Feedlot Cattle with Calm Temperaments Have Higher Average Daily Gains Than Cattle with Excitable Temperaments


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ABSTRACT:
This study was conducted to assess the effect of temperament on the average daily gains of feedlot cattle. Cattle (292 steers and 144 heifers) were transported to Colorado feedlot facilities. Breeds studied included Braford (n = 177), Simmental x Red Angus (n = 92), Red Brangus (n = 70), Simbrah (n = 65), Angus (n = 18), and Tarentaise x Angus (n = 14). Cattle were temperament rated on a numerical scale (chute score) during routine weighing and processing. Data were separated into two groups based on breed, Brahman cross (22.5% Brahman) and non-Brahman breeding. Animals that had Brahman breeding had a higher mean temperament rating (3.45 ± .09) or were more excitable than animals that had no Brahman influence (1.80 ± .10); (P < .001). These data also show that heifers have a higher mean temperament rating than steers (P < .05). Temperament scores evaluated for each breed group also showed that increased temperament score resulted in decreased average daily gains (P < .05). These data show that cattle that were quieter and calmer during handling had greater average daily gains than cattle that became agitated during routine handling.

Key Words: Beef Cattle, Temperament, Weight Gain, Breeds, Gender Differences

1 Supported by the National Cattlemen's Beef Association, Englewood, CO 80155. The authors acknowledge Deseret Cattle and Citrus Company in St. Cloud, Florida for their cooperation and assistance.
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Introduction

"No one likes wild cattle, so why raise them?" This quote, from The Lasater Philosophy of Cattle Raising (Lasater, 1972), seems obvious due to animal and handler safety concerns. Some beef producers do, in fact, consider temperament to be an important trait when selecting cattle for purchase (Elder et al., 1980). Often, however, the economic implications of livestock temperament has been unrecognized. Reports of very excitable cattle that become highly agitated and excited when restrained or handled are increasing (Grandin, 1994). This trend could possibly be counterproductive for the beef industry.

Few experiments have attempted to identify links between temperament and various measures of productivity. One study reported that cows with calm temperaments had a 25 to 30% increase in milk production (Drugociu et al., 1977). Observations tend to show that more excitable cattle with higher temperament scores have lower live weights and (v) weight gains (Tulloh, 1961; Fordyce and Goddard, 1984), though few data have been presented. The present study was conducted to identify the relationship between temperament and productivity as measured by daily weight gain.

Materials and Methods

Cattle. Four hundred thirty-six cattle (7 to 11 months old), 292 steers and 144 heifers, were transported to feedlot facilities near Fort Collins, Colorado, for finishing. Breeds studied included:
Braford (3/8 Brahman x 5/8 Hereford or 1/2 Brahman x 1/2 Hereford)
Simmental x Red Angus
Red Brangus (3/8 Brahman x 5/8 Red Angus or 1/4 Brahman x 3/4 Red Angus)
Simbrah (3/8 Brahman x 5/8 Simmental) Angus
Tarentaise x Angus.

Braford, Red Brangus, and Simbrah cattle will be referred to as Bos indicus-cross; Simmental x Red Angus, Angus, and Tarentaise x Angus cattle will be referred to as Bos taurus.

All cattle were received at the feedlot from October through December 1994 and acclimated to feedlot conditions for 2 to 3 wk before the start of the trial. The B. indicus-cross cattle were obtained from Florida, Simmental x Red Angus were obtained from Nebraska, and Angus and Tarentaise x Angus cattle were obtained from Wyoming. All cattle, regardless of origin, were produced on extensive operations with minimal human interaction. While in the feedlot, cattle were housed in groups of approximately 20 to 50 cattle, with group allotments determined by ranch and thus breed, gender, and weight. Cattle were fed to acquire a constant subcutaneous fat thickness of 9 to 13 mm (target = 11 mm) over the 12th rib, as determined by visual indices and ultrasound measurements.

All cattle received a diet consisting primarily of whole corn and corn silage. For the complete diet, see O'Connor et al. (1997). Growth implants were administered at the start of the finishing period and after approximately 120 days on feed. Implant protocols were as follows: steers were given an initial implant of Synovex-S (Syntex Animal Health, St. Louis, MO, 1994) and a second implant of Revalor-S (Hoechst Roussel Agri-Vet, Somerville, NJ); heifers received Finaplix-H (Hoechst Roussel Agri-Vet) for the initial and the second implants. Each heifer received .4 mg/d of melengestrol acetate (MGA) for the entire feeding period.

Experimental Procedure. Approximately every 28 days, weight gain assessment and ultrasound determination of subcutaneous fat thickness data were recorded for all cattle. During processing, two independent observers assessed the temperament of each animal. A single temperament rating was recorded for each animal by each observer. The number of cattle prohibited temperament observations for all cattle from being completed on a single day. Observer 1 scored cattle after they had four to eight previous experiences with the handling facility at the feed yards. Observer 2 scored cattle during the animals first encounter with the handling facilities. Observers temperament scored the same cattle using slightly different methods. Observer 1 rated 436 B. indicus-cross and B. taurus cattle via a temperament rating system similar to that used in Grandin (1993), assigning scores of 1 through 5. Each animal's temperament was assessed while the animal was in a nonrestraining single-animal scale crate. Observer 2 rated 304 B. indicus-cross cattle in a hydraulic squeeze chute (crush) with a head stanchion. Observer 2 assigned scores of 1 through 4 designating behaviors similar to those denoted by the following five-point system:

- 1: calm, no movement
- 2: restless shiftting
- 3: squirming, occasional shaking of device (squeeze chute or scale)
- 4: continuous vigorous movement and shaking of device
- 5(4): rearing, twisting, or violently struggling.

Restraint of animals in a hydraulic squeeze chute reduces the range of movement and therefore reduces the resolution of discrimination between categories on a rating scale; thus a four-point scale was used. No inter observer comparison can be made because of the differences in animal movement between the squeeze chute and scale and because of numerical differences in temperament rating scale. Due to these differences in method, the data sets have been analyzed separately and presented as two independent experiments. Experiments 1 and 2 will refer to data collected by observers 1 and 2, respectively.

Statistical Analysis. Data were analyzed using the SAS GLM procedure (SAS, 1985). Average daily gain was analyzed with a model that included breed, gender (where appropriate), temperament, sire (breed) (as a random effect), and fat thickness. Temperament was analyzed using a model that included breed, gender (where appropriate), sire (breed), and fat thickness.

Pair wise comparisons were conducted between the means of each level of temperament score, breed, and gender.

Results and Discussion

Table 1 lists the unshrunk on-test and off-test least squares mean weights, days on feed, and average daily gains for animals in the study.
Table 1. Least squares means for growth traits by breeds\(^a\)

<table>
<thead>
<tr>
<th>Breed(^b)</th>
<th>n</th>
<th>On-test wt, kg</th>
<th>Off-test wt, kg</th>
<th>Days on feed</th>
<th>Avg daily gain,(^c) kg/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Braford</td>
<td>177</td>
<td>290</td>
<td>468</td>
<td>201</td>
<td>.95 +/- .03</td>
</tr>
<tr>
<td>Red Brangus</td>
<td>70</td>
<td>308</td>
<td>507</td>
<td>206</td>
<td>.98 +/- .04</td>
</tr>
<tr>
<td>Simbrah</td>
<td>65</td>
<td>320</td>
<td>552</td>
<td>212</td>
<td>1.10 +/- .04</td>
</tr>
<tr>
<td>Angus</td>
<td>18</td>
<td>305</td>
<td>543</td>
<td>194</td>
<td>1.24 +/- .06</td>
</tr>
<tr>
<td>Simmental/Red Angus</td>
<td>92</td>
<td>264</td>
<td>569</td>
<td>213</td>
<td>1.44 +/- .02</td>
</tr>
<tr>
<td>Tarentaise/Angus</td>
<td>14</td>
<td>301</td>
<td>550</td>
<td>207</td>
<td>1.21 +/- .09</td>
</tr>
</tbody>
</table>

\(^a\) Data listed are for all animals temperament scored by Observer 1.

\(^b\) Traits are adjusted to a constant fat thickness of 11 mm using analysis of covariance techniques. The model included breed, gender, (Brahman-cross only), sire(breed), and fat thickness.

\(^c\) Values are means + SE. The error term for analysis of breed differences = sire (breed) (dfs individual breeds = 73, dfs all-breed means = 64).

Analysis of Breed Differences in Temperament

**Experiment 1.** Observer 1 collected data on the Bos indicus and Bos taurus cattle. Our analyses showed that temperament score differed between breed groups. No significant temperament score differences existed within B. indicus-cross cattle with respect to differing percentages of Brahman influence (1/4, 3/8, or 1/2 Brahman). Mean temperament scores of B. indicus-cross cattle were higher (\(P < .001\)) than those for B. taurus steers. This agrees with research that has shown that B. indicus cattle are more temperamental or excitable than B. taurus cattle (Elder et al., 1980; Hearshaw and Morris, 1984; Fordyce et al., 1988). Because of these differences, weight gain data for B. indicus-cross and B. taurus breed groups were analyzed separately. Mean temperament scores by breed are presented in Table 2. Differences were present within the B. indicus cross breed group, with the Braford and Red Brangus cattle having more (\(P < .05\)) excitable temperaments than Simbrah cattle. Accurate representation of mean temperament score for individual B. indicus-cross breeds (Braford, 3.62; Red Brangus, 3.78; Simbrah, 2.89) and the B.indicus cross breed group (3.46) necessitated that heifers be omitted from this analysis because only steers were present in the B. taurus breeds.

Table 2. Least squares means for temperament score by breed, steers only (Experiment 1)

<table>
<thead>
<tr>
<th>Breed(^a)</th>
<th>Mean temperature ranking(^b,c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Braford</td>
<td>3.62 +/- .15(^d)</td>
</tr>
<tr>
<td>Red Brangus</td>
<td>3.78 +/- .22(^d)</td>
</tr>
<tr>
<td>Simbrah</td>
<td>2.89 +/- .22(^c)</td>
</tr>
<tr>
<td>Bos indicus-cross</td>
<td>3.46 +/- .09(^#)</td>
</tr>
<tr>
<td>Angus</td>
<td>1.70 +/- .19(^f)</td>
</tr>
<tr>
<td>Simmental x Red Angus</td>
<td>1.77 +/- .07(^f)</td>
</tr>
<tr>
<td>Tarentaise x Angus</td>
<td>2.36 +/- .31(^c)</td>
</tr>
<tr>
<td>Bos taurus</td>
<td>1.80 +/- .10(^#)</td>
</tr>
</tbody>
</table>

\(^a\) Model included breed, sire (breed), and fat thickness. The error term for analysis of breed differences = sire (breed) (dfs individual breeds = 75; dfs Bos taurus individual breeds = 51 dfs all-breed means = 123).

\(^b\) 1 = calm, no movement; 2 = restless shifting; 3 = squirming occasional shaking of restraint device; 4 = continuous vigorous movement and shaking of restraint device; 5 = rearing, twisting or violently struggling.

\(^c\) Values are means +/- SE.

\(^d,e,f\) Means with different superscripts differ (\(P < .05\)).

\(^#\) "Means differ (\(P < .001\))."
Even though breed group differences were statistically significant, they may not represent true breed based differences in temperament due to confounding by geographic origin. As was discussed in the Materials and Methods section, all B. indicus-cross breeds were obtained from a single location, Angus and Tarentaise x Angus cattle were obtained from a second location, and Simmental x Red Angus cattle were obtained from a third location.

**Experiment 2.** No difference (P < .4) in temperament existed among any of the B. indicus breeds observed in the squeeze chute. Braford cattle had an average temperament score of 2.0 +/- .12, Red Brangus cattle had a score of 2.18 +/- .17, and Simbrah cattle had a score of 2.11 +/- .14, on the 1 to 4 rating system. No B. taurus cattle were included in this experiment (data not shown).

**Analyses of Weight Gain Differences**

**Experiment 1.** Our results show a significant effect of temperament ranking on average daily gain in B. indicus-cross and B. taurus cattle (Table 3). The B. taurus steers with the calmest temperaments had .19 kg/d greater (P < .05) mean average daily gain than the steers with the highest temperament scores or most excitable temperaments. With the exception of B. indicus-cross steers and heifers that had a temperament score of 1, average daily gains in both breed groups decreased as temperament scores increased. The B.indicus cattle with calm temperaments (scores of 1) do not fit with this pattern, because they had the lowest average daily gains (.75 kg/d). We speculate, however, that the small number of animals (n = 4) and large standard error may have contributed to this apparently contradictory result.

<table>
<thead>
<tr>
<th>Temperament ranking(a,b)</th>
<th><strong>Bos taurusc</strong></th>
<th><strong>Bos indicus-crossd</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37</td>
<td>1.38 +/- .05(^f)</td>
</tr>
<tr>
<td>2</td>
<td>70</td>
<td>1.29 +/- .04(^g)</td>
</tr>
<tr>
<td>3</td>
<td>17</td>
<td>1.19 +/- .06(^g)</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>---</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>---</td>
</tr>
</tbody>
</table>

\(^a\) Model included temperament, breed, gender (B. indicus-cross only), sire (breed), and fat thickness. The error term for analysis of temperament differences = residual (df\(Bos\ indicus-cross\) = 274; df\(Bos\ taurus-cross\) = 84).

\(^b\) 1 = calm, no movement; 2 = restless shifting; 3 = squirming, occasional shaking of restraint device; 4 = continuous vigorous movement and shaking of restraint device; 5 = rearing, twisting or violently struggling.

\(^c\) Steers only.

\(^d\) Steers and heifers.

\(^e\) Values are means +/- SE.

\(^f,g,h\) Within each main effect, means with different superscripts differ (P < .05).

**Experiment 2.** Observer 2 temperament ranked 304 B. indicus-cross cattle on the fourpoint system described previously (Table 4). Temperament score was a significant source of variation in average daily gain. Animals with temperament scores of 1 or 2 had higher (P < .05) average daily gains than animals with temperament scores of 3.

<table>
<thead>
<tr>
<th>Temperament ranking(a)</th>
<th><strong>Bos indicus-crossb</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>89</td>
</tr>
<tr>
<td>2</td>
<td>119</td>
</tr>
<tr>
<td>3</td>
<td>76</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
</tr>
</tbody>
</table>

\(^a\) Model included temperament, breed, gender, sire (breed), and fat thickness. The error term for analysis of temperament
differences = residual (df = 267).

b Values are means ± SE.
c,d Means with different superscripts differ (P < .05).

The use of two observers and different experimental methods attests to the robustness of our results and the strength of the temperament effect on weight gain. Due to the lack of body restraint in the scale there was an increased ability for animal movement. As a result, observer 1 assigned more scores of 4 (25.9%) or 5 (14.0%) than observer 2 assigned scores of 4 (6.6%). Despite those differences, the results derived from the study remain consistent. We conclude from these results that the driving force behind average daily gain differences was primarily a product of calm temperaments, as opposed to excitable temperaments. Stated another way, calm cattle had increased average daily gains rather than excitable cattle having decreased average daily gains. More research, however, is necessary to confidently establish this.

Analysis of Gender Differences

Because heifers were present in Bos indicus-cross groups only, gender analyses were limited to the B. indicus-cross breed group. Gender was a significant source of variation, not only in average daily gain, as would be expected, but also in average temperament scores. Regardless of observer or temperament ranking system, heifers consistently had higher temperament scores than their male contemporaries (Table 5). In Experiment 1, heifers had a mean temperament score of 3.72, and steers had a mean temperament score of 3.39. In Experiment 2, the mean temperament score of heifers was 2.23 and that of steers was 1.97.

Table 5. Gender differences in mean temperament score in Bos indicus-cross cattle

<table>
<thead>
<tr>
<th>Gendera</th>
<th>Experiment 1</th>
<th>Experiment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heifers</td>
<td>3.72 ± .11c</td>
<td>2.23 ± .10d</td>
</tr>
<tr>
<td>Steers</td>
<td>3.39 ± .11c</td>
<td>1.97 ± .10d</td>
</tr>
</tbody>
</table>

a Model included breed, gender, sire (breed), and fat thickness. The error term for analysis of gender differences = residual (dfobserver 1 = 278; dfobserver 2 = 270).
b Values are means ± SE.
c Means differ (P < .01).
d Means differ (P < .05).

Similar gender differences in temperament have been found in British and European Continental (exotic) cattle (Stricklin et al., 1980). Other research, which focused on B. taurus breeds, found similar trends, but no significant differences in temperament due to gender were detected (Tulloh, 1961; Shrode and Hammack, 1971). We hypothesize that gender differences may be evident only in certain breeds. For example, due to calmer temperaments among B. taurus breeds, gender differences may not be as pronounced as the gender differences in B. indicus or B. indicus-cross breeds (Eld er et al., 1980; Fordyce et al., 1988).

Studies with rodents, which typically exhibit fear or anxiety (typically considered to be synonymous), have shown common, though inconsistent, gender differences in behavior (Gray, 1987; Johnston and File, 1991). Studies of fear may contribute to our knowledge of temperament by considering that fear, as a physiological state of the nervous system, ultimately results in certain behaviors (Gray, 1987). Additionally, Boissy (1995) defined fearfulness as a trait that determines the extent to which an individual becomes frightened in alarming situations.

The evolutionary and(or) adaptive mechanisms underlying gender differences in temperament are not fully understood. Practical experience on ranches has shown that heifers are more temperamental than cows. The fact that this calming of their disposition occurs just after parturition is verified by rodent experiments. Just after parturition and during lactation, rats exhibit a decrease in emotional reactivity or fearfulness (Hard and Hansen, 1985). Nulliparous rats were more fearful than parturient females in a variety of tests, including those that measured emergence latencies from a box into an open field test arena and the inclination to flee from an intruder (Fleming and Luebke, 1981). Reduced fearfulness of parturient female rats is most likely hormonally mediated (Fleming and Luebke, 1981).

In addition to genetically based differences in temperament, the possibility also exists for temperament to be influenced by growth-promotant implant protocols, which are completely confounded by gender; however, we found no research to support or refute this possibility in heifers. Two studies using steers and bulls have been conducted to examine behavioral effects of zeranol implants.
Neither study showed a significant effect of implantation on agitation scores (Vanderwert et al., 1985; Baker and Gonyou, 1986).

Experience also affects reactions to handling and restraint. Crookshank et al. (1979) showed that agitation and cortisol levels in cattle were decreased over multiple handling experiences. Gentling of animals is at least somewhat successful at reducing aversion to restraint and handling, although not enough to overcome the effects of highly aversive procedures (Hargreaves and Hutson, 1990). European Continental cattle that were worked through a squeeze chute repeatedly in a single day became increasingly agitated (Grandin, 1993). Calm Angus bulls, however, did not become agitated with additional passes through working facilities (B. D. Voisinet, unpublished data). Other research, however, has shown that if given the opportunity to avoid highly aversive handling procedures, such as electro-immobilization, sheep will do so consistently over many trials (Grandin et al., 1986). Differences in the results between studies is likely due to differing levels of fear and how the animal perceives the aversiveness of a procedure. Animals are able to discriminate between different kinds of human interaction, aversive or nonaversive (Gonyou et al., 1986) and also between different areas of a restraint system where highly aversive events occurred (Rusher, 1986). The levels of aversion expressed by an individual animal, however, are relatively persistent across multiple handling experiences (Fordyce and Goddard, 1984; Lyons, 1989; Grandin, 1993). Because of this and regardless of whether agitation in response to a particular handling event increases or decreases over time, one should expect agitation levels or temperament for an individual animal to remain relatively consistent with respect to its contemporaries. Heritability estimates of cattle temperament show that it is a moderately heritable trait (Shrode and Hammack, 1971; Stricklin et al., 1980; Fordyce et al., 1988).

Even though an economic analysis has not been completed at this time, the benefits of selecting for calmer or more docile animals may be more than enhanced animals and handler safety and decreased facility wear. Another advantage of selecting cattle with calmer temperaments would be increased welfare because injuries to the animal would be reduced.

Research is needed to determine the physiological mechanisms underlying the effect of temperament on average daily gain.

**Implications**

Selection for calm temperaments may become a key factor in maximizing production efficiency of cattle weight gains in feedlots. Cattle temperament is heritable, and temperament differences persist when animals are rated over a period of time. These two factors, considered together, imply that careful selection for a calm temperament may not only improve animal and handler safety but also increase economic returns via improved average daily gains.

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