Compliance of large feedyards in the northern high plains with the Beef Quality Assurance Feedyard Assessment

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ABSTRACT

Despite increasing public scrutiny of practices used in raising animals for food, there is little readily available information about how cattle handling is managed in feedyards. The purpose of this study was to score cattle handling in commercial feedyards using the most widely adopted program for managing cattle handling, and to make these scores available as evidence of producer commitment to proper care and handling of cattle. Our objectives were to estimate compliance with the Beef Quality Assurance Feedyard Assessment (BQA FA) for cattle handling, to validate 6 cattle handling categories of the BQA FA, and to document management practices and elements of facility design. Categories scored were electric prod use; chute operation; rates of cattle vocalizing, stumbling, and falling; and rate of cattle jumping and running. This study compiles findings for cattle handling scores in commercial feedlots using the BQA FA. Of 28 sites, average scores

were in compliance with BQA FA for the following 4 categories: electric prod use, vocalization, stumbling, and falling. For the following 2 categories, average scores were not in compliance: a score of 4.2% versus the target of 0% was recorded for cattle caught improperly in the squeeze chute; and a score of 52% versus the target of 25% was recorded for cattle that jumped or ran from the squeeze chute exit. All but one site exceeded this target. Curved crowd systems were recorded for 89% of feedyards, 11% used Bud Box systems, and 78.5% had rubber mats at the squeeze chute exit.

Key words: Beef Quality Assurance, cattle handling, feedyard, handling facilities, handling practices

INTRODUCTION

Numeric scoring of cattle handling is an essential component of many cattle handling and transport assessment programs used to objectively monitor quality of handling (Edge et al., 2005; Grandin, 2010; Nicholson et al., 2013). Numeric scoring of specific cattle handling categories for monitoring welfare in commercial

production first gained substantial traction when guidelines were written and subsequently audited routinely in slaughter plants (Grandin, 1997, 2006; USDA-FSIS, 2009). Following the initial plant audit, much attention was focused on cattle handling categories, and by the second audit, plant compliance with the recommendation for stunning accuracy greatly increased (Grandin, 2000). Ongoing monitoring of cattle handling at packing plants has proved to be an effective approach to maintaining high standards of cattle handling (Grandin, 2005). The 5 cattle handling categories assessed at packing plants are (1) percentage of cattle moved with an electric prod, (2) percentage of cattle vocalizing, (3) percentage of cattle falling, (4) percentage of cattle successfully stunned on the first attempt, and (5) percentage of cattle that remain insensible on the rail (Grandin, 1997, 1998a). The Beef Quality Assurance Feedyard Assessment (**BQA FA**) provides guidelines for cattle handling in feedyards and is a useful tool for assessing cattle handling practices (NCBA, 2009). There are 6 category points in the BQA FA: rates of (1) driving aids/

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electric prod use, (2) squeeze chute operation/miscaught cattle, (3) cattle vocalizing, (4) cattle stumbling, (5) cattle falling, and (6) cattle jumping and running (NCBA, 2009). There is a need to validate the current categories, because numeric scoring may enable feedyard managers to measure and improve cattle handling. The objectives of this study were to (1) estimate feedyard compliance with BQA FA, (2) validate categories of the BQA FA for assessing cattle handling, and (3) document management practices and elements of facility design. Therefore, the BQA FA guidelines were used to assess cattle handling at 28 select large feedyards in Colorado, Kansas, and Nebraska. The median one-time capacity of feedyards in this study was 30,000 cattle, similar to that of a previously study (Barnhardt et al., 2014).

MATERIALS AND METHODS

All methods were approved by the Institutional Animal Care and Use Committee at Colorado State University and reviewed and exempted by the Institutional Review Board.

Description of Sample

To keep travel costs reasonable, a feedyard atlas, BeefSpotter (Spotter Publications, 2012), was used to locate areas where feedyards were clustered in the states of Colorado, Kansas, and Nebraska. Within these clusters, contact was made in alphabetic order. Fifty-six feedyards were contacted primarily by telephone, and an appointment was requested. Requests were also made in person at feedyard offices after visiting previously scheduled feedyards in the same vicinity. When a feedyard manager was contacted, the investigator explained that the purpose of the study was to survey industry adoption of Beef Quality Assurance (BQA) guidelines for cattle handling during administration of routine animal health and management protocols. The names and locations of all participants were kept anonymous in an

effort to increase participation rates. Of the 56 feedyards that were contacted, 47 agreed to participate, 28 were included, and only 9 declined, resulting in an acceptance rate of 84% and a final participation rate of 50%. Not all feedyards that agreed to participate were included due to scheduling conflicts. All feedyards included were classified as large yards (with a one-time capacity of >1,000 cattle), and the sample included yards ranging in size from a one-time capacity of over 1,000 to over 100,000 cattle, with a mean one-time capacity of 34,583 cattle.

Terminology of the BQA FA

The authors recognize that the BQA program was modeled after the hazard analysis and critical control point approach to monitoring relatively few categories that provide information about multiple management practices, which was developed specifically for monitoring food safety concerns. When the hazard analysis and critical control point approach is used outside the original food safety context, numerical scoring may often be used in an effort to eliminate subjectivity in scoring a challenging category, such as behavior (Grandin, 1998a; Edge and Barnett, 2009). Though the entire BQA program was designed to parallel such an approach, the authors believe it is important that the language used in reference to the BQA FA not bear a food-safety connotation. To avoid any associated confusion, the authors adopted terminology designed to be descriptive and accurate. Going forward, BQA FA “category points” will be referred to as “outcome-based measures.” These measures have been further divided into 2 subcategories: “handler-based measures” and “animal-based measures.” The BQA FA term “acceptable level” will be referred to going forward as “target.”

BQA FA

At each site, the BQA FA cattle handling observation scoresheet was

used to score 100 cattle when available during scheduled visits. This approach was used because it is consistent with the guidelines for the BQA FA and how it is suggested to be using for scoring in the field. The following are the current BQA FA category points: (1) rate of electric prod use, (2) squeeze chute operation/rate of miscaught cattle (3) rate of cattle vocalizing, (4) rate of cattle stumbling when exiting the squeeze chute, (5) rate of cattle falling when exiting the squeeze chute, and (6) rate of cattle jumping or running when exiting the squeeze chute. A single observer performed all scoring to reduce variability, and in addition to scoring existing BQA FA outcome-based measures, the observer made note of all improper catches that occurred, with descriptions of the nature and location of the improper capture. Data were collected on the first 100 cattle processed when the investigator arrived at the working facilities, without bias for any specific type of cattle. The observer recorded the type of crowd or forcing pen that was used for handling cattle at each location, as well as the type of squeeze chute and exit flooring conditions. Finally, the observer noted whether feedyards used employees or contracted labor for working cattle.

Feedyard Assessment Assessor's Guidelines

According to BQA FA guidelines for handling cattle, data were collected and proportions were calculated for the following outcome-based measures, according to BQA FA protocol: (1) rate of electric prod use, (2) squeeze chute operation/rate of miscaught cattle, (3) rate of cattle vocalizing, (4) rate of cattle stumbling when exiting the squeeze chute, (5) rate of cattle falling when exiting the squeeze chute, and (6) rate of cattle jumping or running when exiting the squeeze chute. For the measure of driving aids, information was collected about the primary type of driving aid that was used at each site, and the use of electric prod was

recorded and calculated to obtain a score, representing the percentage of cattle observed that were moved using an electric prod. Electric prod use was recorded in the single file alley and squeeze chute and was not observed to occur further back in the handling system at any feedyard. Use of electric prod was defined as the prod being energized while it was in contact with an animal, according to BQA FA guidelines.

If the head gate of the squeeze chute was closed on the head, leg, or body of an animal, it was scored as an improper catch, and information was recorded about the nature of the incorrect catch. Per BQA FA guidelines, the percentage of improper catches in the squeeze chute that were not adjusted to the correct position was also recorded.

Vocalization was scored for any audible call emitted by the animal upon entering the squeeze chute or during capture or restraint, before a procedure was performed (such as vaccination or placement of ear tags). A stumble or slip was recorded if an animal's knee touched the ground during exit from the squeeze chute, and a fall was recorded if the animal's body (i.e., shoulders, belly, or hindquarters) touched the ground during exit from the squeeze chute. An animal received a run score if it moved faster than a trot when exiting the squeeze chute (Vetters et al., 2013), and jumping was defined as both forelegs being suspended in the air simultaneously with forward movement propelled by the hind legs.

In addition to these variables, information was recorded about the type of primary driving aid that was used at each site.

Data Analysis

Frequencies and mean, minimum, and maximum values were calculated for each of the 6 current BQA FA outcome-based measures. The PROC-FREQ and PROCMEAN procedures of SAS (SAS Institute Inc., Cary, NC) were used, with feedlot site considered the experimental unit. The percent-

age of cattle for each variable was calculated for each individual feedlot, and mean, minimum, and maximum values were calculated for each measure for all feedlots. A 95% confidence level was calculated for squeeze chute operation and for jump and run scores, and these were compared with the current BQA FA targets.

RESULTS AND DISCUSSION

Feedyard Assessment

There is little evidence of the process by which the current BQA FA measures and associated targets were set, or that the present BQA FA measures for cattle handling were validated in the population to which they were intended to be applied. One of the authors of the BQA FA guidelines indicated that cattle handling categories audited in packing plants was the basis for the current categories and targets of the BQA FA (T. Grandin, unpublished data, August 2015). When the BQA FA target for electric prod use was set, the authors chose to set it at 5% (approximately half of the North American Meat Institute guideline for electric prod use in the packing plant), because based on experience, cattle would enter a squeeze chute with less prodding than a stun box or restrainer. The BQA FA target for falling was set at 2% (twice the North American Meat Institute guideline) based on the premise that a higher rate of falling should be allowed, because in the feedyard context, individual cattle are scored as they leave the squeeze chute, which is another opportunity for a fall to occur. The BQA FA target for vocalization was set at 5%, which was comparable to the North American Meat Institute guideline for vocalization in the case of head restraint before slaughter. Understanding the basis of the BQA FA is relevant to the discussion of the scores reported below.

Handler-Based Measures

Electric Prod Use. For the 28 sites surveyed, mean rate of electric

prod use was 3.6%, which is well below the BQA FA target of 10% (Table 1). Only 2 sites exceeded this target, having scores of 15 and 45%, respectively; 12 sites surveyed had prod scores of 0%; and 93% of all sites surveyed were in compliance with this BQA FA target. At one site, where handlers used electric prods as their primary driving aid, a prod score of 0% was recorded; prods were carried but were not discharged when in contact with cattle during the observation period. Electric prod use is associated with increased plasma cortisol concentrations (Hemsworth et al., 2011), and Grandin (1998b) found that cattle vocalizations were associated with aversive events such as electric prod use. Awareness of the relationship that may exist between electric prod use and physiological indicators of stress has led to recommendations to reduce electric prod use. By monitoring this handler-based measure, producers may be able to reduce handling stress. Feedyards participating in this study demonstrated a high rate of compliance with the BQA FA guidelines for minimizing electric prod use.

A similar study of cattle handling practices in feedyards (Barnhardt et al., 2014) reported electric prod use was 4%, comparable to the score of 3.6% reported in this study. Our findings for vocalization, which is associated with electric prod use, was a rate of 1.4%, which was similar to 0.9% found by Barnhardt et al. (2014). Finally, falling scores were similar between the 2 studies, as Barnhardt et al. reported 0.2% of cattle fell during observation compared with our score of 0.6%. When compared with scores for cattle handling at packing plants in the mid-1990s, where the mean percentage of cattle vocalizing in the stunning area during handling was 10% (Grandin, 2000, 2005), following 5 yr of third-party audits required by large customers (such as McDonald's, Wendy's, and Burger King), the average percentage of cattle vocalizing dropped to 2% (Grandin, 2006). At one plant, 32% of cattle vocalized during handling

Table 1. Summary of cattle handling scores for commercial feedyards evaluated using the Beef Quality Assurance Feedyard Assessment

Measure ¹	Small feedyards ²	Large feedyards ³	All feedyards ⁴	SD ⁵	Target ⁶
1. Driving aids/electric prod use	9.7	1.5	3.6	9.2	10.0
2. Chute operation/miscaught cattle	2.1	6.3	4.2	3.2	0.0
3. Vocalizing	1.7	1.1	1.4	6.5	5.0
4. Stumbling	6.0	4.6	5.6	6.1	10.0
5. Falling	0.6	0.6	0.6	1.2	2.0
6. Jumping or running	42.0	56.0	52.0	18.0	25.0

¹Current categories for evaluating cattle handling. The number or term for the measure may be used interchangeably in this article. Cattle handling scores are represented as an average percentage for all feedyards. Specific scoring criteria used to obtain these scores can be found on the Cattle Handling Observation Scoresheet, which is part of the Beef Quality Assurance Feedyard Assessment available at http://www.bqa.org/Media/BQA/Docs/feedyard_assessment_062209_blank.pdf.

²Feedyards with a one-time capacity of <20,000 cattle.

³Feedyards with a one-time capacity of ≥20,000 cattle.

⁴All feedyards combined (n = 28).

⁵Standard deviation for all feedyards combined.

⁶Maximum percentage of unacceptable observations.

in an initial audit, and after 5 yr of audits, those results dropped to 6%. Following this precedent, the collection and reporting of similar data for handling of cattle in the feedyard could facilitate improvement in cattle handling.

Chute Operation. The mean score for cattle captured in the squeeze chute improperly and not subsequently adjusted was 4.2%, versus the BQA FA target of 0%. The BQA FA guidelines presently require only the scoring of improper catches that are not adjusted. Currently, there is no requirement to account for cattle that are miscaught and subsequently adjusted in the head gate. A 95% confidence level was calculated for improper catches, resulting in a range of 1.4 to 6.9%. It may be reasonable, based on these findings, to suggest 5% as a target for overall improper catches. It is important to score all improper catches and subsequent readjustments. Few studies document the full effects of improper catches, but aversion to head gate restraint may result in more time and force required to move cattle through working facilities (Goonewardene et al., 1999). Cattle were more reluctant to enter the squeeze chute during

handling after an aversive experience, such as an improper catch with the head gate (Grandin, 1993).

Animal-Based Measures

Cattle Vocalizing. The mean rate of cattle vocalizing was 1.4% across all sites, which is below the BQA FA target of 5%. Only 2 feedyards had vocalization scores that exceeded the BQA FA target, with scores of 5.1 and 6%. Of feedyards surveyed, 92.9% had vocalization scores below the BQA FA target for vocaliza-

tion. These data show that feedyards surveyed have a very high rate of compliance with the BQA FA target for vocalization. Vocalization scoring is a useful tool for identifying cattle handling problems because vocalization during handling and restraint is associated with aversive events such as electric prod use or excessive pressure applied by a restraint device (Grandin, 1998b, 2001; Bourguet et al., 2011). Dunn (1990) found cattle that vocalized while being held in a restraint device had higher blood cortisol concentrations.

Figure 1. Curved cattle handling system with round crowd pen. 12 ft = 3.6576 m.

Cattle Stumbling. The mean rate of cattle that stumbled, slipped, or tripped when exiting the squeeze chute was 5.7%. Though higher than a recent report of 1.8% where cattle were scored similarly (Barnhardt et al., 2014), these findings are still within the BQA FA guideline of 10%. Only 4 sites exceeded the guideline, and the remaining 86% of feedyards were in compliance with BQA FA guidelines for this measure.

Stumbling may be caused by agitation or by floor conditions at the exit of the squeeze chute. Due to the relationship between slips, stumbles, falls, and injuries, many feedyards place a rubber mat at the exit of the squeeze chute.

Cattle Falling. The mean rate of cattle falling was 0.8% for feedyards, which is below the BQA FA guideline of 2%. Of feedyards surveyed, 92.9% were within BQA FA guidelines, and only 2 sites slightly exceeded the target for this measure. Of the feedyards, 70.4% had no cattle fall during the observation period.

Recent results from a survey of cattle handling at a packing plant include similar findings of less than 1% of cattle falling (Hultgren et al., 2014), and a survey of Kansas feedyards reported cattle falling at a rate of 0.2% (Barnhardt et al., 2014). Cattle may fall due to behavioral agitation, a flight response associated with an aversive procedure, or poor flooring at the squeeze chute exit. Falls may result in costly injuries or bruising. These data show that feedyard managers are aware of the importance of reducing falls.

Cattle Jumping or Running. The mean score for cattle that jumped or ran while exiting from the squeeze chute was 52%, which exceeds the BQA FA target of 25%; only one feedyard's score was in compliance with this target. Many feedyards (39.3%) were in compliance with BQA FA targets for every other measure and only exceeded the target for this animal-based measure. The high rate of feedyards (96.4%) that exceeded the BQA FA target for this measure suggests that this

measure may need to be reevaluated. In the present scoring system, cattle that walk, trot, or run, but also jump when exiting the squeeze chute, are counted in the present jump or run animal-based measure. Additionally, if cattle run only, they are scored the same under the current measure. Due to the high score for this animal-based measure, the authors believed additional analysis of behavior scores was warranted for all other measures and for this measure. A separate study conducted in 2013 (Woiwode et al., 2016) confirmed earlier work

(Vetters et al., 2013) that reported ADG was negatively correlated with exit speed. This suggests that exit speed may be associated with agitation, which has a negative, biological effect resulting in decreased ADG. However, the relationship between jumping and running remains largely unexplained, and it is our belief that because the relationship is largely unexplained, it may not be appropriate to evaluate jumping that occurs at slower speeds in the same category as jumping that occurs at higher speeds. Jumping may be affected

Figure 2. Bud Box cattle handling system. Diagram by Gill and Machen (2014). 12 ft = 3.6576; 14 ft = 4.2672 m; 16 ft = 4.8768 m; 20 ft = 6.096 m; 24 ft = 7.3152 m; 30 ft = 9.144 m. Color version available online.

more by breed and facility and may not be as accurate of a measure as gait. In the light of previous work that suggests a linear, negative correlation between exit speed and ADG, it was decided to separately calculate scores for cattle that walked or trotted versus ran from the exit of the squeeze chute and then compare each of these scores to the BQA FA target. Jumping was not included in this step, because it is not considered to be continuous with the other gaits (Vetters et al., 2013). Using this approach, 28.7% of the cattle ran and 71.3% walked or trotted from the exit of the squeeze chute, which resulted in 50% of feedyards having scores in compliance with the current 25% target. Next, scores were calculated only for cattle that performed both jump and run behaviors, and this score was also compared with the present target. After these calculations, 78.6% of feedyard had scores in compliance with the BQA FA target of 25%. A 95% confidence level was computed for the current measure (including cattle that walk, trot, run, and jump, or run only), as well as for a new measure (including only cattle that both jump and run). The confidence level for the current measure was 50.2 to 67.0%; clearly, the current 25% target was not included in the 95% limit. When a confidence level was computed for the new measure, the new bounds were 20.5 to 32.0%. The current measure of the BQA FA may not fully account for behavioral and facility differences that may cause cattle to jump, that otherwise exit the chute slowly, and this may result in high scores for this measure that are not necessarily due to poor handling. In the light of these results, it may be advisable to revise the current guideline from “jump *or* run” to “jump *and* run.” Adopting this change to the present scoring system may improve this measure because there are many factors that influence jumping and running, and the presence of both behaviors concurrently may suggest greater agitation. Exit velocity is positively correlated with increased plasma cortisol concentra-

Figure 3. Bowman squeeze chute (Bowman Mfg. Inc., Fremont, NE; <http://bowmanenterprisesnet.com/>). A Bowman or similar design squeeze chute was found in 50% of feedyards. Color version available online.

tion (Curley et al., 2006). Use of exit gait scoring, as performed in the present study, has been shown to be interchangeable with exit velocity scoring and is related to ADG (Vetters et al., 2013).

Facilities Findings

Two types of crowd pen systems were used at the surveyed feedyards; a majority (89%) of the sites had a round crowd system (Figure 1), and 11% had a Bud Box system (Figure

2). A heavy rubber mat of woven tire tread was used at the squeeze chute exit in 78.5% of sites surveyed. Information was collected about primary driving aids, and 5 sites used an electric prod as the primary driving aid, 15 sites used another tool such as a paddle or a flag as their primary driving aid, whereas handlers at 8 sites did not carry driving aids of any kind. Two types of squeeze chutes were observed: 50% generic scissor type (Figure 3) and 50% Silencers (Figure 4) (Moly Manufacturing Co.,

Figure 4. Silencer squeeze chute (Moly Mfg., Lorraine, KS; <http://www.molymfg.com/Products/Silencer/CommercialProModel/tabid/3648/Default.aspx>). A Silencer squeeze chute was found in 50% of feedyards.

Table 2. Description of scoring system used for evaluation of cattle handling categories in the Beef Quality Assurance Feedyard Assessment

Measure ¹	Description
1. Driving aids/electric prod use	Discharging electric current while prod is in contact with cattle, scored on a yes/no basis
2. Chute operation/miscaught cattle	Any catch by the head gate other than in front of the shoulder and behind the jaw and not adjusted before procedures begin; all catches observed
3. Vocalizing	Scored on a yes/no basis for any audible call made while being restrained in the chute, but before any procedure being performed on that animal
4. Stumbling	Scored on a yes/no basis following release from the squeeze chute, scored if the knee makes contact with the ground
5. Falling	Following release from the squeeze chute, scored if the torso or belly makes contact with the ground
6. Jumping or running	Following release from the squeeze chute, scored if animal moves faster than a trot, rears up with both front feet, or both, followed by both hind feet leaving the ground

¹Cattle handling scores are represented as an average percentage for all feedyards. Specific scoring criteria used to obtain these scores can be found on the Cattle Handling Observation Scoresheet, which is part of the Beef Quality Assurance Feedyard Assessment available at http://www.bqa.org/Media/BQA/Docs/feedyard_assessment_062209_blank.pdf.

Lorraine, KS). Most feedyards (75%) used employees for cattle handling work, and the balance used independent crews that were contracted by the feedyard.

Conclusions

These findings document that the BQA FA targets for electric prod use, vocalization, and cattle stumbling or falling when exiting from the squeeze chute are reasonably attainable in commercial feedyards. These data and discussions with feedyard managers suggest that producers are aware of the importance of good handling practices during administration of routine animal health and management protocols. To better provide producers with a benchmark that can drive continued improvement in handling practices, it is important to continue to document and report scores for cattle handling practices in the feedyard using a systematic approach, such as is found in the BQA FA guidelines. The measurable improvement in similar categories at slaughter plants since the implementation of continuous monitoring affords a good model for a similar approach to the evaluation of cattle handling in feedyards. Such an approach might provide information that would be useful to include in future National Beef Quality Audits.

IMPLICATIONS

Findings of Significance

The states represented in this survey feed approximately half of all cattle fed in the United States (USDA-NASS, 2015). Results of this study revealed 3 important points for the cattle feeding industry regarding the BQA FA. First, this assessment shows a high rate of industry adoption of and compliance with BQA FA guidelines for cattle handling in the feedyard. Second, this study provides validation of 4 current measures for assessing cattle handling as part of the BQA FA. Measures 1, 3, 4, and 5 (see Table 2) are substantiated by scores reported earlier. Third, this study shows that 2 current measures of the BQA FA may warrant further study. The measures that may warrant further work are measure 2 (squeeze chute operation) and measure 6 (cattle jumping and running). Additionally, this study provides descriptive information about large commercial feedyard handling facilities and management practices. Potential changes to the BQA FA (as previously described) would be simple to implement, if such changes were deemed acceptable. With such changes implemented, the next steps would be wider use of third-party verification

and open communication of results regarding cattle handling practices in the feedyard. Much like the packing plant sector, there is wide adoption of guidelines for proper cattle handling in the feedyard. Just as ongoing auditing of cattle handling categories in packing plants led to positive change in handling scores, it would seem reasonable that comparable (or greater) change could be achieved and reported for cattle handling in the feedyard, if these categories were routinely assessed and monitored.

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