I. Full Project Report

National Beef Quality Audit – 2011: In-plant survey phase

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Harvest-Floor Assessment

ABSTRACT

The National Beef Quality Audit - 2011 was conducted to assess the current status of quality and consistency of US fed steers and heifers. Between May and November 2011, survey teams surveyed approximately 18,000 cattle/carcasses in eight beef processing plants to assess the condition of traits known to impact value. Identification method and frequency were lot visual tags (85.7%), individual visual tags (50.6%), electronic tags (20.1%), metal-clip tags (15.7%), other means (5.3%), none (2.5%), and wattles (0.5%). Hide colors or breed type were black (61.1%), red (12.8%), yellow (8.7%), Holstein (5.5%), brown (5.0%), gray (5.0%), white (1.4%), and brindle (1.0%). Brand frequencies were no brands (55.2%), one (40.4%), two (4.4%), and three or more (0.04%), and brands were located on the butt (33.8%), side (8.6%), and shoulder (2.4%). Hide location and incidence of mud or manure were no mud/manure (49.2%), legs (36.8%), belly (23.7%), side (14.9%), top-line (11.0%), and tail region (13.7%). There were 77.2% of cattle without horns, and the majority of those with horns (71.6%) were between 0 cm and 12.7 cm in length. Permanent incisor number and occurrence were zero (87.3%), one (1.4%), two (8.0%), three (0.9%), four (1.9%), five (0.3%), six (0.2%), seven (0.1%), and eight (0.02%). Most carcasses (77.0%) were not bruised, 18.7% had one bruise, 3.4% had two bruises, 0.6% had three bruises and 0.3% had more than three bruises. Bruise location and incidence were loin (50.1%), rib (21.3%), chuck (13.8%), round (7.3%), and brisket, flank, plate (7.5%). Condemnation item and incidence were whole carcass (none recorded), liver (20.9%), viscera (9.3%), lungs (17.3%), tongue (10.0%), and head (7.2%). When compared to the 2005 NBQA, this audit revealed a higher percentage of black hided cattle (2005, 56.3% vs. 2011, 61.1%), cattle with brands (2005, 38.7%, vs. 2011, 44.8%), and more cattle with some form of identification (2005, 93.3% vs. 2011, 97.5%). In addition, there was a lower percentage of carcasses with bruises (2005, 35.2% vs. 2011 23.0%), and carcasses with more than one bruise (2005, 9.4% vs. 2011, 4.2%). Also, a similar percentage of the cattle were deemed greater than thirty months of age using dentition (2005, 2.7% vs. 2011, 3.3%). This information helps the beef industry measure the progress it has made compared to the past four surveys and provides a benchmark for future educational and research activities.

MATERIALS AND METHODS

Overview

There were eight in-plant surveys conducted (one day of production sampled in each of eight different beef packing plants) throughout the United States between May and December 2011 (Table 1-1). A practice and correlation session was held before data collection began to ensure uniformity and consistency in the observations and measurements taken. During data collection, if a specific packing plant processed cattle during two 8 hr shifts per day, then data were collected during both shifts.

Harvest Floor Assessments

Fifty percent of the individual production lots were sampled by the survey teams at each packing plant for a total of approximately 18,000 cattle observations. Animal identification was

recorded as follows: none, electronic, bar code, individual tag, lot tag, metal clip, wattle, or by other means. Hide color was classified based on primary (>50% total hide surface area) color (black, white, yellow, brindle, red, brown, gray, or Holstein). Incidence of hide brands were recorded based on location – butt (round), side (loin), or shoulder (chuck) – and the approximate size was noted. Cattle were assessed visually for the presence of mud/manure based on location (not visible, legs, belly, side, top-line, or tail region) and the amount (none, small, moderate, large, or extreme). The presence of horns were evaluated visually, and if present, the approximate length (<2.54 cm, 2.54 -12.7 cm, and >12.7 cm) were recorded. Dentition was evaluated by assessing the number of permanent incisors present. Carcasses were assessed for number of bruises (0, 1, 2, 3, 4, or 5), their location (round, loin, rib, chuck, and flank/plate/brisket), and severity (minor, major, critical, or extreme). When observed, the presence of grubs and injection site lesions were noted. Offal (liver, lung, and viscera) and heads and tongues were evaluated for wholesomeness by USDA Food Safety and Inspection Service personnel, and the number and reasons for condemnations were recorded. A lung scoring system was implemented to help segment different severities of pneumonia (Griffin, 2006). The number of heifer carcasses carrying fetuses was evaluated at the viscera table.

Statistical Analysis

All analyses were performed using JMP® Software (JMP® Pro, Version 9.0.0, SAS Institute Inc., Cary, NC 1989-2010). Means, standard deviations, minimum and maximum values for each trait measured were generated using the analyze function of JMP. Frequency distributions were analyzed by using the distribution function of JMP.

RESULTS AND DISCUSSION

Animal Identification Method

The animal identification assessment for these audits was first performed and described by NBQA–2005 (Garcia et al., 2008). The percentage of cattle that had some type of identification was 97.5%. This is 4.2 percentage points higher than Garcia et al. (2008). The types and frequency of identification observed in this survey (Table 1-2) were electronic tags (20.1%), individual tags (50.6%), lot tags (85.7%), metal clips (15.7%), wattles (0.5%), and by other means (5.3%). When the percentages are added together they total over 100% because some animals had multiple types of identification. For the carcasses that had identification, number of methods and frequency were one (49.1%), two (27.0%), three (20.9%), four (3.0%), or five (0.01%). This indicates that cattle identification has become more frequent in the cattle industry since the NBQA–2005.

Hide Color

The hide color assessment has been a part of the previous two audits, NBQA–2000 and NBQA–2005 (McKenna et al., 2002; Garcia et al., 2008), to provide an indication of predominant breeds within the fed steer and heifer populations since hide color is used in many of the USDA-certified beef programs today. The characteristics of hide color can be found in Table 1-3. Of the cattle observed in the audit, 61.1% of the cattle were predominantly black and

12.8% were red. The other classifications with significant percentages were yellow (8.7%), the black and white characteristic of Holstein (5.5%), gray (5.0%), brown (5.0%), white (1.4%), spotted (1.1%) brindle (1.0%), Hereford (1.0%), roan (0.3%), and striped (0.3%). Compared to the previous two audits, the percentage of black-hided cattle has dramatically increased from 45.1% reported by McKenna et al. (2002) and 56.3% reported by Garcia et al. (2008). The reason why black-hided cattle continue to increase in the United States is likely due to an increase in the number of branded beef programs that emphasize cattle with Angus heritage from the previous two audits.

Hide Brand Assessment

The hide brand assessment has been a part of all the previous audits (NBQA–1991, NBQA–1995, NBQA–2000, and NBQA–2005). In data not reported in tabular form, percentages of hide-on carcasses with zero, one, two, or three hot-iron brands were 55.2, 42.2, 4.6, and 0.02, respectively. Of the cattle with brands, 90.1% had one brand, 9.8% had two brands, and only 0.1% had three brands. The location of brands is reported in Table 1-4. Brands were located on the butt (35.2%), side (9.0%), and shoulder (2.5%). Mean hot iron brand sizes were 8.6 in. x 8.6 in. for side brands, 5.6 in. x 5.6 in. for butt brands, and 5.6 in. x 5.6 in. for shoulder brands.

Mud or Manure Evaluation

For the beef industry mud and manure has been of great concern due to its potential of contaminating the carcass, especially when it is present on the legs and belly of the animal. During the slaughter process, opening the hide can potentially contaminate the carcass inadvertently if proper care is not taken during the removal process. The percentage of animals with no visible mud and/or manure present on the hide was 50.8%. Of those cattle with mud and/or manure, the number and frequency of locations were 1 (6.4%), 2 (61.4%), 3 (26.5%), 4 (4.6%), and 5 (1.2%). The percentages of cattle with mud and/or manure on specific locations were legs (36.8%), belly (23.7%), side (14.9%), tail region (13.7%), and top-line (11.0%). Severity scores of hide-on carcasses with mud and/or manure were none (49.6%), small (41.5%), moderate (8.1%), large (0.8%), and extreme (0.1%).

Horn Evaluation

Horn prevalence and length has been a part of all the previous audits (NBQA–1991, NBQA–1995, NBQA–2000, and NBQA–2005). Prevalence of horns (Table 1-5) and horn length were evaluated. Of the cattle observed in the audit, 23.8% had horns, which is numerically similar to the frequencies found in the NBQA–2005 (22.3%) reported by Garcia et al. (2008) and NBQA–2000 (22.7%) reported by McKenna et al. (2002). These frequencies were numerically less than those reported for the NBQA–1995 (33.2%) reported by Boleman et al. (1998) and NBQA–1991 (31.1%) reported by Lorenzen et al. (1993). Of the cattle that had horns, 25.4% had horns <2.54 cm in length, 46.14% had horns between 2.54 cm and 12.7 cm in length, and 7.8% had horns >12.7 cm in length.

Dentition

The dentition assessment (Table 1-6) was implemented as described for the NBQA–2005 (Garcia et al., 2008). Of the cattle observed, 87.3% had zero permanent incisors, which was numerically greater than the 82.2% reported by Garcia et al. (2008). The numbers of permanent incisor and occurrences were 1 (1.4%), 2 (8.0%), 3 (0.9%), 4 (1.9%), 5 (0.3%), 6 (0.2%), 7 (0.1%) and 8 (0.02%).

Carcass Bruises

The characteristics of carcass bruising can be found in Table 1-7. Of the carcasses observed, 77.0% of the carcasses had no bruises, 18.8% had one bruise, 3.4% had two bruises, 0.6% had three bruises, 0.2% had four bruises, and 0.1% had more than four bruises. A potential rationale for decreased (numerically) bruising from prior audits could be due to the increased attention to animal handling by the livestock and meat industry.

Of the carcasses with bruises, 50.1% were located on the loin, 21.3% located on the rib, 13.8% located on the chuck, 7.3% located on the round, and 7.5% located on the flank, plate, or brisket. Bruise severity was also recorded, and of the bruises assessed, 73.4% were classified as minor, 24.5% were classified as major, 0.4% were classified as critical, and 0.2% were classified as extreme.

Offal and Carcass Condemnations

Incidence rates for offal and carcass condemnations by USDA Food Safety and Inspection Service (Table 1-8) were livers (20.9%), viscera (9.3%), lungs (17.3%), tongue (10.0%), and head (7.2%). Livers were condemned for major abscesses (5.4%), minor abscesses (8.3%), flukes (1.9%), contamination (3.6%), and other reasons (1.7%). Lungs were condemned for pneumonia-mild (6.3%), pneumonia-moderate (4.3%), pneumonia-severe (1.1%), contamination (4.8%), and other reasons (0.9%). Viscera condemnations included abscesses (3.4%) and contamination (5.9%). Heads were condemned for inflamed lymph nodes (0.4%), abscesses (1.0%), contamination (3.9%), and other reasons (1.8%). Tongues were condemned for inflamed lymph nodes (1.3%), hair sores (2.4%), cactus tongue (0.7%), contamination (2.0%), and other reasons (3.5%).

The number of cattle observed in this audit that had fetuses was 0.5%. This incidence rate is similar to the NBQA–2005 (Garcia et al., 2008), but was numerically lower than the rates reported by the other audits.

Conclusions

The NBQA-2011 continues the process of evaluating and updating the information on the various factors that affect the value of the live cattle along with their carcasses and by-products. Some of the trends observed in the 2011-NBQA include more black-hided cattle, more cattle being identified individually, more cattle with no mud and/or manure present on their hides, and fewer carcasses with bruises. From these data, genetic and management decisions are being made by the rancher, stocker, and feedlot personnel that affect the type of cattle that are coming to the market and how proper animal handling protocols are being implemented.

Table 1-1. Company and location of surveyed plants

Company	Location
Cargill Meat Solutions	Dodge City, KS
Cargill Meat Solutions	Schuyler, NE
Creekstone Farms Premium Beef	Arkansas City, KS
JBS Swift & Company	Cactus, TX
JBS Swift & Company	Greeley, CO
National Beef Packing Company	Brawley, CA
Tyson Fresh Meats	Amarillo, TX
Tyson Fresh Meats	Lexington, NE

Table 1-2. Percentages of hide-on carcasses that were individually identified and by what type of identification they were identified by in NBQA–2005 and NBQA–2011[1]

	NBQA–2005	NBQA–2011
With identification, %	93.3	97.5
No identification, %	9.7	2.5
Electronic tags, %	3.5	20.1
Barcoded tags, %	0.3	0.0
Individual visual tags, %	38.7	50.6
Lot visual tags, %	63.2	85.7
Metal-clip tags, %	11.8	15.7
Wattles, %	0.0	0.5
Other means, %	2.5	5.3

[1]Numbers exceed 100% due to animals having multiple forms of identification.

Table 1-3. Percentages of hide-on carcasses with predominant hide color evaluated in NBQA–2000, NBQA–2005, and NBQA–2011

Predominant Hide Color	NBQA–2000	NBQA–2005	NBQA–2011
Black, %	45.1	56.3	61.1
Red, %	31.0	18.6	12.8
Yellow, %	8.0	4.9	8.7
Holstein (black & white), %	5.7	7.9	5.5
Gray, %	4.0	6.0	5.0
White, %	3.2	2.3	1.4
Brown, %	1.7	3.0	5.0
Brindle, %	1.3	1.0	1.0

Table 1-4. Percentages of hot-iron brands on hide-on carcasses evaluated in NBQA–1991, NBQA–1995, NBQA–2000, NBQA–2005, and NBQA–2011

	NBQA–1991	NBQA–1995	NBQA–2000	NBQA–2005	NBQA–2011
No brands, %	55.0	47.7	49.3	62.0	55.2
On the butt, %	29.9	38.7	36.3	26.8	35.2
On the side, %	13.8	16.8	13.7	7.5	9.0
On the shoulder, %	0.8	3.0	3.6	0.0	2.5
Cattle with more than one brand, %	2.1	6.1	4.4	3.7	9.9

Table 1-5. Percentages of hide-on carcasses evaluated for the presence of horns in NBQA–1991, NBQA–1995, NBQA–2000, NBQA–2005, and NBQA–2011

	NBQA–1991	NBQA–1995	NBQ –2000	NBQA –2005	NBQA–2011
With horns, %	31.1	32.2	22.7	22.3	23.8
No horns, %	68.9	67.8	77.3	77.7	76.2

Table 1-6. Percentages of the number of permanent incisors evaluated in NBQA–2005 and NBQA–2011

Number of Permanent Incisors	NBQA–2005	NBQA–2011
Zero, %	82.2	87.3
One, %	5.2	1.4
Two, %	9.9	8.0
Three, %	0.4	0.9
Four, %	1.2	1.9
Five, %	0.1	0.3
Six, %	0.3	0.2
Seven, %	0.0	0.1
Eight, %	0.7	0.02

Table 1-7. Percentages of bruises for carcasses evaluated in NBQA–1991, NBQA–1995, NBQA–2000, NBQA–2005, and NBQA–2011

	NBQA–1991	NBQA–1995	NBQA–2000	NBQA–2005	NBQA–2011
No bruises, %	60.8	51.6	53.3	64.8	77.0
One bruise, %	25.0	30.9	30.9	25.8	18.8
Two bruises, %	10.6	12.8	11.4	7.4	3.4
Three bruises, %	3.5	3.7	3.5	1.6	0.6
Four bruises, %	0.2	0.9	0.8	0.4	0.2
More than four bruises, %	nd*	0.1	0.1	0.0	0.1
Bruised on the round, %	2.7	7.2	14.9	10.6	7.3
Bruised on the loin, %	23.4	41.1	25.0	32.6	50.1
Bruised on the rib, %	14.4	20.8	19.4	19.5	21.3
Bruised on the chuck, %	16.7	30.8	28.2	27.0	13.8
Bruised on the flank/plate/brisket, %	0.2	0.0	11.6	10.3	7.5

*nd = not determined

Table 1-8. Percentages of offal and carcass condemnations and fetus incidence for carcasses evaluated in NBQA–1991, NBQA–1995, NBQA–2000, NBQA–2005, and NBQA–2011

	NBQA–1991	NBQA–1995	NBQA–2000	NBQA–2005	NBQA–2011
Liver condemnations, %	19.2	22.2	30.3	24.7	20.9
Lung condemnations, %	5.1	5.0	13.8	11.5	17.3
Viscera condemnations, %	3.5	11.0	11.6	11.6	9.3
Head condemnations, %	1.1	0.9	6.2	6.0	7.2
Tongue condemnations, %	2.7	3.8	7.0	9.7	10.0
Whole carcass condemnations, %	0.0	0.1	0.1	0.0	0.0
Fetus incidence, %	0.9	1.4	3.8 in heifers	0.6	0.5

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Cooler Assessment

ABSTRACT

The National Beef Quality Audit-2011 assessed the current status of quality and consistency of US fed steers and heifers. Beef carcasses (n = 9,802), representing approximately ten percent of each production lot in 28 beef packing plants, were selected randomly for the survey. Carcass evaluation for the cooler assessment of this study revealed these traits and frequencies: steer (63.7%), heifer (36.2%), cow (0.05%), and bullock (0.05%) sex classes; dark-cutters (3.2%); blood splash (0.3%); calloused ribeye (0.05%); yellow fat (0.1%); A (92.8%), B (6.0%), and C or older (1.2%) overall maturities; native (88.3%), dairy-type (9.9%), and *Bos indicus* (1.8%) estimated breed types; and United States (97.7%), Mexico (1.8%), and Canada (0.5%) country of origin. Certified or marketing program frequencies were: age and source verified (10.7%), A^{40} (10.0%), Certified Angus Beef® (9.3%), top Choice (4.1%), and non-hormone treated cattle (0.5%), and there were no natural or organic programs observed. Mean USDA yield grade (YG) traits were USDA YG (2.6), HCW (824.6 lbs), adjusted fat thickness (0.51 in.), ribeye area (13.8 in^2), and KPH (2.3%). The USDA YG were YG 1 (25.0%), YG 2 (46.5%), YG 3 (23.0%), YG 4 (4.6%), and YG 5 (0.9%). Mean USDA quality grade traits were USDA quality grade ($Select^{93}$), marbling score ($Small^{40}$), overall maturity (A^{59}), lean maturity (A^{54}), skeletal maturity (A^{62}). Marbling score distribution was Slightly Abundant or greater (2.3%), Moderate (5.0%), Modest (17.4%), Small (39.9%), Slight (34.4%), and Traces or less (1.1%). This information provides a benchmark and helps to measure progress in the beef industry.

MATERIALS AND METHODS

General Overview

In-plant cooler audits were conducted in twenty-eight federally inspected packing plants throughout the United States selected to represent the major fed beef plants (Table 1). These audits were conducted in May 2011 to February 2012 by personnel from seven collaborating institutions. Plants were surveyed to achieve the equivalent of one day's production, and both shifts were surveyed in those packing plants that process cattle during two daily shifts. Data were collected between Monday and Friday of a given week. Prior to the beginning of this study, a correlation session was held to ensure consistency of measurements and observations during data collection.

Carcass Assessment

Beef carcasses representing approximately ten percent (n = 9,802) of each production lot were selected randomly for the survey. Trained personnel evaluated beef carcasses for sex class (steer, heifer, cow or bullock), estimated breed type (native, dairy or *Bos indicus*), ribeye area (measured by either dot grid, blotting paper or beef camera), hot carcass weight, carcass defects (dark cutter, blood splash, calloused ribeye, yellow fat, etc.), certified or other marketing program, country of origin, and whether the carcass was less than or equal to or greater than 30 months of age. Estimated breed types were classified using the protocol established by Garcia et al. (2008): dairy type carcasses were those in which the conformation and overall muscling were

angular and thin in relation to carcass size, *Bos indicus* type carcasses had dorsal thoracic humps (rhomboideus muscle, overlying muscles, and subcutaneous fat) less than 10.2 cm (4 in), and carcasses with no readily distinguishable characteristics that would classify them as dairy or *Bos indicus* type were considered as native. Carcasses qualifying for certified or other marketing programs were noted. United States Department of Agriculture, Agricultural Marketing Service, Meat Grading and Certification Branch personnel evaluated beef carcasses for lean maturity, skeletal maturity, marbling score, adjusted fat thickness, and kidney, pelvic, and heart fat percentage (USDA, 1997).

Statistical Analysis

All analyses were performed by using JMP® Software (JMP® Pro, Version 9.0.0, SAS Institute Inc., Cary, NC 1989-2010) and Microsoft® Excel® for Mac 2011.

RESULTS AND DISCUSSION

Carcass Assessment

Means for USDA QG and USDA YG are shown in Table 2-2. The mean USDA QG for the current study was Select[93], and the mean USDA YG was 2.6. Means for USDA QG and USDA YG from previous audits were Select[86] and 3.2 for NBQA-1991 (Lorenzen et al., 1993), Select[79] and 2.8 for NBQA-1995 (Boleman et al., 1998), Select[85] and 3.0 for NBQA-2000 (McKenna et al., 2002), and Select[90] and 2.9 for NBQA-2005 (Garcia et al., 2008). Frequency distributions of USDA YG by half-grade increments are shown in Figure 2-1. The USDA YG distributions were YG 1 (25.0%), YG 2 (46.5%), YG 3 (23.0%), YG 4 (4.6%), and YG 5 (0.9%). The USDA QG distributions were Prime (2.1%), Choice (58.9%), Select (32.6%), Standard (5.1%), Commercial (0.9%), and Utility (0.3%). The USDA QG distributions from NBQA-2005 (Garcia et al., 2008) were Prime (2.6%), Choice (51.9%), Select (40.2%), Standard (4.4%), Commercial (0.7%), and Utility (0.3%).

Marbling scores across and within USDA QG are shown in Table 2-3. McKenna et al. (2002) reported the need to determine the number of carcasses that were Small[50] or greater because of the growing number of certified beef programs that include such carcasses. It was found that 41.2% of the carcasses surveyed had marbling scores greater than or equal to Small[50], which was numerically greater than that reported (36.6%) by McKenna et al. (2002) and (23.6%) by Garcia et al. (2008).

Distributions of carcasses in various combinations of USDA QG and YG are reported in Table 2-4. Carcasses that were Choice and Select, YG 2 and 3 were 64.74%; comparable percentages were 67.2% for NBQA-2005 (Garcia et al., 2008), 70.5% for NBQA-2000 (McKenna et al., 2002), 75.0% for NBQA-1995 (Boleman et al., 1998), and 67.2% for NBQA-1991 (Lorenzen et al., 1993). Nonconforming carcasses—QG of Standard and lower and (or) YG 4 and 5—represented 11.1%. Garcia et al. (2008) reported 18.3% of the carcasses in NBQA-2005 to be nonconforming.

Frequencies of carcass maturities are reported in Table 2-5. Carcasses that were A maturity comprised 92.8% of the carcasses sampled. The Beef Export Verification program for Japan requires that beef carcasses from cattle of unknown chronological ages must be A[40] or

more youthful in overall maturity. For A-maturity carcasses, 23.2% met this qualification, whereas 76.8% of the carcasses were A^{50} and older.

In data not reported in tabular form, 3.2% of the carcasses were dark cutters. The discounts for dark cutters were one-third grade (1.07%), one-half grade (0.77%), two-thirds grade (0.66%), and full grade (0.69%). Other carcass defects included blood splash (0.3%), calloused ribeye (0.05%), and yellow fat (0.1%).

Least squares means for carcass traits within each USDA QG are show in Table 2-6. As QG increased from Standard to Prime, numerical YG and adjusted fat thickness increased ($P < 0.05$). In contrast, ribeye area and KPH percentage decreased as QG increased from Standard to Prime.

Carcass trait means within each USDA YG are displayed in Table 2-7. As USDA YG increased (from YG 1 to YG 5), marbling, QG, adjusted fat thickness, HCW, and KPH percentage also increased, whereas ribeye area decreased. These relationships between carcass traits and USDA YG are similar to those reported by Lorenzen et al. (1993), Boleman et al. (1998), McKenna et al. (2002), and Garcia et al. (2008).

Figure 2-4 shows the sex-class distribution of carcasses which were the following; steers (63.47%), heifers (36.37%), cows (0.13%), and bullocks (0.03%). The percentages were close to those reported in the NBQA-2005 (Garcia et al., 2008), which included steers (63.7%), heifers (36.2%), cows (0.05%), and bullocks (0.05%).

In data not reported in tabular form, carcass estimated breed types were native type (88.3%), dairy type (9.9%), and *B. indicus* (1.8%). Frequency distributions were shown in Figure 2-5. The trend seen over time in these surveys is the increasing number of carcasses classified as dairy type. Corresponding percentages from previous audits were 6.9% for NBQA-2000 (McKenna et al., 2002) and 8.3% for NBQA-2005 (Garcia et al., 2008). Carcass traits stratified by sex class are displayed in Table 2-8. Carcasses from steers and heifers had more youthful ($P < 0.05$) overall maturity scores than carcasses from bullocks and cows.

Carcass traits stratified by estimated breed type are reported in Table 2-9. Among breed types, marbling score, HCW, KPH, and ribeye area differed significantly. Dairy-type carcasses had greater ($P < 0.05$) QG and marbling scores than the other two breed types.

Figure 2-6 shows the frequency distribution of carcasses from different country of origins. Those carcasses from the United States were 97.7%, Mexico was 1.8%, and Canada was 0.5%.

Figure 2-7 displays the frequency distribution of carcasses identified as eligible for certain certified or marketing programs. Frequencies were as follows: age and source verified (10.7%), A^{40} (10.0%), Certified Angus Beef® (9.3%), top Choice (4.1%), and non-hormone treated cattle (0.5%). There were no natural or organic programs observed. This is the first time in the history of the National Beef Quality Audits that this information has been obtained.

Conclusions

The NBQA serves as a benchmark study to measure and report certain producer-related cattle and carcass traits in the US beef industry. Some of the trends observed in the NBQA-2011 included an increase in USDA Prime and Choice carcasses, lower numerical USDA yield grade, increased HCW, increased ribeye area, and more dairy-type carcasses compared with previous audits. Information from this audit adds to the existing knowledge base of the beef industry.

Findings will be used to mark the progress that has been made in the industry and pinpoint the areas of improvement for the future.

Table 2-1. Company and location of surveyed plants

Company	Location
AB Foods Washington Beef	Toppenish, WA
Cargill Meat Solutions	Fort Morgan, CO
Cargill Meat Solutions	Schuyler, NE
Cargill Meat Solutions	Dodge City, KS
Cargill Meat Solutions	Plainview, TX
Cargill Meat Solutions	Friona, TX
Creekstone Farms	Arkansas City, KS
Greater Omaha Packing Company	Omaha, NE
Harris Ranch Beef Company	Selma, CA
JBS Green Bay	Green Bay, WI
JBS Plainwell	Plainwell, MI
JBS Souderton	Souderton, PA
JBS Swift Cactus	Cactus, TX
JBS Swift Grand Island	Grand Island, NE
JBS Swift Greeley	Greeley, CO
JBS Swift Hyrum	Hyrum, UT
JBS Tolleson	Tolleson, AZ
National Beef	Brawley, CA
National Beef	Dodge City, KS
National Beef	Liberal, KS
Nebraska Beef	Omaha, NE
Sam Kane Beef Processors	Corpus Christi, TX
Tyson Fresh Meats	Joslin, IL
Tyson Fresh Meats	Finney County, KS
Tyson Fresh Meats	Dakota City, NE
Tyson Fresh Meats	Lexington, NE
Tyson Fresh Meats	Amarillo, TX
Tyson Fresh Meats	Pasco, WA

Table 2-2. Means, standard deviations, and minimum and maximum values for USDA carcass grade traits

Trait	Mean	SD	Minimum	Maximum
USDA yield grade	2.6	0.9	-0.6	6.9
USDA quality grade[1]	693	61	220	887
Adjusted fat thickness, in.	0.5	0.2	-0.4	1.6
Hot carcass weight, lbs	824.6	102.5	309.5	1203.0
Ribeye area, in[2]	13.8	1.8	7.8	23.0
Kidney, pelvic, and heart fat, %	2.3	0.8	0.0	5.0
Marbling score[2]	440	98	100	960
Lean maturity[3]	154	28	110	550
Skeletal maturity[3]	162	34	100	600
Overall maturity[3]	159	29	110	585

[1]100 = Canner^{00}, 400 = Commercial^{00}, 600 = Select^{00}, and 800 = Prime^{00}.
[2]100 = Practically devoid^{00}, 300 = Slight^{00}, 500 = Modest^{00}, 700 = Slightly Abundant^{00}, and 900 = Abundant^{00}.
[3]100 = A^{00} and 500 = E^{00}.

Table 2-3. Occurrence[1] of marbling scores within USDA quality grades[2]

Marbling score, %	Overall[3]	Prime	Choice	Select	Standard
Abundant	0.03	1.46			
Moderately Abundant	0.44	20.49			
Slightly Abundant	1.78	78.05	0.09		
Moderate	4.99		8.27		
Modest	17.41		28.93	0.06	
Small	39.89		62.71	0.38	46.73
Slight+	19.51			56.20	20.61
Slight-	14.85			43.35	11.63
Traces	1.02				19.59
Practically Devoid	0.08				1.43

[1]Rounding error prevents all categories from adding to 100.0.
[2]USDA quality grade was affected by maturity and dark cutting.
[3]Overall category represents USDA quality grades of Prime, Choice, Select, Standard, Commercial, Utility, and Cutter.

Table 2-4. Percentage distribution[1] of carcasses stratified by USDA quality[2] and yield grades

USDA Yield Grade	USDA Quality Grade, %						
	Prime	Choice	Select	Standard	Commercial	Utility	Cutter
1	0.04	9.40	13.00	1.98	0.11	0.09	0.03
2	0.86	29.53	13.92	1.90	0.33	0.14	0.00
3	0.91	16.73	4.56	0.69	0.26	0.04	0.00
4	0.31	3.48	0.63	0.10	0.09	0.03	0.00
5	0.10	0.64	0.09	0.03	0.01	0.00	0.00

[1]Carcasses with missing values for USDA quality or yield grades are not included.
[2]USDA quality grade was affected by maturity and dark-cutting beef, and there were no Canner carcasses observed in the audit.

Table 2-5. Characteristics of overall maturity[1]

Overall maturity	n	Percentage of sample	Mean	SD	Minimum	Maximum
A	8,901	92.80	153.0	14.24	110	196
B	578	6.03	218.0	20.65	200	295
C	102	1.06	307.3	16.12	300	370
D	6	0.06	444.2	27.82	410	485
E	5	0.05	531.0	39.12	500	585

[1]100 = A^{00}, 200 = B^{00}, 300 = C^{00}, 400 = D^{00}, and 500 = E^{00}.

Table 2-6. Least squares means for carcass traits (SEM[1]) within USDA quality grades

Trait	USDA quality grade			
	Prime (n = 205)	Choice (n = 5,634)	Select (n = 3,121)	Standard (n = 490)
USDA yield grade	3.3[a] (0.06)	2.8[b] (0.01)	2.2[c] (0.01)	2.2[c] (0.04)
USDA quality grade[2]	819[a] (1.59)	727[b] (0.30)	650[c] (0.41)	582[d] (1.03)
Adjusted fat thickness, in.	0.66[a] (0.01)	0.55[b] (0.003)	0.45[c] (0.004)	0.44[c] (0.009)
HCW, lbs	850.0[a] (7.10)	833.1[b] (1.36)	808.8[c] (1.83)	823.9[d] (4.68)
REA, in^2	13.0[c] (0.13)	13.6[b] (0.02)	14.1[a] (0.03)	14.1[a] (0.08)
KPH, %	2.4[a] (0.06)	2.4[a] (0.01)	2.2[b] (0.01)	1.8[c] (0.04)
Marbling score[3]	759[a] (4.04)	484[b] (0.77)	351[d] (1.04)	377[c] (2.61)
Lean maturity[4]	151[b] (1.11)	151[b] (0.29)	151[b] (0.39)	201[a] (0.98)
Skeletal maturity[4]	160[b] (1.61)	159[b] (0.31)	154[c] (0.41)	206[a] (1.04)
Overall maturity[4]	157[b] (1.28)	155[b] (0.24)	153[c] (0.33)	204[a] (0.83)

[a-d]Means within a row lacking a common superscript letter differ ($P < 0.05$).
[1]SEM is the SE of the least squares means.
[2]100 = Canner[00], 400 = Commercial[00], 600 = Select[00], and 800 = Prime[00].
[3]100 = Practically devoid[00], 300 = Slight[00], 500 = Modest[00], and 700 = Slightly Abundant[00].
[4]100 = A[00] and 500 = E[00].

Table 2-7. Least squares means for carcass traits (SEM[1]) within USDA yield grades

Trait	USDA yield grade				
	1 (n = 2,032)	2 (n = 3,787)	3 (n = 1,875)	4 (n = 370)	5 (n = 72)
USDA yield grade	1.5[e] (0.007)	2.5[d] (0.05)	3.4[c] (0.007)	4.3[b] (0.02)	5.4[a] (0.04)
USDA quality grade[2]	665[e] (1.31)	696[d] (0.95)	712[c] (1.35)	720[b] (3.03)	738[a] (6.99)
Adjusted fat thickness, in.	0.33[e] (0.003)	0.48[d] (0.002)	0.64[c] (0.003)	0.88[b] (0.007)	1.07[a] (0.02)
HCW, lbs	790.2[e] (2.13)	825.5[d] (1.56)	856.2[c] (2.22)	884.8[b] (5.00)	923.67[a] (11.34)
REA, in[2]	15.1[a] (0.03)	13.7[b] (0.03)	12.9[c] (0.04)	12.3[d] (0.08)	11.3[e] (0.18)
KPH, %	1.98[e] (0.02)	2.26[d] (0.01)	2.52[c] (0.02)	2.82[b] (0.04)	3.46[a] (0.08)
Marbling score[3]	387[e] (2.02)	442[d] (1.48)	478[c] (2.10)	506[b] (4.73)	555[a] (10.72)
Lean maturity[4]	157[a] (0.63)	153[b] (0.46)	152[b] (0.65)	151[b] (1.45)	150[b] (3.35)
Skeletal maturity[4]	160[a] (0.75)	160[a] (0.55)	162[a] (0.78)	163[a] (1.74)	1.58[a] (3.95)
Overall maturity[4]	159[a] (0.64)	157[a] (0.46)	158[a] (0.66)	158[a] (1.47)	156[a] (3.41)

[a-d]Means within a row lacking a common superscript letter differ ($P < 0.05$).
[1]SEM is the SE of the least squares means.
[2]100 = Canner[00], 400 = Commercial[00], 600 = Select[00], and 800 = Prime[00].
[3]100 = Practically devoid[00], 300 = Slight[00], 500 = Modest[00], and 700 = Slightly Abundant[00].
[4]100 = A[00] and 500 = E[00].

Table 2-8. Least squares means for carcass traits (SEM[1]) within sex class

	Sex class			
Trait	Steer (n = 6,171)	Heifer (n = 3,536)	Cow (n = 13)	Bullock (n = 3)
USDA yield grade	2.6[a]	2.6[a]	2.2[a]	1.0[b]
	(0.01)	(0.02)	(0.26)	(0.50)
USDA quality grade[2]	693[a]	693[a]	562[b]	571[b]
	(0.79)	(1.04)	(16.99)	(43.31)
Adjusted fat thickness, in.	0.48[b]	0.56[a]	0.29[c]	0.20[c]
	(0.003)	(0.003)	(0.06)	(0.12)
HCW, lbs	852.7[a]	776.3[b]	792.9[b]	880.5[ab]
	(1.23)	(1.62)	(28.84)	(55.22)
REA, in[2]	13.8[a]	13.6[b]	12.1[c]	15.8[a]
	(0.02)	(0.03)	(0.50)	(1.04)
KPH, %	2.2[a]	2.4[b]	1.5[c]	0.7[c]
	(0.01)	(0.01)	(0.21)	(0.43)
Marbling score[3]	436[b]	448[a]	488[ab]	280[ab]
	(1.25)	(1.65)	(27.13)	(56.48)
Lean maturity[4]	154[d]	155[c]	232[b]	400[a]
	(0.35)	(0.46)	(7.56)	(19.27)
Skeletal maturity[4]	158[c]	169[b]	302[a]	177[bc]
	(0.43)	(0.56)	(9.24)	(19.24)
Overall maturity[4]	156[c]	163[b]	276[a]	275[a]
	(0.36)	(0.48)	(7.78)	(19.83)

[a-d]Means within a row lacking a common superscript letter differ ($P < 0.05$).
[1]SEM is the SE of the least squares means.
[2]100 = Canner[00], 400 = Commercial[00], 600 = Select[00], and 800 = Prime[00].
[3]100 = Practically devoid[00], 300 = Slight[00], 500 = Modest[00], and 700 = Slightly Abundant[00].
[4]100 = A[00] and 500 = E[00].

Table 2-9. Least squares means for carcass traits (SEM[1]) within estimated breed types

	Estimated breed type		
Trait	Native (n = 7,776)	Dairy (n = 876)	*Bos indicus* (n = 159)
USDA yield grade	2.6[a]	2.5[a]	2.4[b]
	(0.01)	(0.03)	(0.07)
USDA quality grade[2]	692[b]	701[a]	689[b]
	(0.71)	(2.13)	(4.90)
Adjusted fat thickness, in.	0.53[a]	0.31[c]	0.39[b]
	(0.002)	(0.006)	(0.02)
HCW, lbs	827.1[a]	810.7[b]	739.0[c]
	(1.17)	(3.47)	(8.31)
REA, in[2]	13.9[a]	12.3[b]	12.8[c]
	(0.02)	(0.06)	(0.14)
KPH, %	2.2[c]	2.3[b]	2.5[a]
	(0.009)	(0.03)	(0.06)
Marbling score[3]	440[b]	451[a]	424[c]
	(1.10)	(3.30)	(7.68)
Lean maturity[4]	155[a]	154[a]	152[a]
	(0.33)	(0.98)	(2.26)
Skeletal maturity[4]	163[a]	157[b]	154[b]
	(0.39)	(1.16)	(2.73)
Overall maturity[4]	160[a]	156[b]	154[b]
	(0.33)	(1.00)	(2.31)

[a-d]Means within a row lacking a common superscript letter differ ($P < 0.05$).
[1]SEM is the SE of the least squares means.
[2]100 = Canner[00], 400 = Commercial[00], 600 = Select[00], and 800 = Prime[00].
[3]100 = Practically devoid[00], 300 = Slight[00], 500 = Modest[00], and 700 = Slightly Abundant[00].
[4]100 = A[00] and 500 = E[00].

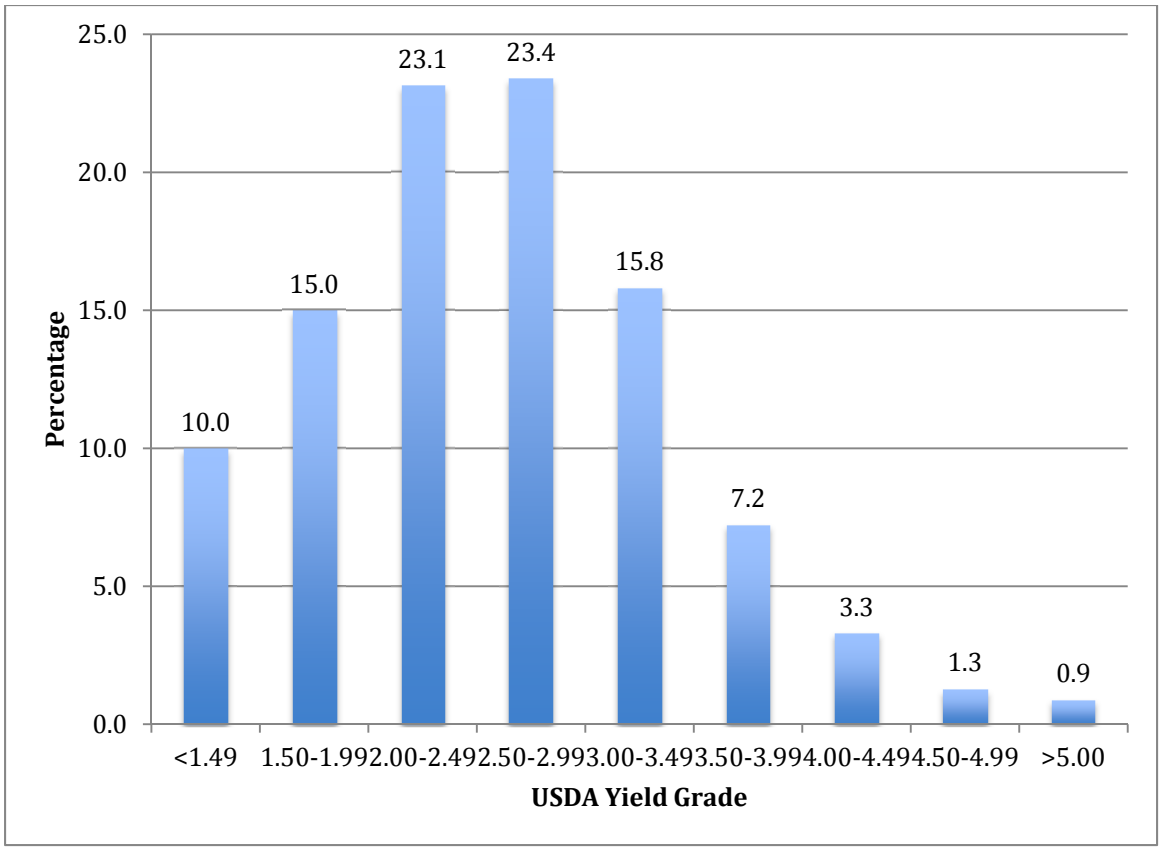

Figure 2-1. Frequency distribution of carcass by one-half yield grade increments from the NBQA-2011.

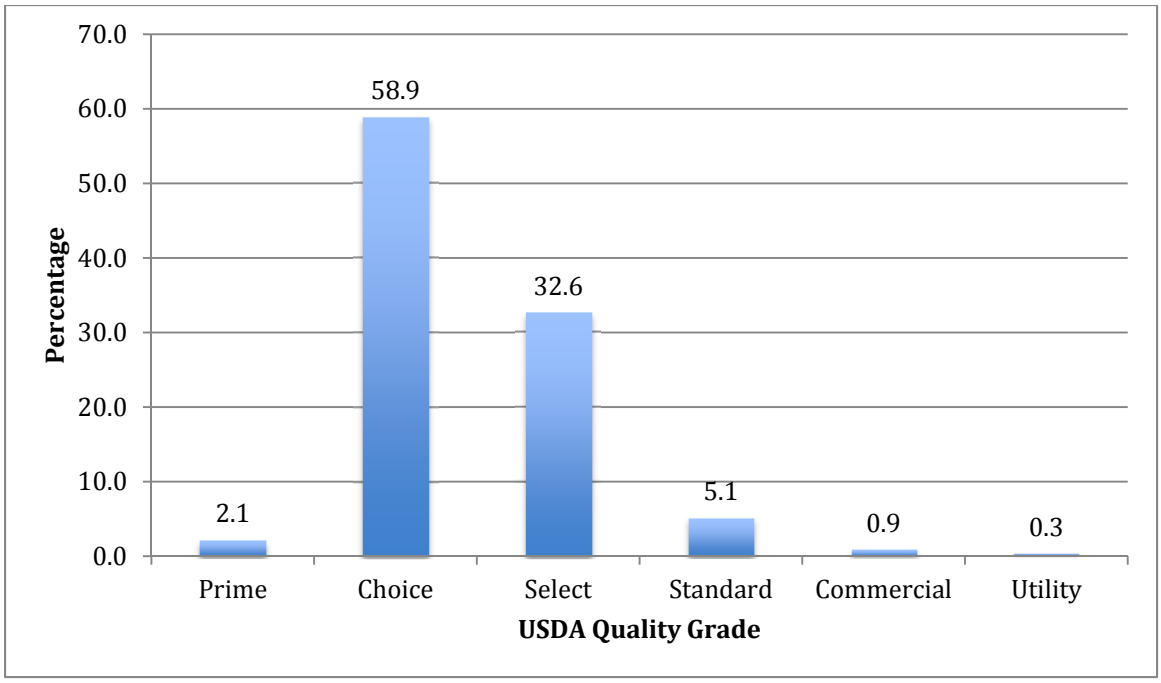

Figure 2-2. Frequency distribution of USDA Quality Grade from the National Beef Quality Audit-2011.

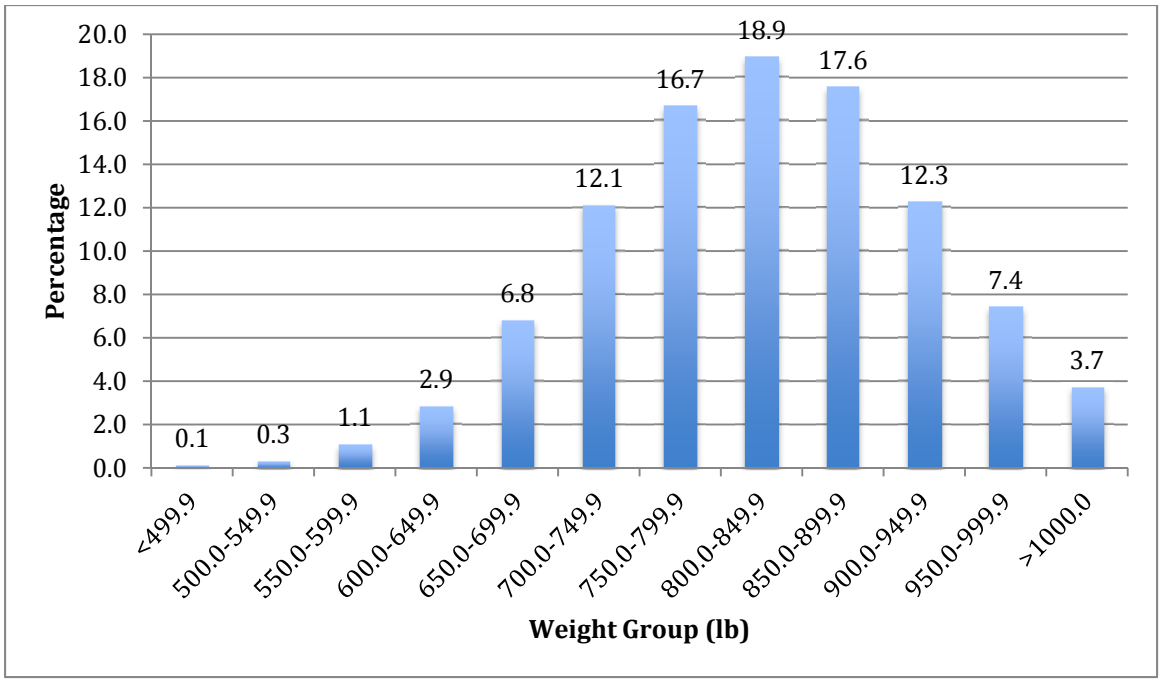

Figure 2-3. Frequency distribution of carcasses by weight groups from the National Beef Quality Audit-2011.

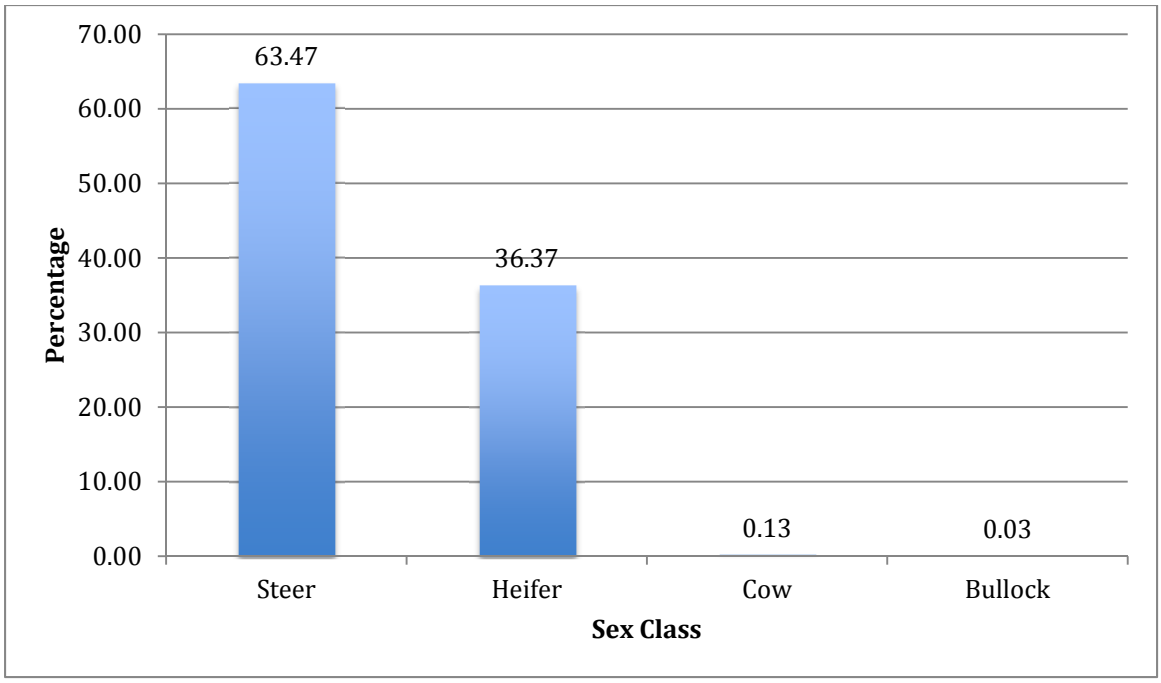

Figure 2-4. Frequency distribution of sex class from the National Beef Quality Audit-2011.

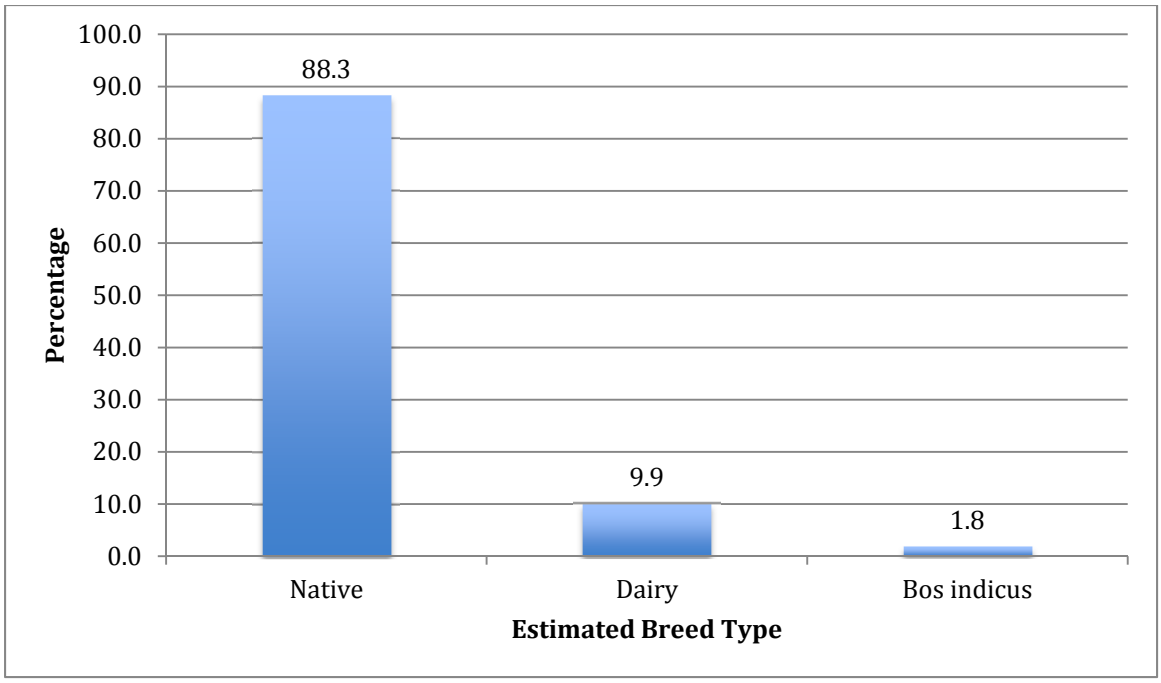

Figure 2-5. Frequency distribution of estimated breed type from the National Beef Quality Audit-2011.

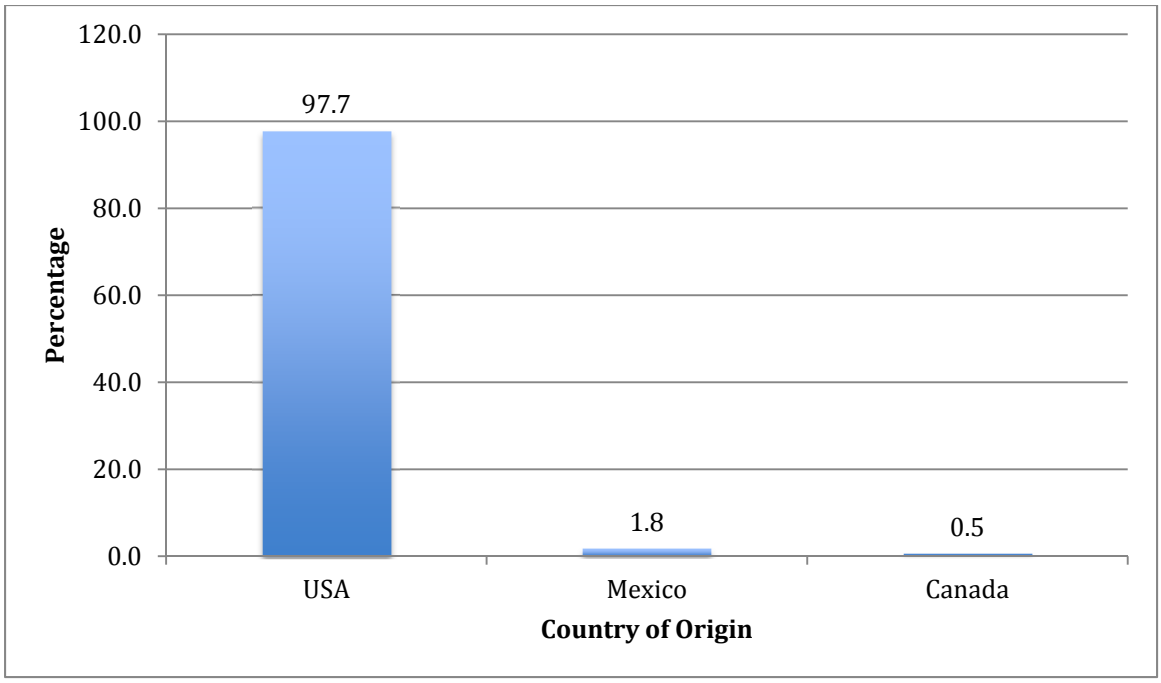

Figure 2-6. Frequency distribution of country of origin from the National Beef Quality Audit-2011.

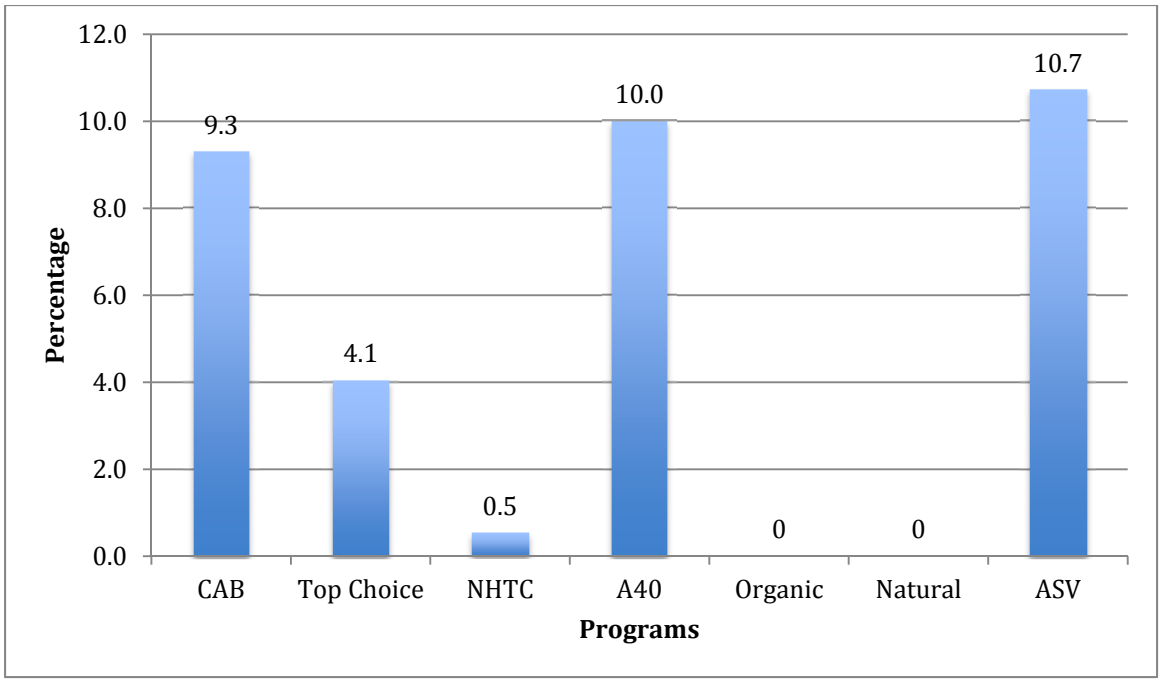

Figure 2-7. Frequency distribution of different certified and marketing programs from the National Beef Quality Audit-2011.

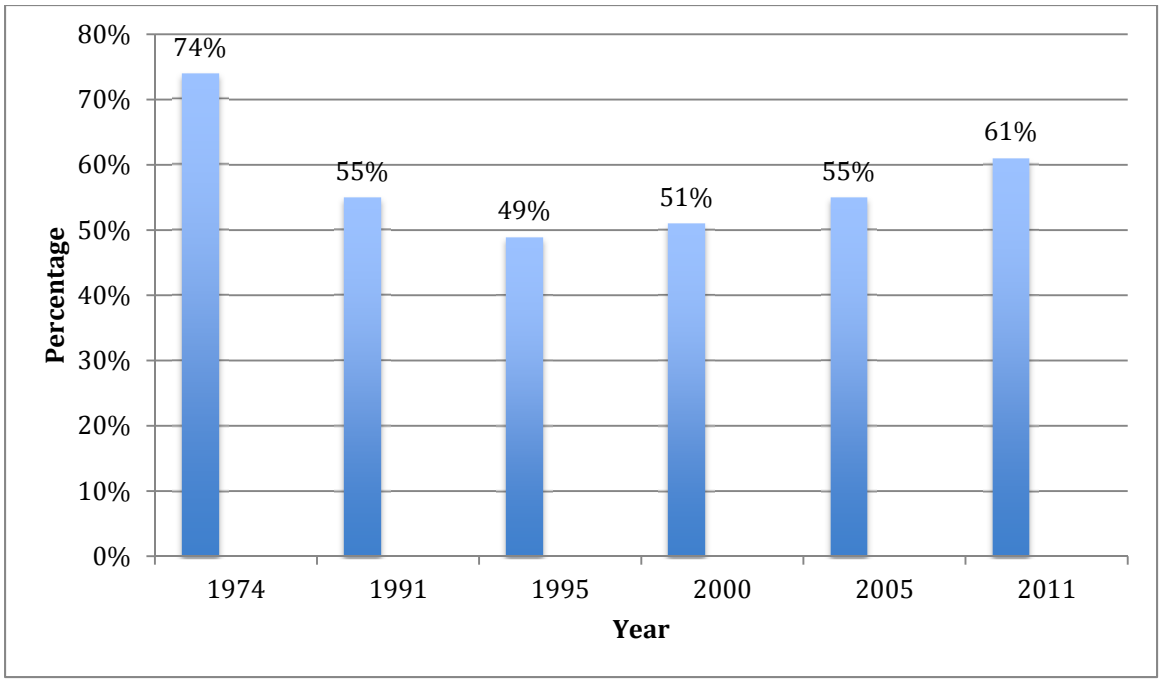

Figure 2-8. Comparison of percent USDA Prime and Choice from USDA-1974, NBQA-1991, 1995, 2000, 2005, and 2011.

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Instrument Grading Assessment

ABSTRACT

The instrument grading assessment for the National Beef Quality Audit–2011 evaluated the quality attributes and trends seasonally and over the course of the year. Instrument grading data (n = 2,427,074) were collected over a 12-month period (November 2010 through November 2011) from four beef processing corporations, encompassing 17 federally inspected packing plants, to create a "snapshot" of quality attributes and trends with a large quantity of data that could be evaluated on a monthly, quarterly, etc., basis. Data for carcass weight, gender, quality grade, and yield grade groups were obtained from one week's production, every other month, beginning in November of 2010. Mean USDA yield grade (YG) traits were USDA YG (2.9), HCW (818.5 lbs), adjusted fat thickness (0.47 in.), and ribeye area (13.7 in^2) as well as average marbling score (449.6). The USDA YG distribution was YG 1 (15.7%), YG 2 (41.0%), YG 3 (33.8%), YG 4 (8.5%), and YG 5 (0.9%). Carcass weight distribution was <600 lbs (1.6%), 600 lbs to 1000 lbs (95.1%), ≥1000 lbs (3.3%). Month-by-month mean carcass weights were November 2010 (840.6 lbs), January 2011 (828.8 lbs), March 2011 (807.3 lbs), May 2011 (789.0 lbs), July 2011 (821.3 lbs), September 2011 (829.1 lbs), and November 2011 (823.5 lbs). Month-by-month quality grade distribution for Prime, Choice, and Select, respectively, were November 2010 (3.0, 58.3, and 33.9%), January 2011 (2.8, 64.9, and 28.7%), March 2011 (3.1, 64.7, and 27.8%), May (2.3, 62.4, and 31.8%), July 2011 (2.3, 61.7, and 32.3%), September 2011 (2.5, 58.8, and 33.3%), and November 2011 (2.7, 57.7, and 34.3%). The mean fat thickness distribution for each month was were November 2010 (0.51 in.), January 2011 (0.48 in.), March 2011 (0.46 in.), May 2011 (0.44 in.), July 2011 (0.47 in.), September 2011 (0.48 in.), and November 2011 (0. 48 in.). Interestingly, seasonal decreases in carcass weights and fat thicknesses were accompanied by increases in marbling and quality grade. This data set presents the opportunity to further investigate the whole array of value-determining factors that influence the viability and profitability of the beef industry.

MATERIALS AND METHODS

Instrument grading data (n = 2,427,074) were collected over a 12-month period (November 2010 through November 2011) from four beef processing corporations, encompassing 17 federally inspected packing plants, to create a "snapshot" of quality attributes and trends with a large quantity of data that could be evaluated on a monthly, quarterly, etc., basis. Data for carcass weight, gender, quality grade, and yield grade groups were obtained from one week's production, every other month, beginning in November of 2010. Carcass data collection consisted of subcutaneous fat thickness, ribeye area, kidney, pelvic, and heart fat percentage, hot carcass weight, USDA marbling score, genetic type, sex condition, and carcass discounts. From this information, USDA (1997) yield and quality grades were determined. In addition, the frequencies of the quality defects and combinations of these categories were determined.

The following describes how instrument grading is conducted generally: An in-plant employee aligns the calibrated camera onto the ribeye muscle between the 12^{th} and 13^{th} rib for each side. The image is stored and displayed for the USDA grader to verify that the objective assessments for USDA quality grade and USDA yield grade were made correctly. The USDA grader may make adjustments to the grade, or if necessary, reject the instrument's assessment

altogether. Adjustments are entered manually for maturity or any other defects (blood splash, calloused ribeye, dark cutter, etc.) that a carcass may possess. Factors that would not be ascertained from the camera, such as sex class, breed classification, and hot scale weight, would follow each individual carcass through the trolley tracking system and their individual identification number.

Data were obtained from each of the four beef processing corporations in a Microsoft® Excel® spreadsheet (Microsoft® Corporation, Redmond, WA). Data were harmonized so it could be consolidated to prevent the detection of one processor from another. Microsoft® Excel® was used to generate means and frequency distributions for data analysis.

RESULTS AND DISCUSSION

Instrumental Carcass Assessment

Means for instrumentally assessed UDSA YG traits and marbling scores are shown in Table 3-1. The mean USDA YG was 2.9 and the mean marbling score was 449.6 for the current study. The USDA YG distributions for the instrumentally assessed carcasses, shown in Figure 3-1, were YG 1 (15.7%), YG 2 (41.0%), YG 3 (33.8%), YG 4 (8.5%), and YG 5 (0.9%).

Distributions of carcasses and combinations of USDA QG and USDA YG are shown in Table 3-2. Instrumental assessment found 70.5% of the carcasses to be Choice and Select, YG 2 and 3. Carcasses classified as "Other" consisted of no roll, Standard, Commercial, Utility, heiferette, dark cutter, blood splash, hard bone, and calloused ribeye, comprising 4.3% of the instrumentally surveyed carcasses.

Carcass weight distributions are presented in Figure 3-2. Of the instrumentally assessed carcasses, 95.1% of the carcasses were between 600 and 1000 pounds. May carcass weights (Figure 3-3) were lowest for the year (789 lbs), which was 29.5 lbs less than the average carcass weight for the year (818.5 lbs). Carcass prices had reached a peak and began to decline sharply around the time these carcasses were being observed. Cattle may have been sent to slaughter earlier, resulting in lighter carcasses and higher percentage of yield grades 1-3 (92.5%) for the May observations when compared to the average percentage of yield grades 1-3 (90.6%) for the survey (data not reported in tabular form).

As shown in Figure 3-4, the percentage of Choice carcasses was highest in January (64.9%), and the highest percentage of Choice and Prime carcasses was observed in March (67.8%). Due in part to an increased percentage of Select carcasses, May exhibited the highest percentage of Prime, Choice, and Select carcasses (96.5%). Carcasses in March resulted in the highest average marbling score (460.2), followed by a decline for the month of May (Figure 3-5). In data not reported in tabular form, frequency of dark cutters was at the lowest points in January 2011 (0.43%) and March 2011 (0.38%) with an increase that peaked in September 2011 (1.94%).

Of the instrumentally assessed carcasses, March and May resulted in the highest percentage of carcasses with ribeye areas between 10 in^2 and 16 in^2, 90.7% (Figure 3-6). May also had the lowest percentage of ribeye areas greater than 16 in^2 (7.5%) for the year.

As shown in Figure 3-7, November 2010 had the highest average fat thickness (0.51 in.), which was higher than the average for the instrumental assessment (0.47 in.). May had the lowest average fat thickness (0.44 in.), again suggesting that more cattle were sent to slaughter earlier at that time. The distribution of steers, heifers, and other sex class categories are represented in Figure 3-8.

CONCLUSIONS

For the first time in the NBQA, sufficient information was available that allowed for quality and yield traits to be evaluated seasonally. Some of the seasonality shifts in carcass weights observed were a decline from the highest point in November 2010 to the lowest mean carcass weight observed in May 2011. Mean fat thickness followed the same trend line as mean carcass weight. Conversely, mean marbling score increased from November 2010 to the peak in March 2011, and then declined for the remainder of the study. This data set presents the opportunity to further investigate the whole array of value-determining factors that influence the viability and profitability of the beef industry.

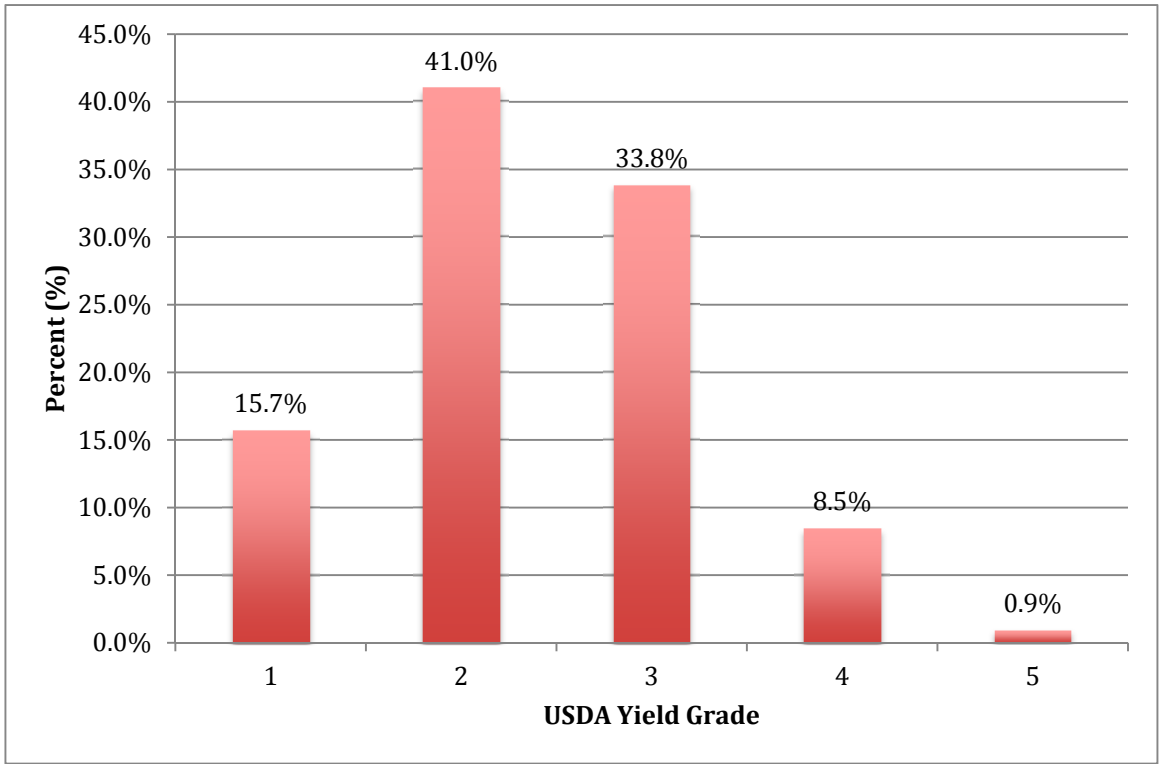

Figure 3-1. Frequency distribution of USDA YG from the NBQA-2011.

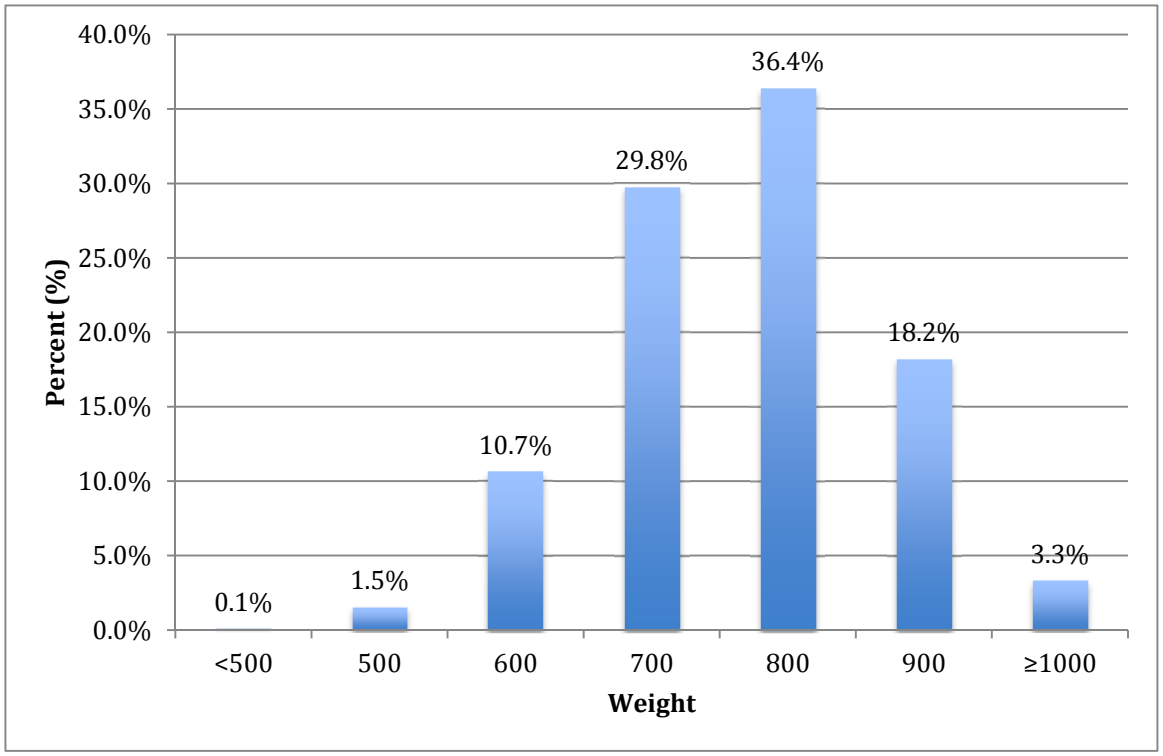

Figure 3-2. Frequency distribution of carcasses by weight groups from the NBQA-2011.

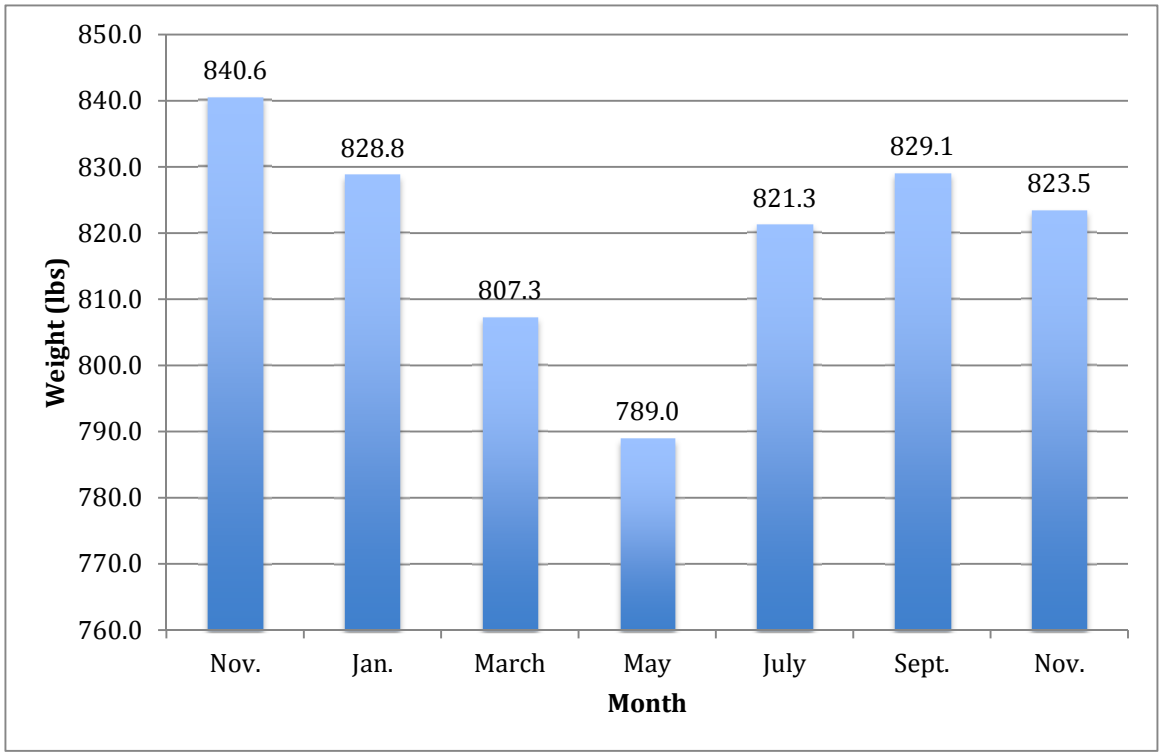

Figure 3-3. Frequency distribution of average hot carcass weight by month from the NBQA-2011.

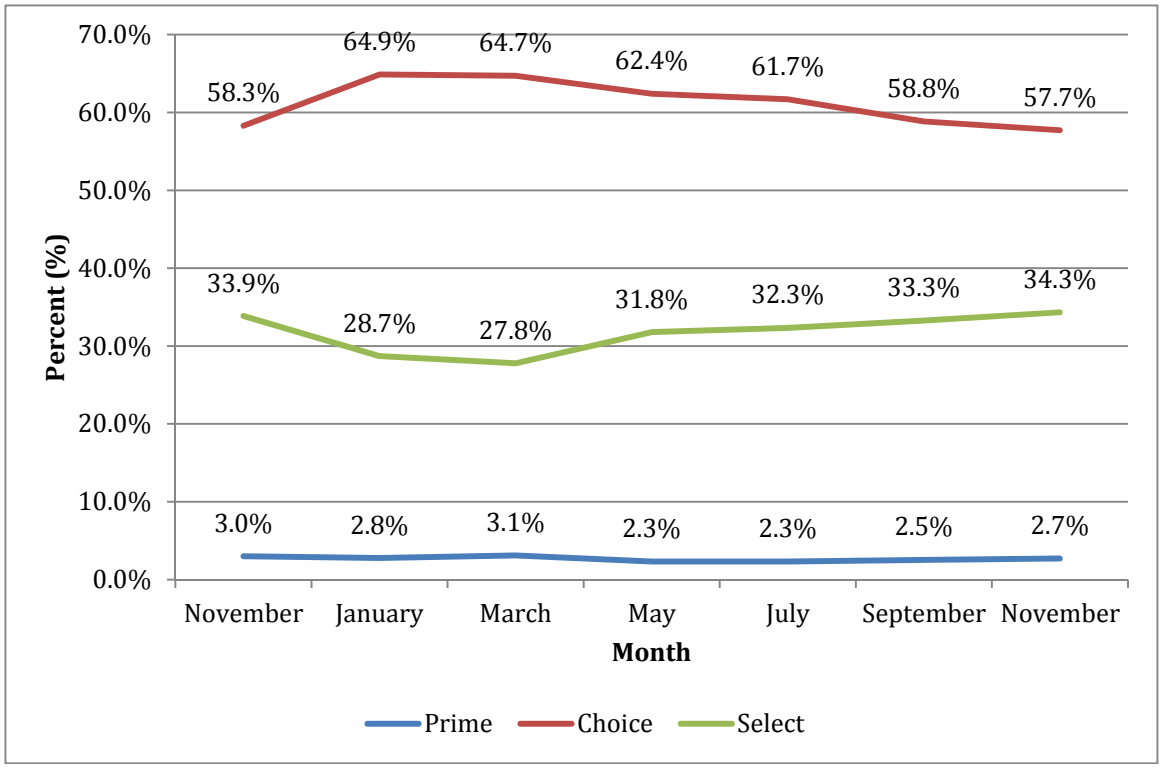

Figure 3-4. Frequency distribution of quality grade by month from the NBQA-2011.

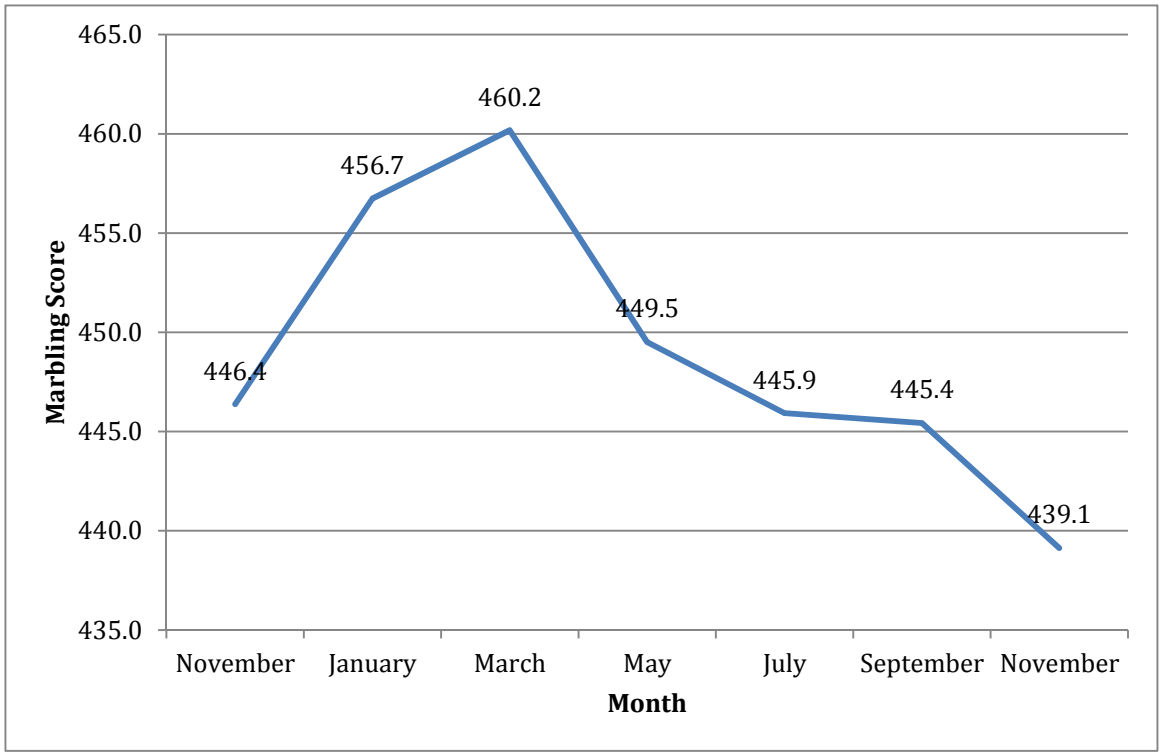

Figure 3-5. Frequency distribution of average marbling score by month from the NBQA-2011.

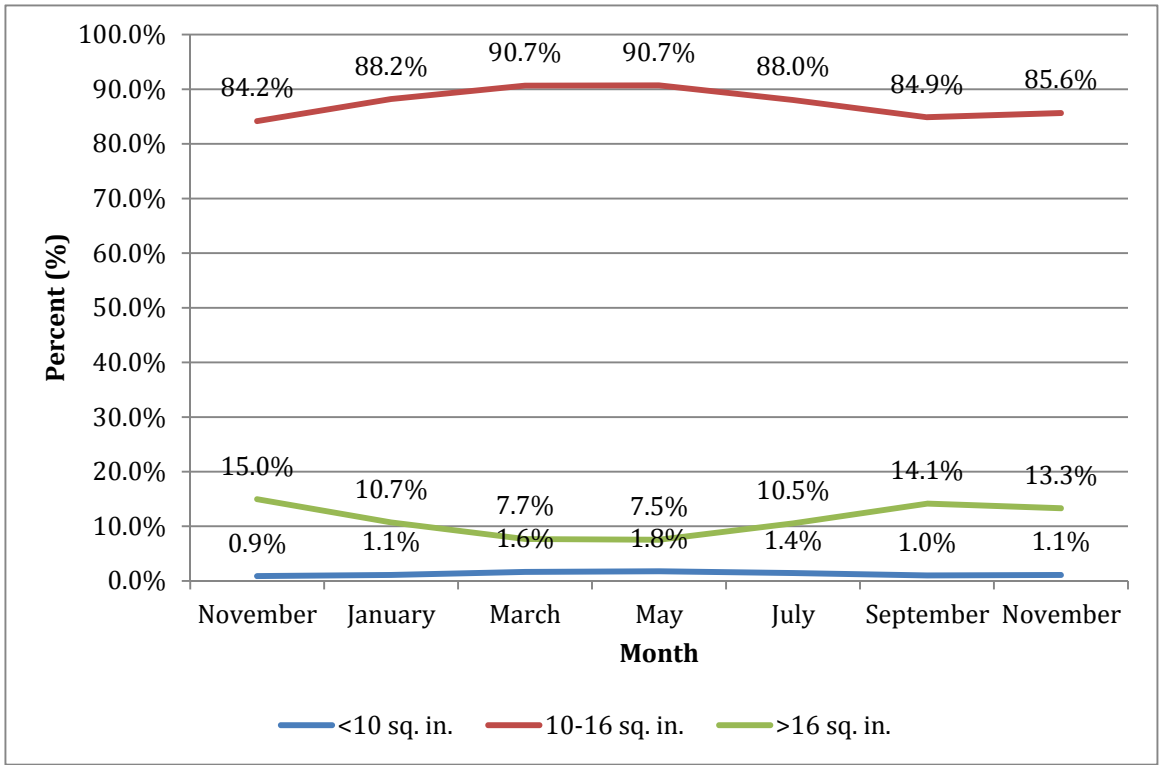

Figure 3-6. Frequency distribution of ribeye area by month from the NBQA-2011.

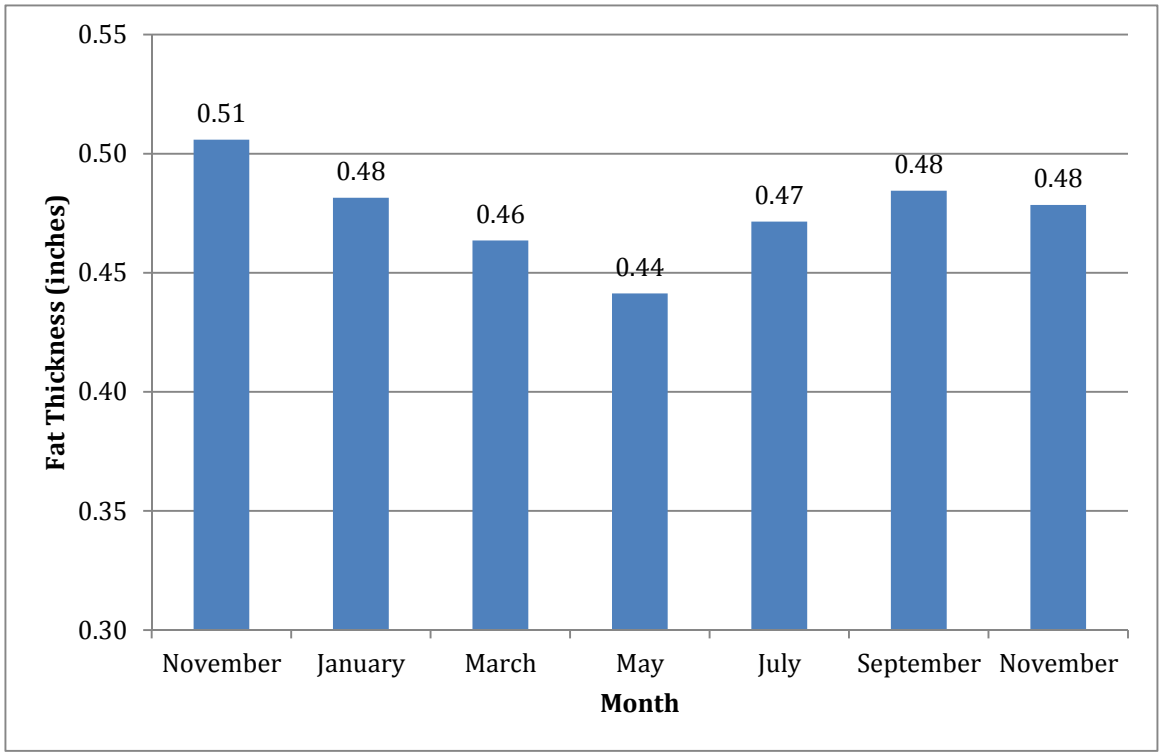

Figure 3-7. Frequency distribution of fat thickness by month from the NBQA-2011.

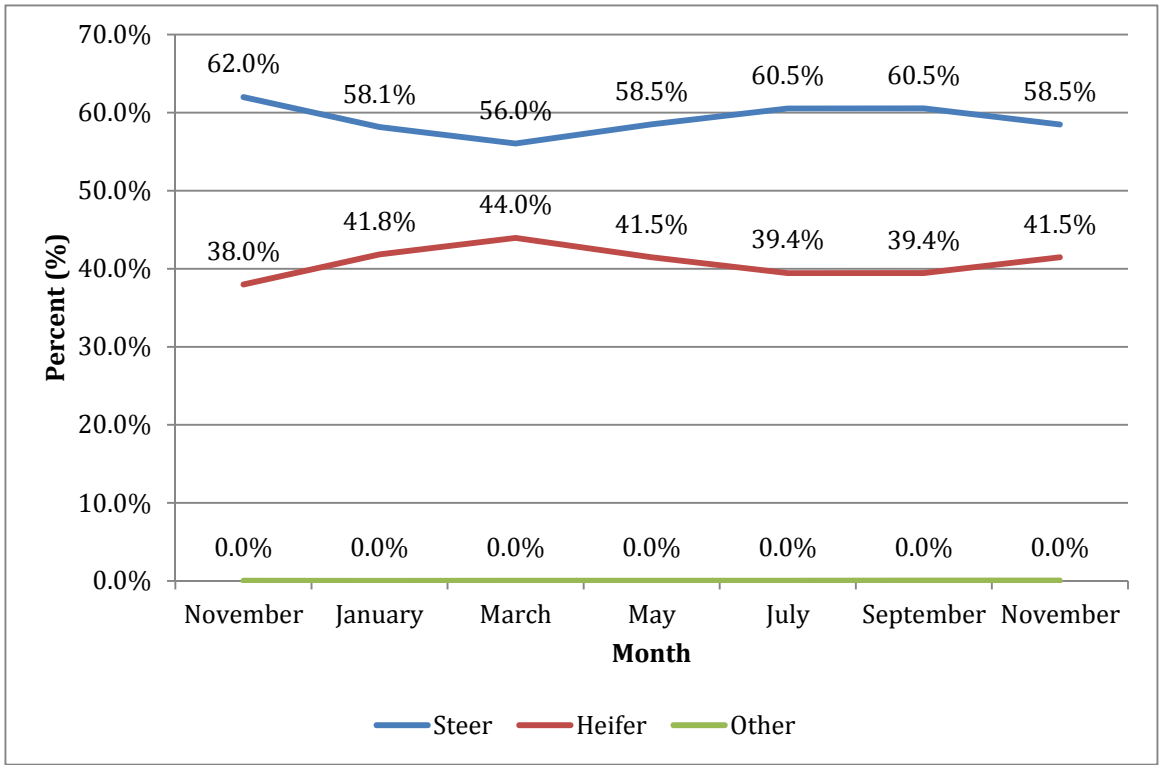

Figure 3-8. Frequency distribution of sex class by month from the NBQA-2011.

Table 3-1. Means, standard deviations, and minimum and maximum values for USDA carcass grade traits

Trait	Mean	SD	Minimum	Maximum
USDA yield grade	2.9	0.8	-0.04	7.4
Adjusted fat thickness, in.	0.47	0.2	-0.4	2.5
Ribeye area, in^2	13.7	1.7	4.4	28.2
Hot carcass weight, lbs	818.5	97.1	300	1358
Marbling score[1]	449.6	94.8	100	1090

[1]100 = Practically devoid^{00}, 300 Slight^{00}, 500 = Modest^{00}, 700 = Slightly Abundant^{00}, and 900 = Abundant^{00}.

Table 3-2. Percentage distribution[1] of carcasses stratified by USDA quality[2] and yield grades

USDA yield grade, %	USDA quality grade			
	Prime	Choice	Select	Other
1	0.03	4.91	9.27	1.53
2	0.47	23.91	14.98	1.65
3	1.30	25.31	6.33	0.89
4	0.72	6.67	0.87	0.22
5	0.13	0.72	0.07	0.03

[1]Carcasses with missing values for USDA quality or yield grades are not included.
[2]Other includes: no roll, Standard, Commercial, Utility, heiferette, dark cutter, blood splash, hard bone, and calloused ribeye.

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II. Executive Summary

a. Title, Authors, University or organization, Date of submission

National Beef Quality Audit – 2011: In-plant survey phase
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April, 2012

b. Background

The National Beef Quality Audits have been conducted four previous times over the past twenty years with a major component of these audits being the harvest-floor and cooler assessments (Lorenzen et al., 1993; Boleman et al., 1998; McKenna et al., 2002; Garcia et al., 2008). These scientific articles are widely cited by the scientific and industry communities and are relied on as the greatest source of documenting the actual quality and quantity characteristics of the carcasses and by-products of the fed-beef cattle supply in the U.S.

Over the years, new and important information has been gathered with each National Beef Quality Audit reflecting the trends or regulations impacting the industry. Some of these have included dentition (addressing specified risk materials), A^{40} designation (for the Japanese export market), predominant hide color (used in various certification programs), certification/marketing programs, and Country of Origin Labeling to name a few. In recent years, instrument grading of beef carcasses has become more mainstream, and the opportunity to obtain information from some of the beef packers who use this system provided a chance to greatly increase the number of observations to the audit that would not have been available in past audits.

The National Beef Quality Audit – 2011: In-Plant Survey Phase was conducted to obtain traditional and new information from: (1) harvest-floor assessments of various traits for the hide-on carcasses, carcasses, and offal, (2) cooler assessments of quality, yield, and other factors for the chilled carcasses, and (3) instrument grading programs that detailed camera data from multiple plants from multiple companies.

c. Objectives

(1) To collect information regarding the traditional live animal/harvest-floor assessments along with survey data points that examine the adoption of Beef Quality Assurance principles.
(2) To obtain in-depth quality/yield factors from cooler carcass assessments from each of the major steer/heifer plants in the United States.
(3) To analyze instrument grading data from multiple plants from multiple companies to evaluate carcass characteristics throughout the year.

d. Methods

This phase of the National Beef Quality Audit – 2011 consisted of three components: (1) harvest-floor assessment where 50% of hide-on carcasses, carcasses, and offal of each production lot were evaluated during one-day's production at eight beef packing plants (approximately 18,000 animals), (2) cooler assessment where 10% of beef carcasses in each production lot were evaluated during one day's production in all of the major fed-beef packing plants in the U.S. (n = 28 plants; approximately 9,800 carcasses), and (3) instrument grading assessment where camera-grading information from one-week's production for every other month was obtained from multiple plants from multiple companies (approximately 2.4 million carcasses). For the harvest-floor assessments, hide-on cattle were evaluated for predominant hide color, horns (presence and size), hide branding (presence, location, and size), animal identification (presence and type), and mud/manure (presence, location, and amount). Carcasses were evaluated for bruises (presence, location, and severity), and heads and offal were evaluated for condemnations (incidence and reasons). For the cooler assessment, carcasses were evaluated for USDA quality and yield grade information, sex-class (steer, heifer, cow, and bullock), estimated breed type (native, dairy, or *Bos indicus*), fat color (noted if yellow), and certification/marketing program. For the instrument grading data, information was obtained for carcass weight, gender, quality grade and yield grade so means, trends, and frequencies could be determined overall and seasonally.

e. Important Findings

For the harvest-floor assessments, identification method and frequency were lot visual tags (85.7%), individual visual tags (50.6%), electronic tags (20.1%), metal-clip tags (15.7%), other means (5.3%), none (2.5%), and wattles (0.5%). Hide colors or breed type were black (61.1%), red (12.8%), yellow (8.7%), Holstein (5.5%), brown (5.0%), gray (5.0%), white (1.4%), and brindle (1.0%). Brand frequencies were no brands (55.2%), one (40.4%), two (4.4%), and three or more (0.04%), and brands were located on the butt (33.8%), side (8.6%), and shoulder (2.4%). Hide location and incidence of mud or manure were no mud/manure (49.2%), legs (36.8%), belly (23.7%), side (14.9%), top-line (11.0%), and tail region (13.7%). There were 77.2% of cattle without horns, and the majority of those with horns (71.6%) were between 0 cm and 12.7 cm in length. Permanent incisor number and occurrence were zero (87.3%), one (1.4%), two (8.0%), three (0.9%), four (1.9%), five (0.3%), six (0.2%), seven (0.1%), and eight (0.02%). Most

carcasses (77.0%) were not bruised, 18.7% had one bruise, 3.4% had two bruises, 0.6% had three bruises and 0.3% had more than three bruises. Bruise location and incidence were loin (50.1%), rib (21.3%), chuck (13.8%), round (7.3%), and brisket, flank, plate (7.5%). Condemnation item and incidence were whole carcass (none recorded), liver (20.9%), viscera (9.3%), lungs (17.3%), tongue (10.0%), and head (7.2%). When compared to the 2005 NBQA, this audit revealed a higher percentage of black-hided cattle (2005, 56.3% vs. 2011, 61.1%), cattle with brands (2005, 38.7%, vs. 2011, 44.8%), and more cattle with some form of identification (2005, 93.3% vs. 2011, 97.5%). In addition, there was a lower percentage of carcasses with bruises (2005, 35.2% vs. 2011 23.0%), and carcasses with more than one bruise (2005, 9.4% vs. 2011, 4.2%). Also, a similar percentage of the cattle were deemed greater than thirty months of age using dentition (2005, 2.7% vs. 2011, 3.3%).

For the cooler assessments, beef carcasses (n = 9,802), representing approximately ten percent of each production lot in 28 beef packing plants, were selected randomly for the survey. Carcass evaluation for the cooler assessment of this study revealed these traits and frequencies: steer (63.7%), heifer (36.2%), cow (0.05%), and bullock (0.05%) sex classes; dark-cutters (3.2%); blood splash (0.3%); calloused ribeye (0.05%); yellow fat (0.1%); A (92.8%), B (6.0%), and C or older (1.2%) overall maturities; native (88.3%), dairy-type (9.9%), and *Bos indicus* (1.8%) estimated breed types; and United States (97.7%), Mexico (1.8%), and Canada (0.5%) country of origin. Certified or marketing program frequencies were: age and source verified (10.7%), A^{40} (10.0%), Certified Angus Beef® (9.3%), top Choice (4.1%), and non-hormone treated cattle (0.5%), and there were no natural or organic programs observed. Mean USDA yield grade (YG) traits were USDA YG (2.6), HCW (824.6 lbs), adjusted fat thickness (0.51 in.), ribeye area (13.8 in^2), and KPH (2.3%). The USDA YG were YG 1 (25.0%), YG 2 (46.5%), YG 3 (23.0%), YG 4 (4.6%), and YG 5 (0.9%). Mean USDA quality grade traits were USDA quality grade ($Select^{93}$), marbling score ($Small^{40}$), overall maturity (A^{59}), lean maturity (A^{54}), skeletal maturity (A^{62}). Marbling score distribution was Slightly Abundant or greater (2.3%), Moderate (5.0%), Modest (17.4%), Small (39.9%), Slight (34.4%), and Traces or less (1.1%).

For the instrument grading assessments, the quality/quantity attributes and trends were evaluated seasonally and over the course of the year. Mean USDA yield grade (YG) traits were USDA YG (2.9), HCW (818.5 lbs), adjusted fat thickness (0.47 in.), and ribeye area (13.7 in^2) as well as average marbling score (449.6). The USDA YG distribution was YG 1 (15.7%), YG 2 (41.0%), YG 3 (33.8%), YG 4 (8.5%), and YG 5 (0.9%). Carcass weight distribution was <600 lbs (1.6%), 600 lbs to 1000 lbs (95.1%), ≥1000 lbs (3.3%). Month-by-month mean carcass weights were November 2010 (840.6 lbs), January 2011 (828.8 lbs), March 2011 (807.3 lbs), May 2011 (789.0 lbs), July 2011 (821.3 lbs), September 2011 (829.1 lbs), and November 2011 (823.5 lbs). Month-by-month quality grade distribution for Prime, Choice, and Select, respectively, were November 2010 (3.0, 58.3, and 33.9%), January 2011 (2.8, 64.9, and 28.7%), March 2011 (3.1, 64.7, and 27.8%), May (2.3, 62.4, and 31.8%), July 2011 (2.3, 61.7, and 32.3%), September 2011 (2.5, 58.8, and 33.3%), and November 2011 (2.7, 57.7, and 34.3%). The mean fat thickness distribution for each month was were November 2010 (0.51 in.), January 2011

(0.48 in.), March 2011 (0.46 in.), May 2011 (0.44 in.), July 2011 (0.47 in.), September 2011 (0.48 in.), and November 2011 (0. 48 in.). Interestingly, seasonal decreases in carcass weights and fat thicknesses were accompanied by increases in marbling and quality grade.

f. Implications/Industry Impact

There were several interesting and important trends observed from the in-plant survey: (1) almost all of the cattle coming into the packing plant were identified, with a numerical increase in the number individually identified (50.6%) compared to the previous audit (38.7%), (2) the number of bruises were numerically lower reflecting increased awareness of the importance of animal handling to the beef industry, (3) the number of black-hided cattle continue to increase (61.1% vs. 56.3%), (4) the number of cattle with no mud or manure present almost doubled (50.8% vs. 25.8%) compared to the previous audit, (5) As has been noted for many years now, hot carcass weights continue to increase (824.6 lbs for NBQA-2011 vs. 793.4 lbs for NBQA-2005), (6) even with increasing carcass weights, 95.1% of the carcasses ranged between 600 and 1,000 lbs, (7) ribeye areas have increased numerically (13.8 in^2 for NBQA-2011 vs. 13.4 in^2 for NBQA-2005), (8) USDA yield grade means continue to improve and are at the all-time high for this audit (USDA YG 2.6), which translates to an improvement in red meat yield, (9) the percentage of Prime and Choice beef increased numerically and is at a 20-year all-time high (NBQA-2011 = 61.1%; NBQA-2005 = 54.5%), (10) marbling scores of $Small^{50}$ and above continued to increase (41.2% vs. 23.6%), (11) conforming carcasses, those hitting targets of U.S. Select or higher and USDA yield grades 1-3, totaled 88.9% compared to 81.7% for the previous audit, and (12) Certain carcass measurements were surprising similar: ribeye area (13.76 in^2 vs. 13.71 in^2), adjusted fat thickness (0.51 in. vs. 0.47 in.), marbling score ($Small^{40}$ vs. $Small^{50}$), and carcass weights (824.6 lbs vs. 818.5 lbs) for cooler and instrument grading, respectively.

Improvements in red meat yield with increases in marbling scores and USDA quality grade indicate that the beef industry has made great strides in selection and management to reach carcass targets not easily attained and never before achieved. These findings are of great importance to cattle producers and others along the beef chain where improvements in leanness while maintaining or increasing quality are important to building the demand for beef.

g. Graphs/Tables – include at least one relevant graph and/or data table

Table 4-1. Means for USDA carcass grade traits from NBQA-1991, NBQA-1995, NBQA-2000, NBQA-2005, and NBQA-2011

Trait	NBQA-1991	NBQA-1995	NBQA-2000	NBQA-2005	NBQA-2011
USDA yield grade	3.2	2.8	3.0	2.9	2.6
USDA quality grade[1]	686	679	685	690	693
Adjusted fat thickness, in.	0.6	0.5	0.5	0.5	0.5
Hot carcass weight, lbs	760.6	747.8	786.8	793.4	824.6
Ribeye area, in^2	12.9	12.8	13.1	13.4	13.8
Kidney, pelvic, and heart fat, %	2.2	2.1	2.4	2.3	2.3
Marbling score[2]	424	406	423	432	440
Lean maturity[3]	163	154	165	157	154
Skeletal maturity[3]	175	163	167	168	162
Overall maturity[3]	169	160	166	164	159

[1]100 = Canner^{00}, 400 = Commercial^{00}, 600 = Select^{00}, and 800 = Prime^{00}.
[2]100 = Practically devoid^{00}, 300 = Slight^{00}, 500 = Modest^{00}, 700 = Slightly Abundant^{00}, and 900 = Abundant^{00}.
[3]100 = A^{00} and 500 = E^{00}.

Table 4-2. Means for carcass traits between cooler and instrument data from the NBQA-2011

Trait	Cooler Mean (n = 9,802)	Instrument Mean (n = 2,427,074)
USDA yield grade	2.56	2.86
Adjusted fat thickness, in.	0.51	0.47
Hot carcass weight, lbs	824.6	818.5
Ribeye area, in^2	13.76	13.71
Marbling score[1]	440	450

[1]100 = Practically devoid^{00}, 300 = Slight^{00}, 500 = Modest^{00}, 700 = Slightly Abundant^{00}, and 900 = Abundant^{00}.

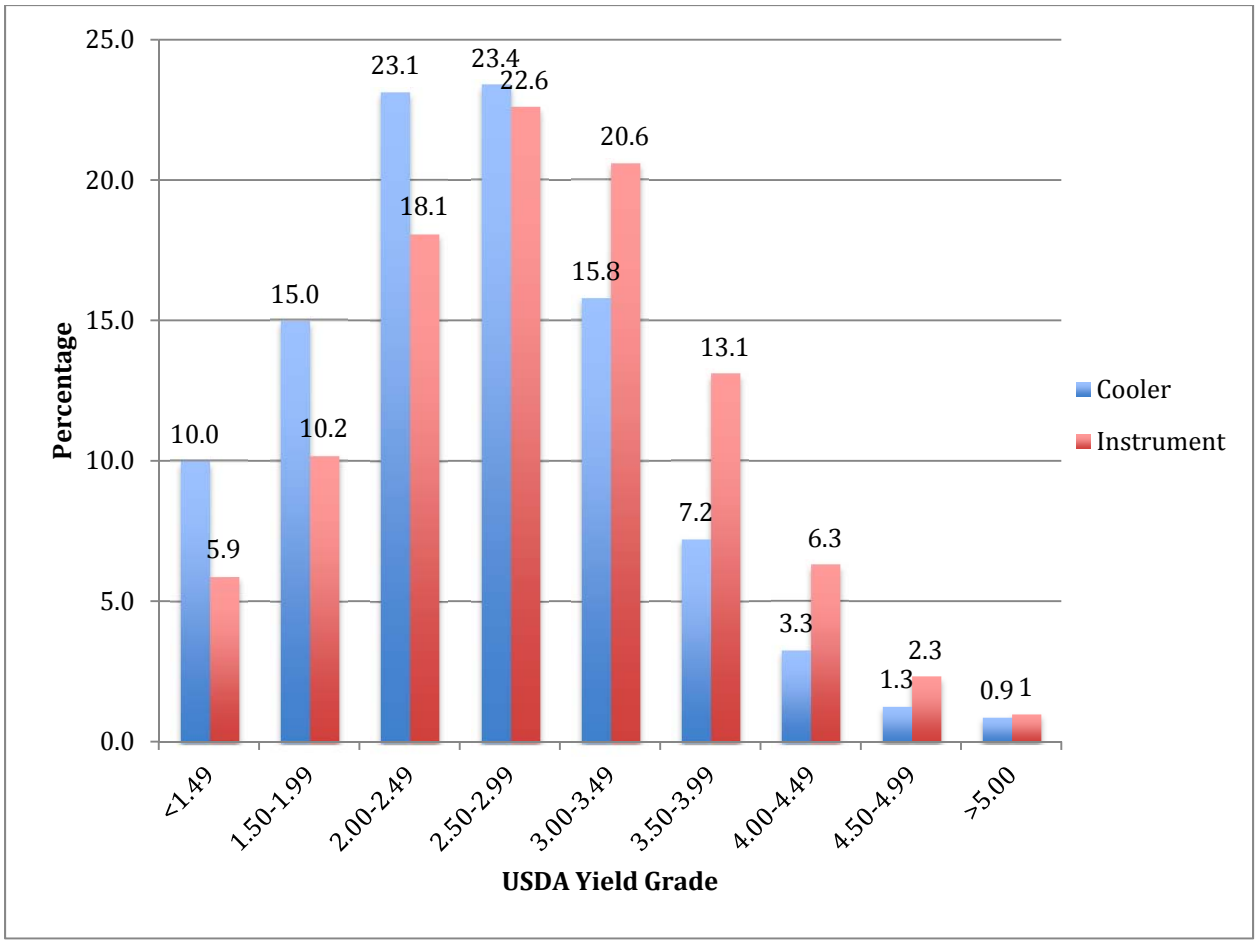

Figure 4-1. Frequency distribution of carcass by one-half yield grade increments for cooler and instrument data from the NBQA-2011.

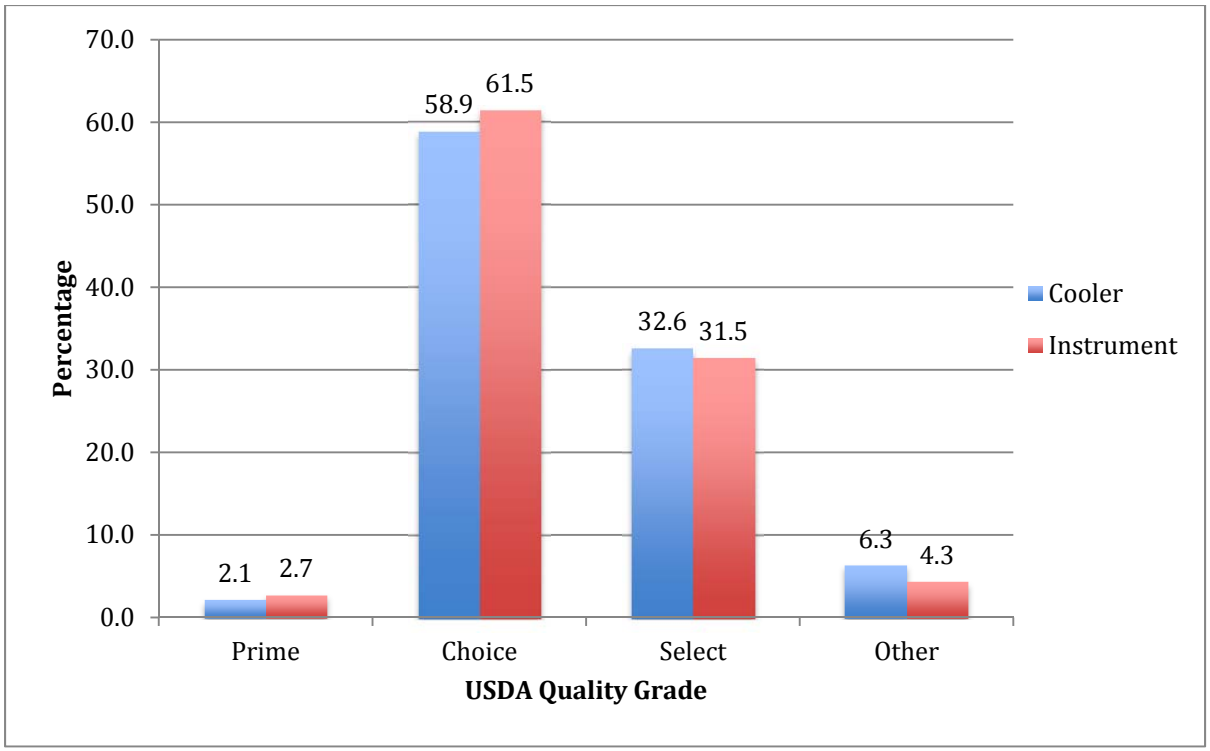

Figure 4-2. Frequency distribution of USDA Quality Grade for cooler and instrument data from the National Beef Quality Audit-2011.

h. Photos – include at least 2 relevant photographs (jpg format)

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