} \pm 65.8$	$470.5^{f} \pm 28.6$	$311.3^{fgh} \pm 105.8$	$299.1^{f} \pm 15.8$	$525.0^{f} \pm 26.1$
November 1997	$310.5^{fg} \pm 84.2$	$216.6^{hi} \pm 15.2$	$356.9^{ab} \pm 91.8$	$240.4^{g} \pm 11.1$	$277.8^{gh} \pm 11.9$
March 1998	$293.6^{g} \pm 83.3$	$94.2^{k} \pm 13.9$	$352.8^{fg} \pm 90.3$	$108.4^{o} \pm 6.8$	$149.0^{l} \pm 12.1$
July 1998	$256.7^{g} \pm 91.6$	$180.1^{ij} \pm 16.6$	$316.8^{fgh} \pm 82.8$	$175.3^{hij} \pm 7.3$	$224.1^{jk} \pm 12.1$
November 1998	$439.0^{f} \pm 166.8$	$158.2^{jk} \pm 14.7$	$482.3^{f} \pm 246.3$	$127.2^{no} \pm 6.1$	$206.7^{k} \pm 14.7$
March 1999	$482.4^{f} \pm 245.9$	$235.1^{gh} \pm 18.6$	-	$197.7^{h} \pm 6.8$	$303.0^{g} \pm 11.3$
July 1999	$194.0^{g} \pm 52.0$	$169.8^{jk} \pm 16.4$	-	$151.2^{jklmn} \pm 5.5$	$213.9^{k} \pm 7.8$
November 1999	$512.0^{f} \pm 318.7$	$208.5^{hij} \pm 23.0$	-	$196.2^{hi} \pm 7.5$	$267.8^{hi} \pm 13.0$
March 2000	$374.4^{fg} \pm 92.0$	$298.1^{g} \pm 30.9$	$132.0^{ghi} \pm 18.0$	$168.6^{ijkl} \pm 10.4$	$215.1^{k} \pm 12.8$
July 2000	$93.0^{g} \pm 0.0$	$173.1^{jk} \pm 30.2$	-	$171.4^{hijk} \pm 8.3$	$296.7^{gh} \pm 28.1$

[a] Cystic = Encapsulated lesion containing fluid.
[b] Nodular = Lesion with nodules, the central foci of necrosis, surrounded by granulomatous inflammation.
[c] Mineralized = Lesion containing mineralized remnants of muscle cells.
[d] Clear = Older lesion that contains primarily clear connective tissue.
[e] Woody Callus = Older lesion characterized by infiltration with organized connective tissue and fat.
[f, g, h, i, j, k, l, m, n, o] Means, within a column, lacking a common superscript letter differ ($P < 0.05$).

COOLER AUDITS;
RESULTS OF PHASE II OF THE NATIONAL BEEF QUALITY AUDIT—2000

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Background

The second portion of Phase II of the NBQA–2000 was the collection of cooler data. Cooler information collected included sex class (steer, heifer, bullock, or cow), carcass breed-type (native, *Bos indicus* [hump greater than 4"], or dairy), yield grade factors (adjusted fat thickness; kidney, pelvic, and heart fat [KPH]; ribeye area; and carcass weight), quality grade factors (lean and skeletal maturity, and marbling score), and major defects such as dark cutters, blood splash, and yellow fat. USDA personnel provided official marbling scores and adjusted preliminary yield grades. All other observations were collected by highly trained personnel from Colorado State University, Oklahoma State University, West Texas A&M University, and Texas A&M University. Thirty plants were audited beginning in May 2000 and concluding in November 2000. University teams audited each plant for the equivalent of one day's production. Ten percent of each lot for each shift was audited in each plant, resulting in a total sample size of 9,396 carcasses

Results

Figure 1 shows frequency distribution of steers, heifers, and bullocks from the previous two audits (NBQA-1991, NBQA-1995) and the current audit (NBQA-2000). The NBQA–2000 showed a frequency of 67.9% steers, 31.4% heifers, and 0.3% bullocks. Compared with the NBQA-1995, there were essentially no changes in the sex class dynamics of the fed-beef population. Table 1 shows the yield grade and quality grade factors for steer and heifer carcasses. Heifers had a slightly lower yield grade (2.9 versus 3.2) and a much lower carcass weight (741.4 lb. versus 807.8 lb.) compared to steers. In contrast, steers had a slightly lower adjusted fat thickness. There were virtually no differences in ribeye area and KPH percentage between steers and heifers. Quality grade data indicated that heifers had slightly higher marbling scores, but overall quality grade was essentially the same. Steers had lower overall maturities, however, both were very youthful A maturity carcasses.

Figure 2 shows the frequency distribution of carcass type from the previous and current audits. The NBQA–2000 data indicate a continuation of the increase in percentage of native-type carcasses, up an additional 2.4 percentage points from 1995 to 90.1%. There was a decrease in the number of *Bos indicus* type carcasses, down 4.3 percentage points and 3.5 percentage points from the NBQA-1991 and NBQA-1995, respectively. Also, there was a 2.1 percentage point increase in the percentage of dairy type carcasses from 1995, back to a level reported in 1991. Percentage of dairy carcasses corresponded very closely to the percentage of Holstein's reported

on the harvest floor. Yield grade characteristics between native and *Bos indicus* type carcasses were essentially equal with both recording an average yield grade of 3.0, and adjusted fat thickness of 0.50 in. Native type carcasses had slightly heavier carcass weights. Dairy type carcasses had higher yield grades, heavier carcass weights, higher KPH percentages, lower adjusted fat thicknesses, and smaller ribeyes. It should be noted that 6.7% of the slaughter facilities used streamlined KPH removal on the harvest floor. The KPH percentages for plants with streamlined removal systems were reported as actual calculated values, and consequently some were much higher than those that were subjectively evaluated. Streamlined KPH removal may have resulted in slightly higher KPH percentages in the dairy type carcasses, however, dairy type carcasses are noted for having higher KPHs than native and/or *Bos indicus* type carcasses. There were no observed differences in overall maturity between the carcass breed types. There were incremental differences between carcass breed type and marbling score and quality grade. Dairy type carcasses had higher marbling scores (Small[89]) and consequently a higher quality grade than both native and *Bos indicus* type carcasses. A similar result was seen between native type carcasses and *Bos indicus* type carcasses. Data in Table 3 show the breakdown of quality grades within breeds. Clearly, dairy type carcasses had the highest marbling with 67.4% grading Low Choice or higher, including 8.2% Prime, compared to 50.6% and 32.2% for native and *Bos indicus* type carcasses, respectively. In contrast, 66.3% of *Bos indicus* type carcasses graded Select or Standard.

Table 4 shows means for USDA yield grade factors for the previous and current audits. The mean yield grade for NBQA–2000 was 3.0, which was slightly higher than the 2.8 reported for 1995, but still lower than the 3.2 reported in 1991. Mean adjusted fat thickness for NBQA–2000 was 0.49 in., which is very comparable to the 1995 (0.47 in.) result and much lower than 1991 (0.59 in.). The most dramatic change involving yield grade factors was the average carcass weight, which was 787 lb. for NBQA–2000. This value increased nearly 40 lb. and 30 lb. from the 1995 and 1991 audits, respectively. Mean KPH percentage was 2.3% for 2000, which was up from the previous audit, however, factors affecting this slight increase were mentioned in the previous paragraph. Mean ribeye areas increased from 12.9 and 12.8 in^2 reported in 1991 and 1995, respectively, to 13.1 in^2 in 2000.

The distribution of carcasses across half-yield grade increments is shown in Figure 3. Distribution among yield grade groups shows that NBQA-2000 data were very similar to the yield grade distribution reported in 1991. In contrast, NBQA–2000 data showed a shift towards lower cutability carcasses as evidenced by a lower percentage of yield grade 2 carcasses (37.4% versus 45.3%) and an increase in the percentage of yield grade 3.5 and higher carcasses (28.2% versus 20.0%) as compared to the 1995 results.

Figure 4 shows the distribution of carcasses based on adjusted fat thickness. NBQA–2000 data showed a similar distribution to the fat thickness reported in 1991 although there was a tendency to have a slightly greater percentage of carcasses between 0.4-0.7 in. (50.4% versus 42.7%). NBQA–2000 data had a much lower percentage of carcasses having greater than 0.5 in. of adjusted fat thickness compared to 1991 (47.0% versus 69.4%, respectively).

The distribution of carcasses across carcasses weights are reported in Figure 5. Data from each audit form a normally distributed bell-shaped curve. Clearly, the NBQA–2000 data indicated a

shift towards carcasses with heavier weights. Nonetheless, the percentage of outlier carcasses, those less than 550 lb. or greater than 950 lb., was 4.6%, 3.2%. and 3.9% for 2000, 1995, and 1991, respectively.

The distribution of KPH showed a tendency towards higher percentages of perinephric fat (Figure 6). There was a much greater percentage of carcasses with greater than 3.5% KPH in NBQA–2000 than was reported in 1995 (9.4% versus 2.3%, respectively). Again, a portion of this difference may be explained by the streamlined KPH removal systems addressed earlier.

Figure 7 shows the distribution of carcasses according to ribeye areas from the previous and current audits. NBQA-2000 data showed that 64% of ribeyes were between 11.0 and 13.9 in^2, which is comparable to the 69% and 62% reported in 1995 and 1991, respectively. Also, there appears to be a trend towards a greater percentage of "large" (>15.0 in^2) ribeyes with 13.0% recorded in 2000 compared to 9% and 3% in 1995 and 1991, respectively.

The means for USDA quality grade factors are reported in Table 5. Means for the NBQA-2000 audit for Lean, Skeletal, and Overall maturities were A^{65}, A^{67}, and A^{66}, respectively. Maturity values were slightly higher than those reported in 1995, however, in practice, the values were essentially equivalent. Figure 8 shows the distribution based on carcass maturities. NBQA–2000 showed a slight increase in the percentage of "A" maturity carcasses. The percentage of "B" maturity carcasses decreased to 2.5% compared to the 6.7% and 4.3% reported in the 1991 and 1995 audits, respectively. There was a slight increase in the percentage of carcasses considered to be "hardbone" (C maturity and older). Mean marbling score for 2000 was a $Small^{23}$, which translated into an overall average quality grade of $Select^{85}$. Marbling scores and quality grade were almost identical to the values reported in 1991, and were slightly higher than the values reported in 1995.

The distribution of carcasses based on marbling score is shown in Figure 9. The "Slight" marbling score was the category with the greatest percentage of carcasses (43.3%), which was also the case in 1995. Of the carcasses in 2000, 53.2% had a marbling score of Small or higher compared to 49.5% in 1995. Figure 9 shows the distribution of youthful carcasses (A or B overall maturity) by quality grade. The percentage of carcasses grading Choice or Prime was 51.1%, up from the 48.0% reported in 1995. Table 6 shows the breakdown of quality grades by marbling score. Of the carcasses that graded Standard, 14.5% had a marbling score of Small and 24.8% had a marbling score of Slight. The reason for these marbling scores being present in Standard is the presence of B-maturity carcasses and/or dark cutters, which would result in a reduction in quality grade. Small and Modest amounts of marbling were found in 1.4% and 0.2%, respectively, of the carcasses that graded Select.

Beef merchandising/marketing programs have progressed from primarily focusing on Premium Choice carcasses to including the top half of the Low Choice grade. Figure 10 shows the distribution of marbling scores for youthful (A and B maturity carcasses) with Small and Select separated into halves. Premium Choice carcasses were 17.9% of the carcasses. The top half of Small accounted for 12.2% of the carcasses, whereas 21.1% of the carcasses were in the bottom

portion of Small. Over 25% of the carcasses had a marbling score between ≥Slight^{50} and <Small^{00}.

Figure 11 shows the distribution of whole quality grades. NBQA–2000 showed an increase in the percentage of Choice grading carcasses and a decrease in Select grading carcasses although the percentage of carcasses grading Choice and Select was 91.4%, 93.4%, and 89.6% for the 2000, 1995, and 1991 audits, respectively. There was a slight increase in the frequencies of carcasses grading Prime and Standard compared to the 1991 audit. Figure 12 shows the distribution of carcasses in one-third quality grade increments. Low Choice was the predominant quality grade at 31.8%, which was the same as the previous audits, however, the frequency was slightly lower than the 35.6% reported for both 1991 and 1995. Premium Choice carcasses (Average and High Choice carcasses) were 17.3% of the population, which was an increase from the 11.1% observed in 1995, but was comparable to 1991. The percentage of Low Select carcasses decreased 3.9 percentage points from the 1995 audit to 13.8%, which was similar to the 13.2% reported in 1991. The percentage of High Select carcasses was slightly higher than the 15.3% and 11.8% observed in 1995 and 1991, respectively.

Mean values for yield and quality grade factors stratified by whole yield grades are displayed in Table 7. Average yield grades were near the middle of each whole grade, with the yield grade 4's slightly biased towards the lower end. As expected, adjusted fat thickness increased as yield grade increased. Carcass weight and kidney, pelvic, heart fat increased with increasing yield grade, and ribeye area decreased with increasing yield grade. Data demonstrate that cutability is most influenced when all factors in the yield grade equation are synergistic or antagonistic. For example, yield grade 1 carcasses had the lowest adjusted fat thickness, lightest carcass weights, lowest KPH percentage, and largest ribeyes whereas the yield grade 5 carcasses had the highest adjusted fat thickness, heaviest carcass weights, highest percentage of KPH, and the smallest ribeyes. No differences were observed for overall maturities within yield grades. Marbling score and quality grade tended to increase with increasing yield. Yield grade 1 carcasses had the lowest quality grades and yield grade 3, 4, and 5's had very similar quality grades. Table 8 shows the percent breakdown of each quality grade within yield grade. Yield grade 1 carcasses had the highest percentage of Standard (15.4%) and Select (62.0%) carcasses. Yield grade 3's and 4's had a relatively consistent percentage of carcasses that graded Premium Choice, Low Choice and Select. Yield grade 5's had the highest percentage of carcasses that graded Prime and the lowest of carcasses that graded Select and Standard (19.2%).

Mean values for yield and quality grade factors stratified by quality grade are presented in Table 9. Yield grade decreased incrementally as quality grade decreased. Prime and Choice carcasses had nearly identical adjusted fat thicknesses, however, Prime carcasses had heavier carcass weights, higher KPH percentages, and smaller ribeyes. Overall maturities were not different between Prime, Choice, or Select carcasses, but Standard carcasses had higher overall maturities. Moreover, Standard carcasses had an average marbling score of Slight^{11}, which would typically correspond to the Select grade. The higher overall maturity and Slight^{11} marbling score can be attributed to the portion of B maturity carcasses that had a marbling score of Slight or Small that fall into the Standard grade under USDA beef grade standards.

Figure 13 shows the distribution of Choice and Select carcasses by half yield grade increments. Select carcasses tended to have higher cutabilities, as 18% were yield grade 1's and 63.1% ranged from yield grade 2.0 to 3.49. Choice carcasses had slightly lower cutabilities, as 68.2% were between yield grade 2.5 to 3.99. In addition, 15.2% of Choice carcasses had a yield grade greater than 4.0.

The distribution of dark cutting carcasses is shown in Figure 14. The incidence rate of dark cutting carcasses continued to decline from the previous audits (2.3% in 2000 versus 2.7% and 5.0% in 1995 and 1991, respectively). A new category, one-half dark cutter, was incorporated in to the NBQA–2000. Assuming carcasses classified as "one-half dark cutter" would have been classified as two-thirds dark cutter in the previous audits, the severity of dark cutting carcasses has changed little since 1995. Blood splash and yellow fat occurred at an incidence rate of 0.5% and 0.4%, respectively, and there were no callused ribeyes reported in 2000.

Table 1. Yield grade and quality grade characteristics of steer and heifer carcasses – NBQA-2000

Trait – Yield Grade	Steer	Heifer
Yield Grade	3.2	2.9
Adjusted Fat Thickness, in.	0.47	0.53
Carcass Weight, lb.	807.8	741.4
Kidney, Pelvic, and Heart fat, %	2.35	2.35
Ribeye Area, in^2	13.1	13.0
Trait – Quality Grade		
Overall Maturity	A[64]	A[69]
Marbling score	Small [18]	Small [31]
Quality Grade	Select [85]	Select [88]

Table 2. Yield grade and quality grade characteristics of native, *Bos indicus*, and dairy type carcasses – NBQA-2000

Trait – Yield Grade	Native	*Bos indicus*	Dairy
Yield Grade	3.0	3.0	3.4
Adjusted Fat Thickness, in.	0.50	0.50	0.33
Carcass Weight, lb.	786.3	769.4	803.8
Kidney, Pelvic, and Heart fat, %	2.3	2.2	3.6
Ribeye Area, in^2	13.1	13.0	11.7
Trait - Quality Grade			
Overall Maturity	A[66]	A[68]	A[68]
Marbling Score	Small[19]	Slight[81]	Small[89]
Quality Grade	Select[84]	Select[62]	Choice[10]

Table 3. USDA quality grade percentages[a] within native, *Bos Indicus*, and dairy type carcasses – NBQA-2000

USDA Quality Grade	Native	*Bos Indicus*	Dairy
	----------%----------		
Prime	1.6	0.0	8.2
Premium Choice[b]	16.8	7.4	28.9
Low Choice	32.2	24.8	30.3
Select	42.9	59.2	26.6
Standard	5.7	7.1	3.7
Hardbone[c]	0.9	1.4	2.3

[a]Rounding error prevents all categories from summing to 100.0.
[b]Premium Choice is composed of High and Average Choice.
[c]Hardbone is the category for C maturity and older carcasses.

Table 4. Means for USDA yield grade factors for the three audits – NBQA-1991, NBQA-1995, NBQA-2000

Trait	NBQA 1991	NBQA 1995	NBQA 2000
Yield Grade	3.2	2.8	3.0
Adjusted Fat Thickness, in.	0.59	0.47	0.49
Carcass Weight, lb.	759.9	747.9	787.0
Kidney, Pelvic, and Heart fat, %	2.0	2.1	2.3
Ribeye area, in^2	12.9	12.8	13.1

Table 5. Means for USDA quality grade factors for the three audits – NBQA-1991, NBQA-1995, NBQA-2000

Trait	NBQA 1991	NBQA 1995	NBQA 2000
Lean Maturity	A^{63}	A^{54}	A^{65}
Skeletal Maturity	A^{75}	A^{63}	A^{67}
Overall Maturity	A^{69}	A^{60}	A^{66}
Marbling Score	$Small^{24}$	$Small^{06}$	$Small^{23}$
Quality Grade	$Select^{87}$	$Select^{79}$	$Select^{85}$

Table 6. Occurrence[a] of marbling scores within USDA quality grades[b] – NBQA-2000

Marbling Score	Overall[c]	Prime	Choice	Select	Standard
	----------%----------				
Abundant	0.16	6.32	–	–	–
Moderately Abundant	0.46	21.58	–	–	–
Slightly Abundant	1.56	72.11	0.17	–	–
Moderate	4.78	–	9.49	–	–
Modest	13.07	–	25.98	0.20	0.19
Small	33.28	–	64.36	1.41	14.53
Slight+	25.34	–	–	57.93	10.90
Slight-	17.97	–	–	40.44	13.96
Traces	3.36	–	–	–	60.04
Practically Devoid	0.02	–	–	–	0.38

[a]Rounding error prevents all categories from summing to 100.0.
[b]USDA Quality grade was affected by maturity and dark cutting.
[c]Overall category represents USDA Quality grades of Prime, Choice, Select, Standard, Commercial, Utility, Cutter, and Canner.

Table 7. Mean values of yield grade and quality grade factors within yield grades – NBQA-2000

	USDA Yield Grade				
Trait – Yield Grade	1	2	3	4	5
Yield Grade	1.55	2.55	3.45	4.35	5.42
Adjusted Fat Thickness, in.	0.25	0.39	0.57	0.78	1.08
Carcass Weight, lb.	753.8	772.2	799.1	825.9	860.2
Kidney, Pelvic, and Heart fat, %	1.97	2.24	2.49	2.65	2.83
Ribeye area, in^2	15.1	13.5	12.5	11.8	11.3
Trait – Quality Grade					
Overall Maturity	A^{67}	A^{66}	A^{65}	A^{65}	A^{66}
Marbling Score	$Slight^{60}$	$Small^{04}$	$Small^{45}$	$Small^{71}$	$Small^{93}$
Quality Grade	$Select^{49}$	$Select^{77}$	$Select^{98}$	$Choice^{09}$	$Choice^{11}$

Table 8. USDA quality grade percentages[a] within yield grades – NBQA-2000

	USDA Yield Grade				
USDA Quality Grade	1	2	3	4	5
	----------%----------				
Prime	0.2	0.6	2.8	5.5	7.5
Premium Choice[b]	5.0	11.8	23.3	28.3	25.0
Low Choice	16.9	31.5	31.4	35.5	45.0
Select	62.0	49.1	34.3	27.5	16.7
Standard	15.4	6.1	3.0	1.9	2.5
Hardbone[c]	0.5	0.9	1.2	1.2	3.3

[a]Rounding error prevents all categories from summing to 100.0.
[b]Premium Choice is composed of High and Average Choice.
[c]Hardbone is the category for C maturity and older carcasses.

Table 9. Mean values of yield grade and quality grade factors within quality grades – NBQA-2000

	USDA Quality Grade			
Trait – Yield Grade	Prime	Choice	Select	Standard
Yield Grade	3.72	3.23	2.76	2.36
Adjusted Fat Thickness, in.	0.55	0.54	0.45	0.37
Carcass Weight, lb.	816.1	792.1	781.8	767.2
Kidney, Pelvic, and Heart fat, %	3.08	2.44	2.24	2.11
Ribeye area, in^2	12.1	12.8	13.4	13.7
Trait – Quality Grade				
Overall Maturity	A[66]	A[63]	A[64]	A[85]
Marbling Score	Slightly Abundant[64]	Small[80]	Slight[53]	Slight[11]
Quality Grade	Prime[21]	Choice[26]	Select[51]	Standard[48]

Figure 1. Frequency distribution of sex class -- NBQA-1991, NBQA-1995, NBQA-2000

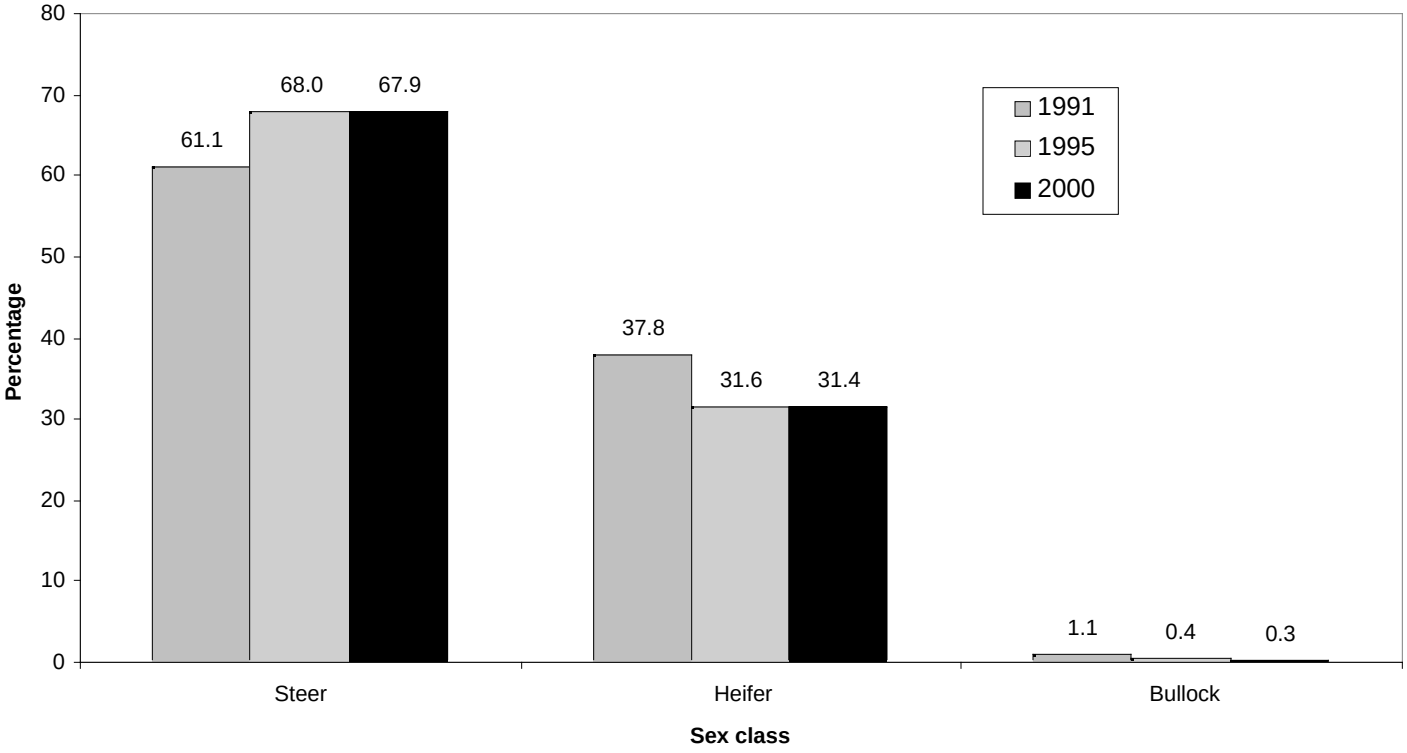


Figure 2. Frequency distribution of carcass type -- NBQA-1991, NBQA-1995, NBQA-2000

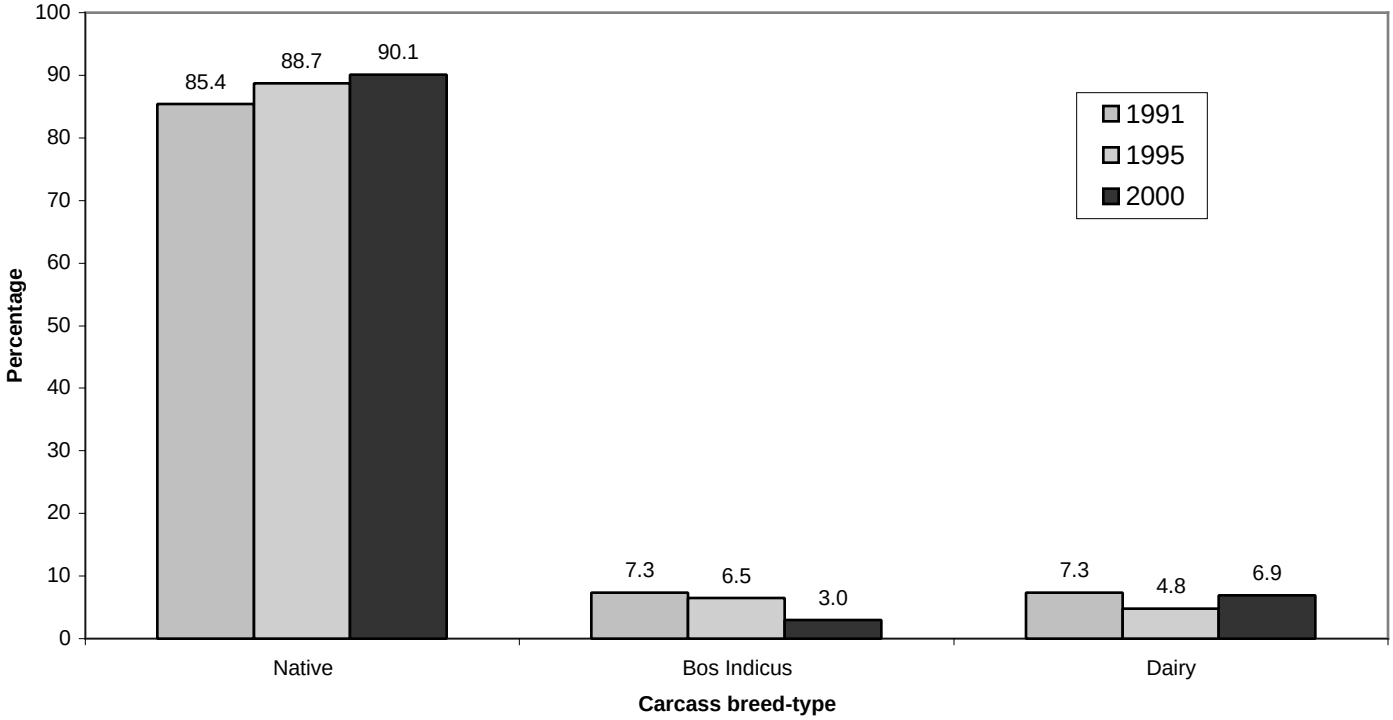


Figure 3. Frequency distribution of yield grades -- NBQA-1991, NBQA-1995, NBQA-2000

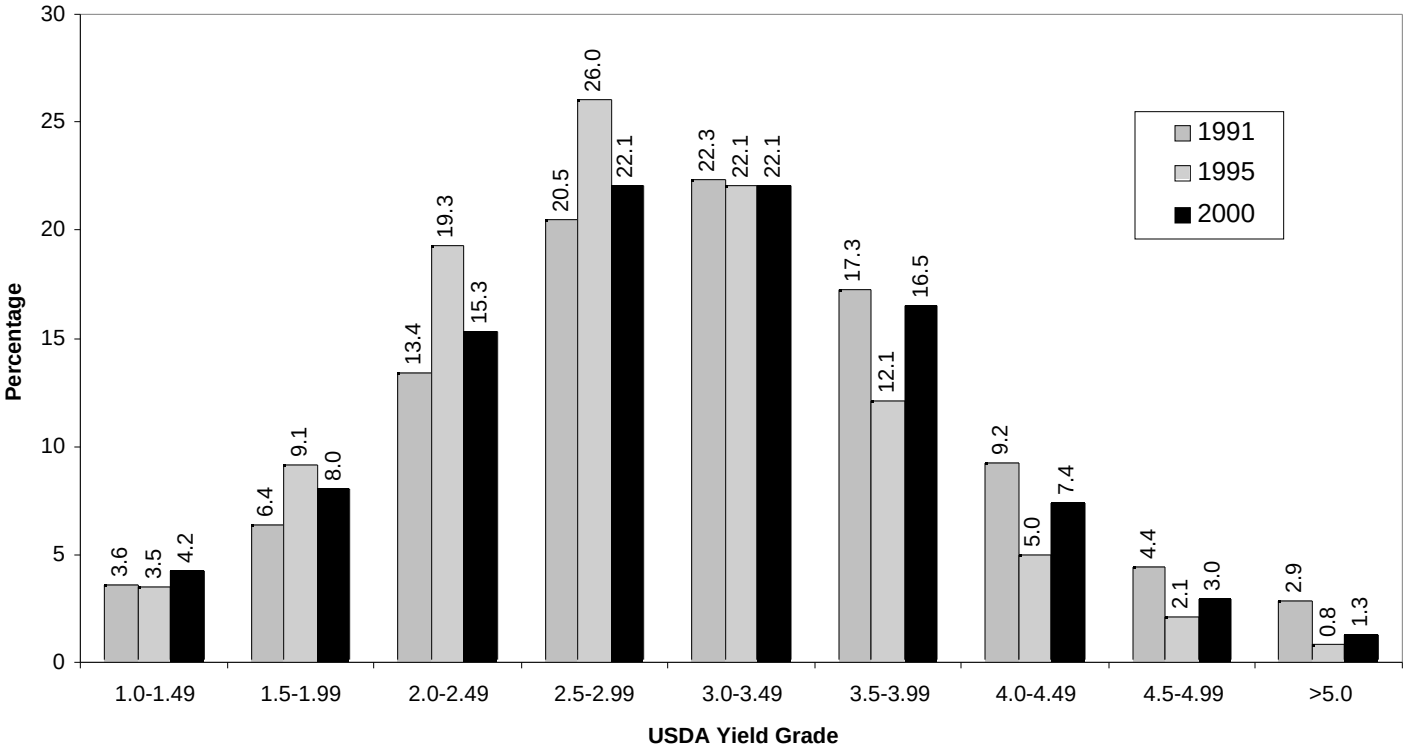


Figure 4. Frequency distribution of fat thickness -- NBQA-1991, NBQA-1995, NBQA-2000

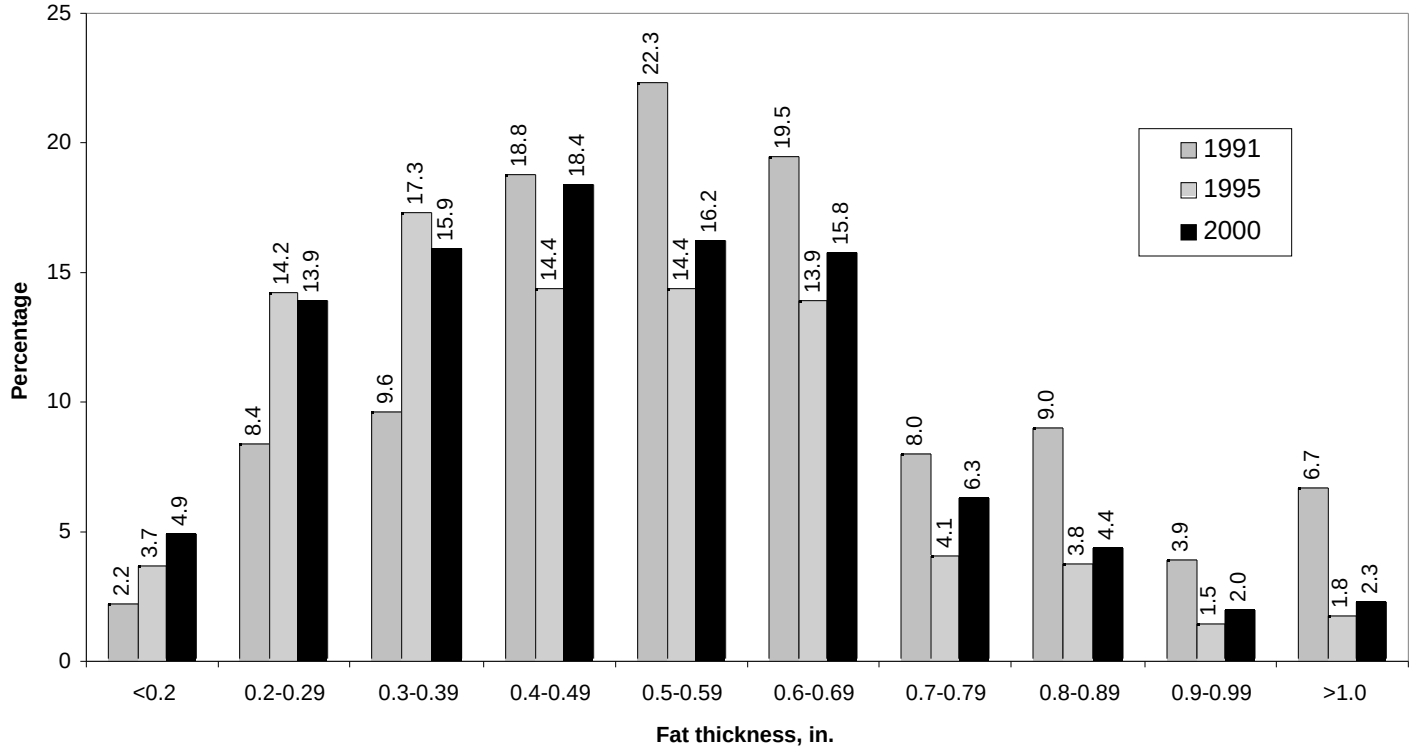


Figure 5. Frequency distribution of carcass weights -- NBQA-1991, NBQA-1995, NBQA-2000

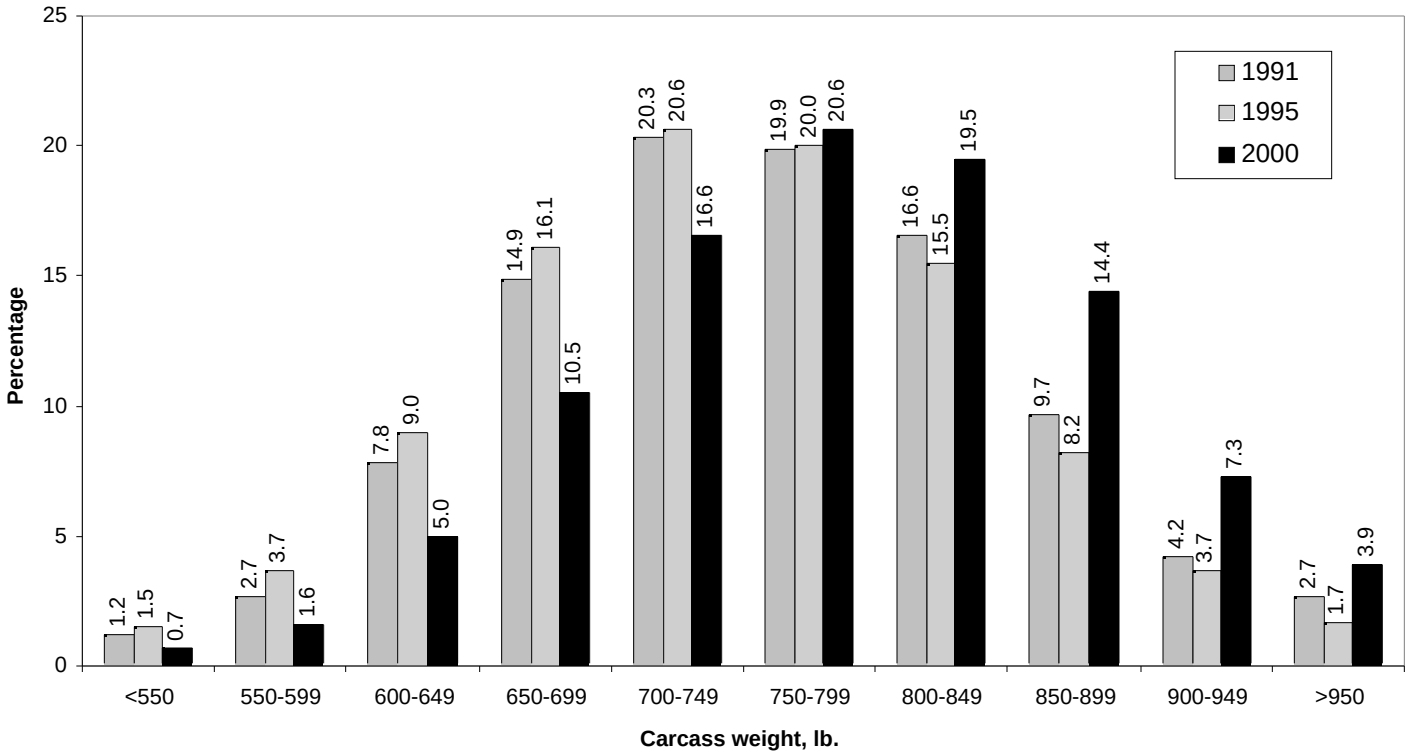


Figure 6. Frequency distribution of kidney, pelvic, & heart fat -- NBQA-1995, NBQA-20(

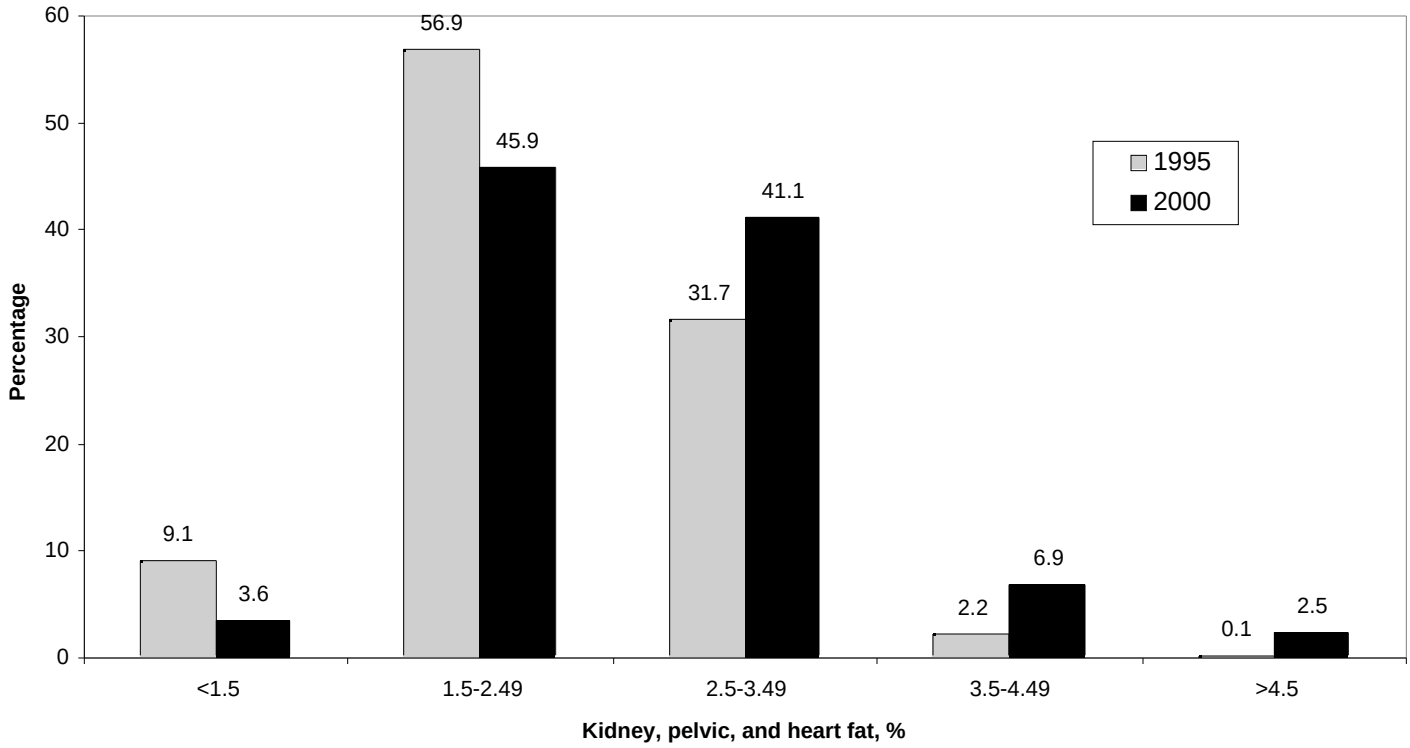


Figure 7. Frequency distribution of ribeye area -- NBQA-1991, NBQA-1995, NBQA-2000

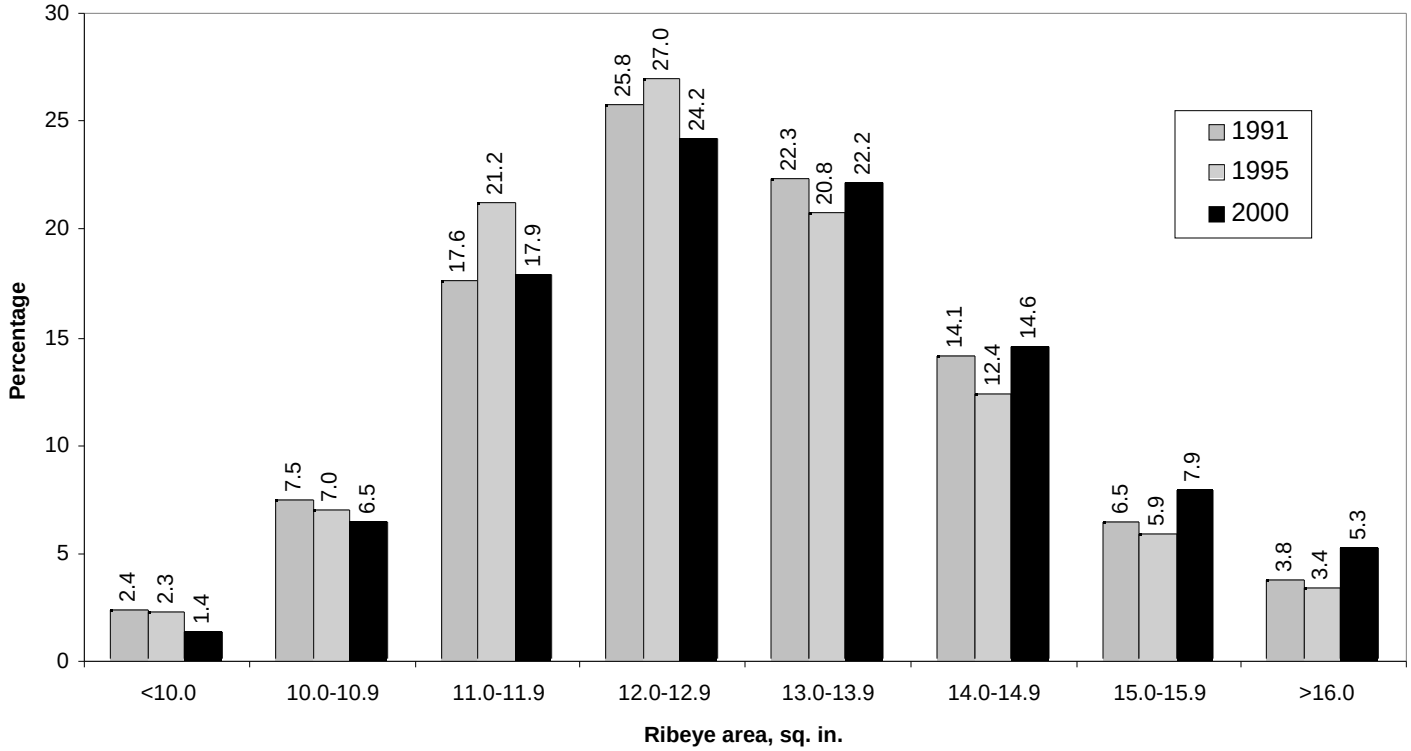


Figure 8. Frequency distribution of carcass maturities -- NBQA - 1991, NBQA - 1995, NBQA - 2000

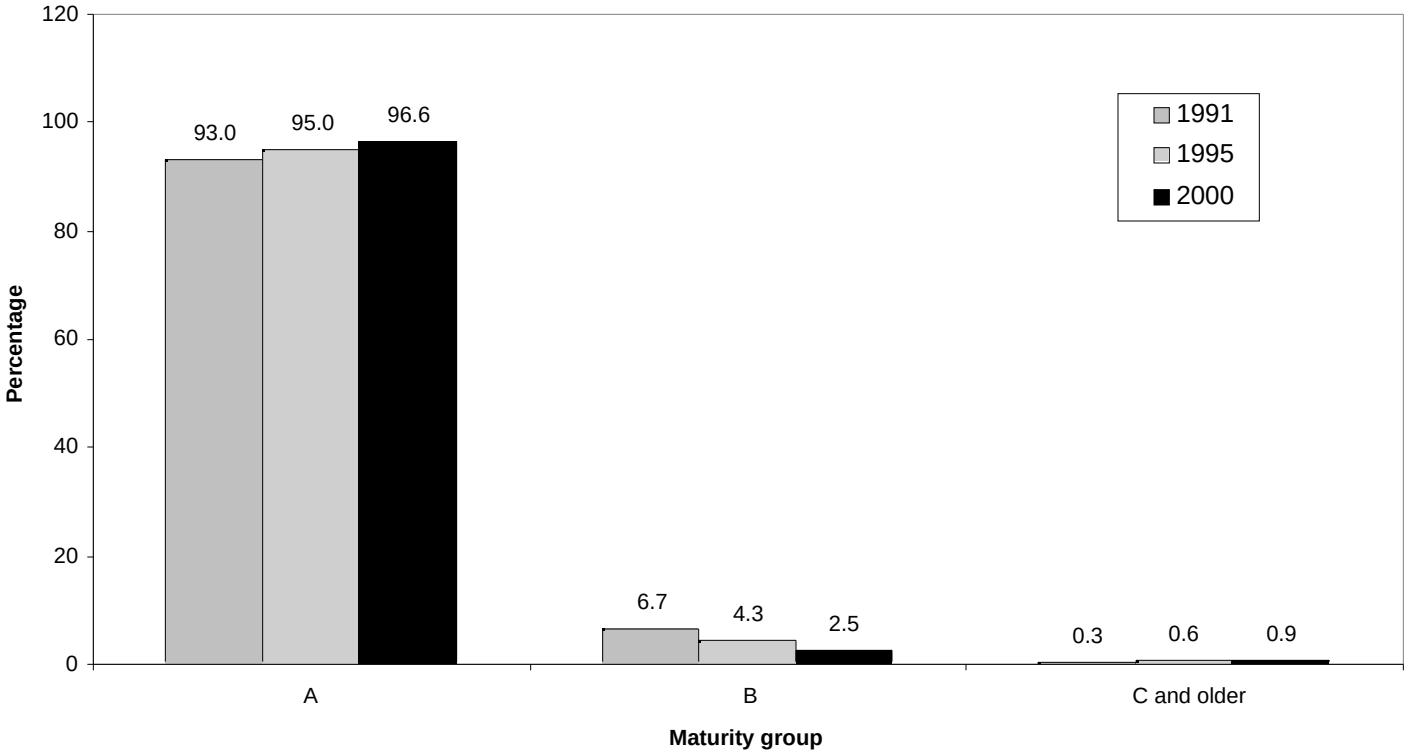


Figure 9. Frequency distribution of marbling scores -- NBQA-1991, NBQA-1995, NBQA-2000

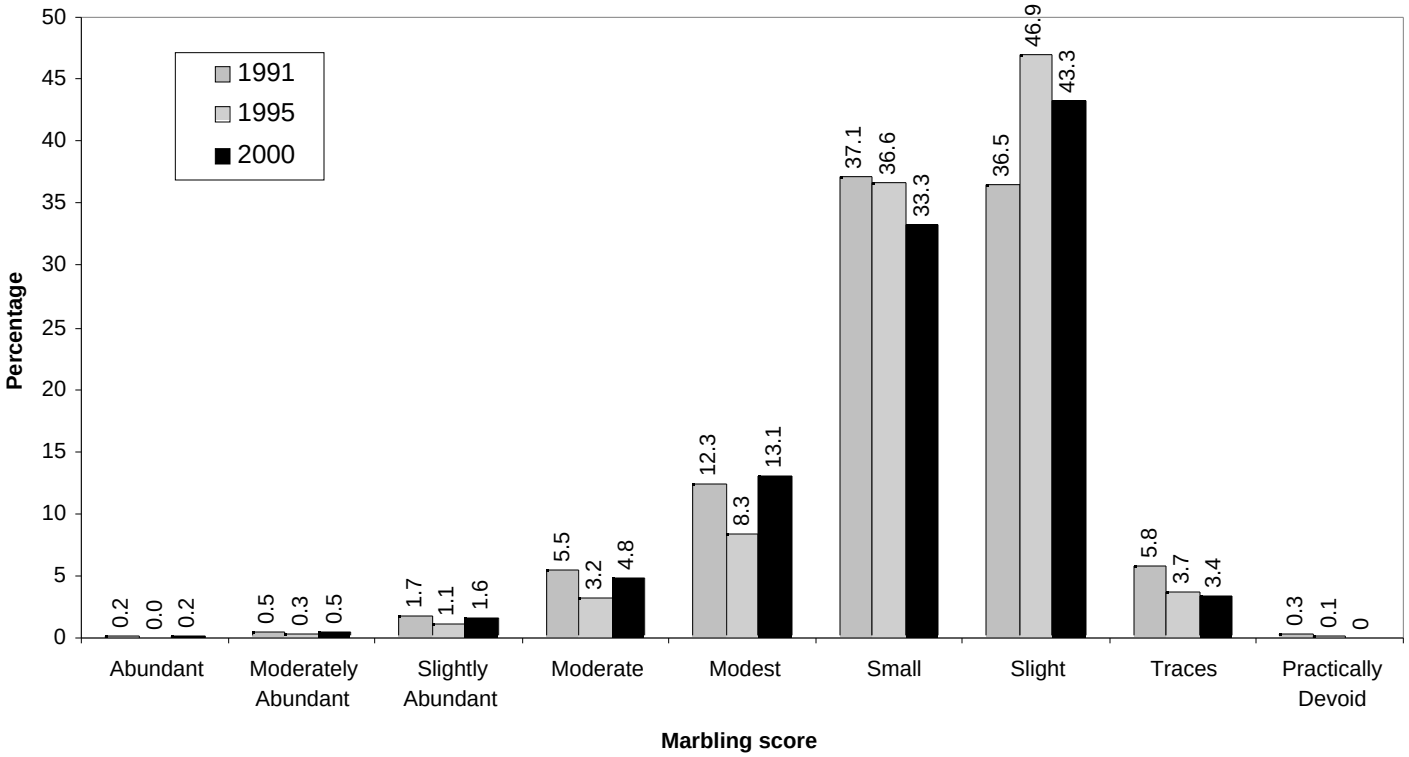


Figure 10. Frequency distribution of marbling scores -- NBQA-2000

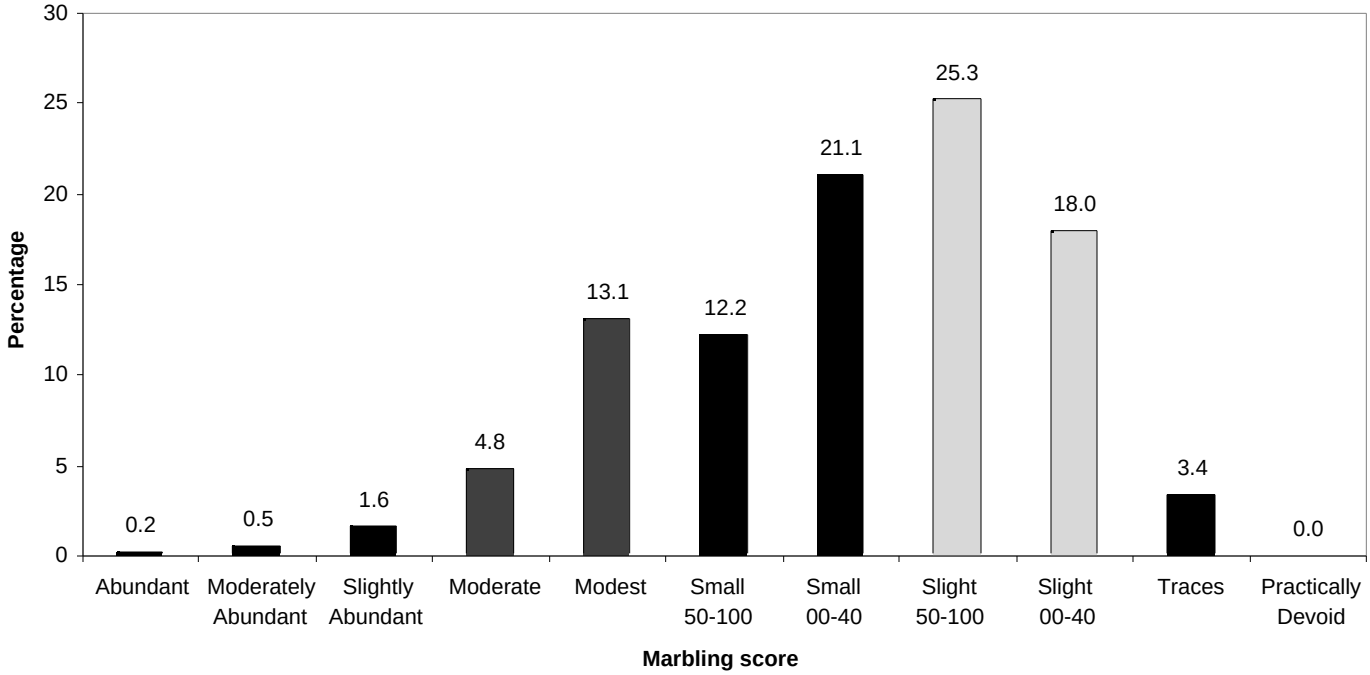


Figure 11. Frequency distribution of quality grades -- NBQA-1991, NBQA-1995, NBQA-2000

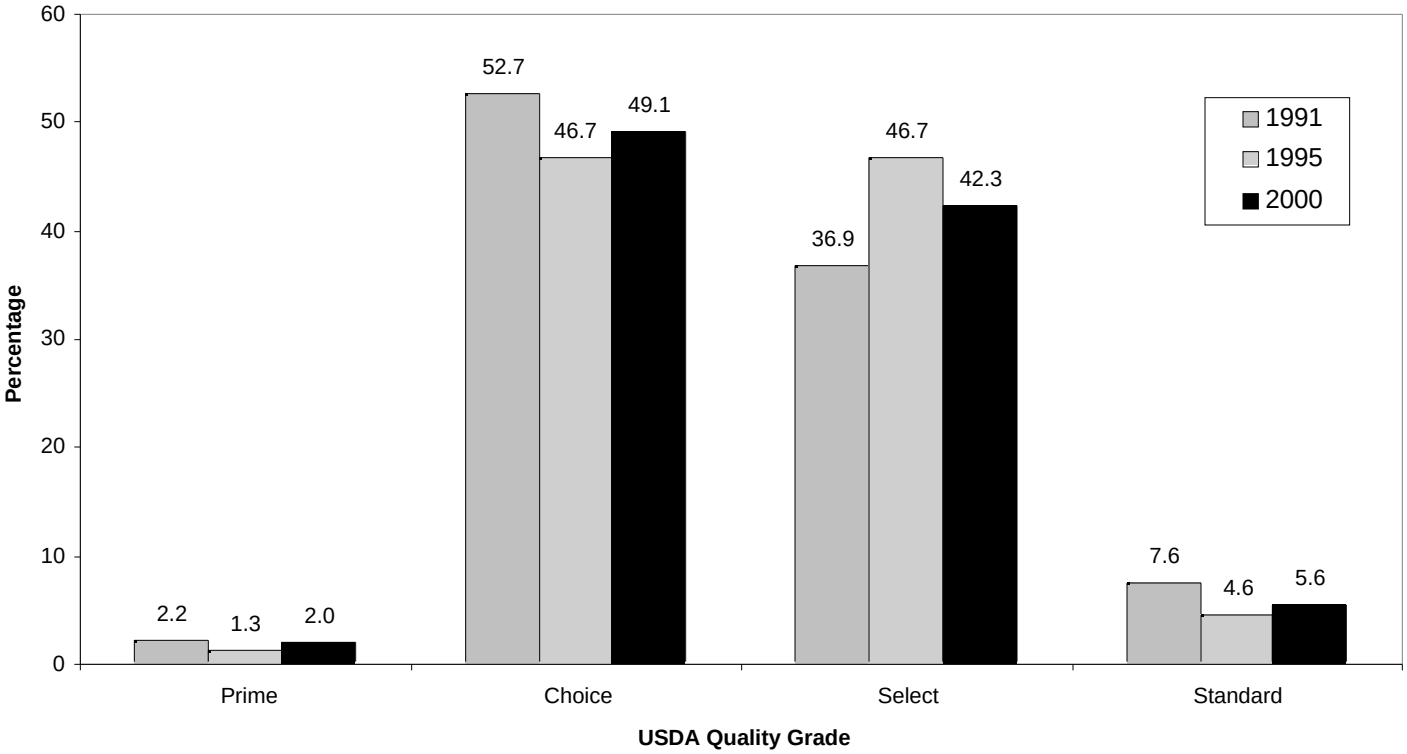


Figure 12. Frequecy distribution of one-third quality grades -- NBQA-1991, NBQA-1995, NBQA-2000

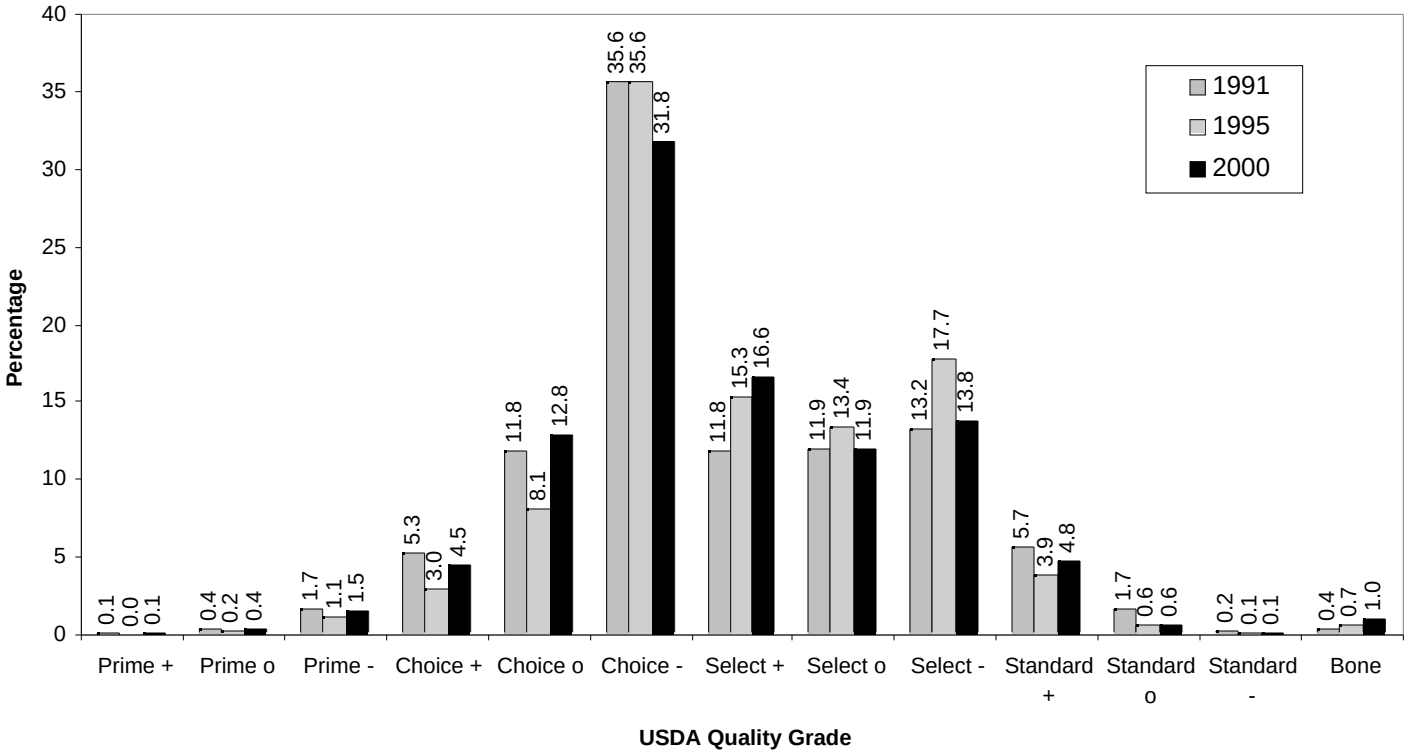


Figure 13. Frequency distribution for yield grade within USDA Choice and USDA Select carcasses -- NBQA-2000

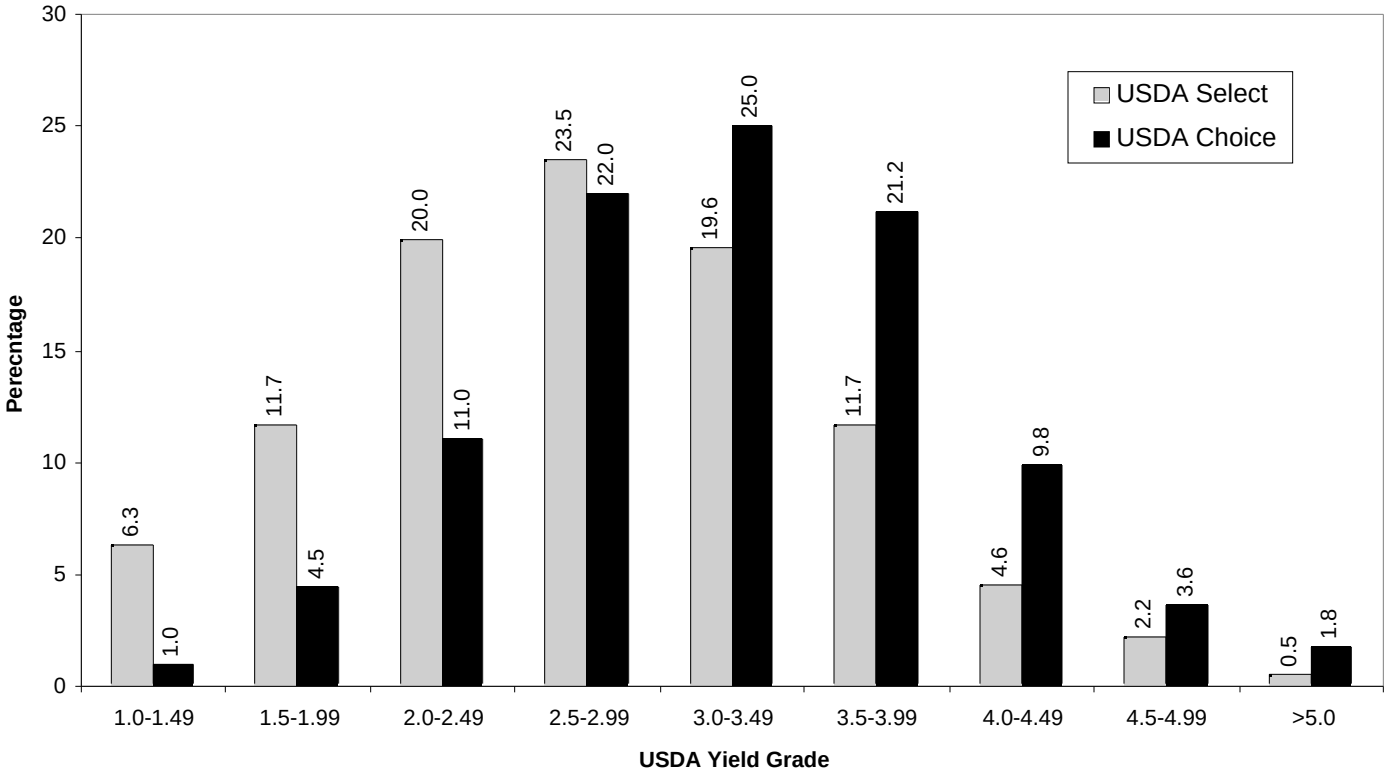
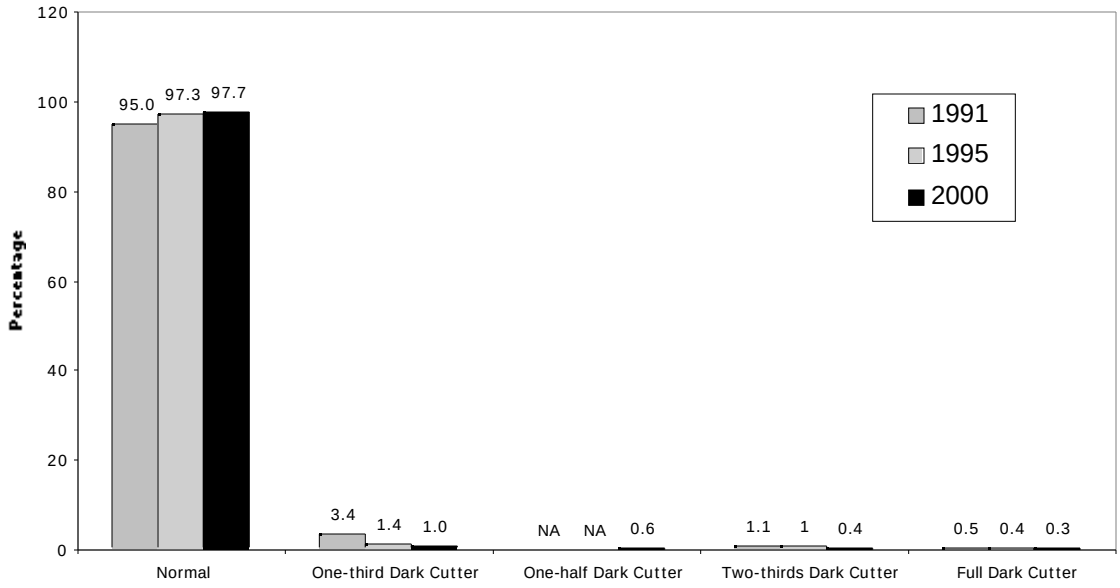


Figure 14. Frequency distribution of dark cutting carcasses -- NBQA-1991, NBQA-1995, NBQA-2000



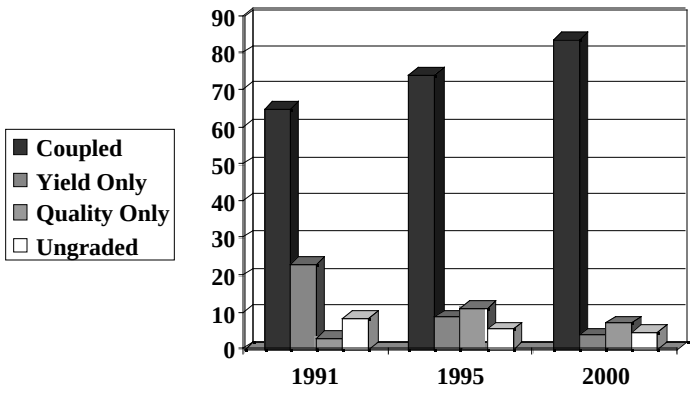
QUALITY GRADE AND YIELD GRADE, COMPARATIVE DATA FROM THE 1991, 1995 AND 2000 NATIONAL BEEF QUALITY AUDITS AND U.S.D.A. ANNUAL SUMMARIES

J.W. Wise, Marketing and Regulatory Programs, AMS-USDA

Comparative data for Quality Grades and Yield Grades from the 1991, 1995 and 2000 National Beef Quality Audits and USDA Annual Summaries revealed that for 1974, 1987, 1991, 1995 and 2000, respectively, percentages of carcasses grading: (a) Prime were 6.6, 2.0, 1.4, 2.1 and 3.0; (b) Choice were 68.0, 60.7, 54.2, 53.9 and 52.4; (c) Select were 21.3, 1.5, 12.5, 29.5 and 36.1, while; (d) ungraded/no-roll were 4.1, 35.8, 31.9, 14.5 and 8.5. Comparison of USDA Annual Summary data for FY-2000 as compared to data from the National Beef Quality Audit—2000, respectively, for steers/heifer carcasses indicated that 3.0% vs. 2.0% graded Prime, 52.4% vs. 49.1% graded Choice, 36.1% vs. 42.3% graded Select while ungraded/no-roll were 8.5% vs. 6.6% and that 9.8% vs. 12.3% were Yield Grade 1, 40.7% vs. 37.4% were Yield Grade 2, 35.5% vs. 38.6% were Yield Grade 3, 1.8% vs. 10.4% were Yield Grade 4 and 0.2% vs. 1.3% were Yield Grade 5 (according to the USDA Annual Summary, 12.0% of steer/heifer carcasses were not Yield Graded). According to USDA Annual Summaries, fiscal year trends (1993 through 2000), total numbers of “Certified” carcasses (by USDA Marketing & Regulatory Programs) increased from approximately 850,000 to about 3,500,000 under all “Schedules” approved by USDA and total numbers of “Certified” carcasses with Modest-minus or higher marbling scores increased from about 1,000,000 in 1994 to approximately 2,600,000 in 2000.

Quality Grade and Yield Grade Comparative Data from the 1991, 1995, and 2000 National Beef Quality Audits and USDA Annual Summaries

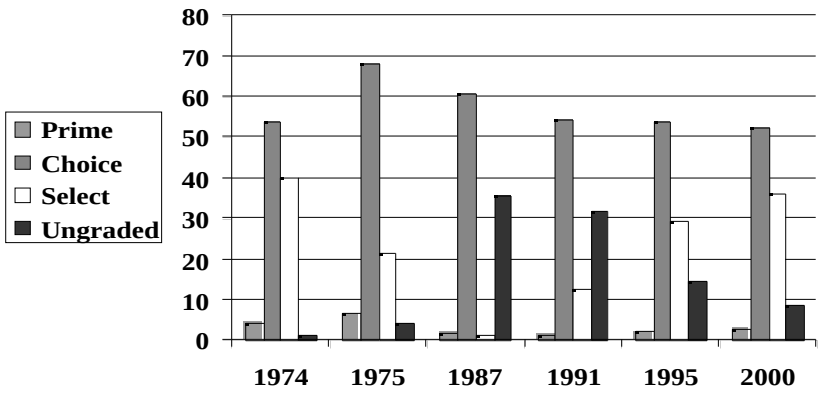
Percent of Federally Inspected Steer and Heifer Slaughter Graded by USDA



Marketing & Regulatory Programs

Quality Grade Consist of Total Steer and Heifer Slaughter

USDA Grade Summaries (Percent)



Marketing & Regulatory Programs

Quality Grade Consist of Total Steer and Heifer Slaughter

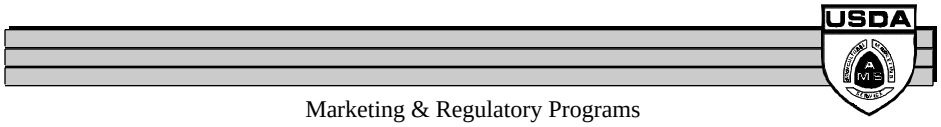
USDA Grade Summaries (Percent)

	1974	1975	1987	1991	1995	2000
Prime	4.5	6.6	2.0	1.4	2.1	3.0
Choice	54.1	68.0	60.7	54.2	53.9	52.4
Select	39.9	21.3	1.5	12.5	29.5	36.1
Ungraded	1.5	4.1	35.8	31.9	14.5	8.5

Marketing & Regulatory Programs

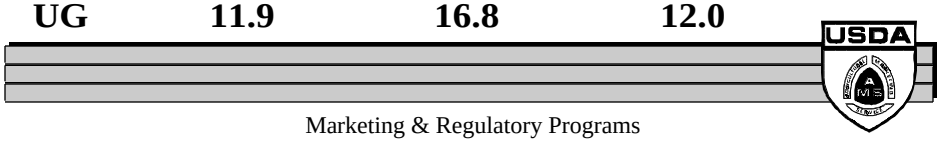
Quality Grade Consist of Total Steer and Heifer Slaughter (Percent)

	1991 USDA	1991 NBQA	1995 USDA	1995 NBQA	2000 USDA	2000 NBQA
Prime	1.4	2.2	2.1	1.3	3.0	2.0
Choice	54.2	52.7	53.9	46.7	52.4	49.1
Select	12.5	36.9	29.5	46.4	36.1	42.3
Ungraded	31.9	8.2	14.5	5.6	8.5	6.6



Yield Grade Consist of Total S&H Slaughter

	1991 USDA	1991 NBQA	1995 USDA	1995 NBQA	2000 USDA	2000 NBQA
YG 1	7.1	10.0	8.9	12.6	9.8	12.3
YG 2	39.5	33.9	38.8	45.3	40.7	37.4
YG 3	38.3	39.6	33.5	34.2	35.5	38.6
YG 4	2.9	13.6	1.8	7.1	1.8	10.4
YG 5	0.3	2.9	0.2	0.8	0.2	1.3
UG	11.9		16.8		12.0	

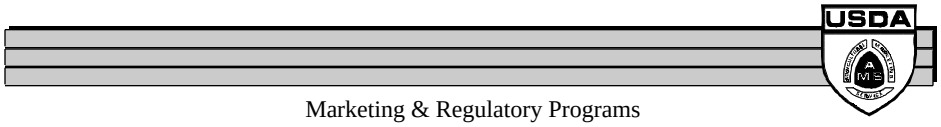


BEEF

SCHEDULE CERTIFICATION

Fiscal Year Trends

1994 to 2000

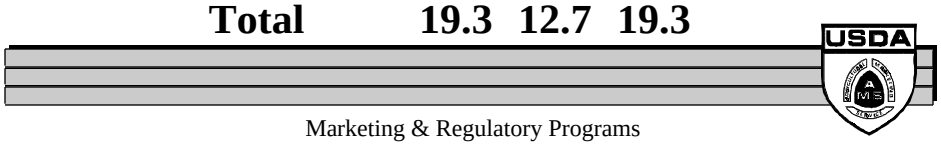


Marketing & Regulatory Programs

Premium Grade Consist of Total Steer and Heifer Slaughter

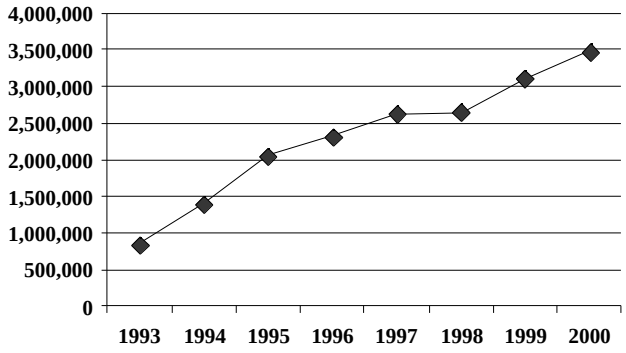
NBQA (Percent)

	1991	1995	2000
Choice o	**11.8**	**8.1**	**12.8**
Choice +	**5.3**	**3.3**	**4.5**
Prime -	**1.7**	**1.1**	**1.5**
Prime o	**0.4**	**0.2**	**0.4**
Prime +	**0.1**	**0.0**	**0.1**
Total	**19.3**	**12.7**	**19.3**

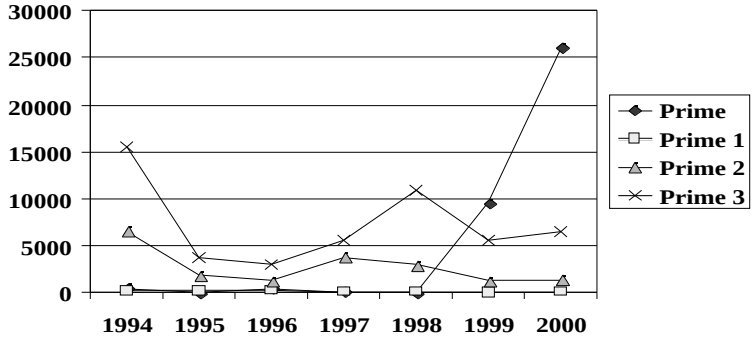


Marketing & Regulatory Programs

Total Certified Carcasses
All Schedules



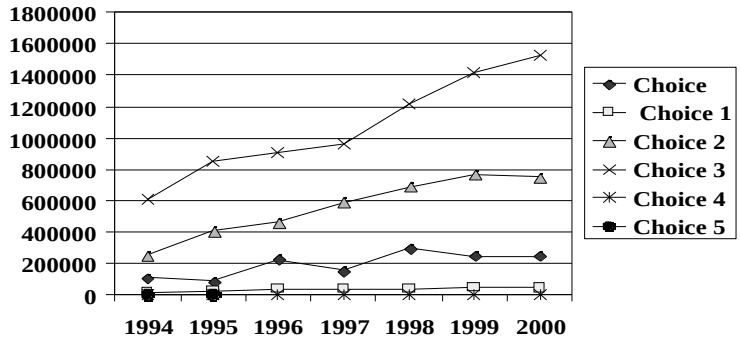
Certified Carcasses
(Prime)
G1, G2, G8, G9A, G12, G16, G17, G20, G22B, G24, G26, G36, P2



Certified Carcasses

(Choice--Modest & Higher)

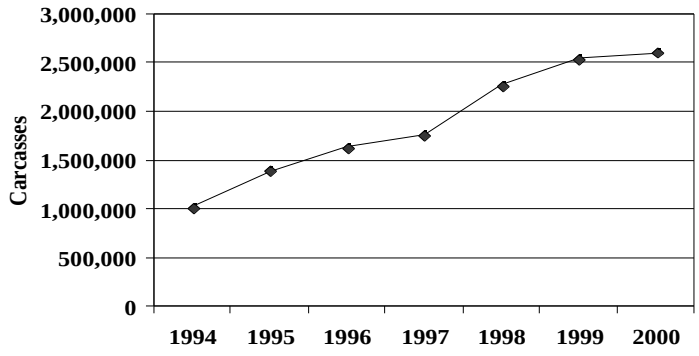
G1, G2, G8, G9A, G12, G16, G17, G20, G22B, G24, G26, G36, P2



Total Certified Carcasses

(Modest & Higher)

G1, G2, G8, G9A, G12, G16, G17, G20, G22B, G24, G26, G36, P2



WHAT IS THE U.S. BEEF INDUSTRY DOING WELL?

J.B. Morgan, Oklahoma State University; T.G. Field, Colorado State University;
Z.L. Carpenter, Texas A&M University

Included among items in the "Success Story" for the National Beef Quality Audit—2000 were: (a) 86.3% of steers/heifers are appropriately branded or not hot-iron branded. (b) 96.2% of steers/heifers are free of excess mud. (c) 77.3% of steers/heifers are polled or dehorned. (d) 88.4% of steer/heifer carcasses are free of major and critical bruises. (e) 93.5% of steer/heifer carcasses graded U.S. Select or better. (f) 88.3% of steer/heifer carcasses had Yield Grades of 3 or better. (g) 97.5% of top sirloin butts are free of injection-site lesions (up from a low of 78.7%). (h) 100% of federally inspected packing facilities implemented a HACCP approach to food safety. (i) 85% of fed cattle are harvested in plants that are using multiple-hurdle decontamination systems. (j) 47 states have a Beef Quality Assurance program. (k) 52 USDA certified/process-verified beef programs have been developed. (l) _-inch trim beef is now the industry standard.

WHAT ARE THE COSTS (LOSSES PER STEER/HEIFER) FOR QUALITY DEFECTS/NONCONFORMITIES IDENTIFIED BY THE NATIONAL BEEF QUALITY AUDIT—2000?

D.L. Roeber, Colorado State University; J.W. Savell, Texas A&M University;
J.B. Morgan, Oklahoma State University; T.H. Montgomery, West Texas A&M University;
K.E. Belk, Colorado State University; D.B. Griffin, Texas A&M University;
J. C. Brooks, Oklahoma State University; T.B. Schmidt, West Texas A&M University;
P.K. Bates, Oklahoma State University; D.R. McKenna, Texas A&M University

An objective of Phase III (Strategy Workshop) of the National Beef Quality Audit – 2000 was to achieve consensus regarding the economic costs associated with "Quality Losses For Each Fed Steer/Heifer Harvested In 2000." These costs were estimated based on the frequency/incidence at which each defect occurred (according to the results of Phase II, In-Plant Audits). The average loss of value associated with the presence of the defect was then computed for **each fed steer/heifer harvested in 2000**. The "Value-Losses" were computed to be $279.82 in the National Beef Quality Audit – 1991 and $137.82 in the National Beef Quality Audit – 1995.

The economics ("Value Losses") associated with findings of the National Beef Quality Audit – 2000 were estimated using three forms of logic: (1) using the same logic and prices as in the 1991 Audit, to allow direct comparison of results of the economic losses in the NBQA-1991 and in the NBQA-2000 and to measure producer progress over the past nine years, (2) using the same logic and prices as in the 1995 Audit to allow direct comparison of the results of the economic losses in the NBQA-1995 and in the NBQA-2000 and to measure producer progress over the past five years, and (3) employing new logic and updated prices and expanding

coverage, as needed, of quality losses for which there was no accounting in 1991 and/or 1995. A summary of quality losses is presented in Table 1.

Estimates were made of the losses of product value for each of the quality defects that was identified in Phase II of the National Beef Quality Audit – 2000 by conferring with knowledgeable resource persons in the fed steer and heifer packing industry that were present at the Strategy Workshop. Estimates were made, presented, and consensus was achieved on the rationale behind each of the "Value-Losses" that follow.

1. *Value-Losses, Excess External Fat/Excess Seam Fat:* Losses associated with excess external and seam fat from carcasses was determined by the following steps: (1) mean Yield Grades and marbling scores (300=Slight, 400=Small, 500=Modest) for carcasses from steers (USDA Yield Grade=2.98, marbling score=411.3), heifers (USDA Yield Grade=2.93, marbling 429.6), and Holsteins (USDA Yield Grade=3.34, marbling score=4.86.2) were determined and were used to estimate percent trimmable carcass fat from each using specific regression equations developed from Griffin (1989); (2) after the percent trimmable fat was estimated (steers=20.60%, heifers=21.91%, Holsteins= 21.38%), the number of carcasses from steers (n=5,772), heifers (n=2,925), and Holsteins (n=611) was multiplied by the estimated fat percentage and was weighted (n=9,308) across all groups (21.07%); (3) the average carcass weight (787.0 pounds) was multiplied by the average estimated percent excess trimmable fat (21.07%) to derive the pounds of excess trimmable fat (165.8209 pounds per head); (4) the target fat percent from NBQA-1995 (16.5%) was multiplied by the average carcass weight (787.0 pounds) to get 129.855 pounds of acceptable trimmable fat; (5) the estimated excess trimmable fat from NBQA-2000 (165.8209 pounds) was subtracted from the target amount (129.855 pounds) to get 35.9659 pounds of excess fat produced; (6) the excess fat (35.9659 pounds) was multiplied by $1.22 (the value of fat at carcass price) to arrive at $43.88; (7) the excess fat (35.9659 pounds) was multiplied by $.03 (the value of fat at fat price) to arrive at $1.08; (8) the cost of the fat to produce ($43.88) had the value of the fat at the fat price ($1.08) subtracted from it to generate the value loss due to excess trimmable fat ($42.80). The total value lost to the beef industry due to excess external fat is $1,297,268,000 or **$42.80 per fed steer and heifer harvested in 2000.**

2. *Value-Losses, Inappropriate Muscling:* Carcasses were considered to be "too light muscled" if they were either dairy steers or had a ribeye area adjustment in the Yield Grade equation of greater than "plus 0.6." Carcasses were considered to be "too heavy muscled" if they had a ribeye area adjustment in the Yield Grade equation greater than "minus 0.8." From the Phase II data, 6.89% of carcasses evaluated were determined to be "too light muscled," while 76.67% of carcasses evaluated were determined to be "too heavy muscled." The frequency of too light muscled carcasses (6.89%) was multiplied by 30,310,000 (estimated Federally Inspected Slaughter of Fed Steers and Heifers for 2000); revealing that in 2000, 2,088,359 too light muscled carcasses were produced. The total number of too light muscled carcasses was multiplied by $101.71 (the value determined to be lost for a carcass that was too light muscled), resulting in a total value of $212,406,994 lost in 2000 due to too light muscled carcasses. Likewise, the frequency of too heavy muscled carcasses (76.67%) was multiplied by 30,310,000 (estimated

Federally Inspected Slaughter of Fed Steers and Heifers for 2000); revealing that in 2000, 23,238,677 too heavy muscled carcasses were produced. The total number of too heavy carcasses was multiplied by $1.50 (the value determined to be lost for a carcass that was too heavy muscled), resulting in a total value of $34,858,016 lost in 2000 due to too heavy muscled carcasses. The total value lost to the beef industry due to inappropriate (too light plus too heavy) muscling totals $247,265,010 (sum of $212,406,994 plus $34,858,016) or **$8.16 per fed steer and heifer harvested in 2000**.

3. *Value-Losses, Palatability*: When addressing economic variables associated with beef tenderness, a great deal of caution should be exercised for several reasons. The first reason is that a concise information base associated with beef tenderness ratings for consumers does not exist. In other words, most beef tenderness conclusions are based on objective tenderness ratings (i.e., Warner-Bratzler shear force) and results from trained consumer panels. Secondly, the question arises, "How often are consumers unsatisfied and when those times arise, do they consistently complain about inadequate beef tenderness?" This scenario is certainly occurring with beef purchased at both retail outlets and food service establishments. So, unlike many of the quality variables quantified in the National Beef Quality Audit (NBQA), inadequate beef tenderness is very difficult to assess from an economic standpoint. To complicate the issue of value loss estimates for inadequate beef tenderness even more, NBQA-2000 was conducted differently in terms of collection of beef tenderness information than were previous NBQAs (1991 and 1995). During the first two NBQAs, the top ten retail organizations—based on total retail sales—along with several food service establishments were contacted and questions were asked regarding the percentage of their beef sales in which complaints were received that were associated with inadequate beef tenderness. In the NBQA-1991, toughness problems associated with retail beef cuts were estimated to occur at 0.6%. Using Cattle· Fax information on the average retail beef for 1991, it was calculated that approximately $75.25 million was lost due to beef toughness. In the NBQA-1995, a similar process was used to estimate the percentage of tough beef cuts that were being merchandised at retail and foodservice outlets. Interview responses indicated that 0.8% and 3.2% of the retail and foodservice beef cuts were tough, respectively. These estimated percentages represented approximately $91 and $342 million of losses associated with tough beef cuts merchandised in retail and food service markets in 1995, respectively. Even though questionnaires were sent to participating retail, food service and restaurateur sectors of the beef industry, protocols followed in conducting the NBQA-2000 did not include estimation of the percentage of retail or foodservice beef that was tough. In an attempt to estimate the economic impact associated with tough beef, several information sources were utilized in NCBA—2000. A comparison of National Beef Tenderness Survey (NBTS-1990 and NBTS-1998) findings for overall tenderness of retail cuts from the rib, loin, chuck, and round were utilized. The average shear values of NBTS-1998 retail cuts from the ribeye, top loin, and top sirloin have improved 1.3, 1.3, and 1.5 pounds, respectively, when compared to those from NBTS-1990. These data indicate that improvements in tenderness of middle meats have been made since 1990. Improvements in tenderness values of retail cuts from the chuck and round have also been noted since 1990. The clod, chuck roll, top round, and eye of round exhibited lower shear values when evaluated in 1998 than was the case

in 1990. The bottom round steak was the only retail cut sampled that did not show improvements in WBS values. These findings were used to estimate the total value lost to the beef industry due to inadequate palatability which is $72,440,900 or **$2.39 per steer and heifer harvested in 2000.**

4. *Value-Losses, Insufficient Marbling:* The participants at the Strategy Workshop determined that the ideal Quality Grade consist, in 2000, would be 6% Prime, 27% Upper 2/3 Choice, 32% Lower 1/3 Choice, 35% Select, and 0% Standard. The prices, in 2000, per 100 pounds carcass weight (USDA, AMS) used to calculate the economic losses were $128 for Prime, $125 for Upper 2/3 Choice, $124 for Lower 1/3 Choice, $115 for Select, $103 for Standard, and $77 for hardboned carcasses. The actual consist from the 2000 audit data was 2% Prime, 17.3% Upper 2/3 Choice, 31.8% Lower 1/3 Choice, 42.3% Select, 5.5% Standard, and 1.0% hardboned carcasses. The percentages of each Quality Grade were multiplied by the appropriate price and multiplied by the average hot carcass weight for the 2000 audit (787 lb) for each ideal and actual consist (**IDEAL**: 6%*128*7.87, 27%*125*7.87, 32%*124*7.87, 35%*115*7.87, 0%*103*7.87, 0%*77*7.87; **ACTUAL**: 2%*128*7.87, 17.3%*125*7.87, 31.8%*124*7.87, 42.3%*115*7.87, 5.5%*103*7.87, 1%*77*7.87). The total value of the ideal Quality Grade consist was $955.10 ($60.44 + $265.61 + $312.28 + $316.77); the total value of the actual Quality Grade consist was $934.15 ($20.15 + $170.19 + $310.33 + $382.84 + $44.58 + $6.06). The total value lost to the beef industry in 2000 was **$20.96 per fed steer and heifer harvested in 2000** ($955.10 - $934.15).

5. *Value-Losses, Hardboned Carcasses:* During Phase II, it was determined that the incidence of hardboned carcasses was 0.4%. The incidence (0.4%) was multiplied by 30,310,000 (estimated Federally Inspected Slaughter of Fed Steers and Heifers in 2000), revealing that 121,240 carcasses in the coolers of packing plants in 2000 had advanced skeletal maturity. It was determined that packers discount hardboned carcasses $20 per 100 pounds of carcass weight, or $157.40 per head ($20*7.87[average hot carcass weight from the 2000 audit]). The value lost per carcass ($157.40) was multiplied by 121,240 to determine the total value lost to the beef industry. The total value lost in 2000 due to hardboned carcasses was calculated to be $19,083,176 or **$0.63 per fed steer and heifer harvested in 2000**.

6. *Value-Losses, Bullock Carcasses:* During Phase II, it was determined that the incidence of bullock carcasses was 0.3%. The incidence (0.3%) was multiplied by 30,310,000 (estimated Federally Inspected Slaughter of Fed Steers and Heifers in 2000), revealing that 90,930 carcasses in the coolers of packing plants in 2000 were bullocks. It was determined that packers discount bullock carcasses $20 per 100 pounds of carcass weight, or $157.40 per head ($20*7.87[average hot carcass weight from the 2000 audit]). The value lost per carcass ($157.40) was multiplied by 90,930 to determine the total value lost to the beef industry. The total value lost in 2000 due to bullock carcasses was calculated to be $14,312,381 or **$0.47 per fed steer and heifer harvested in 2000**.

7. *Value-Losses, Hide Defects due to Branding:* During Phase II, Audit personnel determined that the incidence of cattle branded on the hip only was 33.48% and the

frequency of cattle with at least one brand on the side or shoulder was 17.20%. Using the data from Phase II, it was calculated that 10,147,788 cattle have only a hip brand and that 5,213,320 cattle have a brand on the side and/or shoulder. Information obtained from the USDA, Agricultural Marketing Service, Tallow, Protein, and Hide Report indicated that the value lost per hide for a hip brand was $2.50, while the value lost per hide for a side/shoulder brand was $5. The total value lost for hide defects due to branding was calculated to be $51,436,070 (sum of 10,147,788*2.50 + 5,213,320*5) or **$1.70 per fed steer and heifer marketed in 2000**.

8. *Value-Losses, Carcass Pathology:* According to the Audit data, 0.1% of carcasses are condemned for pathological reasons. Based on these data, 30,310 carcasses were condemned in 2000. The value per carcass was calculated to be $960 (787 lb hot carcass weight * $1.22 [dressed steer/heifer price according to the USDA, AMS beef carcass price equivalent index value]). Multiplying $960*30,310, the total value lost in the beef industry due to carcass pathology was $29,097,600 or **$0.96 per fed steer and heifer harvested in 2000**.

9. *Value-Losses, Offal Condemnations:* The rate of liver condemnations, lung condemnations, tripe condemnations, head condemnations, hair sores (resulting in the trimming of tongues), and tongue condemnations were 30.27%, 13.80%, 11.64%, 6.24%, 2.19%, and 4.80%, respectively, according to the data collected in Phase II. Based on values of offal obtained from the USDA, AMS by-product price report, it was determined that the lost value for livers, lungs, tripe, heads, trimmed tongues, and whole tongues was $3.60, $0.12, $4.42, $35, $3.88, and $13.50, respectively. Based on this information, it was determined that the lost value of liver condemnations was $33,029,413 (30,310,000 [2000 estimated federally inspected slaughter] *30.27% [incidence] *3.60 [lost value per condemnation]), the lost value for lung condemnations was $501,934 (30,310,000*13.80%*0.12), the lost value for tripe condemnations was $15,594,131 (30,310,000*11.64%*4.42), the lost value for head condemnations was $66,197,040 (30,310,000*6.24%*35), the lost value for trimmed tongues was $2,575,501 (30,310,000*2.19%*3.88), and the lost value for whole tongue condemnations was $19,640,880 (30,310,000*4.8%*13.50). The total value lost to the beef industry for offal condemnations was $137,538,899 (sum of 33,029,413 + 501,934 + 15,594,131 + 66,197,040 + 2,575,501 + 19,640,880) or **$4.54 per fed steer and heifer harvested in 2000**.

10. *Value-Losses, Injection-Site Lesions:* The incidence of injection-site lesions in fed steer and heifer top sirloin butts is 2.5% and the incidence of injection-site lesions in fed steer and heifer rounds is 11.3%. The average weight per lesion is 8.7 ounces and 12.5 ounces in the top sirloin butt and round, respectively.

    Top Sirloin Butt: Using the information provided above: (1) Multiplying 30,310,000 (estimated Federally Inspected Slaughter of Fed Steers and Heifers in 2000) * 2.5% *2 equals 1,515,500 top sirloin butts with an injection-site lesion. (A) If one-third of lesioned top sirloin butts are partially fabricated prior to the discovery of an injection-site lesion (at an average fabrication period of .5 times total fabrication times 5.5 minutes per

butt time $0.55 per minute equals $1.51 per lesioned butt), claimed and destroyed—unusable because of tenderness and/or microbiological concerns—this represents a loss of $12,877,961 (.33 * 1,515,500 total lesioned top sirloin butts * $2.02 per pound * 12 pounds, plus $1.51 * .33 * 1,515,500). (B) If one-third of lesioned top sirloin butts are partially fabricated prior to discovery of an injection-site lesion (at an average fabrication period of .5 times total fabrication times 5.5 minutes per butt time $0.55 per minute equals $1.51 per butt) converted into ground beef—acceptable microbiologically, unacceptable in tenderness—(at a conversion cost $0.15 per pound) this represents a loss of $6,027,386 ($2.02 per pound minus 1.2915 ground sirloin price plus 0.15 per pound grinding * 12 pounds * .33 * 1,515,500 total lesioned top sirloin butts, plus $1.51 * .33 * 1,515,500). (C) If one-third of the lesioned top sirloin butts have the lesion dissected and discarded, along with some salvage value, the following would result. Average price per pound for U.S. Choice top sirloin butts sold by packers during the calendar year 2000 was $2.02. At an average yield of 55% (as finished portions) and with no margin for profit, the steak cutter would have generated 6.6 lb (12 or 13 pieces) of top sirloin steaks, now worth $3.76. If, as has been assumed, 3 steaks and/or 1.5 pounds (3 pieces at 8 oz each) are lost completely each time a top sirloin butt has an injection-site lesion, the economic consequence of a single occurrence of such defect is $5.64 (1.5 * $3.76). Presume though, that based on the fact that 80% of purveyors contacted during the Audits cut out and discard the area of the injection-site lesion and then salvage the remainder of the three lesion-afflicted steaks as kabobs, stew meat, and/or ground beef, that some recovery of meat around the injection-site can be effected. Based on the average price received for beef salvaged ($1.44 per pound) and that an average cost for labor to perform the salvage operation is $1.10 (2.0 minutes at $0.55 per minute), 1.13 pounds of the 1.50 pounds would be recovered and could be sold for $1.63 (1.13 * $1.44). Net recovery from the latter operation would be $0.53 ($1.63 minus $1.10) per injection-site lesion. Presuming that the economic consequence of an injection-site lesion for the 20% of end-users who do not attempt to salvage anything from the affected tissue is $5.64 per butt, and that the economic consequence of an injection-site lesion for the 80% of end-users who do salvage the tissue surrounding the lesion is $5.11 ($5.64 minus $0.53), these estimates can be used to provide another estimate of value loss. Because one-third of lesioned butts are handled in this manner, (.33 * 1,515,500 equals 500,115 butts), the loss in value of these top sirloin butts during 2000 would be $2,608,500 ($5.64 * .20 * 500,115; plus $5.11 * .80 * 500,115). Thus the total value lost from injection-site lesions in top sirloin butts is $21,513,947 ($12,877,961 plus $6,027,386 plus $2,608,500).

Bottom-Rounds: Given this information: (1) Multiplying 30,310,000 (estimated Federally Inspected Slaughter of Fed Steers and Heifers in 2000) * 11.3% *2 equals 6,850,060 with an injection-site lesion. (A) If one-third of lesioned rounds are partially fabricated prior to the discovery of an injection-site lesion (at an average fabrication period of .5 times total fabrication times 5.5 minutes per round time $0.55 per minute equals $1.51 per lesioned round), claimed and destroyed—unusable because of tenderness and/or microbiological concerns—this represents a loss of $50,224,229 (.33 * 6,850,060 total lesioned rounds * $1.67 per pound * 12.4 pounds, plus $1.51 * .33 * 6,850,060). (B) If one-third of lesioned rounds are partially fabricated prior to discovery

of an injection-site lesion (at an average fabrication period of .5 times total fabrication times 5.5 minutes per round time $0.55 per minute equals $1.51 per round) converted into ground beef—acceptable microbiologically, unacceptable in tenderness—(at a conversion cost $0.15 per pound) this represents a loss of $24,909,934 ($1.67 per pound minus 1.0531 ground round price plus 0.15 per pound grinding * 12.4 pounds * .33 * 6,850,060 total lesioned rounds, plus $1.51 * .33 * 6,850,060). (C) If one-third of the lesioned rounds have the lesion dissected and discarded, along with some salvage value, the following would result. Average price per pound for U.S. Choice rounds sold by packers during the calendar year 2000 was $1.67. At an average yield of 50% (as finished portions) and with no margin for profit, the steak cutter would have generated 6.2 lb (12 or 13 pieces) of rounds, now worth 3.26. If, as has been assumed, 5 steaks and/or 1.88 pounds (3 pieces at 8 oz each) are lost completely each time a bottom round has an injection-site lesion, the economic consequence of a single occurrence of such defect is $6.13 (1.88 * $3.26). Presume though, that based on the fact that 80% of purveyors contacted during the audits cut out and discard the area of the injection-site lesion and then salvage the remainder of the three lesion-afflicted steaks as kabobs, stew meat, and/or ground beef, that some recovery of meat around the injection-site can be effected. Based on the average price received for beef salvaged ($1.44 per pound) and an average cost for labor to perform the salvage operation is $1.10 (2.0 minutes at $0.55 per minute), 1.4 pounds of the 1.88 pounds would be recovered and could be sold for $2.02 (1.4 * $1.44). Net recovery from the latter operation would be $0.92 ($2.02 minus $1.10) per injection-site lesion. Presume the economic consequence of an injection-site lesion for the 20% of end-users who do not attempt to salvage anything from the affected tissue is $6.13 per round, and that the economic consequence of an injection-site lesion for the 80% of end-users who do salvage the tissue surrounding the lesion is $5.21 ($6.13 minus $0.92). Because one-third of lesioned rounds are handled in this manner, (.33 * 6,850,060 equals 2,260,520 rounds), the loss in value of these rounds during 2000 would be $12,193,245 ($6.13 * .20 * 2,260,520; plus $5.21 * .80 * 2,260,520). Thus the total value lost from injection-site lesions in bottom rounds is $87,327,407 ($50,224,229 plus $24,909,934 plus $12,193,245). Thus, the total value lost for injection-site lesions is $108,841,354 or **$3.59 per fed steer and heifer harvested in 2000.**

11. *Value-Losses, Bruise Trim:* According to the data that were collected in Phase II of the audit, 35.07% of carcasses had a minor bruise, 9.90% of carcasses had a major bruise, and 1.73% of carcasses had a critical/extreme bruise. From the past Audits (National Beef Quality Audit – 1995 and the National Market Cow and Bull Beef Quality Audit – 1999), it has been determined that minor bruises result in 0.66 pounds of trim, major bruises result in 1.54 pounds of trim and critical/extreme bruises result in 3.19 pounds of trim. The value lost in the beef industry due to minor bruises was $8,559,048 (30,310,000*35.07%*0.66*$1.22 [carcass price]), major bruises cost the industry $5,637,696 (30,310,000*9.9%*1.54*1.22), and critical/extreme bruises cost the industry $2,040,716 (30,310,000*1.73%*3.19*1.22) in trim losses. In addition, critical/extreme bruises also cause the devaluation of primals due to the severity of trimming required. The devaluation of primals cost the beef industry $6,582,227 (Table 2). In total bruise trim cost the beef industry $22,819,687 (sum $8,559,048 + 5,637,696 + 2,040,716 + 6,582,227) or **$0.75 per fed steer and heifer in 2000**.

12. *Value-Losses, Dark Cutters:* The frequency of dark cutters was determined to be 2.3% during Phase II of the Audit. Thus, 697,130 carcasses exhibited the dark cutting beef characteristics in 2000. According to the USDA, AMS reports, the discount for dark cutters is $30 per 100 lbs of carcass weight. Thus, the total value lost to the beef for dark cutters was $164,592,393 (697,130*30*7.87) or **$5.43 per fed steer and heifer harvested in 2000**.

13. *Value-Losses, Blood Splash, Callused Ribeyes, Yellow Fat:* The frequency of blood splash, callused ribeyes, and yellow fat were 0.5%, 0%, and 0.4%, respectively. Thus, 151,500 carcasses exhibited blood splash and 121,240 carcasses exhibited yellow fat. The discounts for blood splash and yellow fat were determined to be $20/cwt and $15/cwt, respectively. Thus, the total lost value to the beef industry was $38,166,352 (30,310,000*0.4%*7.87*15; plus 30,310,000*0.5%*7.87*20) or **$1.26 per fed steer and heifer harvested in 2000**.

14. *Value-Losses, Light and Heavy Weight Carcasses:* The frequency of carcasses that had a hot carcass weight of less than 550 lb, those considered to have carcass weights that were too light, was determined to be 0.7%, while the frequency of carcasses that had a hot carcass weight of greater than 949 pounds, those considered to have carcass weights that were too heavy, was determined to be 3.9%. The discount associated with light weight carcasses, as determined from USDA, AMS reports, was $18.67/cwt and the discount associated with heavy weight carcasses was $15.17/cwt. The value lost in the beef industry due to light weight carcasses was $20,913,900 (30,310,000*0.7%*525 pounds*$18.67/cwt) and the value lost due to heavy weight carcasses was $174,888,700 (30,310,000*3.9%*975 pounds*$15.17/cwt). Thus, the total value lost in the beef industry due to inappropriate hot carcass weights was $195,802,600 (sum of 20,913,900 plus 174,888,700) or **$6.46 per fed steer and heifer harvested in 2000**.

TABLE 1. Benchmark value-losses for quality challenges identified in Phase II of the Audits, NBQA-1991 vs. NBQA-1995 vs. NBQA-2000.

	1991	2000 1991 Logic/Prices	1995	2000 1995 Logic/Prices	2000 New Logic
Excess External Fat	111.99	113.20			
Excess Seam Fat	62.94	63.90	27.42	35.25	42.80
Beef Trim (20%)	14.85	16.58			
Muscling	29.47	14.22	20.34	8.16	8.16
Total Waste	**219.25**	**207.90**	**47.76**	**43.41**	**50.96**
Palatability	2.89	2.39	7.64	2.39	2.39
Marbling	21.68	18.67	28.41	19.17	20.96
Hardboned	1.29 (3.80)	0.52	1.35	0.90	0.63
Bullocks	0.44	0.27	0.90	0.68	0.47
Total Taste	**26.30 (28.81)**	**21.85**	**38.30**	**23.14**	**24.45**
Hide Damage	16.88	28.12	24.30	23.92	1.70
Carcass Condemnations	1.35	1.93	0.46	0.72	0.96
Offal Condemnations	0.91	1.50	3.44	5.49	4.54
Injection-Site Lesions	1.74	0.25	5.11	3.02	3.59
Bruises	1.00	1.19	4.03	0.61	0.75
Dark Cutters	5.00	2.33	6.08	5.18	5.43
Grubs/BS/YF/CRE	0.38	0.13	1.74	1.20	1.26
Total Management	**27.76**	**35.45**	**45.16**	**40.14**	**18.23**
Weight (550-949)	**4.50**	**6.07**	**4.66**	**8.23**	**6.46**
	$277.81	**$271.27**	**$135.88**	**$114.92**	**$100.10**
	RECAPTURED	**$6.54**	**RECAPTURED**	**$20.96**	
	RECAPTURED	**2.35%**	**RECAPTURED**	**15.43%**	

TABLE 2. Cost of critical/extreme bruises due to devaluation of primal cuts.

	RIB	LOIN		CHUCK		ROUND			
Subprimal	Ribeye	Strip loin	Top Butt	Chuck roll	Clod	Knuckle	Inside	Gooseneck	
% of 787 lb YG3 Carcass	0.0318	0.0369	0.0347	0.0846	0.0577	0.0284	0.0582	0.0743	
x 787 lb carcass	787	787	787	787	787	787	787	787	
Subprimal weight	25.0266	29.0403	27.3089	66.5802	45.4099	22.3508	45.8034	58.4741	
x $/lb for 50:50 choice/select	4.145	4.015	1.92	1.63	0.95	1.72	1.76	1.185	
Total subprimal value	103.74	116.60	52.43	108.53	43.14	38.44	80.61	69.29	
-10% discount	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Dollars lost for # 2 product	10.37	11.66	5.24	10.85	4.31	3.84	8.06	6.93	
Subprimal % of primal	1	0.52	0.48	0.59	0.41	0.18	0.36	0.46	
Adj loss/piece of #2	10.37	6.06	2.52	6.40	1.77	0.69	2.90	3.19	
Dollars lost per primal	10.37	8.58		8.17		6.78			
Projected slaughter	30310000	30310000		30310000		30310000			
Freq of critical/extreme	0.008556	0.006314		0.007642		0.001738			
Pieces of #2 prod (freq*slaughter)	259332.36	191377.3		231629		52678.78			
Total Dollars Lost	$2,690,191	$1,641,984		$1,892,811		$357,242			**$6,582,227**

STRATEGIES/TACTICS FOR REDUCING QUALITY DEFECTS/NONCONFORMITIES IN, AND FOR IMPROVING QUALITY, CONSISTENCY, COMPETITIVENESS AND MARKET-SHARE OF, THE U.S. FED BEEF SUPPLY

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As a part of the Strategy Workshop (Phase III) of the National Beef Quality Audit—2000, five panels were convened. Participants on those panels were representatives of the appropriate industry sectors. The first panel was moderated by Tom Field (Colorado State University), was comprised of Mark Gardiner (Kansas), Tom Woodward (Texas) and Jim Peterson (Montana), and discussed "Strategies/Tactics For Reducing Quality Defects/Nonconformities In The Seedstock And Cow/Calf Production Sectors." The second panel was moderated by John McNeill (Texas A&M University), was comprised of Ted Kendall (Mississippi), Tom Moxley (Kansas) and Bill Rhea (Idaho/Nebraska), and discussed "Strategies/Tactics For Reducing Quality Defects/Nonconformities In The Stocker/Backgrounder Sector." The third panel was moderated by Bill Mies (Texas A&M University), was comprised of David Baumann (Texas), Bill Nice (Illinois) and Mike Engler (Texas/ Kansas), and discussed "Strategies/Tactics For Reducing Quality Defects/Nonconformities In The Feedlot Sector." The fourth panel was moderated by Brad Morgan (Oklahoma State University), was comprised of Charlie Mostek (IBP, Inc.), Glen Dolezal (Excel, Inc.), James Henderson (B3R Beef) and Steve Van Lannen (Packerland), and discussed "Reaction/Response Of The Packer Sector To Findings Of The National Beef Quality Audit—2000." The fifth panel was moderated by Ted Montgomery (West Texas A&M University), was comprised of Dennis Stiffler (Allen Brothers), Russ Wolfe (Topco Associates), Billy Lloyd (FoodBrands America; KPR Foods) and John Story (formerly of Fairway Foods), and discussed "Reaction/Response Of The Purveyor, Food Service Operator And Supermarket Retailer To Findings Of The National Beef Quality Audit—2000."

From these discussions, "A Commitment To Never-Ending Improvement" and "Strategies/ Tactics For Improving Quality, Consistency, Competitiveness And Market-Share Of The U.S. Fed Beef Supply" were formulated. The Directives and Strategies/Tactics were discussed in open forum, finalized and agreed-upon by participants in the Strategy Workshop.

Participants in the Strategy Workshop of the National Beef Quality Audit—2000 agreed that those in the fed beef industry should make "A Commitment To Never-Ending Improvement" that stated the following: "I am a member of the U.S. beef industry and because I am committed to the role I play as a producer of safe, nutritious and wholesome food for myself, my family and humanity, I promise to: (a) Continually seek to learn more about my business and my industry so that my family can prosper, that opportunities can be created for others, and that better products can be made available to the world's consumers. (b) Collect, share and use meaningful information that affects the value and quality of beef. (c) Seek opportunities to improve relationships with others in the production, processing and marketing of cattle, beef and beef by-products. (d) Train and retrain myself and my employees in the principles and procedures of Beef Quality Assurance. (e) Be a good steward of the natural resources, the animals and the products under my care."

"Strategies" for improving the quality of beef from fed steers/heifers are: (1) Assist producers with use of selection and management techniques to produce cattle that fit customer expectations for marbling, red meat yield, weight and other value-determining attributes. (2) Assist producers with the process of collecting and analyzing data and sharing and utilizing information. (3) Enhance an already commendable record in regards to the production of safe, nutritious and wholesome beef. (4) Assure delivery of predictable and uniform lots of cattle by more correctly managing implants, nutrition, horns, castration, sorting and health programs while refining selection strategies to meet specific market windows. (5) Assure that the needs of case-ready product marketing efforts can be met by improving the yield, consistency and palatability characteristics of beef. (6) Implement new production technologies only after carefully considering the consumer demand-perception, economic, environment and animal welfare consequences. (7) Encourage continued use of cattle-marketing systems that identify, categorize and assign price to product attributes that affect consumer satisfaction by appropriately rewarding and discounting performance. (8) Identify breeding, management and sorting systems that optimize production, palatability, cutability and profitability. (9) Encourage post-harvest product enhancement technologies to assure the delivery of suitably tender and flavorful products to consumers while simultaneously managing the pre-harvest production process to achieve the same objectives.

"Tactics" for improving the quality of beef from fed steers/heifers are: (1) Develop and implement a voluntary, industry-driven, standardized electronic individual animal identification system that is tied to a seamless system of transmitting information up and down the production, processing and distribution chain. (2) Merchandize and purchase only those seedstock that are accompanied by objective performance information relative to economically important traits (production and end-product). (3) Eliminate side brands. (4) Eliminate horns via selection or early dehorning. (5) Castrate early. (6) Match implant strategies to cattle types to optimize product quality with economic returns. (7) Develop management/production practices to reduce variation in weight and cut sizes within a lot. (8) Utilize health management and nutrition protocols that contribute to improved quality attributes. (9) Match a vast majority of the fed cattle to carcass weight targets of 650-850 pounds. (10) Handle and transport cattle in a safe and humane manner. (11) Train 100% of beef and dairy producers, veterinarians, transport providers and others with an impact on cattle in Beef Quality Assurance principles and procedures as well as humane handling practices. (12) Move all injections to the neck region and eliminate intramuscular injections. (13) Reduce immediately those genetic and management practices that contribute to production of USDA Standards, Yield Grade 4s and 5s, dark cutters and non-conforming carcass weights and cut sizes. (14) Change the Quality Grade and Yield Grade mix to 6% Prime, 27% Upper Two-Thirds Choice, 32% Low Choice and 35% Select, and to 15% Yield Grade 1, 26% Yield Grade 2A, 27% Yield Grade 2B, 24% Yield Grade 3A and 8% Yield Grade 3B. (15) Participate in partnerships and coordinated market chains to foster communications and the delivery of products that meet consumer demands. (16) Continue to support and encourage development of branded beef product concepts and value-added, further processed beef items.

WHAT ARE THE "TOP TEN QUALITY CHALLENGES" FOR THE U.S. FED-BEEF INDUSTRY; CONSENSUS OF THE PARTICIPANTS IN PHASE III, THE STRATEGY WORKSHOP, OF THE NATIONAL BEEF QUALITY AUDIT—2000

D.L. Roeber, Colorado State University; K.E. Belk, Colorado State University; J.W. Savell, Texas A&M University; J.B. Morgan, Oklahoma State University; T.H. Montgomery, West Texas A&M University; G.C. Smith, Colorado State University

According to participants in the Strategy Workshop of the National Beef Quality Audit—2000, the "Top Ten Quality Challenges" for the fed-beef industry are: (1) Low overall uniformity and consistency of cattle, carcasses and cuts. (2) Inappropriate carcass size and weight. (3) Inadequate tenderness of beef. (4) Insufficient marbling. (5) Reduced Quality Grade/tenderness due to growth promoting implants. (6) Excess external fat cover. (7) Inappropriate USDA Quality Grade mix. (8) Too much hide damage due to brands. (9) Too frequent and severe bruises. (10) Too frequent liver condemnations.

WHAT ARE THE "RECOMMENDED INDUSTRY GOALS" AND "RESEARCH GOALS" FOR ATTAINMENT BY THE U.S. BEEF INDUSTRY BY THE TIME OF THE NEXT NATIONAL BEEF QUALITY AUDIT, IN 2005?

T.G. Field, Colorado State University; Z.L. Carpenter, Texas A&M University

"Goals, By 2005" for improving the quality of beef from fed steers/heifers are: (1) Eliminate USDA Standards. (2) Eliminate Yield Grades 4 and 5. (3) Eliminate injection-site lesions from whole-muscle cuts including the chuck. (4) Eliminate side branded hides. (5) Reduce horns to less than 5% of the fed cattle supply. (6) Develop and implement a standardized electronic individual animal identification system. (7) Develop an information system that allows each producer to conduct a quality audit for his/her own herd. (8) Assure that 100% of seedstock animals are accompanied by meaningful genetic data (EPDs, etc.) for production and end-product traits. (9) Assure that 100% of cattlemen complete BQA training. (10) Eliminate major and critical bruises that result in a devaluation of subprimals (11) Improve the transportation (handling and equipment) of cattle. (12) Improve continually the eating quality of beef.

Research Goals identified by participants in the Strategy Workshop of the National Beef Quality Audit—2000 are: (1) Better understanding the influence of calfhood and lifetime management on the quality of beef. Specifically, how does stress at various points of a calf's life affect its ability to deposit marbling? (2) What are the levels of stress caused by dehorning at various life-stages versus the improvement in bruise prevention that results from dehorning? (3) How can we sort/implant/manage/re-sort cattle of unknown genetics to achieve uniformity

targets in cut size for retail and hotel/restaurant/institutional end-users? (4) Better understand how to interpret feedlot and endproduct data at the cow/calf and seedstock levels. (5) Better understand how automation at the packing and processing sectors will affect desired characteristics of cattle and carcasses. (6) Better understand and communicate the role of each production sector on the wholesomeness, nutritional value and quality of beef. (7) Develop carcass and cattle specifications for weight, muscling, fat and marbling based on case-ready fabrication requirements, rather than trying to fit current cattle to a case-ready approach. (8) What are the tenderness implications of injection-site lesions in the lower round (as a follow-up to the top-butt research).

HOW WILL RESULTS OF THE NATIONAL BEEF QUALITY AUDIT—2000 BE DISSEMINATED?

Chad A. Vorthmann, National Cattlemen's Beef Association;
Renee M. Lloyd, National Cattlemen's Beef Association

Results of the National Beef Quality Audit—2000 will first be presented at the three Council Meetings and in a press conference at the Annual Convention of the National Cattlemen's Beef Association in San Antonio, TX in late January and early February. It will also be presented to members of the Quality Assurance Committee at the convention. Eric Grant will prepare a brief summary of the outcome of NBQA—2000 to serve as a handout during the convention and an executive summary that will be printed by the time of the Midyear NCBA Conference. Present plans are to roll-out the complete presentation of results of NBQA—2000 as a part of the Cattlemen's College at the Midyear NCBA Conference in Denver in July 2001. As has been done in the past, with NBQA—1991, NBQA—1995, National Non-Fed Beef Quality Audit—1994 and National Market and Bull Beef Quality Audit—1999, limited quantities will be distributed of the complete Final Report of NBQA—2000. Complete Final Reports are disseminated on a by-request-only basis and are usually requested by university personnel who desire greater detail about NBQA—2000 and its findings than are included in the Executive Summary.