NBQA-2000: SURVEY OF U.S. CARCASS CHARACTERISTICS RELATED TO QUALITY, QUANTITY, AND VALUE OF FED STEERS AND HEIFERS

McKenna D.R[1], Roeber D.L.[2], Bates P.K.[3], Schmidt T.B.[4], Hale D.S.[1], Griffin D.B.[1], Savell J.W.[1], Brooks J.C.[3], Morgan J.B.[3], Montgomery T.H.[4], Belk K.E.[2], Smith G.C.[2]

[1]Department of Animal Science, Texas A&M University, College Station, TX, USA 77843-2471
[2]Department of Animal Sciences, Colorado State University, Ft. Collins, CO, USA 80523-1171
[3]Department of Animal Science, Oklahoma State University, Stillwater, OK, USA 74078-0425
[4]Division of Agriculture, West Texas A&M University, Canyon, TX, USA 79016

Background

The National Beef Quality Audit-1991 (NBQA-1991) (Lorenzen et al., 1993) was conducted to establish a benchmark that identified what the U.S. beef industry was producing. A subsequent audit, the National Beef Quality Audit-1995 (NBQA-1995) (Boleman et al., 1998), was conducted to monitor progress regarding the quality, consistency, and competitiveness of beef. Since the completion of the NBQA-1995, there have been a number of management and market changes that may have influenced the type of beef being produced. Most notably, a resurgence in demand for beef (NCBA, 2001), the introduction of over 47 USDA certified branded beef programs (USDA, 2001a), and an affordable, abundant supply of grain (USDA, 2001b,c,d). Such changes may influence hide, bruise, and quality and yield grade factors. The objective of the NBQA-2000 was to assess the current status of the quality and consistency of the U.S. fed steer and heifer population and pinpoint inadequacies and shortfalls that the industry needs to improve upon and track progress made since the previous audits. This phase of the audit encompassed in-plant surveys of qualitative and quantitative attributes of beef carcasses in the cooler.

Objectives

The objective of the NBQA-2000 was to assess the current status of the quality and consistency of the U.S. fed steer and heifer population and pinpoint inadequacies and shortfalls that the industry needs to improve upon and track progress made since the previous audits. This phase of the audit encompassed in-plant surveys of qualitative and quantitative attributes of beef carcasses in the cooler.

Methods

Federally inspected fed-beef packing plants (n = 30) were selected to represent various geographical regions of the U.S. and comprise approximately 80% of the fed steer and heifer slaughter capacity. University personnel surveyed assigned plants once during the prescribed month for the equivalent of one day's production. Plants were eligible to be audited on any day of the week, however, 14% of the audits were conducted on a Monday to account for "weekend" cattle and carcasses (additional post-mortem chilling may influence USDA quality grade factors).

Cooler. For cooler data, 10% of each lot for each shift in each plant was audited, resulting in a total sample size of 9,396 carcasses. Carcasses were evaluated for USDA yield and quality grade factors (USDA, 1997), sex class (steer, heifer, bullock or cow), breed type (native, dairy, *Bos Indicus* [hump height > 10 cm]) and quality defects (blood splash, yellow fat, and/or dark cutters). All data obtained in the cooler were collected and recorded as detailed by Lorenzen et al. (1993) with the following modifications: area supervisors from the USDA, Agricultural Marketing Service, Meat Grading and Certification branch determined marbling score, identified and evaluated dark cutting carcasses, and determined adjusted fat thickness; and a one-half grade deduction was added to the dark cutter category.

Statistical Analysis. Statistical analyses were performed to generate means and frequency distributions. The General Linear Model procedure of the Statistical Analysis System (Cary, NC, USA) was used to generate least squares means. When significant, least squares means were separated by the P-DIFF procedure and an alpha level of $P < 0.05$ was used to determine significance.

Results and discussion

Mean USDA quality and yield grade traits are shown in Table 1. The mean USDA quality grade was Select^{85} and mean yield grade was 3.0. Boleman et al. (1998) reported mean quality grade of Select^{79} and a mean yield grade of 2.8, and Lorenzen et al. (1993) reported a mean USDA quality grade of Select^{87}and a mean USDA yield grade of 3.2. Distribution of USDA yield grades were as follows: yield grade 1, 12.2%; yield grade 2, 37.4%; yield grade 3, 38.6%; yield grade 4, 10.4%; and yield grade 5, 1.3%. Least squares means for carcass traits within USDA yield grades are shown in Table 2. Average yield grade within each USDA yield grade group was near the center of each grade, with mean Yield Grade 4 carcasses deviating the furthest from the center of the grade. As USDA yield grade decreased (numerically), quality grade, adjusted fat thickness, hot carcass weight, and percentage kidney, pelvic, and heart fat (KPH) decreased, whereas longissimus muscle area increased ($P < 0.05$). The distribution of USDA quality grades were as follows: Prime, 2.0%; Choice, 49.1%; Select, 42.3%; Standard, 5.6%; and Commercial, Utility, Cutter, and Canner, 0.9%. Table 3 shows the least squares means for carcass traits within USDA quality grade group. As USDA quality grade increased, numerical yield grade, carcass weight and percentage KPH increased ($P < 0.05$). Longissimus muscle area decreased with increasing quality grade ($P < 0.05$).

Conclusions

The NBQA-2000 continues the process of obtaining updated information on various production factors that affect the value of live cattle and their carcasses. Quality as measured by marbling and USDA quality grade appears to be back to the level found in the early 1990's, but carcass weights continue to increase dramatically. This information adds to the existing knowledge base of beef quality and consistency factors, and will be a useful reference for various educational and research endeavors in the beef industry.

Pertinent literature

Boleman, S.L., S.J. Boleman, W.W. Morgan, D.S. Hale, D.B. Griffin, J.W. Savell, R.P. Ames, M.T. Smith, J.D. Tatum, T.G. Field, G.C. Smith, B.A. Gardner, J.B. Morgan, S.L. Northcutt, H.G. Dolezal, D.R. Gill, and F.K. Ray. 1998. National Beef Quality Audit-1995: Survey of producer-related defects and carcass quality and quantity attributes. J. Anim. Sci. 76:96-103.

Lorenzen, C.L., D.S. Hale, D.B. Griffin, J.W. Savell, K.E. Belk, T.L. Frederick, M.F. Miller, T.H. Montgomery, G.C. Smith. 1993. National Beef Quality Audit: Survey of producer-related defects and carcass quality and quantity attributes. J. Anim. Sci. 71:1495-1502.

NCBA. 2001. Beef demand up for the seventh consecutive quarter. National Cattlemen's Beef Association. Available at: http://www.beef.org/newsroom/ncba/2001/ncba01_0201a.htm. Accessed May 15, 2001.

USDA. 1997. Official United States standards for grades of carcass beef. USDA Agricultural Marketing Service. Washington, DC.
USDA. 2001a. Comparison of certified beef programs (5-10-2001) – PDF version. USDA Agricultural Marketing Service. Available at: http://www.ams.usda.gov/lsg/certprog/industry.htm. Accessed May 15, 2001.
USDA. 2001b. U.S. corn production (1-11-2001). USDA National Agricultural Statistic Service. Available at: http://www.usda.gov/nass/aggraphs/cornprod.htm. Accessed May 15, 2001.
USDA. 2001c. U.S. corn stocks (3-30-2001). USDA National Agricultural Statistic Service. Available at: http://www.usda.gov/nass/aggraphs/cornstks.htm. Accessed May 15, 2001.
USDA. 2001d. Prices received by farmers, corn, U.S. (3-30-2001). USDA National Agricultural Statistics Service. Available at: http://www.usda.gov/nass/aggraphs/pricecm.htm. Accessed May 15, 2001.

Acknowledgements
This study was supported, in part, by the National Cattlemen's Beef Assoc. on behalf of the Cattlemen's Beef Board through its $1 per head check-off program.

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

Trait	Mean	SD	Minimum	Maximum
USDA yield grade	3.0	0.9	-0.3	7.6
USDA quality grade[a]	685.0	60.6	180	890
Adjusted fat thickness, cm	1.2	0.5	-0.2	4.4
Carcass weight, kg	356.9	42.7	189.5	540.6
Longissimus muscle area, cm^2	84.5	10.8	50.3	149.7
Kidney, pelvic, and heart fat, %	2.4	0.8	0	9.0
Marbling score[b]	422.5	101.0	170	990
Lean maturity[c]	164.5	19.9	110	430
Skeletal maturity[c]	166.9	30.5	120	590
Overall maturity[c]	166.1	23.8	120	590

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

Table 2. Least squares means for carcass traits (SEM[a]) within quality grades

	USDA quality grade			
Trait	Prime	Choice	Select	Standard
USDA yield grade	3.7^{h} (0.06)	3.2^{g} (0.01)	2.8^{f} (0.01)	2.4^{e} (0.04)
USDA quality grade[b]	821^{h} (1.8)	726^{g} (0.4)	651^{f} (0.4)	584^{e} (1.1)
Adjusted fat thickness, cm	1.4^{g} (0.04)	1.4^{g} (0.01)	1.1^{f} (0.01)	0.9^{e} (0.02)
Hot carcass weight, kg	370.1^{h} (3.08)	359.2^{g} (0.63)	354.6^{f} (0.68)	347.9^{e} (1.86)
Longissimus muscle area, cm^2	78.0^{e} (0.77)	82.7^{f} (0.13)	86.3^{g} (0.13)	88.6^{h} (0.45)
Kidney, pelvic, and heart fat, %	3.1^{h} (0.05)	2.4^{g} (0.01)	2.2^{f} (0.01)	2.1^{e} (0.03)
Marbling score[c]	764^{h} (4.2)	479^{g} (0.9)	352^{g} (0.9)	312^{e} (2.5)
Lean maturity[d]	161^{e} (1.3)	161^{e} (0.3)	164^{f} (0.3)	185^{g} (0.9)
Skeletal maturity[d]	169^{g} (1.5)	164^{f} (0.3)	163^{e} (0.3)	186^{h} (0.9)
Overall maturity[d]	166^{f} (1.1)	163^{e} (0.2)	164^{f} (0.3)	186^{g} (0.7)

[a]SEM is the standard error of the least squares means.
[b]100 = Canner^{00}, 400 = Commercial^{00}, 600 = Select^{00}, and 800 = Prime^{00}.
[c]100 = Practically devoid^{00}, 300 = Slight^{00}, 500 = Modest^{00}, 700 = Slightly abundant^{00}, and 900 = Abundant^{00}.
[d]100 = A^{00} and 500 = E^{00}.
[e,f,g,h]Means within a row lacking a common superscript differ ($P < 0.05$).

Table 3. Least squares means for carcass traits (SEM[a]) within yield grades

	USDA yield grade				
Trait	1	2	3	4	5
USDA yield grade	1.6^{e} (0.01)	2.6^{f} (0.01)	3.5^{g} (0.01)	4.4^{h} (0.01)	5.4^{I} (0.03)
USDA quality grade[b]	649^{e} (1.7)	677^{f} (1.0)	698^{g} (1.0)	709^{h} (1.9)	712^{h} (5.3)
Adjusted fat thickness, cm	0.6^{e} (0.01)	1.0^{f} (0.01)	1.5^{g} (0.01)	2.0^{h} (0.01)	2.7^{I} (0.03)
Hot carcass weight, kg	341.9^{e} (1.22)	350.2^{f} (0.70)	362.4^{g} (0.69)	374.6^{h} (1.33)	390.1^{I} (3.78)
Longissimus muscle area, cm^2	97.6^{I} (0.26)	86.8^{h} (0.13)	80.7^{g} (0.13)	76.2^{f} (0.26)	72.7^{e} (0.77)
Kidney, pelvic, and heart fat, %	2.0^{e} (0.02)	2.2^{f} (0.01)	2.5^{g} (0.01)	2.7^{h} (0.02)	2.8^{I} (0.07)
Marbling score[c]	360^{e} (2.8)	404^{f} (1.6)	445^{g} (1.6)	471^{h} (3.1)	493^{I} (8.7)
Lean maturity[d]	167^{g} (0.6)	166^{f} (0.3)	163^{e} (0.3)	162^{e} (0.6)	164^{efg} (1.8)
Skeletal maturity[d]	167^{e} (0.9)	166^{e} (0.5)	167^{e} (0.5)	167^{e} (1.0)	176^{f} (2.8)
Overall maturity[d]	167^{f} (0.7)	166^{ef} (0.4)	165^{e} (0.4)	165^{e} (0.8)	170^{f} (2.2)

[a]SEM is the standard error of the least squares means.
[b]100 = Canner^{00}, 400 = Commercial^{00}, 600 = Select^{00}, and 800 = Prime^{00}.
[c]100 = Practically devoid^{00}, 300 = Slight^{00}, 500 = Modest^{00}, 700 = Slightly abundant^{00}, and 900 = Abundant^{00}.
[d]100 = A^{00} and 500 = E^{00}.
[e,f,g,h,i]Means within a row lacking a common superscript differ ($P < 0.05$).