Veterinary Technician Program

Moderator: Dick Wiley

Disposition – Convenience Trait or Economically Important?

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Abstract

Disposition or temperament of cattle is a measure of the animal's relative docility, wildness, and handling ability during processing in the pen as well as in the handling facilities. Easily excitable animals compromise both their own safety and the safety of handlers. The Iowa Tri-County Steer Carcass Futurity collects sires, dams, and birth dates from cow-calf producers who retain ownership, as well as growth data, health treatments, disposition scores, and complete carcass data on steers and heifers. In the last 10 years data has been collected on 66,620 head of cattle from 23 states and Manitoba. Cattle are disposition scored at on-test, reimplant, and first sort; the cattle in the second harvest group are scored one additional time. Based on their average disposition score, the cattle were grouped as docile, restless, and aggressive.

When compared to docile cattle, aggressive cattle gained less in the feedlot (2.91 vs 3.17 lb/day; 1.32 vs 1.44 kg/day), produced fewer Choice carcasses (58.1 vs 72.4%), more Select carcasses (36.2 vs 23.3%), and the black-hided cattle produced a lower percentage of Certified Angus Beef (CAB) carcasses (14.3 vs 29.1%). Morbidity rates were similar across disposition scores; however, death loss increased significantly as disposition scores increased. Non-replacement heifers had higher disposition scores than steer mates, as cow-calf producers selected for more docile replacement heifers. Average profit for docile cattle was $46.63 per head compared to $7.62 per head for aggressive cattle.

Résumé

L'« attitude » ou le « tempérament » des bovins est une mesure relative de leur docilité par rapport à un animal sauvage. Cette mesure évalue aussi la facilité avec laquelle on peut manipuler les bovins dans l'enclos et dans les autres aires de manutention. Des animaux nerveux compromettent à la fois leur propre sécurité et la sécurité des manipulateurs. L'entreprise Iowa Tri-County Steer Carcass Futurity reçoit des bovins géniteurs mâles et femelles expédiés par les éleveurs vache-veau qui restent propriétaires de leurs animaux, et consigne les dates de naissance de leurs bovins. Cette firme recueille également des données sur la croissance, les soins relatifs à la santé, les cotes d'attitude et toutes les données reliées aux carcasses des bouvillons et des génisses qu'elle reçoit. Au cours des 10 dernières années, nous avons recueilli des données sur 66 620 bovins provenant de 23 États américains et du Manitoba. Nous évaluons la cote d'attitude des bovins en début d'épreuve, et lors de la réimplantation et du premier tri ; la cote d'attitude est évaluée à nouveau dans le second groupe de récolte. Sur la base de leur cote moyenne d'attitude, les bovins ont été répartis en trois groupes : dociles, agités ou agressifs.

Par rapport aux bovins dociles, les bovins agressifs ont gagné moins de poids dans le parc d'engraissement (2,91 lb/jour versus 3,17 lb/jour; 1,32 kg/jour versus 1,44 kg/jour), ont produit moins de carcasses de Choix (58,1 % versus 72,4 %) et plus de carcasses Select (36,2 % versus 23,3 %), et les bovins au cuir noir ont produit davantage de carcasses certifiées « Boeuf Angus » (CAB) (14,3 % versus 29,1 %). Le taux de morbidité était semblable pour l'ensemble des cotes d'attitude, bien que les pertes par mortalité aient augmenté significativement avec la cote d'attitude. Les génisses non destinées au remplacement avaient des cotes d'attitude plus élevées que les bouvillons du même troupeau, puisque les éleveurs vaches-veaux sélectionnent leurs génisses de renouvellement en privilégiant une attitude docile. Le profit moyen rapporté par les bovins dociles était de 46,63 $ par tête, contre 7,62 $ par tête pour les bovins agressifs.

Introduction

Disposition or temperament of cattle is a measure of the animal's relative docility, wildness, and handling

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ability during processing in the pen as well as in the handling facilities. As with most traits in beef production, part of the final product is inherited from the sire and dam, and the other part is influenced by management and the environment the animal is developed in and exposed to.

Easily excitable animals compromise their own safety and the safety of stockpersons in charge of raising them. Producers have recognized the importance of temperament in successful management.[5]

Is the value of good-disposition cattle only in less gas used in the four-wheeler to move the cattle from one pasture to another? Or does the disposition or temperament of cattle impact feedlot gain, carcass quality, and other economically important traits?

How Does One Measure Disposition?

The Beef Improvement Federation (BIF) scoring system was used to score disposition as follows:
Disposition Score = 1 to 6 chute scoring system

1. Docile. Mild disposition, gentle, and handles quietly. Exits chute calmly.
2. Restless. Quieter than average, but may be stubborn during processing. Some tail flicking. Exits the chute promptly.
3. Nervous. Typical temperament is manageable, but nervous and impatient. Constant movement. Repeated pushing and pulling on headgate. Exits chute briskly.
4. Flighty (wild). Jumpy and out of control, quivers, and struggles violently. Continuous tail flicking. Frantically runs fence line and may jump when penned individually. Exhibits long flight distance and exits chute wildly.
5. Aggressive. Similar to Score 4, but with added aggressive behavior, fearful, extreme agitation, continuous movement which may include jumping and bellowing while in chute. Exits chute frantically and may exhibit attack behavior when handled alone.
6. Very aggressive. Extremely aggressive temperament, "killers". Pronounced attack behavior.

Another subjective system is a pen scoring system using similar criteria as the BIF chute scoring system. One method of evaluating temperament is exit velocity, which is the rate at which an animal covers a set distance, usually five to 10 feet (1.52 to 3.05 m) after exiting the chute. Infrared sensors are used to remotely trigger the start and stop of a timing apparatus. Exit velocity is an objective number that is more valuable in a research setting and requires an investment in equipment. Curley *et al*[3] concluded, "whereas the various methodologies for temperament assessment may measure slightly different aspects of animal behavior, they do relate to one another, and in the case of exit velocity and pen score, to increased circulating glucocorticoids."

My experience training students and the Iowa Tri-County Steer Carcass Futurity (TCSCF) employees to do disposition scores has found that most people are able to understand the BIF scoring system and accurately apply it to feedlot cattle after co-evaluating 100 head. However, producers' self-evaluation of their own cattle has left a lot to be desired. Visiting with producers whose cattle have been above average in disposition at the feedlot surfaces a few comments that are consistent. They were not aware their cattle were difficult to handle, and assumed everyone else's cattle were just as wild. One or two sires are identified as producing most of the undesirable disposition calves. Working cattle quietly and without electric prods had not been done in the past. Australian work concluded temperament is highly repeatable, and an animal's temperament changes little over time.[11]

Is Disposition an Important Economic Trait?

From 2002 to 2009, 47,410 calves fed at 18 southwest Iowa feedyards were used to evaluate the effect of disposition during the feedlot period on feedlot gain and carcass quality. Steers and heifers were consigned to the TCSCF by cow-calf producers representing 23 states and provinces, including Georgia, South Carolina, Alabama, Florida, Virginia, Missouri, Indiana, Mississippi, Tennessee, Minnesota, Illinois, Kentucky, West Virginia, Maryland, Nebraska, North Carolina, Louisiana, Oklahoma, Kansas, North Dakota, South Dakota, Iowa, and Manitoba. Cattle were weighed multiple times: upon arrival to the feedlot, after 28 to 35 days, at re-implant, and prior to harvest. A disposition score using the BIF six-point scoring system (1 = very docile and 6 = aggressive) was assigned at on-test weighing, re-implant time, and pre-harvest. A common diet and health program was utilized at each feedlot. Calves were sorted and harvested when they were visually evaluated to have 0.40 to 0.45 inches (1.0 to 1.14 cm) of fat cover.

The six-point system was condensed to three classifications for analysis: 1 and 2 = docile, 3 and 4 = restless, and 5 and 6 = aggressive.

Carcass quality and yield grade have become increasingly important to the beef feeding industry over the last decade. Today's beef producer has to continually balance feedlot performance with payment premiums and discounts associated with grid-based marketing systems. While calmer cattle perform better in a feedlot environment, producers still need to consider how temperament could affect the US Department of Agriculture carcass quality grade. The influence of temperament on cattle quality and yield grades is important to any producer marketing their cattle to fit grids that reward

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low yield grade and middle USDA Choice or higher quality grade.

Research from the TCSCF program showed significant trends between temperament and cattle reaching the upper two-thirds USDA Choice or higher ($P<0.0002$) quality grade (Table 1). Docile cattle are more likely to reach the upper two-thirds Choice or higher quality grade than nervous to aggressive cattle. The reverse effect was seen on the lower quality grades. Nervous to aggressive cattle were more likely than docile cattle to reach the lower quality grades of Select and Standard (Table 1). In the end, calmer cattle achieved a higher mean average quality grade than cattle with more excitable temperaments.[1] Nervous or aggressive cattle produced more Yield Grade 1's and 2's (70 vs 58%) than the docile cattle.[1]

In our first analysis (2002-2004), a greater percent of the docile cattle were treated for bovine respiratory disease (BRD) as compared to the aggressive cattle (19.2 vs 16.2%). However, death loss was higher for the aggressive cattle when compared to docile cattle (1.91 vs 1.09%). Why the differences in morbidity and mortality? The TCSCF feedlots use the DART assessment for BRD management, where DART stands for Depression, Appetite, Respiratory Index, and Temperature. Signs of depression are lowered head, ears dropped, eyes dulled, and stimulation to move. When walking the pens looking for depressed calves, aggressive calves are most likely in the back of the pen, head held high, ears up, and eyes watching every move. One part of the appetite factor is evaluated by how the animal approaches the bunk as the feed truck drives by. Cattle with higher disposition scores tend to stay away from the bunk until the feed truck is out of sight. In other words, two of the four factors used to assess BRD are impacted by the disposition of the animal. Another factor that may explain why less aggressive cattle are pulled more often, but have lower death loss, is the question the feedlot manager may ask each time an aggressive animal is pulled: "will sorting the animal out of the pen, driving it to the treatment area, and administering treatment result in the animal responding to the treatment, the animal injuring itself or in the worst case, an animal handler being injured?" There are two options from a feedlot standpoint: 1) avoid feeding cattle with poor dispositions, which may not be a viable option, or 2) discount the depression factor in the DART assessment guide.

Pull rates in cattle with high disposition scores has been similar among docile and restless cattle in TCSCF feedlots after the above data was presented to them. However, the death loss continues to be almost twice as high as the docile cattle.

Table 1. Relationship of cattle temperament to performance, health, and carcass quality.

Item	Docile	Restless	Aggressive
No. of head	27,617	15,720	4,071
% of total	58.2%	33.2%	8.6%
Arrival weight, lb	643	642	642
Overall ADG, lb	3.22[a]	3.15[b]	3.01[c]
Est. feed-to-gain	6.86[a]	6.84[b]	6.97[c]
Est. dry matter intake, lb	22.11	21.55	20.98
Morbidity rate, %	17.2	18.4	17.0
Mortality rate, %	0.95[a]	1.06[b]	1.69[c]
% Prime	1.24[a]	0.70[b]	0.25[c]
% Choice	68.68[a]	64.49[b]	51.94[c]
% Select	27.90[a]	32.05[b]	42.57[c]
% Standard	2.18[a]	2.76[b]	5.23[c]
% CAB®	20.65[a]	15.21[b]	9.08[c]
Profit/head, $	46.63[a]	26.16[b]	7.62[c]

[a,b,c]Values within a factor without a common superscript differ ($P<0.05$).

2002 to 2006 TCSCF Disposition Analysis

Further analysis of the TCSCF data,[13] along with two additional years of steer and heifer (n=21,096) data, adds additional insight into differences between steers and non-replacement heifers, as well as the changes in feedlot management of cattle with poor disposition.

Consignors have indicated they are culling heifers based on disposition. Our data (Table 2) confirms that decision, with 5.7% of the steers being scored as aggressive compared to 8.2% of the non-replacement heifers being aggressive. Wilder cattle weighed significantly less at arrival, and steers were impacted more than heifers. Average daily gain was significantly higher in docile cattle, resulting in significantly heavier final weights. Death loss was significantly higher for aggressive cattle, and aggressive steers die prematurely at a higher rate than heifers.

More docile steers and heifers produced significantly heavier carcasses, with more fat cover and larger ribeyes, than aggressive steers and heifers (Table 3). More docile cattle produced higher quality carcasses with fewer YG 1 and 2's. Heifers produced significantly higher quality carcasses than steers with similar disposition scores.

Docile cattle had an average profit of $46.63 per head, while restless cattle had an average profit of $26.16 per head, and aggressive cattle returned an average profit of $7.62 per head. Disposition is more than a convenience trait. Calves with poor disposition gained

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Table 2. Relationship of disposition score to performance and health of feeder steers and heifers (2002-2006).

Item	Docile steers	Restless steers	Aggressive steers	Docile heifers	Restless heifers	Aggressive heifers	Sex	D X Sex
No. of head	10,740	3,707	875	3,721	1,578	475		
% of sex total	70.1%	24.2%	5.7%	64.4%	27.3%	8.2%		
Arrival wt, lb	673	664	644	629	625	614	<0.001	0.03
ADG, lb	3.56	3.45	3.37	3.26	3.19	3.06	<0.001	0.44
Final wt, lb	1,201	1,190	1,177	1,120	1,112	1,106	<0.001	0.08
No. of treatments	0.27	0.24	0.29	0.19	0.15	0.16	0.02	0.81
Mortality rate, %	1.1%	1.3%	2.4%	1.0%	0.4%	1.0%	<0.01	0.02

Table 3. Relationship to disposition score to carcass quality in feeder steers and heifers (2002-2006).

Item	Docile steers	Restless steers	Aggressive steers	Docile heifers	Restless heifers	Aggressive heifers	Sex	D X Sex
No. of head	10,740	3,707	875	3,721	1,578	475		
Hot carcass wt, lb	737	733	728	688	687	684	<0.001	0.26
Fat cover, in	0.43	0.42	0.39	0.47	0.46	0.43	<0.001	0.36
REA, sq in	12.4	12.3	12.2	12.1	12.1	12.0	<0.001	0.82
REA/cwt of hot carcass weight	1.68	1.68	1.67	1.76	1.76	1.75	<0.001	0.05
% CH & +	16.6%	15.0%	8.6%	22.7%	18.3%	15.7%	<0.001	0.06
% CH -	51.8%	51.4%	47.8%	50.0%	56.0%	55.6%	0.004	<0.001
% Select	23.0%	24.5%	31.8%	16.8%	17.4%	21.2%	<0.001	0.57
% Std	1.2%	1.2%	1.8%	0.7%	0.6%	0.9%	<0.001	0.86
% YG 1 & 2	61.3%	65.5%	74.7%	55.1%	58.8%	67.8%	<0.001	0.80
% YG 4 & 5	1.6%	1.2%	0.3%	3.4%	3.5%	1.6%	<0.001	0.54

less, had higher mortality rates, reduced quality grades, and reduced Certified Angus Beef (CAB®) acceptance rates when compared to docile calves. This is in agreement with work by Faber[4] demonstrating statistically lower ADG and profit for wild steers as compared to docile steers.

Texas A&M University researchers evaluated mass medication with ceftiofur crystalline free acid[a] (CCFA) on arrival based on temperament of the calves; exit velocity was used to score temperament.[12] Exit velocity was measured on each steer on days 0, 14, and 28. On day 0, half of the steers were administered 1.5 mL/cwt of CCFA, and the other half served as non-treated controls. The steers were fed in a GrowSafe[b] system to measure individual feed intake. Only one steer out of 119 was clinically morbid during the 28-day trial. Calm or docile cattle showed no gain response to CCFA. The excitable cattle treated with CCFA spent 17 minutes per day more time eating than their non-treated counterparts. Calm steers showed no gain response to CCFA, whereas the excitable steers treated with ceftiofur had higher dry matter intake and ADG than controls. Use of this product to improve performance is extra-label, therefore cannot be recommended.

Toughness and dark-cutting characteristics are two critical components of carcass quality. The negative consumer response to tough and dark-cutting carcasses reduce producer profits by as much as $5.00 and $2.89 per head, respectively. Surveys conducted among restaurateurs and retailers have shown that these traits rank among the top 10 concerns about quality beef.[15]

Studies show a significant relationship between dark-cutting carcasses and animal behavior. Animal behaviors caused by mixing unfamiliar cattle together can result in fighting, mounting, and other aversive behavior that can increase physical stress, which increases chances of producing a dark-cutting carcass.[15]

Voisinet *et al*[15] studied the effects of temperament on toughness and dark-cutting carcasses in *Bos indicus*-cross feedlot cattle by determining chute scores and comparing them to individual carcass data. A four-point temperament score (chute scores) was used to assess

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each animal's disposition; and after being harvested at a large commercial beef packing plant, carcass characteristics were evaluated. USDA graders determined the incidence of dark-cutting carcasses, and researchers evaluated toughness by cooking a strip loin from each animal and testing them with a Warner-Bratzler shear machine. Results from the experiment showed that excitable animals had more borderline dark cutters and tougher meat characteristics than animals with a calm temperament. Some 40% of the time, excitable animals had carcasses that exceeded the food service industry's acceptable threshold for tenderness. Steers with a temperament ranking of 1 to 3 averaged a steak beyond acceptable tenderness levels 13.7%. Dark-cutting characteristics followed the same trend. Cattle with calm temperament scores had dark-cutting carcasses 6.7% of the time, whereas 25% of the carcasses from highly excitable animals were dark-cutting.[15]

One might assume that breed influenced the presence of dark cutters; however, previous research has been inconsistent in determining a breed's relationship to dark-cutting. A possible reason might be that animals with a more excitable temperament are more susceptible to stress generated by routine handling practices that occur prior to slaughter. The increased susceptibility to stress could then lead to more borderline dark-cutting beef carcasses.[15]

Carcasses from more excitable animals have a greater tendency to produce less tender, borderline darker-cutting carcasses. With this in mind, producers can make culling decisions within a breeding program and select for temperament as a possible option to decrease the number of carcasses that produce lower-quality meat at slaughter time.

What Determines Disposition?

Along with differences in calving ease, marbling, and ADG, there are differences in temperament which can be largely influenced by the genetics used in breeding decisions.[5] A variety of factors can contribute to the temperament of an animal, but research shows that temperament is moderately heritable. Producers thus have some control over the temperament of cattle by selecting cattle based on behavior.[14]

Canadian workers examined the genetic and phenotypic relationships of feeding behavior and temperament with performance, feed efficiency, ultrasound, and carcass merit of beef cattle.[10] They estimated direct heritability for flight speed or exit velocity at .49. Results of their study indicate that even though feeding behavior may be phenotypically independent of temperament, the two classes of behavior may not be genetically independent. The positive genetic correlation between feeding duration and temperament may indicate a commonality in the genetics of the two traits; however, there may be an inverse relationship between the genetic factors that affect temperament and those directly related to feed consumption. This is not only evident from the negative correlation between exit velocity and head-down time, but also from the phenotypic and genetic correlations between exit velocity and dry matter intake. The results suggested that the more time animals spent at the bunk, the more feed they consumed. They concluded that feeding behavior and temperament may need to be included in the definition of beef cattle breeding goals and approaches. The goals and approaches include culling unmanageable cattle and introducing correct handling facilities; however, early life provisions of appropriate handling experiences are also useful.

In the early 1990s, the North American Limousin Foundation members identified improving disposition as the number one breed priority. They developed a temperament scoring system, as well as the industry's first temperament or docility EPD. Rapid genetic progress was possible, given the strong heritability of .40 that was estimated for the Limousin breed. In 1993, 73% of the Limousin cattle evaluated were scored as calm. In 2003, the percent of Limousin cattle evaluated as calm increased to 91%.[8]

Studies have been conducted that compare the temperament scores of a variety of breeds. Research conducted in 1997 by Voisinet *et al* found *B. indicus* cattle to be more aggressive than *B. taurus* breeds.[14] Another study on the influence of breed and rearing conditions found that Salers and Limousin cattle had significant differences in mobility.[1] However, other studies found no difference in temperament between cattle raised in similar environments.[5,6] Even observations between *B. indicus*-cross cattle were inconsistent in establishing a relationship between temperament and the percent of Brahman influence in a steer.[14]

A variety of explanations have been given to justify the mixed results. One reason may be the limited population size and number of breeds evaluated.[5] A difference in sire temperament within a breed was also listed as a possibility. Boivin *et al*[1] noticed that among Limousin-sired calves used in the study, one sire in particular produced eight out of 11 calves that received an aggressive temperament score, while other sires had a mean of only two in 11 calves receive an aggressive score.

The larger, more diverse populations studied in the Iowa TCSCF addressed the possible inconsistencies among earlier research (Table 4). A total of 11,619 sire-identified steers were temperament scored with a six-point system three or four different times, from on-test and re-implant to being sorted and delivered to the meat processing plant. Of the known purebred cattle evaluated, Brangus were the most aggressive with a mean disposition score of 2.243, and Hereford and Polled

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Table 4. Effect of sire breed on average disposition score of all calves where sire breed was identified.

Sire breed	Number of calves	Average disposition score
Hereford & Polled Hereford	651	1.297
Simmental	894	1.589
Red Angus	464	1.617
Angus	6,914	1.618
Gelbvieh	579	1.701
Charolais	561	1.834
Limousin	263	1.860
Brangus	479	2.243

Hereford were the most docile with a score of 1.297. The small score differentiation between breeds could possibly support earlier data that found no significant difference between certain breeds of cattle.[2]

A possible confounder complication in our evaluation is that the cattle were all reared in different environments, which could impact temperament and the ability to understand the full effect of breed on temperament. Producers involved in the TCSCF program do not randomly select sires or breeds.

Canadian work compared beef heifers exposed to pre-recorded human handling noise, metal clanging, and no noise. For five consecutive days the heifers' heart rate and movement were measured while they were constrained in an electronic scale in a chute complex. Researchers concluded that by eliminating or reducing the sounds of metal clanging, and particularly the sounds of humans shouting, the level of fear cattle experience during handling should be reduced.[16]

Detecting Temperament and Selecting for Calmness

The moderate heritability of temperament coupled with an increased producer interest in the effects it can have on profitability and animal welfare, have made selecting animals based on behavior more popular. Producers have a variety of opportunities to identify the temperament of cattle. One way to evaluate an animal's temperament can be watching how it reacts to various stimuli.[9]

In a study involving six livestock auction markets, Lanier *et al* observed that cattle flinched or immediately moved in response to sudden sounds, motions, touches or any combination of stimuli. Observers in the study evaluated animals' attentiveness to stimuli and also scored animal temperament. Through the evaluation, they found cattle with higher temperament scores to be more receptive to the environment around them.[9]

The data collected was quite interesting. Researchers found that cattle with temperament scores of 3 or 4 were less likely to defecate in the auction ring. This could possibly be linked to more excitable animals defecating before reaching the auction ring. The auctioneer's continual sale call did not startle animals as much as sudden, intermittent sounds like a ring man yelling out a bid or a child making noise in the stands. Sudden movements, like an auctioneer raising an arm or a child running by the front of the sale pen, were also noticed by cattle more frequently than slow movements. The reason for this could be that cattle were historically animals of prey. Their senses give them a heightened response to sudden movements similar to those of a predator.[9]

In August 2005, the ISU Armstrong Research Farm received 252 head of yearling cattle from three auction barns. As the steers were being unloaded, it was noted one source of cattle did not have a good disposition. Our protocol is to weigh cattle two consecutive days to determine test weights. The steers were disposition scored on the first day using the BIF scoring system. In Table 5, steers with disposition scores 1 and 2 are docile, disposition scores 3 and 4 are restless, and disposition scores 5 and 6 are aggressive.

The above observations suggest excitable feeder calves may leave considerable weight behind and support Lanier's[9] observation that excitable cattle did not defecate in the auction ring.

Producers could possibly evaluate cattle reaction times to stimuli as a method to assess cattle temperament when selecting breeding stock, without needing to see actual handling or chute scores. Cow/calf producers do consider temperament as an important selection trait. Surveys have found that disposition ranked second, only to birth weight, as the most important trait in bull selection. If producers desire to have calm cattle

Table 5. Effect of disposition on percent shrink of feedlot cattle.

Item	Docile	Restless	Aggressive
No. of head	152	59	41
Ave. disposition score	1.6	3.4	5.3
Weight on day 1, lb	945	894	856
Weight on day 2, lb	943	880	833
Average weight, lb	944	887	845
Weight change from day 1 to day 2, lb	-1.3	-14.2	-23.5
% shrink	-0.1%	-1.6%	-2.8%

(Unpublished data, Iowa State University)

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that are easy to work with, studying cattle's sensitivity to stimuli could offer an easy method of determining temperament.[9]

Handling Facilities

A 1997 study conducted by the Biosystems and Agricultural Engineering Department at Oklahoma State University described conditions associated with 150 cattle handling injuries on 100 Oklahoma cow-calf operations. The study showed that more than 50% of injuries were due to human error, while equipment and facilities accounted for about 25% of perceived causes. In most cases, a better understanding of how an animal may respond to human interaction and to its immediate surroundings will help keep the animal handler from becoming an injury victim.[7]

Human error is the primary cause of many types of accidents. Errors in judgment and action are due to a variety of reasons, but occur most often when people are tired, hurried, upset, pre-occupied or careless. Remember that human physical, psychological, and physiological factors greatly affect the occurrence of life-threatening accidents. Using this information in combination with proper cattle handling techniques can reduce your risk and your cattle's risk of injury.

An animal's senses function like those of a human; however, most animals detect and perceive their environments very differently compared to the way humans detect and perceive the same surroundings. While cattle have poor color recognition and poor depth perception, their hearing is extremely sensitive relative to humans. Knowing these characteristics, we can better understand why cattle are often skittish or balky in unfamiliar surroundings.

Cattle have panoramic vision, meaning they can see in all directions except directly behind without moving their head. Additionally, cattle have poor depth perception, especially when they are moving with their heads up. In order to see depth, they have to stop and put their heads down. For this reason, unfamiliar objects and shadows on the ground are the primary reasons for cattle balking and delaying the animals behind them. This is why it is important that handling and working facilities be constructed to minimize shadows.

Cattle have a tendency to move towards light. If working cattle at night, use frosted lamps that do not glare in the animal's faces. Position these lights in the area where you are moving cattle, such as a trailer or barn.

Moving a group of cattle takes some knowledge and understanding of the animal's "flight zone." The flight zone is an animal's personal space. When a person penetrates the flight zone, the animal will move. Conversely, when you retreat from the flight zone, the animal will stop moving. Understanding the flight zone is a key to easy, quiet handling of your cattle.

The size of an animal's flight zone depends on the animal's temperament, the angle of the handler's approach, and the animal's state of excitement. Work at the edge of the flight zone at a 45 to 60 degree angle behind the animal's shoulder. Cattle will circle away from you. The flight zone radius can range from five to over 25 feet (1.5 to 7.6 m) for feedlot cattle, and as far as 300 feet (91.4 m) for some range cattle. If you are within its flight zone, the animal moves away or retreats.

Cattle follow the leader and are motivated to follow each other. Each animal should be able to see others ahead of it. Make single-file chutes at least 20 to 30 feet (6.1 to 9.1 m) long. In crowding pens, consider handling cattle in small groups up to 10 head; the cattle need room to turn. Use their instinctive following behavior to fill the chute. Wait until the single-file chute is almost empty to fill the chute. Leaving one animal in the single-file chute serves as bait for the next group. A crowding gate is used to follow the cattle, not to shove against them.

Pens serve several purposes, including catching, holding cattle being worked, and sorting cattle into groups. When designing and constructing pens for working facilities, consider the following:

- Provide at least 20' x 20' (6.1 x 6.1 m) per head for mature cattle.
- Size pens for a maximum of 50 head of mature cattle.
- Larger, wider pens can make effective sorting difficult for a single worker.
- Pens too small or narrow can result in workers entering the animal's flight zone. The smallest pen dimensions should be no less than 16 feet (4.9 m).
- Too few pens can make separating animals difficult. This can also put handlers at risk, as they must physically enter pens with large numbers of agitated animals.
- Use proper gate placement to facilitate animal movement from pen to pen and to other areas. Poor animal movement puts workers at risk by having to force the movement. If there are too few gates, some animals can become separated. Thus, when animals enter the alley, separated herdmates will follow along the inside of the pen. This is often referred to as "backwash". There may be problems guiding these pen-bound animals back to the exit gate as their herdmates move away from them down the alley.
- Placing gates in a herringbone style avoids a 90-degree angle corner in the pen.

Keep the design of sorting facilities and alleyways simple. For most operations, a single alley is used for

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sorting, as well as moving cattle to and from the working area. Alley width should be 12 to 14 feet (3.7 to 4.3 m) with a 10 foot (3.0 m) minimum. Wider alleys can make it easier for cattle to escape around you. Pens that are too narrow fail to give the animals enough room to maneuver.

The crowding area should be designed and located so that cattle can be easily moved into this area from a common sorting alley that is fed by adjacent holding pens. A circular crowding area with totally enclosed sides and crowding gate is effective, because the only escape route visible to the cattle is through the working or loading chute exits. The crowding gate should also be solid and designed to prevent animals from reversing the gate's direction. Do not overload the crowding area. A catwalk around the outside of the crowding pen allows workers to maneuver animals toward the chute while avoiding direct animal contact. Position the catwalk 36 inches (91.4 cm) below the top of the fence.

Ideally, the single file alley to the working chute should be curved with totally enclosed sides. Cattle move more freely because they cannot view the handlers or the squeeze chute until they approach the chute's rear gate. Sloped sides in the working chute restrict the animal's feet and legs to a narrow path, which in turn reduces balking and helps prevent an animal from turning around. Sloping sides work well in most cow-calf operations because different sizes of cattle can be worked efficiently in the same chute. Recommended width for the bottom of the chute is 16 inches (40.6 cm), while the top should be about 28 inches (71.1 cm). For large-framed cattle over 1,200 lb (545 kg), the top dimension should be increased two inches (5.1 cm). To accommodate large-framed bulls, it may be necessary to increase the top width by four inches (10.2 cm) or more. For adjustable straight-sided alleyways, the range in width should be from 18 inches to 32 inches (45.7 to 81.3 cm). Emergency release panels are highly recommended. With solid-sided chutes, backstops are normally suspended or mounted from above. Backstops should be adjusted to block an animal six to eight inches (15 to 20 cm) below the top of the tailhead.

Handling Facility Comparison

From 2002 to 2007, 1,070 groups of steers and heifers totaling 96,685 head have been processed at 15 different SW Iowa feedlots through the TCSCF program. The total time required to process the group, number of head, number of people, and processes done were recorded. All working systems had tubs; 13 of 15 systems (1,056 out of 1,070 groups) had solid sides in alleys directly behind the chute. Time for equipment repairs was not included in the summary. Facilities with the tub, alley, and chute under roof were considered to be inside facilities. All feedlots had completed the Feedlot Animal Welfare Audit, and the quality of processing work was considered to be acceptable and similar across all facilities. Table 6 shows the number of feedlots, groups and cattle in each category.

Labor costs were $10 per hour for everyone. Of the labor force, 28% were TCSCF or ISU staff members. TCSCF and/or ISU staff recorded data, removed home tags, applied TCSCF tags, and determined harvest dates. Processing tasks were split into four categories: 1) arrival: vaccination, implant, weigh, and 31% of the groups were tagged; 2) re-implant: implant, weigh, and disposition score; 3) sorting: weigh, disposition score, mud score, and sort for harvest; and 4) weigh only: weigh and disposition score.

The arrival processing of vaccinating and implanting required significantly more labor per head than the other tasks (Table 7). Tagging significantly increased the processing time by 11 seconds per head and the labor requirement by 60 seconds or a minute per head. Re-implant, sorting, and weigh only were not statistically different from each other. Working larger groups of cattle reduced processing time. For every additional 20 head, processing time per head was reduced one second. Eight of the working facilities were outside and seven were inside or under roof. All tasks are combined for Table 8.

The differences in total staff time/head were significant (P=0.16). My observation is that more time was spent designing the holding pens, tub, and alley into and away from the inside facilities, before the investment of building is made.

Eight of the feedlots had manual chutes, three had hydraulic chutes, and four had Silencer®[c] chutes. The manual and Silencer® chutes were equal across inside and outside facilities; however, only one feedlot had a

Table 6. Number of feedlots, cattle groups, and individual cattle processed in 15 SW Iowa feedlots from 2002 to 2007.

System	Outside	Inside
Manual chute	4 feedlots 267 groups 25,379 hd	4 feedlots 295 groups 25,763 hd
Hydraulic chute	2 feedlots 28 groups 2,751 hd	2 feedlots 48 groups 4,571 hd
Silencer®[c] chute	2 feedlots 97 groups 8,225 hd	2 feedlots 333 groups 29,996 hd

[c]Silencer®, Moly Manufacturing, Inc., Lorraine, KS 67459

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Table 7. Summary of staff size and processing speed to complete various animal management procedures.

Item	Arrival	Re-implant	Sorting	Weigh only
Total feedlot staff	3.2 staff	3.1 staff	3.1 staff	3.0 staff
Total staff*	5.16 staff	4.88 staff	4.95 staff	4.28 staff
Seconds/hd	51.3 sec.	34.6 sec.	37.5 sec.	34.4 sec.
Head/hour	70 hd	104 hd	96 hd	105 hd
Total staff time/hd	4.26 min.	2.48 min.	3.03 min.	2.28 min.
Labor cost/hd	$0.740	$0.468	$0.508	$0.412

*May include TCSCF and ISU staff and feedlot veterinarian

Table 8. A comparison of staff size and speed of processing between outside and inside processing facilities.

Item	Outside	Inside
Total feedlot staff	3.3 staff	3.0 staff
Total staff *	4.92 staff	4.66 staff
Seconds/hd	40.9 sec.	38.2 sec.
Head/hour	88 hd	94 hd
Total staff time/hd	3.23 min.	2.59 min.
Labor cost/hd	$0.565	$0.498

Table 9. A comparison of staffing, processing speed, and labor costs for feedlots using manual, hydraulic, or Silencer®[c] chutes.

Item	Manual	Hydraulic	Silencer®
Total feedlot staff	3.1 staff	2.8 staff	3.1 staff
Total staff *	4.90 staff	4.18 staff	4.66 staff
Seconds/hd	42.1 sec.	41.6 sec.	34.8 sec.
Head/hour	86 hd	87 hd	103 hd
Total staff time/hd	3.29 min.	2.55 min.	2.43 min.
Labor cost/hd	$0.580	$0.485	$0.454

hydraulic chute inside and two feedlots had hydraulic chutes outside. All summary tasks are combined in Table 9.

The total staff time/head was significantly less when using the Silencer® chute compared to the manual and hydraulic chutes. The total staff time/head between the manual and hydraulic was similar (P=0.30).

Conclusions

Disposition or temperament of cattle is a measure of the animal's relative docility, wildness, and handling ability during processing. Easily excitable animals compromise their own safety as well as the safety of handlers. Disposition is moderately heritable and is more influenced by handling than genetics. The percentage of aggressive cattle has declined over time from both selection and implementation of low stress handling techniques. Morbidity rates were similar across disposition scores; however, death loss increased significantly as disposition scores increased. When compared to docile cattle, aggressive cattle gained less in the feedlot (2.91 vs 3.17 lb/day; 1.32 vs 1.44 kg/day), produced fewer Choice carcasses (58.1 vs 72.4%), more Select carcasses (36.2 vs 23.3%), and the black-hided cattle produced a lower percentage of Certified Angus Beef carcasses (14.3 vs 29.1%). Average profit for docile cattle was $46.63 per head compared to $7.62 per head for aggressive cattle. Disposition is both a convenience trait and economically important.

Endnotes

[a]Excede, Pfizer Animal Health, New York, NY
[b]GrowSafe Systems Ltd., Airdrie, Alberta, Canada
[c]Silencer®, Moly Manufacturing, Inc., Lorraine, KS

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