Canadian beef quality audit

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Abstract — A study was conducted in 4 Canadian processing plants in 1995–96 to determine the prevalence of quality defects in Canadian cattle. One percent of the annual number of cattle processed in Canada were evaluated on the processing floor and 0.1% were graded in the cooler.

Brands were observed on 37% and multiple brands on 6% of the cattle. Forty percent of the cattle had horns, 20% of which were scurs, 33% were stubs, 10% were tipped, and 37% were full length. Tag (mud and manure on the hide) was observed on 34% of the cattle. Bruises were found on 78% of the carcasses, 81% of which were minor in severity. Fifteen percent of the bruises were located on the round, 29% on the loin, 40% on the rib, 16% on the chuck, and 0.02% on the brisket. Grubs were observed in 0.02% of the steers, and injection sites were observed in 1.3% of whole hanging carcasses. Seventy percent of the livers were passed for human food and 14% for pet food; 16% were condemned. Approximately 71% of the liver condemnations were due to liver abscesses. Four percent of the heads, 6% of the tongues, and 0.2% of whole carcasses were condemned. The pregnancy rate in female cattle was approximately 6.7%.

The average hot carcass weight was 357 kg (s = 40) in steers, 325 kg (s = 41) in heifers, 305 kg (s = 53) in cows, 388 kg (s = 62) in virgin bulls and 340 kg (s = 39) in mature bulls. The average ribeye area in all cattle was 84 cm^2 (s = 12); range 29 cm^2 to 128 cm^2. Grade fat was highly variable and averaged 9 mm (s = 4) for steers and heifers, 6 mm (s = 6) for cows, 5 mm (s = 1) for virgin bulls, and 4 mm (s = 0.5) for mature bulls. The average lean meat yield was 59.7% in cattle (s = 3.4); range 39% to 67%. One percent of the carcasses were devoid of marbling, 1% were dark cutters, and 0.05% of the steer carcasses were staggy. Six percent of the carcasses had poor conformation, 3.7% were underfinished, and 0.7% were overfinished. Yellow fat was observed in 4% of the carcasses; 10% of carcasses were aged.

Based on January 1996 prices, the economic analysis showed that the Canadian beef industry lost $70.52 per head or $189.6 million annually from quality nonconformities. Methods identified to reduce these nonconformities included improvements in management, animal identification, handling, genetic selection, marketing, grading, and information transfer.

Résumé — Vérification de la qualité du bœuf au Canada. Une étude a été menée dans 4 usines canadiennes de transformation en 1995–1996 afin de déterminer la prévalence des défauts affectant les bovins au Canada. Un pour cent du nombre annuel des bovins abattus au Canada ont été évalués sur le plancher d'abattage et 0,1 % l'ont été au réfrigérateur. Des estampes ont été observées chez 37 % des bovins et des estampes multiples chez 6 %. Quarante pour cent des bestiaux avaient des cornes, 20 % de celles-ci étaient des cicatrices, 33 % des moignons, 10 % avaient l'extrémité

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coupée et 37 % étaient complètes. On a remarqué des plaques (boue et fumier sur la peau) chez 34 % des bestiaux. Des meurtrissures ont été trouvées chez 78 % des carcasses, 81 % de celles-ci étaient mineures. Quinze pour cent des meurtrissures étaient localisées sur la ronde, 29 % sur la longe, 40 % sur les côtes, 16 % sur le paleron et 0,02 % sur la poitrine. Des asticots ont été observés chez 0,02 % des bouvillons et des sites d'injection sur 1,3 % des carcasses entières suspendues. Soixante-dix pour cent des foies ont été destinés à la consommation humaine, 14 % à la consommation des animaux de compagnie et 16 % ont été condamnés. Approximativement 71 % des foies condamnés l'ont été à cause d'abcès. Quatre pour cent des têtes, 6 % des langues et 0,2 % des carcasses complètes ont été condamnées. Le taux de gestation chez les vaches et génisses était d'environ 6,7 %. Le poids moyen d'une carcasse à l'abattage était de 357 kg (E.T. = 40) pour les bouvillons, 325 kg (E.T. = 41) pour les génisses, 305 kg (E.T. = 53) pour les vaches, 388 kg (E.T. = 62) pour les jeunes taureaux et 340 kg (E.T. = 39) pour les taureaux matures. La surface moyenne du centre de la côte était de 84 cm^2 (E.T. = 12) chez tous les bovins, avec des variations allant de 29 cm^2 à 128 cm^2. Le gras de classification variait beaucoup et avait en moyenne 9 mm (E.T. = 4) pour les bouvillons et les génisses, 6 mm (E.T. = 6) pour les vaches, 5 mm (E.T. = 1) pour les jeunes taureaux et 4 mm (E.T. = 0,5) pour les taureaux matures. Le rendement en viande maigre représentait en moyenne 59,7 % du poids des bestiaux (E.T. = 3,4), variant de 39 à 67 %. Un pour cent des carcasses n'étaient pas persillées, 1 % étaient violacées à la coupe et 0,05 % des carcasses de bouvillons avaient un aspect de venaison. Six pour cent des carcasses présentaient une mauvaise conformation, 3,7 % étaient sous engraissées et 0,7 % sur engraissées. Un gras jaune était observé chez 4 % des carcasses et 10 % des carcasses étaient âgées.

Selon les prix de janvier 1996, l'analyse économique montre que l'industrie canadienne du bœuf a perdu 70,52 $ par tête, soit 189,6 millions par année à cause des problèmes de non-conformité. Les moyens recommandés pour réduire ces problèmes de non-conformité comprennent une amélioration de la gestion, l'identification des animaux, la manipulation, la sélection génétique, la mise en marché, la classification et le transfert d'information.

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Introduction

Beef quality and food safety are important market and trade issues for the Canadian beef industry. In 1994, Canadian beef industry stakeholders adopted a mission to have Canadian beef recognized as the best for quality and safety in the world. To achieve that goal, baseline information on the kind of beef currently being produced was required, so that strategies to achieve improvement could be identified. Quality must be measured in order to be managed. Therefore, the management committee of the *Canadian Cattlemen — Quality Starts Here* program initiated a study at the processing sector of the food chain to determine shortfalls in the current beef production system that could be addressed by the producer. The management committee consists of major stakeholders in the beef industry, from pasture to plate, and its function is to oversee food quality and safety projects. A working group, with representatives from Canada's 4 largest processing plants, the Canadian Cattlemen's Association, the Alberta Cattle Commission, Agriculture and Agri-Food Canada, and Alberta Agriculture, Food & Rural Development, was established to determine the objectives of the study and to plan its design and execution.

The objectives were 4-fold. The 1st was to determine the prevalence of "producer manageable" quality defects in Canadian cattle. The 2nd objective was to estimate the economic losses incurred from these defects. The 3rd objective was to identify strategies to reduce nonconformities, and the last objective was to disseminate the findings to all interested parties.

Materials and methods

Processing plants

Four processing plants in Canada agreed to participate in this study; they were Lakeside/IBP Packers in Brooks, Alberta; Cargill Foods in High River, Alberta; XL Beef in Calgary, Alberta; and Better Beef in Guelph, Ontario. These 4 plants currently process approximately 80% of the cattle slaughtered annually in Canada. Lakeside/IBP and Cargill are high-speed plants, processing approximately 300 cattle per hour, and the other 2 plants are slow-speed plants, processing approximately 130 cattle per hour. Each plant was visited on 5 consecutive days in August 1995, November 1995, and March 1996 to try to establish yearly prevalence data. Three days were spent on the processing floor and 2 d were spent grading carcasses in the cooler. Using prevalence estimates of nonconformities at 1%, with an allowable error of 0.005%, the minimum sample size required was approximately 1584 animals (1). The sample sizes used in the audit of the processing floor and cooler were well above this minimum number, as described below.

Processing floor audit

Three technicians collected data on the processing floor from 50% of the animals in each lot of cattle, with a lot size of ≥10 head. Lot generally refers to a group of cattle sold by 1 owner in a particular day. Depending on the line speed and human fatigue, the technicians recorded data either on the first 50% of carcasses in the lot, every other carcass in the lot, or the last 50% of carcasses in the lot. A formal random selection method to

sample carcasses could not be used in this study because of the practical limitations listed above. Based on the large number of carcasses sampled and the lack of a consistent selection bias of carcasses within a lot, the estimates are most likely close to the true prevalence. The design for this study was similar to the National Cattlemen's Beef Association (NCBA) Audits in 1991, 1994, and 1995 (2–4); it was deemed desirable that the Canadian study be designed similarly to provide comparisons. The 1st author trained with the Colorado beef audit team from the NCBA and then trained the Canadian technicians. During the audit, technicians did not switch tasks, but stayed with the same job throughout the study to reduce variability in subjective measures of outcome.

The 1st technician recorded data on brands, horns, and tag (mud and manure on the hide). Brands were individually recorded for their location (hip, rib, shoulder) and number per hide. The frequency and type of horns were recorded. Horns that were ≤2 in (5.0 cm) long were called scurs; those 2 to 3 in (5.0 to 7.5 cm) long were called stubs; those ≥4 in (10.0 cm) long with a tipped point were called tipped, and those ≥4 in long with a sharp point were called a full horn. Type of horn was only recorded in November and March, because this was a measure added-on after the August audit. A tag score that ranged from 0 for a clean dry hide to 10 for a very dirty wet hide was used; it included a subjective score of 0 to 3 for the area and extent of tag on each of the legs, belly, and sides, and a score of 1 if the hide was wet rather than dry.

The 2nd technician recorded the number, location, and severity of bruises, and the frequency and severity of grubs and surface injection site lesions in whole hanging carcasses prior to trimming. Bruises were scored for their number per carcass, location (brisket, chuck, rib, loin, round), and severity (minor approximately 0.66 lb (300 g) of trim; major approximately 1.5 lb (680 g) of trim; critical approximately ≥3.2 lb (1451 g) of trim) (2,4). Grubs and injection site lesions were similarly scored for location and severity.

The 3rd technician scored livers for abscesses according to the ELANCO scoring system (0 = no abscesses; A− = 1 or 2 abscesses or abscess scars; A = 2 to 4 well organized abscesses, generally <1 in (2.5 cm) in diameter; and A+ = 1 or more large active abscesses with inflammation of the liver tissue) (5,6). The technician also recorded the disposition of the livers, based on the meat inspector's decision to categorize livers for human food, pet food, or condemnation. Plant data were collected on the number of head, tongue, and whole carcass condemnations, and on fetuses bled for fetal calf serum, as a surrogate measure of pregnancy.

Cooler audit

In the cooler, 2 technicians graded 10 percent of the animals in lots of cattle with ≥10 head. Sometimes the 1st 10% of carcasses in a lot were graded, sometimes the middle 10%, and sometimes the last 10% depending on the speed of the line and when the technicians had to warm up because of chilling; there was no obvious consistent selection bias. Carcasses that had been chilled for 24 h were evaluated; carcasses that had been chilled >24 h were excluded to avoid the appearance of greater marbling. Data were recorded on the type (beef, dairy), sex (steer, heifer, cow, virgin bull, bull), ribeye fat thickness (top, middle, bottom, grade), muscle score, marbling score (devoid, A, AA, AAA), hot carcass weight, finish, dark cutters, staggy, conformation, yellow fat, and carcass age, using the Canadian grading system (7). Lean meat yield was calculated from the following grading equation: lean yield = 63.65 + (1.05 × muscle score) — (0.76 × grade fat). Grades were determined for each carcass from the information listed above as per the Canadian grading system (7).

Statistical analysis

All data were entered in a database (Reflex 2.0, Borland International, Scotts Valley, California, USA) and then transferred to analytical software (STATISTIX 4.1, Analytical Software, Tallahassee, Florida, USA). Simple descriptive statistics for the nonconformities, such as, prevalence and means, were calculated for the entire dataset and by sex and type of animal and season.

For the economic analysis, CANFAX developed spreadsheets in Lotus 1.2.3 (Lotus 1.2.3 release 5, Lotus Development Corporation, Cambridge, Massachusetts, USA), using the study's prevalence data, current market and packer price information for January 1996, and the economic formulas described in the NCBA Audits (2–4). The losses were assessed and confirmed by consensus when major stakeholders in the beef industry met at the strategic meeting described below. Hide losses from brands were based on price quotes from the Jacobsen report for May 1996 (8), with discounts of $10 for rib brands, $5 for hip and shoulder brands, and $10 for multiple brands. Horn losses were based on losses from additional labor to remove the horns. Tag losses were based on additional employee costs, production line slowdown, hide damage, and trim loss. Losses for bruises were based on trim losses and 10% discounts in primal cuts from critical bruises, as described in the NCBA audit (2–4). Grub losses were based on estimated trim losses by the working group. Losses due to injection site lesions were based on values from the NCBA Audit at a Canadian: USA dollar conversion of $0.72 (2–4,9,10). The USA losses were based on the national incidence of injection site lesions in top sirloin butts, bottom rounds, eye of rounds, and inside rounds in 1995, the weight of trimmed tissue, the price per pound of USA Choice subprimals during the calendar year 1995, the salvage value of the remaining piece (kabobs, stew meat, ground hamburger), and the costs for material and labor (4). Since Canadian beef prices reflect USA beef prices, and the incidence of injection site lesions in top butts and rounds from the Canadian injection site audit is similar to the NCBA injection site audits (unpublished observations), the USA value most likely reflects losses in Canada. The incidence of injection site lesions in the whole hanging carcass was not used in the economic analysis, because it grossly underestimates the true prevalence, since most injection sites are found deep in the muscle (2–4,9,10). Liver discounts, overall and for abscesses, were based on average January 1996 prices for edible and pet food livers and an average liver weight of 6.8 kg, based on packers' experience. An additional loss for negative

feedlot performance in steers and heifers with A+ livers was based on previously reported estimates (5,6). Head discounts were based on a price of $5.75 per head, and tongue discounts were based on average January 1996 prices and a weight of 1.5 kg for a #1 tongue and 1.4 kg for a # 2 tongue, according to the packers. Carcass condemnation losses were based on data from Agriculture and Agri-Food Canada and average January 1996 prices per carcass. Economic losses were not attributed to pregnancy, since pregnancy could not be accurately determined. The plants did not keep track of whether the fetuses came from cows or heifers. Weight and grade discounts were based on January 1996 packer information. Losses were calculated on a per head basis, which is the total industry loss divided by the total number of cattle slaughtered, and a total loss to the industry.

Strategic meeting

On May 9 and 10, 1995, major stakeholders in the beef industry met to discuss the results of the audit and to come to an agreement on how to determine economic losses. Additionally, the participants identified targets to strive for and strategies to reduce nonconformities based on a general consensus of the group.

Results

Processing floor audit

One percent of the Canadian annual slaughter of 2.7 million head of cattle were assessed in the processing audit. From cattle evaluated, 59% of lots were steers, 33% were heifers, 7% were cows, 0.1% were bulls, and 1% were mixed (more than 1 type within the lot). The proportion of cows processed was 4% in August, 10% in November, and 8% in March.

Brands, horns, and tag were scored on 26 029 head of cattle. Brands were observed on 37% and multiple brands on 6% of the cattle. Ten percent of the brands were located on the shoulder, 43% on the rib, and 47% on the hip. Brands were observed on 57% of the cattle in August, 23% in November, and 31% in March. Forty percent of the cattle had horns. Twenty percent were scurs, 33% were stubs, 10% were tipped, and 37% were full horns (November and March data only). Tag was observed on 34% of the hides and the average tag score was 1.9 in August and 2.7 in March.

Of the 26 054 carcasses evaluated for bruises, 22% had no bruises, 26% had 1 bruise, 24% had 2 bruises, 16% had 3 bruises, and 12% had 4 or more bruises. Eighty-one percent of the bruises were minor in severity, 14% were major, and 5% were critical. The proportion of carcasses with critical bruises was 5% in August, 6% in November, and 2% in March. Fifteen percent of the bruises were located on the round, 29% on the loin, 40% on the rib, 16% on the chuck, and 0.02% on the brisket. Bruise severity within location is shown in Figure 1A. Grubs were only observed on steer carcasses (0.02%). Surface injection site lesions were observed on 1.3% of whole hanging carcasses. Ninety-one percent of the injection site lesions were located on the shoulder, 1% on the rib, and 8% on the hip. Eighty-two percent of the lesions were minor in severity, 14% were major, and 4% were critical.

Livers from 25 944 carcasses were assessed. Seventy percent of the livers were passed for human food, 14% for pet food, and 16% were condemned. Livers were scored for abscesses as follows: 0 = 78%, A− = 10%, A = 6% and A+ = 6%. Four percent of heads were condemned. Approximately 6% of tongues were condemned, 73% were graded #1, and the remaining 21% were graded #2. Whole carcasses were condemned at the level of 0.2%. Reasons for carcass condemnation included: emaciation, neoplasia, pneumonia/pleuritis, arthritis, nephritis, septicemia/toxemia, peritonitis, edema, bruising, cellulitis, abscesses, sarcosporidiosis, serous fat atrophy, icterus, mastitis, and myositis. Fetal blood collections were made from 6.7% of female cattle, and the estimated pregnancy rate was 3% in August and November, and 11% in March. For the breakdown of nonconformities by type of cattle, refer to Table 1.

Cooler audit

In total, 3225 carcasses were graded for this audit, representing approximately 0.1% of the annual slaughter of cattle in Canada. The carcasses were 61% steer carcasses, 29% heifer carcasses, 10% cow carcasses, and 0.3% bull carcasses. The proportion of cow carcasses graded in this audit was 4% in August, 15% in November, and 11% in March. The majority of carcasses (56%) were beef and the remaining 44% were dairy.

The average hot carcass weight was 357 kg (s = 40) for steers, 325 kg (s = 41) for heifers, 305 kg (s = 53) for cows, 388 kg (s = 62) for virgin bulls (n = 6), and 340 kg (s = 39) for mature bulls (n = 4). The carcass weight was highly variable as shown in Figure 1B.

The average ribeye area in all cattle was 84 cm^2 (s = 12) ; range 29 cm^2 to 128 cm^2. The average ribeye area by type of cattle is shown in Table 2. Ribeye areas were variable as shown in Figure 1C. The average ribeye area was 75 cm^2 in beef cows and 64 cm^2 in dairy cows.

The average ribeye fat measurement was 12 mm (s = 6) for the top, 11 mm (s = 5 mm) for the middle, 10 mm (s = 4 mm) for the bottom, and 9 mm (s = 4 mm) for the grade. Beef cows had an average of 8 mm grade fat and dairy cows had an average of 4 mm grade fat. The variability observed in grade fat is shown in Figure 1D.

The average lean meat yield was 59.7% (s = 3.4); range 39% to 67%. The yield was ≤53% in 3% and ≥61% in 37% of the steer and heifer carcasses (Figure 1E). All of the bulls were yield 1 (≥59% lean). The average lean yield in beef cows was 59.6% and in dairy cows it was 61.7%.

One percent of the carcasses were devoid of marbling (Table 2). Fifteen percent of the dairy cows and 6% of the beef cows were devoid of marbling. The percentage distribution of marbling within grade is shown in Table 3 and the grade distribution is shown in Table 2.

Overall, 1.6% of the carcasses were dark cutters. Seven percent of the beef cows were dark cutters in comparison with 1% of the dairy cows. Among beef cows, the prevalence of dark cutters was 15% in August, 7% in November, and 0% in March.

Six percent of the carcasses had poor conformation and this was only observed in cows. Overall, 3.7% of the carcasses were underfinished and 0.7% were overfinished.

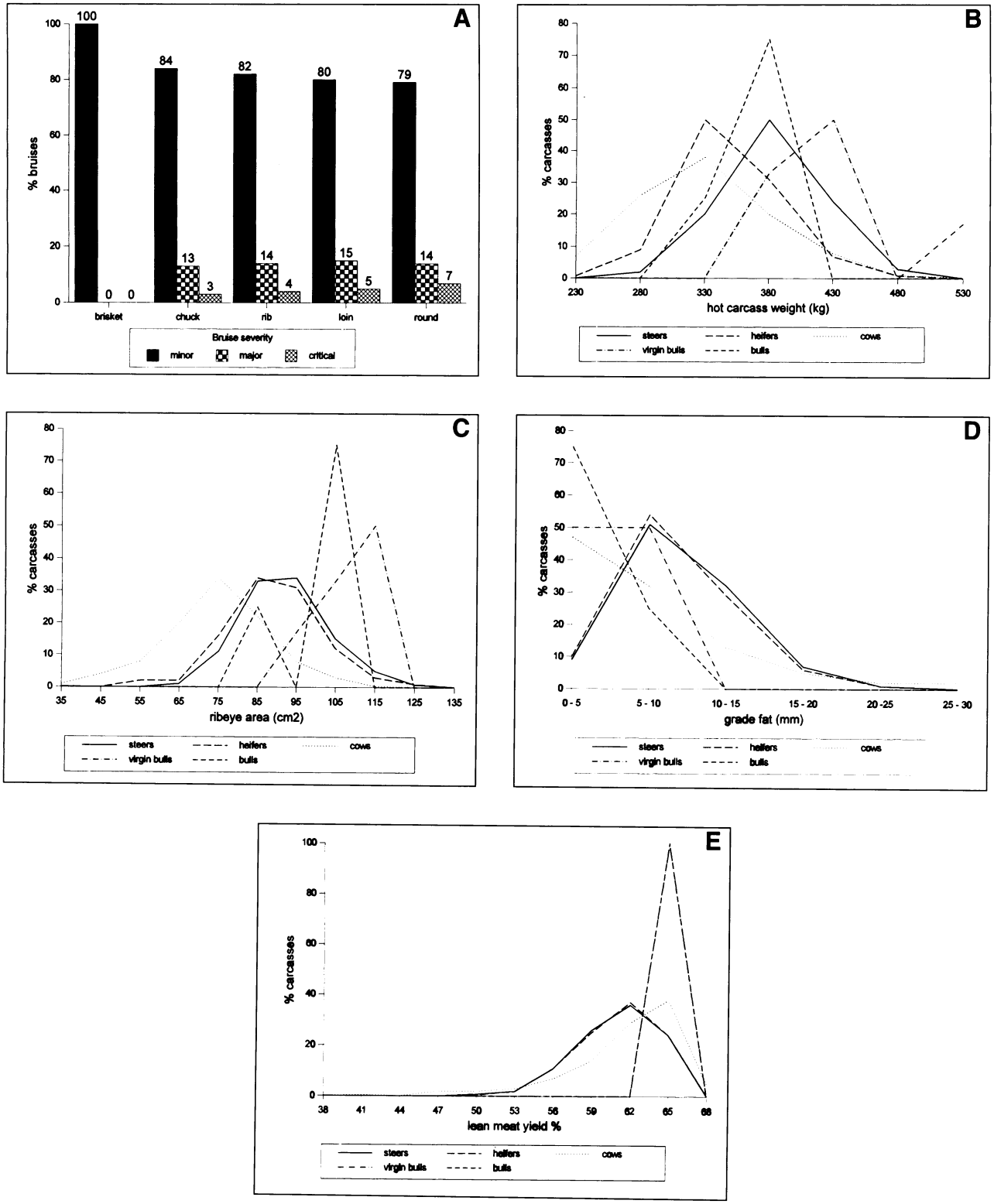

Figure 1. Distribution of nonconformities in carcasses of Canadian cattle processed at 4 plants. The occurrence of bruises is shown by severity and location on 26 054 carcasses (A). The distribution of hot carcass weight (B), ribeye area (C), grade fat (D), and lean meat yield (E) are shown in 3225 carcasses.

Twenty-two percent of the beef cows were underfinished and 45% of the dairy cows were underfinished. Seven percent of the cows were overfinished and 80% of these were beef cows. Staggy traits were observed in 0.05% of the steers and 67% of the virgin bulls. Yellow fat was present in 31% of the beef cows and 52% of the dairy cows. Overall, 10% of the carcasses were aged, and 0.6% of the heifers were aged, whereas 6% of the beef cows graded as young carcasses.

Economic analysis

Results are shown in Table 4 and, where applicable, they are broken down by sex of cattle. Losses on the processing floor from nonconformities amounted to $27.99

Table 1. Prevalence of nonconformities in carcasses of Canadian cattle on the processing floor of 4 plants

Nonconformity	Steers	Heifers	Cows	Bulls	Mixed	Overall
% with brands[a]	37	33	51	32	16	37
% with multiple brands	5	4	19	2	6	6
Distribution of brands (%)						
shoulder	10	11	9	7	3	10
rib	43	38	56	86	44	43
hip	47	51	35	7	52	47
% with horns[b]	42	36	40	56	37	40
scurs	26	15	6	NA	16	20
stubs	27	39	47	NA	30	33
tipped	10	9	6	NA	6	10
full horn	37	37	41	NA	48	37
% with tag	32	43	5	0	35	34
Average tag score	2.4	2.5	4.1	0	2.4	2.5
% with bruises[c]						
Bruise number						
0	21	25	6	35	25	22
1	27	28	13	24	24	26
2	25	24	20	24	21	24
3	16	14	22	5	15	16
≥4	10	9	39	11	14	12
Bruise severity						
% minor	83	81	74	87	82	81
% major	13	14	19	12	13	14
% critical	4	5	8	2	5	5
Average number of bruises per carcass	1.8	1.7	1.6	3.0	1.4	1.8
Distribution of bruises %						
brisket	0.01	0.008	0.07	0	0	0.02
chuck	18	15	8	15	12	16
rib	42	40	28	46	39	40
loin	27	30	34	25	31	29
round	12	15	30	13	18	15
% with grubs	0.02	0	0	0	0	0.01
% with observable injection site lesions	1.9	0.6	0.1	0	0	1.3
Distribution of injection site lesions %						
shoulder	95	69	100	0	0	91
rib	0.3	4	0	0	0	1
hip	5	27	0	0	0	8
Severity of injection site lesions %						
minor	85	60	50	0	0	82
major	13	21	0	0	0	14
critical	2	19	50	0	0	4
% with liver abscesses[d]						
0	79	78	70	92	83	78
A−	9	11	14	3	8	10
A	6	6	10	0	5	6
A+	6	5	7	5	3	6
% livers for						
human food	73	71	40	76	70	70
pet food	12	14	35	11	13	14
condemned	15	14	24	14	16	16

NA = not available
[a]Number of carcasses = 26 029
[b]Breakdown of type of horn only available from November and March audit data
[c]Number of carcasses = 26 054
[d]Number of carcasses = 25 944

Table 2. Results of cooler audit of 3225 carcasses of Canadian cattle processed in 4 plants

Carcass trait	Steers	Heifers	Cows	Virgin Bulls	Bulls	Overall
n	1957	935	323	6	4	3225
Average carcass weight kg (*s*)	357 (40)	325 (41)	305 (53)	388 (62)	340 (39)	342 (46)
Average ribeye area cm^2 (*s*)	86 (11)	84 (11)	70 (13)	102 (7)	94 (11)	84 (12)
Average ribeye fat mm (*s*)						
top	13 (5)	13 (5)	10 (8)	6 (2)	4 (1)	12 (6)
middle	12 (5)	11 (4)	8 (7)	7 (4)	6 (1)	11 (5)
bottom	10 (4)	10 (4)	7 (6)	6 (2)	4 (0.5)	10 (4)
grade	9 (4)	9 (4)	6 (6)	5 (1)	4 (0.5)	9 (4)
Average % lean (*s*)	59.6 (3.3)	59.6 (3.2)	60.6 (4.4)	63.9 (1.1)	63.6 (0.9)	59.7 (3.4)
Distribution of marbling %						
devoid	0.4	0.2	9	17	25	1
A	41	23	54	83	75	37
AA	35	42	19	0	0	35
AAA	24	35	17	0	0	27
Distribution of grade %						
A1	59	59	2	17	0	53
A2	34	34	0.6	0	0	31
A3	5	4	0	0	0	4
B1	0.7	0.9	0.9	0	0	0.8
B4	1	1	0.3	17	0	1
D1	NA	0.4	16	NA	NA	2
D2	NA	0	46	NA	NA	5
D3	NA	0	27	NA	NA	3
D4	NA	0.2	7	NA	NA	0.8
E	0.05	NA	NA	67	100	0.3
% dark cutters	1	1	4	17	0	1.6
% poor conformation	0	0	63	0	0	6
% underfinished	0.4	0.7	32	0	0	3.7
% overfinished	0	0.2	7	0	0	0.7
% lacked marbling	0.4	0.2	9	17	25	1
% staggy	0.05	NA	NA	67	100	0.3
% yellow fat	0	0	41	0	0	4
% aged	0	0.6	96	0	0	10

NA = not applicable

Table 3. Percentage distribution of marbling within grade of 3225 carcasses of Canadian cattle processed in 4 plants

Grade	Devoid	A	AA	AAA	Total
A1	NA	41	37	22	53.2
A2	NA	26	38	36	30.9
A3	NA	16	38	46	4.0
B1	32	52	16	0	0.8
B4	3	50	18	29	1.2
D1	0	38	36	26	1.7
D2	6	57	21	16	4.5
D3	26	72	2	0	2.6
D4	0	8	27	65	0.8
E	22	78	0	0	0.3
Total	37	35	27	1	100

NA = not applicable

per head or $75 230 991 annually for the entire Canadian beef industry. Cooler audit losses amounted to $42.53 per head or $114 327 018 annually. In total, nonconformities cost the Canadian beef industry $70.52 per head processed or $189 558 009 annually.

Discussion

The 1st step in reducing nonconformities is to measure current performance and determine what change, if any, is needed to improve quality and to reduce economic losses. The quality audit reported here is the 1st study of its kind to determine the level of quality defects in Canadian slaughter cattle. Since the 4 plants used in this study process approximately 80% of the beef processed in Canada, the sample studied was representative of the Canadian beef industry.

Formal random selection procedures could not be used in this study due to the practical limitations in a processing plant, such as, line speed, human fatigue, and the chill factor in the cooler. The large sample size, the high proportion of carcasses sampled within a lot and the lack of any consistent selection bias of carcasses within a lot, should have reduced potential bias to affect the results. Findings from the cooler audit were compared with the 1995 averages from CANFAX and they did not differ significantly (data not shown), suggesting that the study sample was representative of cattle processed in Canada. Only lots with 10 or more animals were studied. The prevalence of nonconformities may be slightly biased downward, if smaller lots of cattle (<10 head) have higher levels of nonconformities. However, small lots of cattle (<10 head) made up less than 1% of the total number of cattle processed each day, as determined from the drive schedules. Therefore, the bias should be small, if it exists. Caution should be taken in drawing

Table 4. Economic costs of nonconformities to the Canadian beef industry

Nonconformity	$ per head loss	Total per head loss	Loss to the industry $	Total $ to the industry
Brands		3.57		9 584 186
steers	3.15		4 566 369	
heifers	2.75		1 929 265	
cows	5.95		2 964 599	
bulls	3.20		123 952	
Horns	0.036	0.036	97 752	97 752
Tag		1.21		3 265 141
extra labor	0.02		64 516	
production slowdown	0.18		483 872	
hide damage	0.22		586 023	
trim	0.79		2 130 729	
Bruising		3.92		10 537 629
steers	2.79		4 051 739	
heifers	2.98		2 091 249	
cows	8.75		4 357 484	
bulls	0.96		37 159	
Grubs	0.0004	0.0004	598	598
Injection site lesions	9.79	9.79	26 317 272	26 317 272
Liver discounts		5.31		14 269 379
steers	2.07		3 000 757	
heifers	2.10		1 473 257	
cows	4.26		2 122 554	
bulls	1.92		74 371	
performance loss in fed cattle	3.53		7 598 440	
Condemned heads	0.24	0.24	649 195	649 195
Tongue discounts	1.55	1.55	4 173 398	4 173 398
Condemned carcasses		2.36		6 336 440
steers & heifers	0.97		2 090 197	
cows & bulls	7.91		4 246 243	
Off-weight carcasses[a]	23.25	23.25	62 498 675	62 498 675
Grade losses		19.28		51 828 343
steers & heifers	16.93		36 420 858	
cows & bulls	30.92		15 407 485	
Total losses		70.52		189 558 009

[a]Off-weight carcasses were only discounted in steers and heifers, and in steers and heifers they accounted for $29.05

any conclusions about groups of cattle with a small sample size, such as bulls, because the findings may not be representative of the population.

Results of the processing audit indicate that brands significantly depreciate hide value. Individual animal identification is an important component of efficient and effective production systems to ensure ownership and information traceback. Currently, no alternative permanent cattle identification system exists. Therefore, the working group suggested that those producers who need to brand their cattle should try to move away from rib brands and multiple brands and use a single hip or shoulder brand. Additionally, the industry will encourage the government to eliminate the charge for moving a rib brand to the shoulder or hip. A number of alternative identification systems exist, such as, tattoos, eartags, and electronic identification, and their use is encouraged as an alternative to branding.

Complete elimination of all types of horns in cattle before the final marketing stage is an industry target. Producers are encouraged to use polled bulls in breeding programs or to dehorn cattle using effective techniques. Horns cause losses from bruising, head condemnations, and extra labor in the packing plant.

Tag is a quality and a food safety concern. The target is to reduce taggy lots of cattle (tag score ≥4) to less than 10%. Tag damages the hide and results in contamination of the carcass during the removal of the hide. Any visual demerits, such as, manure, dirt, or rumen content, on the carcass during skinning must be trimmed. Taggy cattle also result in additional labor costs in the processing plant, production line slowdowns, and damage to equipment in the leather making process. Tag can be reduced by keeping feedlot pens and transport trucks dry and clean. Increasing the amount of bedding in feedlot pens and reducing overcrowding should also reduce the occurrence of taggy cattle.

Bruises were commonly observed in carcasses in this study. Bruises result in significant trim and devaluation of primal cuts. Severe bruising, such as that seen in nonambulatory animals, can result in condemnation of the entire carcass. The target suggested by the working group is to try and reduce bruising in cattle by 50% in the next 2 y, at which time the beef audit will be conducted again. Bruising can be reduced with proper handling and transportation. A new working group of the *Canadian Cattlemen — Quality Starts Here* program, called the Cattle Handling Working Group, has been

developed to address the problem of bruising and to identify strategies that will reduce it, from both a carcass quality and an animal welfare perspective.

The infrequent finding of grubs may have been due to our inability to observe them on the processing line. Most likely it reflects fairly effective warble control programs on the farm. Grubs damage the hide and cause trim. Therefore, producers are encouraged to continue to work with their veterinarian to develop effective preventive programs for fly control.

The infrequent observation of injection site lesions in the whole hanging carcass was not unexpected, since most injection site lesions are to be found deep in the muscle (2–4,9,10). An audit at purveyors is currently being conducted on a biannual basis to determine the true prevalence of injection site lesions in top butts, rounds, and blades, as they are cut into steaks. To reduce injection site lesions, veterinarians and producers are encouraged to give all injections in the neck rather than the hip; to give drugs SC, if the label permits; to use long-acting products to reduce the number of injections; to avoid extra-label use of drugs that may cause adverse tissue reactions and drug residues; to change needles every 10 to 15 uses or when dull, burred, or bent; to keep equipment and injection sites clean; to give no more than 10 mL in any 1 site; to keep multiple injections 2 to 3 in (5.0 to 7.5 cm) apart; to use 16 g × 1 1/2 in (3.75 cm) needles for IM injections and 16 g × 3/4 in (1.9 cm) for SC injections; to inject straight and deep in the muscle for IM injections; and to use the tented technique for SC injections.

A target identified at the strategic meeting is to try to eliminate A and A+ livers. Methods to reduce severely abscessed livers include good feed management practices, such as, bunk management, effective ration changes, and antimicrobial prophylaxis (9,10).

Head, tongue, and whole carcass condemnations caused significant economic losses. Many of the condemnations were due to advanced pathology. The target is to reduce condemnations by 50% within 2 y. Producers are encouraged to minimize condemnations by instituting herd health programs, marketing cattle with disorders in a timely manner, and humanely euthanizing those that have advanced pathology.

Losses from fetuses could not be determined in this study, because the plants did not keep track of the source of fetuses, that is, whether they came from cows or feedlot heifers. A previous study in Alberta indicated that a pregnant feedlot heifer results in a loss of $66.35 in comparison with an open heifer (11).

Hot carcass weights, ribeye areas and fat, and lean meat yield were highly variable. Inconsistency was identified as a problem. Targets are to have hot carcass weights between 273 and 364 kg (600 and 800 lbs), and ribeye areas between 64 and 84 cm^2 (10 and 13 in^2) to accommodate a desirable 8 to 10 oz (227 to 283 g) raw steak, with a 6 mm (1/4 in) fat trim. Additional targets are to have 80% of young carcasses with a lean meat yield ≥59%, and 60% of young carcasses with a marble score of AAA. Other targets are to reduce the occurrence of dark cutters by half and eliminate staggy cattle through good animal handling and proper castration techniques. Tools identified to help improve carcass traits include value based marketing, computer vision grading systems, electronic identification, information relay systems, development of carcass expected progeny differences, improvements in genetic and nutritional management, and timely marketing.

In conclusion, the results of this Canadian beef quality audit indicate that there are many lost opportunities for all segments of the beef industry. The findings are similar to those of the NCBA audits in 1991, 1994, and 1995 (2–4), and they indicate that producers must work together with all sectors of the beef industry to prevent unnecessary production inefficiencies.

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