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 × Red Angus (n = 92), Red Brangus (n = 70), Simbrah (n = 65), Angus (n = 18), and Tarentaise × 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 (≥ 25% 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, Sex Differences

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 (or) 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 mo old), 292 steers and 144 heifers, were transported to feedlot facilities near Fort Collins, Colorado, for finishing. Breeds studied included Braford (3/8 Brahman × 5/8 Hereford or 1/2 Brahman × 1/2 Hereford), Simmental × Red Angus, Red Brangus (3/8 Brahman × 5/8 Red Angus or 1/4 Brahman × 3/4 Red Angus), Simbrah (3/8 Brahman × 5/8 Simmental), Angus, and Tarentaise × Angus. Braford, Red Brangus, and Simbrah cattle will be referred to as Bos indicus-cross; Simmental × Red Angus, Angus, and Tarentaise × 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 × Red Angus were obtained from Nebraska, and Angus and Tarentaise × Angus cattle were obtained from Citrus Company in St. Cloud, Florida for their cooperation and assistance.
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, sex, 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 d 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 d, 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. Observers temperament-scored the same cattle using slightly different methods. Observers temperament-scored the same cattle using slightly different methods. Observer 1 rated 436 cattle during the animals first encounter with the handling facility at the feedyards. Observer 2 completed on a single day. Observer 1 scored cattle after they had four to eight previous experiences with the handling facilities. Observers temperament-scored the same cattle using slightly different methods. Each heifer received .4 mg/d of melengestrol acetate (MGA) for the entire feeding period.

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, 5/8).
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; Hearnshaw 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 analyzed separately. Mean temperament scores by breed, steers only (Experiment 1)

<table>
<thead>
<tr>
<th>Breed</th>
<th>Mean temperament ranking b,c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Braford</td>
<td>3.62 ± .15&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Red Angus</td>
<td>3.78 ± .22&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Simbrah</td>
<td>2.89 ± .22&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Bos indicus-cross</strong></td>
<td><strong>3.46 ± .09&lt;sup&gt;g&lt;/sup&gt;</strong></td>
</tr>
<tr>
<td>Angus</td>
<td>1.70 ± .19&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>Simmental × Red Angus</td>
<td>1.77 ± .07&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>Tarentaise × Angus</td>
<td>2.36 ± .31&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Bos Taurus</strong></td>
<td><strong>1.80 ± .10&lt;sup&gt;g&lt;/sup&gt;</strong></td>
</tr>
</tbody>
</table>

<sup>a</sup>Model included breed, sire(breed), and fat thickness. The error term for analysis of breed differences = sire(breed) (df<sub>bos indicus-cross individual breeds = 75</sub>; df<sub>bos taurus individual breeds = 51</sub> df<sub>all-breed means = 123</sub>).

<sup>b</sup>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.

<sup>c</sup>Values are means ± SE.

<sup>d</sup>Means with different superscripts differ (P < .05).

<sup>e</sup>Means differ (P < .001).

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 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.

Experiment 2: Observer 2 temperament ranked 304 B. indicus-cross cattle on the four-point system

Table 3. Least squares means for temperament score by breed, steers only (Experiment 1)

<table>
<thead>
<tr>
<th>Temperament ranking&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Bos taurus&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Avg daily gain&lt;sup&gt;e&lt;/sup&gt;, kg/d</th>
<th>Bos indicus-cross&lt;sup&gt;d&lt;/sup&gt;</th>
<th>Avg daily gain&lt;sup&gt;f&lt;/sup&gt;, kg/d</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37</td>
<td>1.38 ± .05&lt;sup&gt;f&lt;/sup&gt;</td>
<td>4</td>
<td>.75 ± .12&lt;sup&gt;h&lt;/sup&gt;</td>
</tr>
<tr>
<td>2</td>
<td>70</td>
<td>1.29 ± .04&lt;sup&gt;d&lt;/sup&gt;</td>
<td>40</td>
<td>1.07 ± .04&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>3</td>
<td>17</td>
<td>1.19 ± .06&lt;sup&gt;d&lt;/sup&gt;</td>
<td>94</td>
<td>1.02 ± .03&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>—</td>
<td>113</td>
<td>1.01 ± .03&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>—</td>
<td>61</td>
<td>0.97 ± .04&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>b</sup>Model included temperament, breed, sex (B. indicus-cross only), sire(breed), and fat thickness. The error term for analysis of temperament differences = residual (df<sub>Bos indicus-cross</sub> = 274; df<sub>Bos taurus-cross</sub> = 84).

<sup>c</sup>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.

<sup>d</sup>Steady only.

<sup>e</sup>Steady and heifers.

<sup>f</sup>Values are means ± SE.

<sup>g,h</sup>Within each main effect, means with different superscripts differ (P < .05).
Table 4. Least squares means for average daily gain for animals temperament-ranked for Experiment 2

<table>
<thead>
<tr>
<th>Temperament ranking</th>
<th>Bos indicus-cross</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Avg daily gain², kg/d</td>
</tr>
<tr>
<td>1</td>
<td>1.04 ± .03ᶜ</td>
</tr>
<tr>
<td>2</td>
<td>1.05 ± .03ᶜ</td>
</tr>
<tr>
<td>3</td>
<td>.95 ± .03ᵈ</td>
</tr>
<tr>
<td>4</td>
<td>.94 ± .06ᵈ</td>
</tr>
</tbody>
</table>

ᵃModel included temperament, breed, sex, sire(breed), and fat thickness. The error term for analysis of temperament differences = residual (df = 267).
ᵇValues are means ± SE.
ᶜ,dMeans with different superscripts differ (P < .05).

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.

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 Sex Differences

Because heifers were present in Bos indicus-cross groups only, sex analyses were limited to the B. indicus-cross breed group. Sex 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.

Similar sex 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 sex were detected (Tulloh, 1961; Shrode and Hammack, 1971). We hypothesize that sex differences may be evident only in certain breeds. For example, due to calmer temperaments among B. taurus breeds, sex differences may not be as pronounced as the sex differences in B. indicus or B. indicus-cross breeds (Elder 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, sex 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 sex 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 (Hård 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 sex; 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).

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

<table>
<thead>
<tr>
<th>Sexᵃ</th>
<th>Mean temperament rankingᵇ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heifers</td>
<td>Experiment 1</td>
</tr>
<tr>
<td>₹</td>
<td>3.72 ± .11ᶜ</td>
</tr>
<tr>
<td>Steers</td>
<td>3.39 ± .11ᶜ</td>
</tr>
</tbody>
</table>

ᵃModel included breed, sex, sire(breed), and fat thickness. The error term for analysis of gender differences = residual (df = 278; ²df(observer1) = df(observer2) = 270).
ᵇValues are means ± SE.
ᶜMeans differ (P < .01).
ᵈMeans differ (P < .05).
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 electroimmobilisation, 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 (Rushen, 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.

Literature Cited


