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Quality defects in market beef and dairy cows and bulls sold through livestock auction markets in the Western United States: II. Relative effects on selling price

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Quality defects in market beef and dairy cows and bulls sold through livestock auction markets in the Western United States: II. Relative effects on selling price[1]

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ABSTRACT: Relative effects of Beef Quality Assurance (BQA)-related defects in market beef and dairy cows and bulls on selling price at auction was evaluated during 2008. The presence and severity of 23 BQA-related traits were determined during sales in Idaho, California, and Utah. Overall, 18,949 unique lots consisting of 23,479 animals were assessed during 125 dairy sales and 79 beef sales. Mean sale price ± SD (per 45.5 kg) for market beef cows, beef bulls, dairy cows, and dairy bulls was $45.15 ± 9.42, $56.30 ± 9.21, $42.23 ± 12.26, and $55.10 ± 9.07, respectively. When combined, all recorded traits explained 36% of the variation in selling price in beef cows, 35% in beef bulls, 61% in dairy cows, and 56% in dairy bulls. Premiums and discounts were determined in comparison with a "par" or "base" animal. Compared with a base BCS 5 beef cow (on a 9-point beef scale), BCS 1 to 4 cows were discounted ($P < 0.0001$), whereas premiums ($P < 0.05$) were estimated for BCS 6 to 8. Compared with a base BCS 3.0 dairy cow (on a 5-point dairy scale), more body condition resulted in a premium ($P \leq 0.001$), whereas a less-than-desirable BCS of 2.0 or 2.5 was discounted ($P < 0.0001$). Emaciated or near-emaciated cows (beef BCS 1 or 2; dairy BCS 1.0 or 1.5) were discounted ($P < 0.0001$). Compared with base cows weighing 545 to 635 kg, lighter BW beef cows were discounted ($P < 0.0001$), whereas heavier beef cows received ($P < 0.05$) a premium. Compared with a base dairy cow weighing 636 to 727 kg, lighter BW cows were discounted ($P < 0.0001$), whereas heavier cows (727 to 909 kg) received a premium ($P < 0.01$). Beef and dairy cows with any evidence of lameness were discounted ($P < 0.0001$). Presence of ocular neoplasia in the precancerous stage discounted ($P = 0.05$) beef cows and discounted ($P < 0.01$) dairy cows, whereas at the cancerous stage, it discounted ($P < 0.0001$) all cows. Hide color influenced ($P < 0.0001$) selling price in beef cattle but had no effect ($P = 0.17$) in dairy cows. Animals that were visibly sick were discounted ($P < 0.0001$). Results suggest that improving BCS and BW, which producers can do at the farm or ranch level, positively affects sale price. Furthermore, animals that are visibly sick or have a defect associated with a possible antibiotic risk will be discounted. Ultimately, animals with minor quality defects should be sold in a timely manner before the defect advances and the discount increases.

Key words: auction market, beef quality assurance, market beef cattle, market dairy cattle, price, quality defect

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INTRODUCTION

During the 2007 National Market Cow and Bull Beef Quality Audit (**NMCBBQA**), 31% of cattle evaluated in the holding pens had at least 1 visible quality defect (Hale et al., 2007). The authors reported that the greatest incidence of defects occurred in market dairy cows (37% incidence) compared with beef cows (28%), beef bulls (24%), and dairy bulls (20%). Based on these relatively high rates, it appears that clear economic signals are not being conveyed to many producers to

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Table 1. Number of sales, and ranges of dates by location, for data collected on market cows and bulls at auction (Ahola et al., 2011)[1]

Sale location[2]	Number of sales		Spring		Fall	
	Spring	Fall	Start date	End date	Start date	End date
A	7	7	March 21, 2008	May 9, 2008	September 5, 2008	October 31, 2008
B	7	6	April 1, 2008	April 30, 2008	September 10, 2008	October 15, 2008
C	7	5	March 11, 2008	May 6, 2008	September 16, 2008	November 4, 2008
D	5	5	April 2, 2008	April 30, 2008	September 10, 2008	October 15, 2008
E	6	6	March 19, 2008	April 30, 2008	August 27, 2008	October 8, 2008
F	5	5	April 1, 2008	April 29, 2008	August 26, 2008	September 30, 2008
G	8	8	March 18, 2008	April 29, 2008	August 26, 2008	October 7, 2008
H	7	6	April 1, 2008	April 30, 2008	September 10, 2008	October 15, 2008
I	6	6	March 12, 2008	May 9, 2008	August 29, 2008	October 10, 2008
J	6	7	March 20, 2008	May 1, 2008	August 28, 2008	October 23, 2008
Total	64	61				

[1]Data were collected at 10 major livestock auction markets with regular weekly sales in California (n = 4), Idaho (n = 5), and Utah (n = 1). Market dairy cows and bulls were evaluated at every location and on every date (125 different sales); however, market beef cows and bulls were only evaluated at locations A, C, E, G, I, and J (79 different sales).

[2]Names and locations of individual livestock auction markets were confidential and will not be released.

prevent specific Beef Quality Assurance (**BQA**)-related defects in market cattle and their resulting carcasses.

In 2007, a greater percentage of cow carcasses were fabricated into whole-muscle cuts compared with previous audits (Hale et al., 2007), which could increase the overall value of products from market cow and bull carcasses. Previous researchers have identified factors affecting the selling price of market cows in Arkansas (Troxel et al., 2002) and Kansas (Mintert et al., 1990) at auction. Although, these trials focused on a relatively limited number of BQA-related defects, which focused on animal health status and the presence of obvious defects including horns and brands.

Published literature on the incidence of quality defects in market cows and bulls is available, but it predominantly includes information on cattle evaluated in packing plant holding pens (NCBA, 1994; Roeber et al., 2000; Delmore et al., 2006; Hale et al., 2007). Limited research has been conducted to determine the effect of BQA-related defects on the selling price of market cattle at an auction market before slaughter. Therefore, the objectives of this experiment were to determine if BQA-related factors affect market beef and dairy cow and bull selling price at auction and identify opportunities for producers to add value to market cows and bulls before slaughter.

MATERIALS AND METHODS

Institutional Animal Care and Use Committee approval was not sought for this research project because this was strictly an observational study of animals being sold at auction immediately before slaughter through a licensed livestock auction market, by design. Animals were visually evaluated, and data were collected, from publicly available seating during weekly auction market sale offerings. Data collectors had no influence over the care or handling of animals offered for sale.

Data Collection

To examine the relationship among BQA-related traits of market cows and bulls with selling price, the incidence of quality defects among market cows and bulls was documented (Ahola et al., 2011). As described by the authors, data were collected at 10 major livestock auction markets with regular weekly sales (4 locations in California, 5 in Idaho, and 1 in Utah). During each of 2 seasons in 2008, data were collected on market cows and bulls offered for sale at 5 to 8 sales per location during each season (Table 1). Ultimately, data were collected at a total of 125 different sales (64 spring, 61 fall).

Market cows and bulls were evaluated for the presence and severity of 23 variables (Table 2) while being offered for sale in the auction ring. Data including lot size (number of animals per lot), total weight of the lot, selling price, sex, predominant breed (hide color), BCS, muscle score (**MS**), and locomotion score (**LS**) were collected on every lot. In addition, all cow lots were scored for udder size. Presence of specific BQA-related defects also were recorded [e.g., brand presence and size/number, horn presence and size, and ocular neoplasia (**ON**; cancer eye) presence and score]. Any BQA-related information not included in the 23 preselected variables (e.g., morbidity, lumpy jaw, severe weakness) was recorded under "notes."

The hypothesis for this experiment was that a statistical model could be devised to determine the factors that influence price received for market beef and dairy cows and bulls. The hypothesis was as follows:

$$\text{selling price (\$/45.5 kg)} = f(\text{physical characteristics of lots of cattle and BQA-related factors observed at sale}).$$

Table 2. Beef Quality Assurance (BQA)-related variables evaluated in market beef and dairy cows and bulls at auction (Ahola et al., 2011) [1]

Variable	Scoring options	Additional details
General BQA-related data		
Type	Beef or dairy	
Lot size	Recorded value	
Total weight of lot, kg	Recorded value	
Avg BW per animal, kg	Calculated	
Selling price, $/45.5 kg	Recorded value	
Sex	Cow or bull	
Predominant color/breed		
Beef	Black, red, white, yellow, brown, brindle, gray, roan, or other beef	
Dairy	Holstein, Jersey, other dairy	
BCS		
Beef[2]	1, 2, 3, 4, 5, 6, 7, 8, 9	1 = emaciated, 9 = obese
Dairy[3]	1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0	1 = emaciated, 5 = obese
Muscle score[4]	1, 2, 3, 4, 5	1 = very light muscled, 5 = very heavy muscled
Locomotion score[5]	1, 2, 3, 4, 5	1 = sound, 5 = extremely lame
Udder size score[6]	Small, average, extra large	
Specific BQA-related defect		
Foot abnormality	Yes or no	Screw toe, long toes, and so on
Leg band presence	Yes or no	May be related to antibiotic usage, mastitis, and so on
Bottle teats	Yes or no	
Mastitis evidence	Yes or no	
Knot presence and location	Neck, shoulder/rib, rump	Injection site knot
Retained placenta	Yes or no	
Brand presence	Yes or no	
Major brand(s) presence	Yes or no	Several (or large) brands
Horn presence and length	<2.5 cm, 2.5 to 12.7 cm, >12.7 cm	
Ocular neoplasia (cancer eye) score[4]	0, 1, 2, 3, 4, 5	0 = none, 5 = prolapsed eyeball
Prolapsed rectum or uterus	Yes or no	
Evidence of surgery	Yes or no	Cesarean section, displaced abomasum, and so on
Abscess/sore presence	Knee, hip, hock	
Other BQA defects[7]	Visibly sick, broken penis, lumpy jaw, no sale, and so on	Information related to quality or value of animal

[1]Data were collected during 125 sales at 10 major livestock auction markets with regular weekly sales in California (n = 4), Idaho (n = 5), and Utah (n = 1).
[2]Richards et al. (1986).
[3]Wildman et al. (1982).
[4]Hale et al. (2007).
[5]Sprecher et al. (1997).
[6]Ahola et al. (2009).
[7]Animals were determined to be visibly sick or unhealthy if they displayed characteristics such as lethargy, extreme weakness, significant panting, ears very down, extreme gauntness, and so on.

In particular, we attempted to derive a model and framework that could be used to determine the positive and negative price impacts resulting from observed BQA factors associated with cattle sold in the spring and fall of 2008 during the survey period, as reported by Ahola et al. (2011).

Statistical Analyses

Statistical analyses were conducted using SAS (SAS Inst. Inc., Cary, NC). Statistical analysis by sex was completed using linear regression via PROC REG procedures of SAS. Before analysis, dummy variables (Gujarati, 2003) were used to test for observer bias, regional differences, and selected BQA traits.

Premiums and discounts were determined in comparison with a "par" or "base" animal. The characteristics of a base animal were determined in part based on previous audit results (NCBA, 1994; Roeber et al., 2000; Hale et al., 2007), which highlighted traits of animals absent of any quality defects. For the beef cow model, the base animal was a single, healthy, red-hided cow, sold in the fall, weighed 545 to 635 kg, had a 5 BCS, 3 MS, 1 LS, and no horns, brands, knots, sores, ON, or feet problems. The base beef bull was a single, healthy, red-hided animal that sold in the fall, weighed 682 to 817 kg, and had no visible health issues. For the dairy cow model, the base animal was a Holstein-colored cow in a single animal lot that was healthy, sold during the fall, weighed 636 to 726 kg, and had a 3.0 BCS, 3 MS,

Table 3. Number of market beef and dairy cow and bull lots evaluated for Beef Quality Assurance (BQA)-related data at auction during 2008 (Ahola et al., 2011)[1]

Item	Number of lots	Number of animals represented
Market beef cows	8,213	9,299
Market beef bulls	1,036	1,091
Total beef	9,249	10,390
Market dairy cows	9,177	12,429
Market dairy bulls	523	660
Total dairy	9,700	13,089
Overall total	18,949	23,479

[1]Data on market dairy cows and bulls were collected during 125 sales at 10 major livestock auction markets with regular weekly sales in California (n = 4), Idaho (n = 5), and Utah (n = 1), whereas data on market beef cows and bulls were collected during 79 sales at 6 major livestock auction markets with regular weekly sales in Idaho (n = 5) and Utah (n = 1).

1 LS, average-sized udder, and no horns, brands, knots, sores, ON, foot abnormalities, leg bands, udder defects, or reproductive defects. Finally, the base dairy bull was a Holstein-colored bull that sold in a single animal lot during the fall and was healthy, weighed 682 to 817 kg, and had a 3.0 BCS, 3 MS, 1 LS, and no horns, brands, knots, sores, ON, or foot abnormalities. Dummy variables for base value traits (e.g., BCS 3.0, MS 3, LS 1) were not created because the traits of an animal were compared with the base.

RESULTS AND DISCUSSION

Model Development

Incidences of BQA-related traits in market beef and dairy cows and bulls were collected on a total of 18,949 unique lots, which consisted of 23,479 animals (Table 3), and are reported separately (Ahola et al., 2011). Distribution of selling price for these market cows and bulls is reported in Table 4. Mean selling price ± SD (per 45.5 kg of BW) for market beef cows and bulls was \$45.15 ± 9.42 and \$56.30 ± 9.21, respectively, whereas dairy cows and bulls sold for \$42.23 ± 12.26 and \$55.10 ± 9.07, respectively. Most cows (93% beef, 86% dairy) sold from \$30 to 60/45.5 kg, whereas the majority of bulls (92% beef, 94% dairy) sold for \$40 to 70/45.5 kg. Similar price data collected on over 23,000 market and replacement beef cows in Arkansas during 2001 had a similar average and variation (\$42.84 ± 10.83; Troxel et al., 2002).

Relative effects of BQA-related characteristics on selling price among market beef cows (Table 5), dairy cows (Table 6), beef bulls (Table 7), and dairy bulls (Table 8) have been included. The prediction equation developed for market beef cows enabled 36% of the variation to be explained ($R^2 = 0.3563$) when all variables listed in Table 5 were included in the model. Variables for beef bulls in Table 6 explained 35% of the variation in market beef prices ($R^2 = 0.3481$). In contrast, 61% of the variation in selling price of market dairy cows was explained ($R^2 = 0.6083$) when all variables listed in Table 6 were included in the model. Furthermore, all dairy bull variables (Table 8) explained 56% of the variation ($R^2 = 0.5649$) in dairy bull selling price. Correlation coefficients for beef market animals were not as robust as those observed in the dairy cattle markets, suggesting wider variation among market beef cattle at auction. For instance, SE and CV values reported for this study (Ahola et al., 2011) were greater for beef vs. dairy cows for most of the traits evaluated. This could be due in part to the fact that the dairy cattle that were evaluated were primarily Holsteins (over 90%; Ahola et al., 2011) as well as the possible influence of state BQA programs, which generally focus more on beef cow/calf producers practices.

Premiums and Discounts

Compared with a cow with an average-sized udder, beef cows with extra large udders were discounted \$1.74/45.5 kg ($P < 0.001$). Dairy cows with extra large udders were discounted \$1.18/45.5 kg ($P < 0.0001$). Both of these discounts likely reflect buyers anticipating a less desirable dressing percent at slaughter. In contrast, small udders resulted in a premium of \$0.64/45.5 kg ($P = 0.0001$) for beef cows and \$0.54/45.5 kg ($P = 0.01$) for dairy cows.

Evidence of horns, including animals that had been improperly dehorned shortly after birth (horn length less than 2.5 cm) as well as those with horns greater than 2.5 cm, tended ($P = 0.07$) to be discounted \$0.54/45.5 kg among beef cows, whereas beef bulls received a larger discount of \$1.08/45.5 kg ($P < 0.0001$). There was no discount among horned dairy cows ($P = 0.79$) or dairy bulls ($P = 0.46$) compared with animals without horns. Previous NMCBBQA audits in 1999 and 2007 identified horns as a concern relative to bruising incidence and hide damage (Roeber et al., 2000; Hale et al., 2007). Those audits also consistently indicated that market cow packers, national BQA Program advisory committee members, and USDA Food

Table 4. Sale price distribution of market beef and dairy cows and bulls evaluated at auction[1]

Sale price, \$/45.5 kg	Beef		Dairy	
	Cows, %	Bulls, %	Cows, %	Bulls, %
Less than \$10	0.7	0.4	3.5	0.2
\$10 to 20	0.7	0.1	2.5	0.6
\$20 to 30	3.0	0.5	5.2	1.5
\$30 to 40	18.3	2.6	17.2	3.4
\$40 to 50	50.2	14.8	48.2	14.7
\$50 to 60	24.6	48.6	20.4	44.6
\$60 to 70	2.2	29.0	2.8	35.0
Greater than \$70	0.5	4.2	0.1	—

[1]Data were collected during 125 sales at 10 major livestock auction markets with regular weekly sales in California (n = 4), Idaho (n = 5), and Utah (n = 1).

Table 5. Relative effects of Beef Quality Assurance-related characteristics in market beef cows on selling price at auction ($ per 45.5 kg)[1]

Variable[2]	Parameter estimate	SE	*P*-value	Comment
Intercept	47.65	0.26	<0.0001	
Udder-size small	0.64	0.17	0.0001	
Udder-size average	—	—	—	Base
Udder-size extra large	−1.74	0.47	<0.001	
No horns	—	—	—	Base
Horns (regardless of size)	−0.54	0.30	0.07	
No ON	—	—	—	Base
ON score 1 to 2 (precancerous)	−3.91	2.00	0.05	
ON score 3 to 5 (cancerous)	−14.95	1.21	<0.0001	
BCS 1	−13.01	1.47	<0.0001	
BCS 2	−6.78	0.51	<0.0001	
BCS 3	−5.09	0.29	<0.0001	
BCS 4	−2.12	0.22	<0.0001	
BCS 5	—	—	—	Base
BCS 6	1.65	0.24	<0.0001	
BCS 7	1.65	0.41	<0.0001	
BCS 8	1.97	0.83	0.02	
BCS 9	4.04	2.20	0.07	
BW <364 kg	−7.85	0.54	<0.0001	
BW 364 to 454 kg	−1.76	0.30	<0.0001	
BW 455 to 544 kg	−1.13	0.21	<0.0001	
BW 545 to 635 kg	—	—	—	Base
BW 636 to 726 kg	0.55	0.28	0.05	
BW 727 to 817 kg	1.75	0.48	<0.001	
BW ≥818 kg	2.31	0.81	<0.01	
MS 1	−4.75	0.33	<0.0001	
MS 2	−1.51	0.19	<0.0001	
MS 3	—	—	—	Base
MS 4	2.16	0.52	<0.0001	
MS 5	—	—	—	No incidence
LS 1	—	—	—	Base
LS 2	−1.32	0.26	<0.0001	
LS 3	−2.23	0.54	<0.0001	
LS 4	−8.55	1.04	<0.0001	
LS 5	−14.88	2.77	<0.0001	
Not branded	—	—	—	Base
Branded	1.05	0.19	<0.0001	
Major brand(s)	0.00	0.22	0.98	
Sold during fall	—	—	—	Base
Sold during spring	1.12	0.17	<0.0001	
Black hided	1.69	0.18	<0.0001	
Red hided	—	—	—	Base
Other beef color	0.42	0.31	<0.0001	
Lot size	−2.39	0.85	<0.01	
Foot abnormality	−3.34	1.60	0.04	
Bottle teats	−0.32	0.37	0.38	
Mastitis	−3.49	1.01	<0.001	
Knot on neck	—	—	—	Base
Knot on shoulder/rib	−5.04	3.62	0.16	
Knot on rump	0.34	3.66	0.93	
Retained placenta	−5.43	3.23	0.09	
Prolapse	1.45	2.97	0.62	
Surgery evidence	−8.23	2.33	<0.001	
No sores	—	—	—	Base
Sore on knee	—	—	—	No incidence
Sore on hip	−1.02	1.31	0.43	
Sore on hock	−0.03	7.38	0.99	
Not sick	—	—	—	Base
Visibly sick	−16.20	0.90	<0.0001	

[1]Data were collected during 125 sales at 10 major livestock auction markets with regular weekly sales in California (n = 4), Idaho (n = 5), and Utah (n = 1).

[2]ON = ocular neoplasia (cancer eye); MS = muscle score; LS = locomotion score.

Table 6. Relative effects of Beef Quality Assurance-related characteristics in market dairy cows on selling price at auction ($ per 45.5 kg)[1]

Variable[2]	Parameter estimate	SE	*P*-value	Comment
Intercept	50.96	0.35	<0.0001	
Udder-size small	0.54	0.22	0.01	
Udder-size average	—	—	—	Base
Udder-size extra large	−1.18	0.27	<0.0001	
No horns	—	—	—	Base
Horns (regardless of size)	−0.10	0.37	0.79	
No ON	—	—	—	Base
ON score 1 to 2 (precancerous)	−6.78	2.23	<0.01	
ON score 3 to 5 (cancerous)	−32.04	2.33	<0.0001	
BCS 1.0	−20.47	0.71	<0.0001	
BCS 1.5	−12.19	0.38	<0.0001	
BCS 2.0	−5.82	0.28	<0.0001	
BCS 2.5	−2.81	0.25	<0.0001	
BCS 3.0	—	—	—	Base
BCS 3.5	1.27	0.28	<0.0001	
BCS 4.0	1.35	0.42	0.001	
BCS 4.5	0.80	0.71	0.26	
BCS 5.0	−2.05	1.95	0.29	
BW <455 kg	−6.72	0.46	<0.0001	
BW 455 to 544 kg	−2.89	0.31	<0.0001	
BW 545 to 635 kg	−1.14	0.26	<0.0001	
BW 636 to 726 kg	—	—	—	Base
BW 727 to 817 kg	0.73	0.27	0.01	
BW 818 to 908 kg	0.97	0.36	0.01	
BW ≥909 kg	0.42	0.65	0.52	
MS 1	−6.92	0.36	<0.0001	
MS 2	−1.80	0.26	<0.0001	
MS 3	—	—	—	Base
MS 4	−2.02	1.03	0.05	
MS 5	—	—	—	No incidence
LS 1	—	—	—	Base
LS 2	−1.76	0.20	<0.0001	
LS 3	−2.88	0.27	<0.0001	
LS 4	−4.03	0.44	<0.0001	
LS 5	−12.62	1.72	<0.0001	
Not branded	—	—	—	Base
Branded	0.38	0.19	0.04	
Major brand(s)	0.08	0.74	0.91	
Sold during fall	—	—	—	Base
Sold during spring	−0.77	0.17	<0.0001	
Holstein breed/color	—	—	—	Base
Jersey breed/color	0.63	0.46	0.17	
Other dairy breed/color	−0.83	0.91	0.36	
Lot size	1.07	0.66	0.10	
Foot abnormality	−5.79	1.34	<0.0001	
Leg band	−0.52	0.35	0.14	
Bottle teats	0.23	0.96	0.81	
Mastitis	−2.35	0.48	<0.0001	
Knot on neck	—	—	—	Base
Knot on shoulder/rib	−0.28	1.78	0.88	
Knot on rump	−11.49	2.74	<0.0001	
Retained placenta	−5.06	2.23	0.02	
Surgery evidence	−8.64	2.14	<0.0001	
Prolapse	—	—	—	No incidence
No sores	—	—	—	Base
Sore on knee	−4.85	2.95	0.10	
Sore on hip	−4.58	1.17	<0.0001	
Sore on hock	−2.20	2.10	0.30	
Not sick	—	—	—	Base
Visibly sick	−15.77	0.49	<0.0001	

[1]Data were collected during 125 sales at 10 major livestock auction markets with regular weekly sales in California (n = 4), Idaho (n = 5), and Utah (n = 1).

[2]ON = ocular neoplasia (cancer eye); MS = muscle score; LS = locomotion score.

Table 7. Relative effects of Beef Quality Assurance-related characteristics in market beef bulls on selling price at auction ($ per 45.5 kg)[1]

Variable[2]	Parameter estimate	SE	*P*-value	Comment
Intercept	48.25	1.90	<0.0001	
No horns	—	—	—	Base
Horns (regardless of size)	−1.08	0.27	<0.0001	
No ON	—	—	—	Base
ON score 1 to 2 (precancerous)	0.61	5.34	0.91	
ON score 3 to 5 (cancerous)	−28.62	10.54	<0.01	
BCS 1	—	—	—	No incidence
BCS 2	−1.88	4.64	0.69	
BCS 3	0.07	0.01	<0.0001	
BCS 4	1.62	1.03	0.12	
BCS 5	—	—	—	Base
BCS 6	−5.65	1.45	0.0001	
BCS 7	−15.67	3.27	<0.0001	
BCS 8	−31.52	6.64	<0.0001	
BCS 9	—	—	—	No incidence
BW <409 kg	1.39	1.50	0.35	
BW 409 to 544 kg	−2.59	0.86	<0.01	
BW 545 to 681 kg	−3.45	0.72	<0.0001	
BW 682 to 817 kg	—	—	—	Base
BW 818 to 954 kg	2.55	0.64	<0.0001	
BW 955 to 1,090 kg	3.47	0.87	<0.0001	
BW ≥1,091 kg	2.56	2.02	0.21	
MS 1	−4.27	1.79	0.02	
MS 2	−3.16	0.67	<0.0001	
MS 3	—	—	—	Base
MS 4	0.86	0.60	0.15	
MS 5	0.72	0.93	0.34	
LS 1	—	—	—	Base
LS 2	−1.38	0.78	0.08	
LS 3	−4.10	1.54	<0.01	
LS 4	−7.08	1.94	<0.001	
LS 5	−3.87	4.07	0.34	
Not branded	—	—	—	Base
Branded	0.01	0.53	0.98	
Major brand(s)	−0.06	0.68	0.93	
Sold during fall	—	—	—	Base
Sold during spring	1.30	0.49	<0.01	
Black hided	−0.39	0.60	0.52	
Red hided	—	—	—	Base
Other beef color	−0.13	0.98	0.90	
Lot size	0.98	2.17	0.65	
Foot abnormality	−8.35	3.17	<0.01	
Knot on neck	—	—	—	Base
Knot on shoulder/rib	−0.12	1.56	0.79	
Knot on rump	—	—	—	No incidence
Surgery evidence	—	—	—	No incidence
Prolapse	—	—	—	No incidence
No sores	—	—	—	Base
Sore on knee	—	—	—	No incidence
Sore on hip	6.43	7.50	0.39	
Sore on hock	—	—	—	No incidence
Not sick	—	—	—	Base
Visibly sick	−46.28	7.77	<0.0001	

[1]Data were collected during 125 sales at 10 major livestock auction markets with regular weekly sales in California (n = 4), Idaho (n = 5), and Utah (n = 1).

[2]ON = ocular neoplasia (cancer eye); MS = muscle score; LS = locomotion score.

Safety Inspection Service personnel felt horns should be avoided. In another study, the presence of horns in Arkansas market beef cows did not affect selling price at auction, but horned beef replacement females were discounted almost $2.00/45.5 kg vs. polled cows (Troxel et al., 2002). Results of the current survey suggest that during 2008, horned beef animals, particularly bulls, were discounted; however, there was no economic disincentive for horned dairy market cattle sold at auction. Most producers appear to be avoiding horns, evident by

Table 8. Relative effects of Beef Quality Assurance-related characteristics in market dairy bulls on selling price at auction ($ per 45.5 kg)[1]

Variable[2]	Parameter estimate	SE	*P*-value	Comment
Intercept	59.16	0.78	<0.0001	
No horns	—	—	—	Base
Horns (regardless of size)	−0.57	0.77	0.46	
No ON	—	—	—	Base
ON score 1 to 2 (precancerous)	—	—	—	No incidence
ON score 3 to 5 (cancerous)	—	—	—	No incidence
BCS 1.0	—	—	—	No incidence
BCS 1.5	−4.21	3.28	0.20	
BCS 2.0	−3.28	1.17	<0.01	
BCS 2.5	1.11	0.74	0.14	
BCS 3.0	—	—	—	Base
BCS 3.5	−0.41	0.80	0.61	
BCS 4.0	−0.10	1.36	0.94	
BCS 4.5	—	—	—	No incidence
BCS 5.0	1.48	3.20	0.64	
BW <409 kg	−12.68	2.75	<0.0001	
BW 409 to 544 kg	−10.81	1.10	<0.0001	
BW 545 to 681 kg	−5.59	0.85	<0.0001	
BW 682 to 817 kg	—	—	—	Base
BW 818 to 954 kg	2.31	0.82	<0.01	
BW 955 to 1,090 kg	1.31	1.52	0.39	
BW ≥1,091 kg	4.87	2.44	0.05	
MS 1	−9.49	1.68	<0.0001	
MS 2	−3.33	0.70	<0.0001	
MS 3	—	—	—	Base
MS 4	2.09	1.10	0.06	
MS 5	2.51	2.10	0.26	
LS 1	—	—	—	Base
LS 2	−0.98	0.83	0.24	
LS 3	−1.01	1.43	0.48	
LS 4	0.71	1.19	0.55	
LS 5	−3.08	3.90	0.43	
Not branded	—	—	—	Base
Branded	1.86	0.65	<0.01	
Major brand(s)	−1.77	2.20	0.42	
Sold during fall	—	—	—	Base
Sold during spring	−1.28	0.57	0.02	
Holstein breed/color	—	—	—	Base
Jersey breed/color	2.67	1.50	0.07	
Other dairy breed/color	3.31	1.94	0.09	
Lot size	−5.98	2.41	0.01	
Foot abnormality	−6.00	4.05	0.14	
Knot on neck	—	—	—	Base
Knot on shoulder/rib	—	—	—	No incidence
Knot on rump	—	—	—	No incidence
Surgery evidence	—	—	—	No incidence
Prolapse	—	—	—	No incidence
No sores	—	—	—	Base
Sore on knee	0.61	5.25	0.91	
Sore on hip	3.68	4.06	0.36	
Sore on hock	−1.63	4.11	0.69	
Not sick	—	—	—	Base
Visibly Sick	−19.75	2.76	<0.0001	

[1]Data were collected during 125 sales at 10 major livestock auction markets with regular weekly sales in California (n = 4), Idaho (n = 5), and Utah (n = 1).

[2]ON = ocular neoplasia (cancer eye); MS = muscle score; LS = locomotion score.

the fact that 90% of beef cows, 86% of beef bulls, 95% of dairy cows, and 84% of dairy bulls in the current survey were not horned (Ahola et al., 2011).

Market beef cows with ON present and in the precancerous stage (ON score of 1 or 2) received ($P = 0.05$) a discount of $3.91/45.5 kg and were discounted ($P < 0.0001$) at $14.95/45.5 kg if in the cancerous stage (ON score of 3, 4, or 5). In contrast, beef bulls were not discounted ($P = 0.91$) if in the precancerous stage, but were discounted ($P < 0.01$) by $28.62/45.5 kg if in the cancerous stage. Market dairy cows with precancerous ON were discounted ($P < 0.01$) and sold for $6.78/45.5

kg less than cows with no signs of ON. A discount of $32.04/45.5 kg occurred ($P < 0.0001$) in cows with ON in the cancerous stage compared with dairy cows free of ON, likely due to an increased potential for cows with advanced ON being condemned at slaughter. No dairy bulls evaluated in this survey were observed with ON (Ahola et al., 2011). Among market beef cows in Arkansas observed with "bad eyes" (based on the presence of a spot on the eye) were discounted $14.55/45.5 kg compared with normal and healthy cows (Troxel et al., 2002), but specific ON scores [e.g., the 1 to 5 scale used by Hale et al. (2007)] were not recorded for cows in that study. Furthermore, Kansas market beef cows sold for $8.97/45.5 kg less than normal cows due to "bad eyes," which was equivalent to a discount of approximately 25% of the average price received for healthy cows at the time (Mintert et al., 1990). These discounts can be attributed to the increased likelihood of whole-carcass condemnation if ON is advanced, which was reported to occur in 2.1% of beef cattle and 0.3% of dairy cattle evaluated in the holding pens during the NMCB-BQA-1999 (Roeber et al., 2000). Strong economic disincentives such as those for animals with ON appear to have limited the incidence of ON in the current survey to less than 0.5% of the animals evaluated (Ahola et al., 2011). Further, data suggest that cows be shipped immediately after the first stages of ON are observed (ON score of 1 or 2) to minimize a discount.

Compared with a base animal with BCS of 5, beef cows were discounted ($P < 0.0001$; on a per 45.5 kg basis) if they were BCS 1 ($13.01), 2 ($6.78), 3 ($5.09), or 4 ($2.12). In contrast, premiums were estimated for beef cows that were BCS 6 ($1.65/45.5 kg; $P < 0.0001$), 7 ($1.65/45.5 kg), and 8 ($1.97/45.5 kg; $P < 0.05$), and premiums tended ($P = 0.07$) to occur for BCS 9 cows ($4.04/45.5 kg). Compared with a base BCS 5 beef bull, discounts were present ($P < 0.0001$) for BCS 6 ($5.65/45.5 kg), 7 ($15.67/45.5 kg), and 8 ($31.52/45.5 kg) bulls, and a slight premium was awarded for BCS 3 ($0.07/45.5 kg; $P < 0.0001$) bulls. No premiums or discounts were observed for BCS 2 ($P = 0.69$) or 4 ($P = 0.12$) beef bulls.

Compared with the base animal with BCS of 3.0, dairy cows were discounted ($P < 0.0001$) on a per 45.5 kg basis if they had a BCS of 1.0 ($20.47), 1.5 ($12.19), 2.0 ($5.82), or 2.5 ($2.81). Fleshier dairy cows received premiums of $1.27/45.5 kg ($P < 0.0001$) or $1.35/45.5 kg ($P = 0.001$) if BCS 3.5 or 4.0, respectively. Unlike in beef cows, dairy cows that had substantial flesh (BCS 4.5 or 5.0) did not receive ($P = 0.26$ and 0.29, respectively) a premium or discount compared with base (BCS 3.0) cows. Dairy bulls with a BCS of 2.0 were discounted ($P < 0.01$) at $3.28/45.5 kg, compared with bulls with a base BCS of 3.0. Otherwise, no premiums or discounts existed ($P \geq 0.14$) for dairy bulls at any other BCS. This lack of statistical separation of discounts or premiums might be due to the relatively small number of bull lots that were evaluated in the current survey, in comparison with cow lots. These cow data are consistent with previous research among market beef cows that were evaluated at auctions in Kansas, in which very thin cows received a discount of $16.07/45.5 kg and thin cows were discounted $1.33/45.5 kg compared with average flesh cows (Mintert et al., 1990). The authors also reported that fat market beef cows sold at a premium of $6.34/45.5 kg to average flesh cows.

Among cow lots evaluated in the current survey, it was clear that buyers desired moderate to heavy body fat stores in dairy cows (via premiums of $0.00 to 1.35/45.5 kg for BCS 3.0 to 4.0 dairy cows and premiums of $1.65 to 1.97/45.5 kg for BCS 6 to 8 beef cows). Cows with a less-than-desirable BCS at the lower end of each respective BCS scale were consistently discounted. Most importantly, emaciated or near-emaciated cows (beef BCS of 1 or 2; dairy BCS of 1.0 or 1.5) comprised 13.3% of the market dairy cows and 3.9% of market beef cows in the current survey (Ahola et al., 2011) and were discounted. In fact, the NMCBBQA-2007 indicated that "Poor Conditioning/Nutrition" was ranked fourth on the list of top quality challenges facing the market cow and bull beef industry (Hale et al., 2007). Thus, dairy and beef producers should consider adding value (via improved BCS) to thin market cows before sale at auction to acquire readily available premiums for moderate or fleshy cows.

Premiums and discounts paid based on BW were similar to BCS premiums and discounts. Light BW beef cows (less than 455 kg) were discounted ($P < 0.0001$; $7.85/45.5 kg for BW less than 364 kg, $1.76/45.5 kg for BW 364 to 454 kg, and $1.13/45.5 kg for BW 455 to 545 kg). Heavier BW beef cows, in comparison with cows weighing 545 to 635 kg, received ($P = 0.05$) a premium if they weighed 636 to 726 kg ($0.55/45.5 kg), 727 to 817 kg ($1.75/45.5 kg; $P < 0.001$), or more than 817 kg ($2.31/45.5 kg; $P < 0.01$). Beef bulls, compared with a base animal with a BW of 682 to 817 kg, were discounted if lighter BW ($2.59/45.5 kg for BW 409 to 544 kg, $P < 0.01$; and $3.45/45.5 kg for BW 545 to 681 kg, $P < 0.0001$) but received a premium ($P < 0.0001$) if heavier BW (from $2.55 to 3.57/45.5 kg for BW greater than 818 kg). Beef bulls in the lightest (less than 409 kg) and heaviest (1,091 kg and greater) categories were not different ($P \geq 0.21$) from the base animal (682 to 817 kg).

Dairy cows followed similar trends with discounts for lighter BW animals. Light BW dairy cows (less than 455 kg) were discounted ($P < 0.0001$) $6.72/45.5 kg compared with cows weighing 636 to 726 kg. Dairy cows weighing 455 to 544 kg and 545 to 635 kg were discounted ($P < 0.0001$) $2.89 and 1.14/45.5 kg, respectively, compared with base cows. Conversely, heavier dairy cows (727 to 817 kg and 818 to 908 kg) received premiums ($P = 0.01$) of $0.73 and 0.97/45.5 kg, respectively, vs. base cows. Very heavy cows (909 kg or more) received the same price ($P = 0.52$) as cows weighing 636 to 727 kg. Discounts among market dairy bulls were larger, based on the fact that lighter weight bulls (less than 409 kg, 409 to 544 kg, and 545 to 681

kg) were discounted ($P < 0.0001$) on a per 45.5 kg basis at \$12.68, \$10.81, and \$5.59/45.5 kg, respectively, compared with bulls weighing 682 to 817 kg. In contrast, bull lots weighing 818 to 954 kg received ($P < 0.01$) a premium of \$2.31/45.5 kg compared with base. Heavier dairy bulls (955 to 1,090 kg) did not ($P = 0.39$) receive a premium, but very heavy bulls (1,091 kg or more) sold for \$4.87/45.5 kg more ($P = 0.05$).

Similar to the current survey, Mintert et al. (1990) observed that selling price (on a BW basis) of market beef cows weighing less than 364 kg increased as BW increased compared with a base cow, but at a declining rate up to 523 to 545 kg. In contrast, an increase in selling price due to increased BW in market beef cows has been shown more recently (Troxel et al., 2002). The authors also stated that the positive relationship among BW and price in market cows is opposite to the historical negative relationship between selling price and BW in beef calves and feeder cattle. Thus, dairy and beef producers should consider adding BW to lighter BW market cows (beef cows less than 545 kg, dairy cows less than 636 kg) and bulls (less than 682 kg) before slaughter to avoid the light BW discount and to access the heavy BW premium, as well as to take advantage of an opportunity to sell more BW at a greater price.

Beef cows with lighter muscling were discounted ($P < 0.0001$) \$4.75 or 1.51/45.5 kg for MS 1 and 2, respectively. In contrast, beef cows with a MS 4 received a premium of \$2.16/45.5 kg ($P < 0.0001$). Beef bulls with MS 1 and 2 were discounted \$4.27 ($P < 0.05$) and 3.16 ($P < 0.0001$)/45.5 kg, respectively, but heavier muscled beef bulls (MS 4 or 5) were not different ($P > 0.14$) than the base price. Dairy cows with lighter muscling (MS of 1 or 2) were discounted ($P < 0.0001$) at \$6.92 or 1.80/45.5 kg, respectively, compared with MS 3 cows. Heavier muscled dairy cows (MS 4) also received a discount ($P = 0.05$) of \$2.02/45.5 kg compared with base cows. Dairy bulls with MS 1 or 2 received discounts ($P < 0.0001$) of \$9.49 and 3.33/45.5 kg, respectively, compared with MS 3 bulls. And, compared with the base, MS 4 dairy bulls tended ($P = 0.06$) to receive a premium of \$2.09/45.5 kg, whereas MS 5 dairy bulls did not ($P = 0.26$) receive a premium.

It is not clear why the economic signals observed for heavier muscled market animals were inconsistent by sex. Heavier muscling improves dressing percent and lean yield during fabrication (Boggs and Merkel, 1993). Muscle score 4 was only represented by 0.7% of the market dairy cows and 8.2% of the market dairy bulls evaluated, and only 2.4% of beef bulls and 0.2% of dairy bulls were MS 5 (Ahola et al., 2011); thus it is unlikely that enough animals were evaluated to document a statistical difference in price. Troxel et al. (2002) used a 3-point MS system that was opposite to that used in the current survey (1 = thick muscled, 3 = thin muscled), but reported increasing selling prices as muscling improved (\$36.77 to 40.23/45.5 kg). Previous market cow audits in 1994 and 1999 identified losses to the industry of \$14.43/45.5 kg (1994; NCBA, 1994) and \$18.70/45.5 kg (1999; Roeber et al., 2000) due to inadequate muscling in market animals. Consistent with BCS and BW, producers that can add muscle to lighter muscled market cattle before slaughter could avoid discounts based on inadequate muscling. However, few producers take advantage of this opportunity, based on results of a mailed survey of 142 New Mexico dairies in which no respondents indicated they had a feeding protocol for market cows before selling for slaughter (Rogers et al., 2004). Because the most recent NMCBBQA documented that a greater percentage of cow carcasses were being fabricated into whole-muscle cuts (Hale et al., 2007), it is possible that the overall value of market cow and bull carcasses may increase and thus promote value-adding strategies by producers before slaughter.

Discounts based on LS (compared with normal LS = 1) varied, depending on the severity of lameness exhibited by the market animal. Beef cows with less severe lameness (LS 2 = hunched back only when walking; LS 3 = hunched back when standing and walking) were discounted ($P < 0.0001$) \$1.32 and 2.23/45.5 kg. Beef cows that had a hunched back while standing and walking and favoring one limb (LS 4) were discounted ($P < 0.0001$) at \$8.55/45.5 kg. Beef cows that refused to bear weight on a limb and had great difficulty walking (LS 5) received ($P < 0.0001$) a major discount of \$14.88/45.5 kg. Beef bulls were observed to have discounts based upon LS, because bulls with LS of 2 (mildly lame) tended ($P = 0.08$) to be discounted \$1.38/45.5 kg. True lameness in beef bulls (LS 4) was discounted ($P < 0.0001$) by \$7.08/45.5 kg, whereas bulls with LS of 5 (severely lame) were not different from the base. One would assume that LS 5 animals would receive the largest discount; however, because the incidence of LS 5 animals was low, there were not enough observations in the data set for the discount to be significant at the $P < 0.05$ level. Dairy cows also were discounted due to lameness, based on LS 2 and 3 cows receiving discounts ($P < 0.0001$) of \$1.76 and 2.88/45.5 kg, respectively. Dairy cows with an LS 4 were discounted ($P < 0.0001$) at \$4.03/45.5 kg, and those with an LS 5 received a discount ($P < 0.0001$) of \$12.62/45.5 kg. Arkansas market beef cows classified as lame were discounted \$6.97/45.5 kg compared with normal, healthy cows (Troxel et al., 2002), but cows were not evaluated on the same LS scale that was used in the current survey. There were no discounts ($P \geq 0.24$) based on LS among dairy bulls, probably due to the relatively small number of dairy bulls that were evaluated (compared with cows) and the large amount of variation in the population. Cows or bulls hesitant to bear weight on one or more limbs (LS 4 or 5) should not be marketed through auction markets due to a greatly increased likelihood of becoming nonambulatory.

Compared with unbranded beef cows, those with at least 1 brand received ($P < 0.0001$) a premium of \$1.05/45.5 kg. Dairy cows with at least 1 brand received ($P < 0.05$) a small premium of \$0.38/45.5 kg. Beef bulls had no premiums or discounts ($P = 0.98$)

compared with unbranded animals, whereas dairy bulls observed with at least 1 brand received ($P < 0.01$) a premium of \$1.86/45.5 kg compared with unbranded bulls. The price received for an animal with several brands (or one large brand) was not different ($P \geq 0.91$) from unbranded beef cows, dairy cows, beef bulls, or dairy bulls. Similar to the current survey, Troxel et al. (2002) reported a small premium for market beef cows with 1 (\$1.21/45.5 kg) or 2 or more (\$1.87/45.5 kg) brands compared with unbranded cows.

Reasons branded beef and dairy cows and dairy bulls received a premium are difficult to determine. According to previous market cattle audits (NCBA, 1994; Roeber et al., 2000), the beef industry loses an estimated \$3.10 to 4.56 per animal from hide value loss due to hot-iron brands. Data from the current survey indicate that no market signal was relayed to producers to reduce hide devaluation from branding. In fact, it is feasible that the premiums for branded cattle may be due to buyers purchasing reputation or known-source cattle, which can be determined in part via the presence of a visible brand at auction.

Compared with selling during the fall (August through November), beef cows sold during spring (March through May) received ($P < 0.0001$) a premium of \$1.12/45.5 kg. Beef bulls also received ($P < 0.01$) a premium of \$1.30/45.5 kg for spring vs. fall sale. In contrast, dairy animals sold during the spring were discounted at a rate of \$0.77/45.5 kg for cows ($P < 0.0001$) and \$1.28/45.5 kg for bulls ($P < 0.05$) compared with fall. Seasonal differences observed among dairy cattle were contrary to documented seasonal differences in market cow prices at auction, but not as large in magnitude (personal communication, Kevin Good, Cattle-Fax, Centennial, CO). Previous researchers reported greater market beef cow prices during spring vs. fall (September through November; Troxel et al., 2002). As well, Mintert et al. (1990) reported a large difference in market beef cow price by season in which prices were \$9.34/45.5 kg greater during spring 1987 compared with fall 1986. Our results from the beef models follow similar seasonal trends, though smaller in magnitude than the earlier work.

Beef cows with a predominantly black hide received ($P < 0.0001$) a premium of \$1.69/45.5 kg compared with the base color of red. Other beef colors also received ($P < 0.0001$) a premium compared with red-hided beef cows. Beef bulls were not price differentiated by hide color ($P \geq 0.52$). Predominant hide color or estimated breed makeup or both of market dairy cows did not affect ($P \geq 0.17$) sales price among Holstein (base), Jersey, or other dairy breeds. Dairy bulls with a Jersey appearance tended ($P = 0.07$) to receive a premium of \$2.67/45.5 kg compared with Holstein bulls. Bulls of other dairy breeds also tended ($P = 0.09$) to receive a \$3.31/45.5 kg premium vs. Holstein bulls.

Larger lot sizes among beef cows were discounted ($P < 0.05$) by \$2.39/45.5 kg, whereas lot size did not affect ($P = 0.65$) beef bull price. Dairy cow lots that contained more than 1 animal tended ($P = 0.10$) to sell at a premium to lots with only 1 cow. If bulls were sold in a lot with more than 1 animal, the lot was discounted ($P = 0.01$) \$5.98/45.5 kg compared with if sold in a single-animal lot. In Kansas market beef cows sold at auction during 1986 and 1987, Mintert et al. (1990) documented that premiums were paid for lot sizes greater than 1 animal at a rate of \$0.60/45.5 kg for a 5-animal lot and \$1.25/45.5 kg for an 11- to 15-animal lot.

Beef cows with foot abnormalities received ($P < 0.05$) a discount of \$3.34/45.5 kg, whereas beef bulls received ($P < 0.01$) a discount of \$8.35/45.5 kg. Dairy cows with foot abnormalities were ($P < 0.0001$) discounted \$5.79/45.5 kg compared with normal cows, although foot abnormalities in dairy bulls did not affect ($P = 0.14$) selling price. Presence of 1 or more colored leg bands on a dairy cow, which are typically used in the dairy industry to identify a cow for a variety of reasons (e.g., treated with antiobiotics), did not affect ($P = 0.14$) selling price. Apparently, buyers were not concerned that a leg band might indicate a trait that influences the carcass value of a cow.

Udder problems including bottle teats or mastitis had a low incidence among cows evaluated. Presence of bottle teats did not affect selling price among beef ($P = 0.38$) or dairy ($P = 0.81$) cows; however, beef cows with visible signs of mastitis were discounted ($P < 0.001$) by \$3.49/45.5 kg, and dairy cows with mastitis sold for \$2.35/45.5 kg less ($P < 0.0001$) than cows without mastitis.

Presence of visible injection-site knots located on the shoulder or rib did not affect ($P \geq 0.16$) the selling price of beef or dairy cows, compared with beef or dairy cows with knots on the neck (the ideal location, based on national BQA guidelines). Knots in the rump area did not influence ($P = 0.93$) beef cow selling price, but did result in a discount ($P < 0.0001$) of \$11.49/45.5 kg among dairy cows, compared with cows with a knot in the neck region. Regardless of body location, Mintert et al. (1990) documented a \$3.69/45.5 kg discount among market beef cows with visible knots that were sold in Kansas auction markets. Among market bulls, injection-site knots were only observed in beef animals, but had no effect ($P = 0.79$) on selling price. Based on data from the current survey, it appears that there is an economic disincentive in dairy cows to administer injections in the rump compared with the neck. It is unclear why a discount was present in dairy cows but not in beef cows.

Presence of reproduction-related defects led to discounts, as evidenced by beef cows with a retained placenta tending ($P = 0.09$) to be discounted by \$5.43/45.5 kg. Dairy cows with a retained placenta were discounted ($P < 0.05$) \$5.02/45.5 kg compared with base cows. Beef cows were the only class of cattle in which a prolapsed rectum or vagina was observed; however, no discount was observed ($P = 0.62$) for this problem, primarily because only 0.07% of beef cows had this con-

dition (Ahola et al., 2011). Beef cows with any evidence of a recent surgery were discounted ($P < 0.001$) by \$8.23/45.5 kg, and dairy cows received \$8.64/45.5 kg less ($P < 0.0001$) than cows without evidence of surgery. An increased risk of condemnation and carcass devaluation at slaughter is probably the primary driver behind these discounts.

Beef cows had minimal (1 animal) incidence of sores, and therefore prices were not different ($P \geq 0.43$) from base values. Dairy cows with a visible hip sore resulted in a discount ($P < 0.0001$) of \$4.58/45.5 kg compared with cows without sores. Sores on the knee tended ($P = 0.10$) to result in a discount of \$4.85/45.5 kg compared with no sores, and dairy cows with sores on the hock were not discounted ($P = 0.30$). Among bulls, the presence of active sores did not influence ($P \geq 0.36$) selling price. Presence of a hip sore may be one of the best indications that an animal was recently nonambulatory, which could provide insight into the future likelihood of an animal becoming nonambulatory.

Animals that were visibly sick while in the auction ring were discounted ($P < 0.0001$) \$16.20/45.5 kg (beef cows), \$46.28/45.5 kg (beef bulls), \$15.77/45.5 kg (dairy cows), and \$19.75/45.5 kg (dairy bulls) compared with animals that were not sick. The discount for sick beef bulls should be viewed with caution because only 1 animal was reported in that condition. A discount of \$14.26/45.5 kg was reported among sick market beef cows in Arkansas (Troxel et al., 2002), and a \$5.33/45.5 kg discount was reported by Mintert et al. (1990) in market beef cows that displayed signs of hardware disease. Discounts given to sick cows were probably associated with the likelihood of an animal dying or becoming nonambulatory before slaughter, being condemned, or yielding a poor quality carcass at slaughter.

Implications

Based on this survey, body condition and BW emerged as 2 of the most important factors determining potential premiums that cattle producers can receive for their market cows when selling through a livestock auction. Further, these data have underscored BQA recommendations for producers, including the need to cull animals in a timely manner as one of the best measures to maintain their salvage value. Cattle producers should consider adding value by increasing body condition and BW in thin and light BW market cows before sale to acquire readily-available premiums. Economic models developed can help producers determine if such a strategy is cost-effective by comparing potential added revenue with input costs such as feed and labor.

LITERATURE CITED

Ahola, J. K., H. A. Foster, D. L. VanOverbeke, K. S. Jensen, R. L. Wilson, J. B. Glaze Jr., T. E. Fife, C. W. Gray, S. A. Nash, R. R. Panting, and N. R. Rimbey. 2011. Survey of quality defects in market beef and dairy cows and bulls sold through livestock auction markets in the Western United States: I. Incidence rates. J. Anim. Sci. 89:1474–1483.

Boggs, D. L., and R. A. Merkel. 1993. Live Animal Carcass Evaluation and Selection Manual. 4th ed. Kendall-Hunt Publishing Co., Dubuque, IA.

Delmore, R., J. L. Beckett, L. Delmore, and L. R. Barbieri. 2006. The final report of the California Dairy Cow Quality Audit. California Beef Council, Sacramento, CA.

Gujarati, D. N. 2003. Basic Econometrics. 4th ed. McGraw-Hill/Irwin, New York, NY.

Hale, D. S., J. W. Savell, R. J. Delmore, D. D. Johnson, T. D. Pringle, W. R. Henning, R. J. Maddock, T. E. Lawrence, and J. D. W. Nicholson. 2007. National Market Cow and Bull Beef Quality Audit-2007: A Survey of Producer-Related Defects. Final Report to the National Cattlemen's Beef Association, Centennial, CO.

Mintert, J., J. Blair, T. Schroeder, and F. Brazle. 1990. Analysis of factors affecting cow auction price differentials. Southern J. Agric. Econ. 1990:23–30.

NCBA. 1994. Executive Summary of the 1994 National Non-Fed Beef Quality Audit. National Cattlemen's Beef Association, Englewood, CO.

Richards, M. W., J. C. Spitzer, and M. B. Warner. 1986. Effect of varying levels of postpartum nutrition and body condition at calving on subsequent reproductive performance in beef cattle. J. Anim. Sci. 62:300–306.

Roeber, D. L., K. E. Belk, G. C. Smith, J. D. Tatum, T. G. Field, J. A. Scanga, C. D. Smith, P. D. Mies, H. A. Foster, T. K. Kennedy, B. R. Moore, and S. G. Hodge. 2000. Improving the consistency and competitiveness of market cow and bull beef; and, improving the value of market cows and bulls. The Final Report of the National Market Cow and Bull Beef Quality Audit–1999. National Cattlemen's Beef Association, Englewood, CO.

Rogers, C. A., A. C. Fitzgerald, M. A. Carr, B. R. Covey, J. D. Thomas, and M. L. Looper. 2004. On-farm management decisions to improve beef quality of market dairy cows. J. Dairy Sci. 87:1558–1564.

Sprecher, D. J., D. E. Hostetler, and J. B. Kaneene. 1997. A lameness scoring system that uses posture and gait. Theriogenology 47:1179–1187.

Troxel, T. R., M. S. Gadberry, S. Cline, J. Foley, G. Ford, D. Urell, and R. Wiedower. 2002. Factors affecting the selling price of replacement and market cows sold at Arkansas livestock auctions. Prof. Anim. Sci. 18:380–386.

Wildman, E. E., G. M. Jones, P. E. Wagner, R. L. Boman, H. F. Troutt Jr., and T. N. Lesch. 1982. A dairy cow body condition scoring system and its relationship to selected production characteristics. J. Dairy Sci. 65:495–501.