

## Selection Tools for Temperament

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### Introduction

Temperament in cattle has been defined as the reactivity, or fear response, to humans (Fordyce et al., 1988). Many production practices such as weaning, ear tagging, branding, castration and vaccination have been reported to be stressful to cattle (Burdick et al., 2010; 2011a). Other factors such as social mixing and transportation were also reported to be capable of being stressful. Temperamental cattle have been reported to be more easily stressed than are their calmer herd mates (Curley et al. 2006a-b, 2008). Temperament, the behavioral response to handling, can negatively affect management and beef production as more temperamental cattle can increase the risk of injury to both the handler and the animal (Burrow, 1997). Furthermore, temperamental cattle have reduced growth rates, carcass traits and immune function (Voisinet et al., 1997; Fell et al., 1999; Mondal et al., 2006; Oliphint et al., 2006). Reduction of stress in a herd of cattle should result in improved productivity and therefore profit. Selection of cattle with more easily managed temperaments will result in less stress as well as reduced risk in handling the cattle for routine management. Methods for scoring temperament were developed as early as the 1960s (Strickin and Kautz-Scanavy, 1984). There are several tools available for beef cattle producers to evaluate their cattle for temperament. As temperament is a complex mixture of behaviors each method has some limitations as they are designed.

### Docility Score (Chute Score)

The Beef Improvement Federation guidelines include a method termed docility score which is designed to evaluate temperament when cattle are processed in a squeeze chute. Many refer to this method as “chute score”. This system is recommended to be used at or near weaning as the animal’s behavior can be altered by past experiences. The animal should be evaluated with its head caught but without the squeeze applied. The scoring system is presented in Table 1.

Table 1. BIF Guidelines – Docility Score (Chute Score)

<b>Score 1</b>	Docile. Mild disposition. Gentle and easily handled. Stands and moves slowly during processing. Undisturbed, settled, somewhat dull. Does not pull on headgate when in chute. Exits chute calmly.
<b>Score 2</b>	Restless. Quieter than average, but may be stubborn during processing. May try to back out of chute or pull back on headgate. Some flicking of tail. Exits chute promptly.
<b>Score 3</b>	Nervous. Typical temperament is manageable, but nervous and impatient. A moderate amount of struggling, movement and tail flicking. Repeated pushing and pulling headgate. Exits chute briskly.
<b>Score 4</b>	Flighty (Wild). Jumpy and out of control, quivers and struggles violently. May bellow and froth at the mouth. Frantically runs fence line and may jump when penned individually. Exhibits long flight distance and exits chute wildly.
<b>Score 5</b>	Aggressive. May be similar to Score 4, but with added aggressive behavior, fearfulness, extreme agitation, and continuous movement which may include jumping and bellowing while in chute. Exits chute frantically and may exhibit attack behavior when handled alone.
<b>Score 6</b>	Very Aggressive. Extremely aggressive temperament. Thrashes about or attacks wildly when confined in small, tight places. Pronounced attack behavior.

What are the positive or negative factors for using the docility or chute score? One positive factor is that it is easy to use as calves are routinely handled for management at weaning. This score is positively correlated ( $r \geq 0.35$ ,  $P < 0.005$ ) with other measures of temperament to be discussed later in this paper. However chute score was not correlated ( $r = 0.09$ ,  $P = 0.46$ ) with cortisol concentrations in the blood (Curley et al., 2006a). The lack of a correlation with the stress hormones reduces the utility of this measurement of temperament. More excitable cattle which are temperamental have greater amounts of the hormone, cortisol, in their blood (Stahringer et al., 1990; Burdick et al., 2010; 2011a).

### Pen Score

The Beef Improvement Federation guidelines include another measurement of temperament termed pen score. As with docility or chute score the recommendation is to evaluate pen score at or near weaning. This is to avoid the adaptation of the animals to repeated handling (Curley et al., 2006a). For this measurement a small group ( $n = 5$ ) of calves are penned in a small lot (approximately 24 feet x 24 feet) and approached by two observers. The individual calf is scored for its response to two observers approaching it on a 1 to 5 scale (Table 2).

Table 2. BIF Guidelines – Pen Score

<b>1 = Non-aggressive</b> (docile)	Walks slowly, can be approached closely by humans, not excited by humans or facilities
<b>2 = Slightly Aggressive</b>	Runs along fences, will stand in corner if humans stay away, may pace fence
<b>3 = Moderately Aggressive</b>	Runs along fences, head up and will run if humans move closer, stops before hitting gates and fences, avoids humans
<b>4 = Aggressive</b>	Runs, stays in back group, head high and very aware of humans, may run into fences and gates even with some distance, will likely run into fences if alone in pen
<b>5 = Very Aggressive</b>	Excited, runs into fences, runs over humans and anything else in path, “crazy”

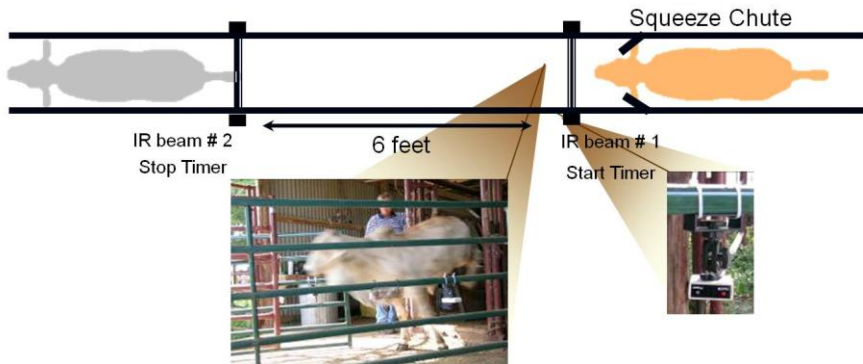
Pen score measures different behaviors than are measured by the docility or chute score. These behaviors are more highly correlated with cortisol concentrations in the blood ( $r = 0.29$ ,  $P < 0.05$ ) than was found for the docility or chute score. It is correlated ( $r = 0.35$ ,  $P < 0.005$ ) with other measurements of temperament (Curley et al., 2006a). Repeated measurements of pen score over several months were correlated ( $r = 0.25$ ;  $P < 0.05$ ) with each other and with cortisol concentrations in the blood. The first pen score rank was predictive of later pen score rank even after the animals were more adapted to handling by humans.

### Exit Velocity (Flight Speed)

An objective method to evaluate temperament in cattle is to determine exit velocity or flight speed (Burrow et al., 1988; Curley et al., 2006a). This method determines the velocity at which an animal leaves a squeeze chute. The standard distance to measure velocity is over 6 feet. The first electronic trigger is placed in front of the squeeze chute within 6 feet and the second trigger 6 feet from the first. The elapsed time is converted to velocity by dividing the distance by the elapsed time. The method uses infrared light beams in a timing system developed for competition horse events (Figure 1).

Figure 1. Exit velocity (Flight speed)

Exit Velocity is the time in feet/second that it takes the calf to travel 6 feet (Burrow et al., 1988).



One positive attribute for exit velocity is that it is an objective measurement of temperament. There is no observer bias as it is a measure of time elapsed for the animal to travel 6 feet after being restrained in a chute. Exit velocity is correlated ( $r = 0.35$ ;  $P < 0.005$ ) with chute score or pen score. Exit velocity is correlated ( $r = 0.26$ ;  $P < 0.005$ ) with concentrations of cortisol in the blood (Curley et al., 2006a). Exit velocity can be measured as early as 3 weeks of age in calves. Exit velocity increases as day of age increases from 3 weeks of age through weaning (Burdick et al., 2011b). Temperamental calves exit velocity increased at a faster rate with age ( $P < 0.001$ ; estimated to be  $0.011 \pm 0.0009$  feet/second daily) compared with intermediate ( $0.0067 \pm 0.0011$  feet/second daily) and calm calves ( $0.0016 \pm 0.0011$  feet/second daily). Temperamental calves increase their rate of speed more rapidly than their calmer herd mates and can be identified before weaning. There are some aspects of temperament such as aggression which are not measured by exit velocity. The principal behavior measured by exit velocity is likely fear and dislike of being restrained and apart from other cattle.

McGregor Genomics Project Temperament Scoring System

An in depth temperament scoring system has been developed for use by the McGregor Genomics Project (Herring et al., 2005). In this system 4 evaluators assign disposition scores post-weaning. Two evaluators are located at each end of an alley that is approximately 12 feet wide and 75 feet long. The evaluators are approximately 50 feet apart. Calves are kept in a pen near the evaluation alley and 2 calves at a time are evaluated in the alley. After 2 minutes an animal is returned to the holding pen and the remaining animal is scored and released into another holding pen. Each animal is scored on a 1 to 9 scale for aggression, nervousness, flightiness, gregariousness and overall temperament (Table 3).

Table 3. McGregor Genomics Project Temperament Scoring

<b>Aggressiveness</b> willingness to hit evaluators	1 = nonaggressive	9 = extremely aggressive
<b>Nervousness</b> animals pacing, running, shaking, vocalizing	1 = completely calm	9 = extremely nervous
<b>Flightiness</b> attempt to escape from handlers	1 = totally quiet	9 = extreme flight
<b>Gregariousness</b> desire to return to the herd	1 = totally willing to be separate	9 = extreme desire to return to the herd
<b>Overall Disposition</b> (scored as a separate trait and not an average of component traits)	1 = completely docile	9 = crazy

The advantages of the McGregor Genomics Project System reside in the evaluation of multiple aspects of behavior which make up the complex behavior we know as temperament or disposition. The overall disposition score is very similar to the pen score but it has a wider scale from 1 to 9. The precision of this system is appropriate for research purposes.

#### Systems in Use (Breed Associations)

Some breed associations are using the 1 to 6 scoring system of BIF. Some are recording docility scores at weaning, some at yearling and some at both ages. Other associations are using docility or pen scoring systems recorded from 1 to 5 (Table 4).

Table 4. Docility or Temperament Scores

<b>Breed</b>	<b>System</b>	<b>Range</b>	<b>Age</b>
Angus	BIF Docility	1 – 6	yearling
Brangus	BIF Docility	1 – 6	weaning and yearling
Simmental	BIF Docility	1 – 6	weaning and yearling
Limousin	BIF Docility	1 – 6	weaning and yearling
Brahman	Pen Score	1 – 5	weaning
Saler	Docility Score	1 – 5	weaning and yearling

#### Markers for Temperament

Genetic markers for temperament or docility are available from commercial DNA laboratories. These markers are usually marketed in conjunction with markers for carcass or efficiency traits. Data regarding the correlation between these markers and behavior is not available in the literature as it is regarded as a commercial secret and may be covered by patents. Therefore it is difficult to determine the predictive value of these markers. They may be extremely valuable if a producer's cattle match the types of cattle the markers were developed for. If animals are not similar to the population used to develop the markers the predictive value may be lower.

#### Heritability of Temperament

Flight speed has been estimated to have a heritability of 0.37 for weaned Australian cattle (Prayaga and Henshall, 2005). Weaning heritability estimates for Brahman and Brahman influenced cattle in the United States for pen score and exit velocity were 0.48 and 0.29, respectively (Loyd et al., 2011). When a combination of pen score and exit velocity was calculated (pen score + exit velocity / 2) to develop a temperament score the estimated heritability of the combined temperament score was 0.43. Heritability estimates for Angus cattle are 0.37 and similar estimates have been made for Limousin cattle. These estimates of heritability fit well with the statement in the BIF guidelines that temperament is a moderately heritable trait.

#### Summary

Temperament is a heritable trait which will respond to selection similar to selection for growth traits. Several methods are available for use by breeders which measure different aspects of behavior related to temperament. All of these measurements change as cattle are exposed to human handling. One principal factor is that these measurements must be done as early in the production process as possible. The evaluation of temperament should be done at or near weaning from a practical viewpoint. The docility or chute score is less robust than the other systems as is, is not correlated with the stress hormones. Both pen score and exit velocity are correlated with concentrations of cortisol in the blood making them more robust than the docility or chute score. From a research standpoint measurement of as many behaviors as possible is appropriate. However, from a practical production view point some selection of a system for evaluating temperament must be selected. The pen scoring system has the

highest heritability and does not require purchase of equipment. It is correlated with the stress hormones and stress responsiveness. If only one system is to be employed the pen score system should be used.

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# SELECTION TOOLS FOR TEMPERAMENT

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## WHAT IS TEMPERAMENT?



# THE REACTIVITY OR FEAR RESPONSE TO HUMANS

(Fordyce et al., 1988)



# TEMPERAMENTAL CATTLE ARE MORE EASILY STRESSED THAN THEIR CALMER HERD MATES

(Curley et al., 2006, 2008)





# Why Is Temperament Important To Cattle Producers?

1. Risk of injury to handlers and cattle.
2. Reduced growth rates, carcass traits and immune function.



## Temperamental Cattle Have Reduced:

1. Feed Intake
2. Average Daily Gain
3. Intramuscular Fat
4. Carcass Quality
5. Response to Vaccination



# Temperamental Cattle Have Increased:

1. Shear Force (tougher meat)
2. Bruised Trim
3. Dark Cutters



## How Can Cattle Be Evaluated For Temperament?

Table 1. BIF Guidelines – Docility Score (Chute Score)

<b>Score 1</b>	Docile. Mild disposition. Gentle and easily handled. Stands and moves slowly during processing. Undisturbed, settled, somewhat dull. Does not pull on headgate when in chute. Exits chute calmly.
<b>Score 2</b>	Restless. Quieter than average, but may be stubborn during processing. May try to back out of chute or pull back on headgate. Some flicking of tail. Exits chute promptly.
<b>Score 3</b>	Nervous. Typical temperament is manageable, but nervous and impatient. A moderate amount of struggling, movement and tail flicking. Repeated pushing and pulling headgate. Exits chute briskly.
<b>Score 4</b>	Flighty (Wild). Jumpy and out of control, quivers and struggles violently. May bellow and froth at the mouth. Frantically runs fence line and may jump when penned individually. Exhibits long flight distance and exits chute wildly.
<b>Score 5</b>	Aggressive. May be similar to Score 4, but with added aggressive behavior, fearfulness, extreme agitation, and continuous movement which may include jumping and bellowing while in chute. Exits chute frantically and may exhibit attack behavior when handled alone.
<b>Score 6</b>	Very Aggressive. Extremely aggressive temperament. Thrashes about or attacks wildly when confined in small, tight places. Pronounced attack behavior.



The docility score (chute score) is recommended to be used at or near weaning. The head should be caught but without the squeeze applied.



## Advantages of the Docility Score (Chute Score):

1. Easy to use during routine handling.
2. Positively correlated with other measures of temperament ( $r \geq 0.35$ ,  $P < 0.005$ ).



## Disadvantages of the Docility Score (Chute Score):

1. Not correlated ( $r = 0.09$ ,  $P = 0.46$ ) with cortisol concentrations in the blood.



## BIF Guidelines – Pen Score

<b>1 = Non-aggressive (docile)</b>	Walks slowly, can be approached closely by humans, not excited by humans or facilities
<b>2 = Slightly Aggressive</b>	Runs along fences, will stand in corner if humans stay away, may pace fence
<b>3 = Moderately Aggressive</b>	Runs along fences, head up and will run if humans move closer, stops before hitting gates and fences, avoids humans
<b>4 = Aggressive</b>	Runs, stays in back group, head high and very aware of humans, may run into fences and gates even with some distance, will likely run into fences if alone in pen
<b>5 = Very Aggressive</b>	Excited, runs into fences, runs over humans and anything else in path, “crazy”



The pen score should be evaluated at or near weaning. A small group of calves (n = 5) are penned in a small lot (approximately 24 x 24 feet) and approached by two observers for scoring.



## Advantages of Pen Scoring:

1. Correlated with cortisol concentrations in the blood ( $r = 0.29$ ,  $P < 0.05$ ).
2. Correlated ( $r = 0.35$ ,  $P < 0.005$ ) with other measurements of temperament.
3. Repeated measurements are correlated ( $r = 0.25$ ;  $P < 0.05$ ) with each other and cortisol concentrations in the blood.



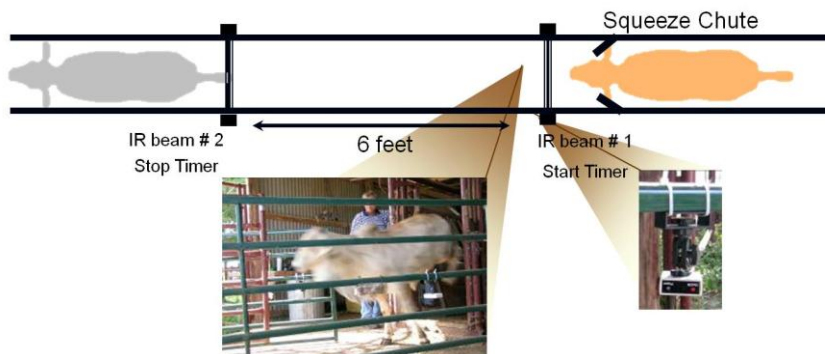
# Disadvantages of Pen Scoring:

1. Requires another handling of the calves.



# Exit Velocity (Flight Speed)

Exit Velocity is the time in feet/second that it takes the calf to travel 6 feet (Burrow et al., 1988).



This method also is recommended to be used at or near weaning.



## Advantages of Exit Velocity:

1. It is an objective measurement with no observer bias.
2. Exit velocity is correlated ( $r = 0.35$ ;  $P < 0.005$ ) with other measurements of temperament.
3. Exit velocity is correlated ( $r = 0.26$ ;  $P < 0.005$ ) with concentrations of cortisol in the blood.



## Disadvantages of Exit Velocity:

1. Requires equipment for measurements.
2. Does not measure all aspects of temperament such as aggression.
3. The principal behavior measured is likely fear and dislike of being restrained alone.



## Other Factors of Exit Velocity

1. Exit velocity can be measured earlier in life (3 weeks of age).
2. Temperamental calves exit velocity increases with age of the calves at a faster rate ( $0.011 \pm 0.0009$  feet/second daily;  $P < 0.001$ ) compared with calmer calves.
3. With exit velocity temperamental calves can be identified before weaning.





# McGregor Genomics Project Temperament Scoring

<b>Aggressiveness</b> willingness to hit evaluators	1 = nonaggressive	9 = extremely aggressive
<b>Nervousness</b> animals pacing, running, shaking, vocalizing	1 = completely calm	9 = extremely nervous
<b>Flightiness</b> attempt to escape from handlers	1 = totally quiet	9 = extreme flight
<b>Gregariousness</b> desire to return to the herd	1 = totally willing to be separate	9 = extreme desire to return to the herd
<b>Overall Disposition</b> (scored as a separate trait and not an average of component traits)	1 = completely docile	9 = crazy



The McGregor Genomics Project temperament scoring system requires 4 evaluators to assign scores postweaning. Two evaluators are located at each end of an alley approximately 12 x 75 feet long. Two calves are evaluated at a time in the alley.



## Advantages of the McGregor Genomics Project System:

1. Evaluates multiple aspects of behavior.
2. Increased precision of measurement with the 1 to 9 scale.



## Disadvantages of the McGregor Genomics Project System:

1. Requires 4 qualified observers.
2. Requires another handling of the calves.



# WHAT IS BEING USED BY BREED ASSOCIATIONS?



## Docility or Temperament Scores

Breed	System	Range	Age
Angus	BIF Docility	1 – 6	yearling
Brangus	BIF Docility	1 – 6	weaning and yearling
Simmental	BIF Docility	1 – 6	weaning and yearling
Limousin	BIF Docility	1 – 6	weaning and yearling
Brahman	Pen Score	1 – 5	weaning
Saler	Docility Score	1 – 5	weaning and yearling



# COMMERCIAL COMPANIES ARE PROVIDING GENETIC MARKES FOR TEMPERAMENT IN CONJUNCTION WITH OTHER MARKERS



# TEMPERAMENT IS A HERITABLE TRAIT



HERITABILITY ESTIMATES  
RANGE FROM 0.25 TO 0.48  
FOR BEEF CATTLE



BIF GUIDELINES STATE THAT  
TEMPERAMENT IS A  
MODERATELY HERITABLE TRAIT



ELIMINATION OF THE MOST  
TEMPERAMENTAL CATTLE FROM  
A BREEDING HERD WILL IMPROVE  
PERFORMANCE OF A HERD



ELIMINATION OF THE MOST  
TEMPERAMENTAL CATTLE FROM  
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