Auditing Cow Comfort - Video behind Barn Doors

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Take Home Messages

- Astute producers are leading the way in cow comfort.
- Cows have feelings.
- Injury, pain, and fear affect cow behaviour, health, and performance.
- Cows respond to choices of systems, barn features, and management.
- Lameness, hock sores, and cleanliness are cow responses.
- Cows audit their care. Reading their report can be a challenge.
- Cow responses can be audited.
- Audits include assessments of cows, barn features, and management.
- Cow comfort scoring is a risk management tool.
- Cows have rights.

Introduction

Dairy barn systems, features, and management are of interest to dairy producers because of their impact on cow health, performance, longevity, and welfare. The losses of valuable cows because of mastitis, lameness or injury are frustrating, tragic and costly. Producers and their advisors are looking to characteristics of the barn and its management for prevention rather than to Band-Aids for treatment. Astute producers also are leading the way and showing that something can be done to improve cow comfort. This presentation uses time-lapse video recordings to audit cow comfort by looking at the cow, the barn, and management. The overall objectives are to increase awareness, change attitude, opinion, or knowledge, and to stimulate action. The goal is to give cows and their caregivers a better life.

A Case for Auditing Cow Comfort

Public confidence and lameness may be the strongest reasons for auditing cow comfort. The public is aware of differences between husbandry-based farming of years ago and the new technology-based animal agriculture. The negative public perception is that the modern dairy industry is tied to technology for successful use of cows and that large, modern dairy farms pay less attention to individual animals. As we enter the 21st century, the public wants assurance that the use of dairy cows is linked to animal well being as well as appropriate technology. An auditing system could benefit cows, their owners, and the dairy industry by evaluating and verifying cow comfort, and correcting shortcomings.

A case should be made for focusing on lameness when auditing cow comfort. Lameness has been described as the number one welfare issue of dairy cattle. Lameness is common, yet under diagnosed by those caring for cows. It is associated with pain, impaired reproductive performance, and lost milk production. Furthermore, lameness is a cow response to choices in systems, barn features, and management of dairy cows. A focus on lameness scores in cow comfort audits could improve recognition of lame cows and address a major welfare issue.

The Tipping Point

The health and welfare of the cows may be tied closely to choices of systems, barn features, and management. Variations within and between systems and farming operations are common. For example, the frequency of injuries associated with a specific stabling system varies from farm-to-farm. However, caregivers tip the balance in the cows' favour (reduce the risk) by providing good footing and deep bedding in the stalls. Similarly, within a farm, the risk of mastitis may change daily because of the variation in intensity of cleaning and maintaining stalls. Auditors must realize that interactions and subtle differences in systems, barn features, and management tip the balance and can either contribute to or impair cow comfort.

Auditing Questions

Children often ask three questions that we can borrow for auditing cow comfort. What's that? Why? So what?

"What's that?" can be answered by observation and studying records. Records are useful for evaluating disease, production, and performance. Observation is necessary to determine cow behavior - normal, unwanted or forced.

"Why?" can be answered by looking for reasons for the observations. A short list pertaining to behaviour should include:

- fear or apprehension,
- pain,
- intrusion on "butt" space,
- forced by design, construction, or ventilation features,
- stalls or tethering systems,
- floors,
- manure systems,
- feeding systems, and
- skills and attitudes of care givers.

"So what?" can be answered by exploring alternatives and acting. This should include exploration of the costs associated with the findings, the options for control or prevention, and the benefits related to acting. When faced with choices in systems, barn features or management, the decision may be clearer by considering the implications. Is the choice to "save now and pay later" or to "pay now and save later?" For example, barns can be built with smaller stalls and alleys, and overpopulated to decrease the cost per stall or per cow housed. One should know if this decision translates into greater costs related to disease, lost production, and culling. Is the choice for the "benefit of the cow" or the "benefit of the man." For example, slatted floor manure systems and under-barn manure storage may be more economical than other systems. Will the choice of flooring and manure system challenge the cows in terms of behaviour, locomotion, foot health, grooming, and air quality? For sure, there will be compromises. Savvy producers are showing the way by "paying now and saving later" and choosing for the "benefit of the cow."

■ Concepts

The most successful producers provide for rather than fight against the behavioral needs of their cows. Leading, following, dominance, and submissiveness are behavioral traits of cows. Behavior can affect health and performance. Lameness in submissive first lactation heifers moving into a milking cow group or an overpopulated barn is an example wherein their management leads to altered behavior, increased standing times, and the disease. Producers leading the way understand the links between behavior, barns, health, performance, and welfare.

Comfort - Behaviour - Ergonomics

Comfort is a state of ease, free of pain, want or other afflictions. A cow's response to the five freedoms enables an audit of her comfort. (Freedom from hunger/ thirst, discomfort, pain/ injury/ disease, normal behaviour, and fear/ distress.) Behaviour refers to actions or reactions under specified circumstances. During an audit, one may see unusual behavior and signs of fear or coping. Cows perching in stalls or rising like horses are examples. (Perching refers to standing with the front feet in the stall and the rear feet in the alley.) Ergonomics refers to the improvement of cow health or performance through the careful design of her workplace. The systems, barn features, and skills and attitudes of caregivers should provide for normal behavior, safety and health, performance, and well being.

Normal Behaviour

In Ontario, confinement housing is the norm on most dairy farms for several months of the year and the entire year on many farms. Because of confinement housing, we may be unfamiliar with normal cow behavior. Some caregivers may be desensitized (a coping mechanism) to abnormal behavior or discomfort of cows. Common behavior may not be normal and common housing may not be best for our cows.

For example, cows rest in wide, narrow, short or long positions (Kammer, 1982), or completely on their side. To allow for normal resting positions, the resting area must provide cows with the freedom to:

- stretch their front legs forward,
- lie on their sides, with unobstructed space for their neck and head,
- rest their heads against their sides without hindrance from a partition,
- rest with their legs, udders and tails on the platform,
- stand or lie without pain or fear from neck rails, partitions, or supports, and
- rest on a clean, dry, and soft bed.

Some of the resting positions and behavioral characteristics are a revelation to experienced stockpersons. Although an interesting observation, it should come as no surprise because their focus is on doing the work. Feeding, milking, cleaning, repairing, medicating, or maintaining take priority over idle observation of cows. Nonetheless, those caring for cows must know normal and abnormal behavior and be sensitive to the needs of cows.

■ Space Requirements

To rise or lie down, the resting area must provide cows with the freedom for vertical, forward and lateral movement without obstruction, injury or fear. A rising motion (Figure 1) includes the freedom to lunge forward, to bob the head up and down, and to stride forward. A resting motion also includes the freedom to lunge forward and to bob the head. The space for lunge and stride can be seen easily using video images with a superimposed grid. The following four photographs show a cow lunging forward. Her nose moves ahead a distance equal to about 3 grids - 22% of her nose-to-tail length. In many barns and stalls, cows cope by changing normal behaviour.

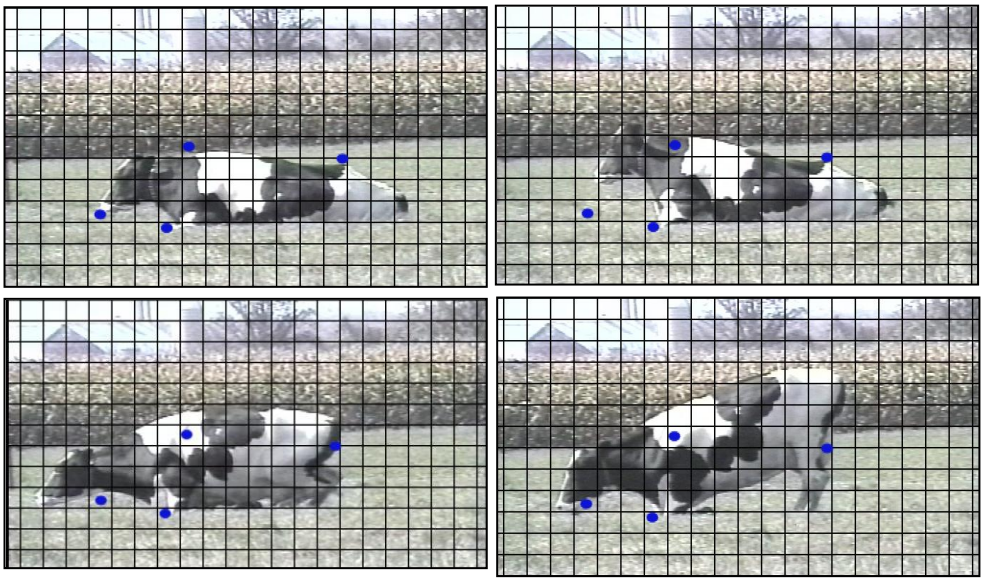

Figure 1. The four photographs show a cow lunging forward while rising. Start at the top left and move clockwise, noting movement of body parts relative to the circular dots.

A recent report of space requirements for cows comes from Faull et al. (1996) in the UK. After observing cows freely lying and rising in a field, they concluded that Friesian/Holstein cows needed 241 x 117 cm (95 x 47 inches) living space and a further 61 cm (24 inches) of head lunging space for rising. After conducting barn audits, they found 87% of cubicles were too short, 50% were too wide or too narrow, and that only 12% of the cubicles permitted real freedom of movement. Fully 10% of cows appeared moderately or severely restricted when lying down, 33% when rising and 55% when standing. Cermak

(1988) and Irish & Merrill (1986) advised sizing stalls by using cow dimensions. For example, they recommended stall widths equal to twice rump width.

■ Cow Dimensions

Cow dimensions are essential for deciding upon stall dimensions, yet these dimensions are not easy to find. The most readily available cow dimension is rump height because it is collected during type classification of purebreds. Fully 25% of Canadian First Lactation Holstein cows stand 150 cm (59 inches) or higher at the rump and weigh greater than 600 kg (1325 lb.). The median is 147 cm (58 inches) at the rump and 569 kg (1255 lb.) for 93,000 recently classified heifers. The web pages for Holstein Canada and Holstein Association USA report mature cows 147 cm (58 inches) at the shoulder and weigh 500 kg (1680 lb.).

Measuring cows is not an easy task, especially the nose-to-tail length. At one farm, a simple duct tape grid on a wall adjacent to a water trough and a video camera helped to determine length and height. The surprise measurement was nose-to-tail length greater than 259 cm (102 inches) leading us to conclude that we needed a longer wall for the research. At another farm, measurements of rump width revealed that 50% of the cows measured greater than 64 cm (25 inches) at the hook bones and the top 25% measured 68 cm (27 inches). The sample size is woefully insufficient to make conclusions about hook bone width or cow length for the Holstein breed. Similar barnyard research showed that imprint width while resting in the narrow position is about equal to twice hook bone width. Rump height is a good substitute measure of withers height.

Current North American extension publications show neither cow dimensions nor space requirements for normal standing, resting, rising or lying behavior. The publications show cow weight and recommended stall dimensions. When using the publications to choose stall size, producers must know the weight of their cows. Producers will find several dimensions for cows of that weight depending upon the source of the publication. Moreover, their choice must be made on faith because there are neither performance data for the stalls nor audit reports for appropriateness of fit. For the most part, stalls have been and are being built for the average Holstein cow - one believed to be 635 kg (1400 lb.). However, experience has shown that our cows have gotten larger over the past decade or more and that they do not fit comfortably in the old barn.

For an example of the distribution of cow weights within a herd, look at the histogram of weights for 87 Holstein cows at an Ontario research farm (Figure 2). The researchers weighed the cows 4 to 7 times during their lactation. This yielded 448 weights to describe the weight distribution for cows in the herd. Thirty-one, 27, 13, 6, 4, 3, 2 and 1 cows were in Lactation 1 to 8, respectively. Weight changed by stage of lactation. Overall, the median weight was 657 kg

(1448 lb.), and the 3rd quartile was 709 kg (1563 lb.). By 200 days in milk, the lactation 1 cows weighed more than 635 kg (1400 lb.). The median weights were 649, 710, and 748 kg (1430, 1565, and 1650 lb.) for Lactation 1, 2, and 3+ cows, respectively. The median weights for the mature cows are greater than the weight for mature Holsteins posted on the Holstein Canada web page. When examined closer, 55% of the cows weighed heavier than the median weight for the group. From this distribution, would you follow standard recommendations and build stalls for the average 635-kg (1400 lb.) cow, the top 25% of this herd, or some combination of sizes?

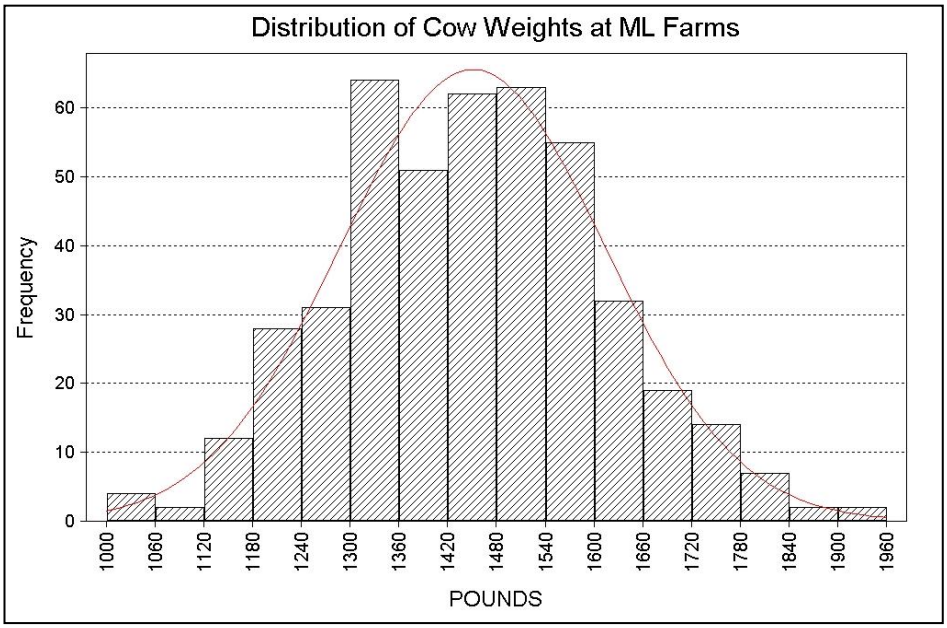

Figure 2. Distribution of Cow Weights for 87 cows at ML Farms.

■ Question Common Advice

Astute producers and equipment suppliers have been questioning or ignoring standard recommendations for stalls. With traditional rural contrariness and handiness, many have experimented with various stall dimensions. Although not all have been successful, this on-farm research has led to several innovations that benefit cows. Measuring and weighing cows makes sense because of the variation in cow size amongst herds. Some producers are now

fitting stalls for their cows. On some farms, 25% of the stalls in a barn have been built for heifers and small cows and 75% built for mature cows.

Canada has no published audits similar to those done in the UK by Faull. Nonetheless, cow responses from case study herds indicate that stalls have not met the space requirements of our dairy cows. With a nose-to-tail length of about 259 cm (102 inches), and a lunge distance of another 61 cm (24 inches), how can a Holstein cow lunge forward in a stall with a curb-to-wall length of 244 - 279 cm (96 to 110 inches)? Would an audit show that 85% of our stalls are too short? With an imprint length (tail to folded knees while in the resting position) of 178 - 183 cm (70 - 72 inches), how can a Holstein cow lie straight in a stall with a brisket board placed 168 - 173 cm (66 - 68 inches) forward of the curb? With an imprint width of 122 cm (48 inches), how can a Holstein cow lie comfortably in stalls built with loops on 114-cm (45-inch centers)? With the tie rail located 102 cm (40 inches) above her bed, how can a Holstein cow lunge forward or eat without the pipe exerting great pressure on her neck? With a 46-cm (18-inch) tie chain, how can a Holstein cow rest her head back in the short resting position? Are standard recommendations for stall dimensions contributing to diagonal standing and lying behaviour, to briefer lying times, hock sores, injuries, and lameness?

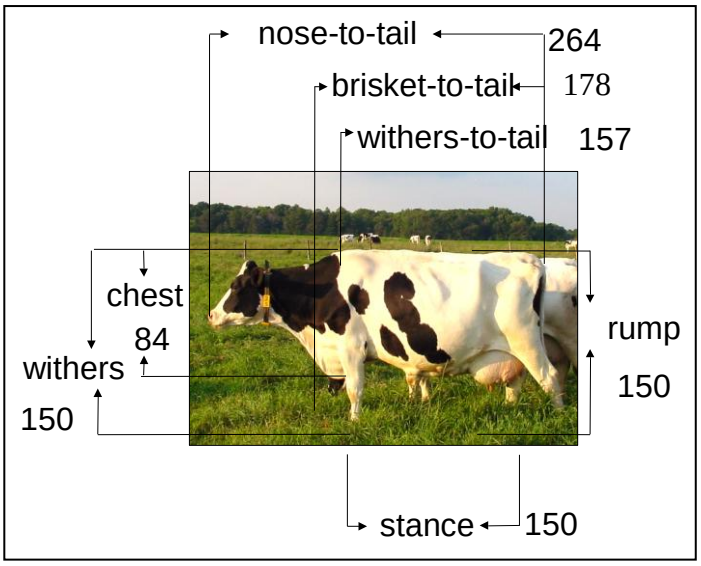

Figure 3. Dimensions (cm) for a mature Holstein cow.

■ Cows Audit Daily. Reading Their Report can be a Challenge.

Cows audit their environment and care daily. The biggest challenge can be reading and understanding their report. For the most part, cows protest in silence. For example, they stand or lie diagonally in their stalls - sentinels pointing at a problem and waiting for us to read their signs of displeasure or discomfort.

Diagonal standing or lying is a concern to dairymen because cows are more likely to defecate onto the corners of stalls. Stall and cow cleanliness influence labor, mastitis, and milk quality. Cleaning stalls or barns is the most disliked work on UK dairy farms (Seabrook and Wilkinson, 2000). The same is likely true in North America. This dislike for cleaning stalls probably explains several design strategies implemented to keep stalls clean. The strategies include narrow stalls, the extension of bottom pipes of loops farther behind the brisket locator, (Johnson, 2001), neck rails placed low and to the rear of the stall, or short resting surfaces. When built to keep cows out, stalls stay clean, and workers are happy.

Contrary to common belief, cows may not be standing and lying diagonally because the stall is too wide. Cows may be standing and lying diagonally because of short stalls, low neck rails, neck rails too close to the curb, or obstructions at the front of the stall. Cows seem to know that the hypotenuse of the triangle provides the greatest space for their comfort in compromised stalls.

Observations at two study herds showed that cows lunge diagonally because of obstructions to forward lunging. At Study Farm 1 the cows were in head-to-head stalls. The basic dimensions included 4.9-m (16-foot) platforms, 122-cm (48-inch) width, open front, 96-cm (38-inch) loop opening, neck rail 124-cm (49-inches) high, mattresses and PolyPillows™. In those stalls, a diagonal lunge was 8 times more likely when a cow occupied the facing stall. Cows lunged diagonally 34% of the time when the facing stall was empty, compared to 81% when the facing stall was occupied (Figure 4). (Odds Ratio =0.12, 95% CI 0.05 - 0.29, $P<0.000$).

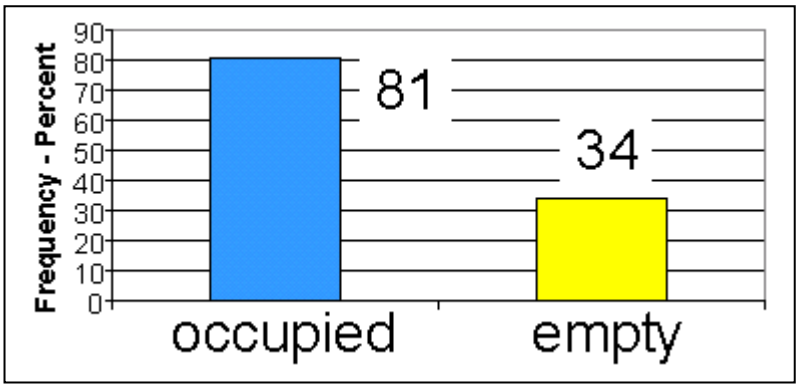

Figure 4. Study Farm 1: Frequency of Diagonal Lunging in Head-to-Head Free Stalls with the Facing Stall Occupied and Empty

At Study Farm 2, data came from cows in a row of stalls facing the feed alley. Holstein cows were in a single group (84 cows and 70 stalls) in the three-year-old free stall barn. Table 1 shows the dimensions and characteristics of the original stalls and the new, replacement stalls and Figure 5 shows the frequency of diagonal lunging. The original stalls had loops suspended on front mounting pipes designed to allow adjustments in stall width. The same rubber-filled mattresses and sawdust, shavings, or wood chips provided the bed for old and new stalls. Individual posts suspended the new loops. The front of the new stalls was open to permit forward lunging. Cows lunged diagonally through the loop 68% of the time in the original stalls with obstructions at the front. Cows lunged diagonally 44% of the time in the modified stalls. The likelihood of diagonal lunging was 2.7 times greater in the original stalls. (χ^2 (1,N=240) = 14.3, *P*<0.0002, OR=2.7, 95% CI 1.6-4.6).

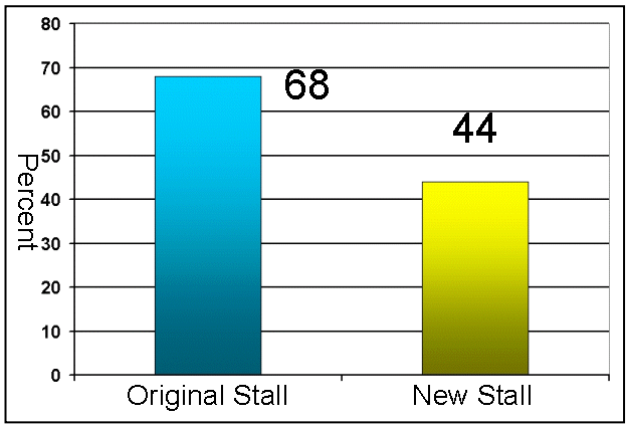

Figure 5. Study Farm 2: Frequency of Diagonal Lunging in Original and New Stalls Facing the Feed Alley

Table 1. Dimensions and characteristics of original and modified (new) free stalls at Farm 2.

cm (Inches)	Stall Front	Stall Width	Neck Rail Height	Neck Rail Forward	Stall Length	Brisket Locator	Loop Opening
Original	Pipes	112 (44)	109 (43)	170 (67)	244 (96)	20-cm high Board at 175 (69)	71 (28)
New	Opened	122 (48)	127 (50)	178 (70)	244 (96)	10-cm high PolyPillow™ at 183 (72)	96 (38)

Study Farm 2 also provided an opportunity to study how cows used the stalls. Figures 6 and 7 show the findings. With a change to new stalls, resting time increased from 40 to 55% of the day - an increase of 3 hours per day (from 10 to 13 hours). Perching time decreased from 14 to 4%, a decrease of 2.4 hours per day (from 3.4 to 1 hours)(Figure 6). The bouts (Figure 7) of resting time increased 23 minutes from a median of 36 minutes in the original stall to 59.5 minutes in the new larger stall (P=0.008). Bouts of standing time decreased 3 minutes from a median of 5.5 minutes in the original stall to 3 minutes in the new stall (P=0.004). Bouts of perching time decreased 4 minutes from a median of 8 minutes in the original stall to 4 minutes in the new stall (P=0.002).

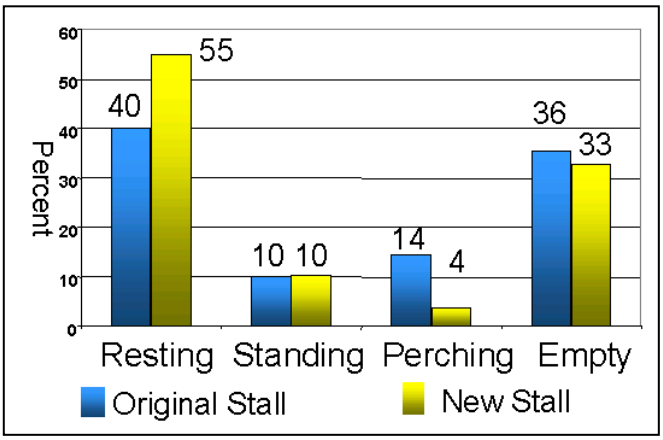

Figure 6. Study Farm 2: Percentage of Day Resting, Standing, and Perching.

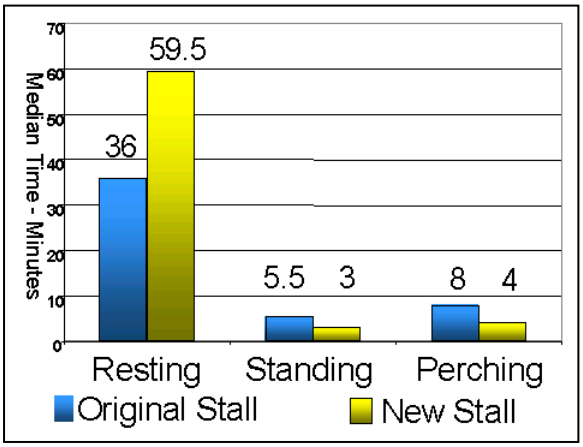

Figure 7. Study Farm 2: Median Time in Minutes for Bouts of Resting, Standing, Perching.

Although, the percent of time in a day spent standing in the stalls did not change, the time in minutes for bouts of standing changed significantly. The data in Figure 6 are useful summaries of activities at the herd level. However, using standing as an example, the overall measure (percent of time) did not reveal the subtle difference in standing activity by individual cows shown by the bouts of time. The bouts of standing and perching time showed that the cows accepted the new stalls more readily than the original stalls.

Without the addition of new cows to the milking string, milk production increased 3 Kg/ cow/ day (from 22 to 25 Kg) within the first week after changing the stalls. Body condition, hock and leg injuries, and lameness were remarkable at the time of the first visit. Fully 100% of the cows had hock injuries. After 6 weeks, hock health showed marked improvement. The cost of materials and labor was $17,000 for 129 stalls (milking cow, dry cow, and bred heifer groups) or $132.00 per stall. The pay back time (using increased milk production for income) could be 4 months.

The new loops had a wider opening to permit easier diagonal lunging and the front of the stall was opened to encourage forward lunging into the feed alley. When given a choice, the cows chose forward lunging about 56% of the time in the new stalls. Regrettably, cows suffered in this three-year-old barn before economic factors and humane care countered contrariness to change beliefs and stalls. This study herd also supports the case for cow comfort audits.

Similar findings from other case studies, or controlled experiments, would test these case study observations. Is the mismatching of stall and cow dimensions detrimental to cow safety and performance? Do cows lunge diagonally because of obstructions at the front of the stall? How much open space at the front of the stall would encourage forward lunging? In head-to-head, open-front stalls, could the space be nose-to-tail length plus head-lunging length - stalls 5.5 m (18 feet), curb-to-curb, perhaps? In stalls facing a wall, would cows need a 3-m (10-foot stall)? Would the benefits outweigh the costs?

There could be several reasons to consider giving cows the space and freedom to lunge forward. The head-to-head separation could provide air space and may decrease heat stress and losses in milk production during the hot months of the year. The unobstructed space could encourage cows to stand, lunge and lie straighter in the stalls. Lastly, the separation may decrease the effects of dominant social behavior and enhance resting opportunities for submissive cows in the herd. Producers and their cows might benefit from research designed to answer these questions.

Because resting, standing, and perching are important behaviors for foot health, cows and their owners should benefit from matching cow dimensions and stall dimensions. Stall dimensions that encourage standing and lying straight in the stall should contribute to stall cleanliness.

■ Cow Comfort Scoring - A Risk Management Tool

The concept of scoring cows is familiar because of type classification and body condition scoring (BCS). For BCS, nutrition advisors and veterinarians view the cows and assign a score to indicate over or under conditioning. The premise being that cows that are too thin or fat for specific stages of their lactation are

more likely to experience an undesirable event such as metabolic disease or impaired reproductive performance. The frequency and costs associated with the diseases represent the magnitude of the negative impact in the herd. The risk assessment of diseases of fat and thin cows includes both the probability of an event and economic impact of the events. Body condition scores alert advisors to investigate shortcomings in feeding management. The findings direct actions to correct those limitations. Body condition scoring is a risk management tool when managers act to decrease the probability and cost of the diseases related to cows in undesirable condition.

On individual farms, a cow comfort scoring system could be a risk management tool by providing an accounting of cow responses to husbandry and alerting managers to remedy shortcomings. At the industry level, summaries of cow comfort scores could address processors' and consumers' concerns about dairy cattle welfare. Cow comfort scoring could reinforce current management practices and lead to improvements in facilities and management.

■ Indicators of Cow Comfort

A thorough on-farm audit should include assessments of cows, facilities, and management. An exhaustive list of items in these categories appears in welfare assessments prepared by Freedom Foods (UK), Free Farmed Foods (USA), and the British Columbia SPCA. Producers and their advisors may find the lists an informative and valuable reference. The extensive lists may be too daunting for common use. A basic cow comfort scoring system should include cow responses that can be easily identified and scored during routine consultations by advisors.

Injury, claw disease, lameness, and cleanliness are common cow responses to choices of systems, barn characteristics, and cow care. Most of the cow responses and the majority of human-cow contact occur at the rear of the cow. Therefore, caregivers can conveniently score several indicators of cow comfort when cows are at feed bunks, in milk parlors, or in tie stalls. Disease, especially mastitis, and culling records should be considered in the evaluation. Behavioural evidence of stress, fear, or frustration such as resting, standing or lying times, and fear of humans would be useful to record. However, these observations are not easy to attain with a cameo appearance and would be more applicable to in depth investigations.

In summary, the short list of individual cow responses to score should include injuries (hock, neck), claws (overgrown, rotated), arch of the back (lameness), tails (normal, docked, broken), and cleanliness (teats, legs). These have been selected because of the increased probability of an undesirable event (premature culling, impaired fertility, lost production, mastitis, public concern, welfare) associated with an undesirable score.

Cows respond to choices of facility and management. Managers choose the size of stalls, space allowance in alleys, number of eating places at bunks, stalls per cow, conditions of the lying area, frequency of regrouping, floor surface, and frequency of manure removal. Experience and research have shown that management affects cow behaviour, comfort and welfare. For example, the associations between feeding practices, stocking densities, and frequency of regrouping are becoming better understood for their role in the health and welfare of transition cows and cows at and after calving.

The husbandry system and the way it is managed may explain why the cow responses are happening. The challenges and the opportunities are to determine how to improve cow comfort.

■ Simple Scores for Cow Comfort

A scoring scale may range from a simple yes/no to multiple levels. For example, one BCS system used a scale of 1 (thin) to 5 (fat) to rate cows, yet some advisors score in ¼-points with a potential for a 17-point scale. E. Marian Scott (Glasgow) determined that a three-point scale - none, mild, significant - was the scale favoured by many for rating several indicators of comfort or behaviour (i.e. kicking, stepping). Dairy Farmers of Ontario (DFO) inspectors evaluate farms for milk quality by using a three level scoring system - acceptable, needs improvement, and unacceptable. Temple Grandin proposed a two-point scoring system - yes or no - for auditing animal welfare in slaughterhouses. For example, the animal fell while being handled or it did not fall; the handler hit the animal or did not hit it. In Grandin's system, an arbitrary threshold determines a pass or a failure for the facility and management. The various scales have advantages and disadvantages. Respondents often show a central tendency when offered a multiple level scale.

A yes/ no scale for auditing cow comfort should be adequate and easy to apply on farms. For injuries and claws, the auditor could select the most severely affected appendage. Auditors would record the findings for the seven cow responses by circling the choice on a form, or entry into a hand-held data logger. Rather than having to decide if the hock has swelling with no hair loss, hair loss with no swelling, or hair loss and swelling, the choice could be injury or no injury. The choice will be determined by the auditor's pre-set definition of injured. For example, the definition of injured could include a range from visible swelling to an open lesion. The other choices are as follows. The neck is injured or it is not. The claw is overgrown and rotated or it is not. The back is arched or it is flat. The tail is present and normal, amputated, or broken. A teat is contaminated with manure or it is not. The lower leg (rear leg) is contaminated with manure or it is not. Scores could be summarized as percentages.

Limits or Cut-off Points

Ultimately, the scoring produces a summary and requires the establishment of limits or cut-off points. Thresholds are a common concept. Speeding while driving is an example. The auditor (police officer) may tolerate 10-over the limit on open highways as acceptable by the public, or insist on zero tolerance for exceeding the speed limit in a school zone. Dairy producers are well aware of cut-offs for milk quality such as somatic cell count, inhibitors, and freezing point. Unacceptable cow comfort scores should trigger action. The Ontario dairy industry established milk quality cut-offs collaboratively with processors and producers. The same type of collaborative effort should be expected when the industry sets cow comfort score cut-offs. The thresholds must address the issues of animal welfare, commercialism, ethics, and public concerns.

Sample Size for Scoring

In our small Ontario herds, scoring all cows would be an easy task. Scoring all cows in larger herds may be too daunting and prompts one to consider scoring a sample of cows in the herd. However, Ontario does not have the data necessary to calculate the sample size.

Conclusion

The objectives of a cow comfort audit are to identify risks, measure change, establish targets, increase awareness, and correct shortcomings. A simple cow comfort audit focuses attention on the cows and stimulates discussions about husbandry systems and management to take advantage of opportunities for cows, their owners, and our dairy industry.

Acknowledgements

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