Performance and Carcass Traits of Grass-finished vs. Grain-finished Steers in Florida

C. Carr\textsuperscript{1}, J. Vendramini\textsuperscript{2}, J. Arthington\textsuperscript{2}, F. Frigoni\textsuperscript{2}, P. Martins\textsuperscript{2}, M. Salin\textsuperscript{2}, R. Cassiolato\textsuperscript{2}

The differences in carcass traits between grass-fed and grain-fed cattle may require specific markets to commercialize grass-finished beef in Florida.

Summary
The objective of this study was to compare animal performance and carcass traits of beef steers finished on pastures or feedlot. Twenty-four Angus crossbred steers at an average initial body weight (BW) of 500 lb ± 37 lb were randomly allotted to either a grass-finishing or grain-finishing programs with 12 steers per dietary treatment. Steers from both treatments grazed stargrass in November and December 2008 and annual ryegrass from January to March 2009, prior to being transitioned to the finishing phase in April. Grain-finished steers were moved to the feedlot and fed a concentrate ration up to 3% of BW on a dry matter basis for 119 d prior to slaughter. Grass-finished steers grazed bahiagrass or stargrass and received 1% BW of a concentrate supplement, 3 d/wk for 144 d prior to slaughter. Carcass data, and objective lean color values of the ribeye and external fat were collected at the 12\textsuperscript{th}/13\textsuperscript{th} rib interface and strip loin steaks were collected from the 13\textsuperscript{th} rib of left carcass sides at 24-h postmortem. There was no difference (P > 0.10) in herbage mass, herbage allowance, or average daily gain (ADG) when all steers were on pastures. The grain-finished steers had greater (P = 0.03) ADG than the grass-finished steers during the finishing phase. For carcass data, grain-finished steers tended (P = 0.09) to have greater adjusted fat thickness, but there was no difference in USDA yield grade. Additionally, there was no difference (P = 0.88) between treatments for marbling score, though a greater proportion of carcasses of grain-finished steers graded USDA Choice than grass-finished steers. Carcasses of grain-finished steers had lighter ribeyes (P = 0.02) and lighter, and less yellow (P = 0.04) external fat than carcasses of grass-finished steers. The differences in carcass traits may require specific markets to commercialize grass-finished beef in Florida.

Introduction
The expense of feed, fuel, and fertilizer has driven several beef producers to try to gain a greater portion of the available profit margin, by becoming a niche meat marketer, rather than just livestock producers. Many of these prospective niche marketers are targeting grass-finishing as a way to add value to their calves. The objective of this study was to compare animal performance and carcass traits of Angus crossbred steers fed a concentrate ration in a feedlot or given a concentrate supplement and constant access to pasture.

Methods and Materials
This study was conducted at the Range Cattle Research and Education Center, in Ona FL from November 2008 to September 2009. Treatments were grass-finished or grain-finished regimes replicated 3 times with a complete randomized design. Twenty-four Angus crossbred steers at an average initial BW of 500 lb ± 37 lb were randomly allotted to 1 of 6 experimental units with 4 steers/experimental unit, 12 steers/dietary treatment. Steers from both treatments grazed stargrass (\textit{Cynodon nlemfuensis}) in November and December 2008 and annual ryegrass (\textit{Lolium multiflorum}) from January to March 2009, prior to being transitioned to the finishing phase in April. Grain-finished steers were moved to the feedlot and fed up to 3% of BW on a dry matter (DM) basis of a ration containing 49% soybean hulls, 30.3% wheat middlings, 12.2% dried distillers grain, 4.5% molasses, 3.2% canola pellets, and 0.8% calcium carbonate for 119 d prior to slaughter. Grass-finished

\textsuperscript{1}\textsuperscript{1}\textsuperscript{1}Department of Animal Sciences, University of Florida, Gainesville, FL
\textsuperscript{2}\textsuperscript{2}Range FloridaCattle Research and Education Center, University of Florida, Ona, FL
steers grazed bahiagrass (*Paspalum notatum*) or stargrass and received 1% BW of a concentrate supplement containing 35% soybean hulls, 29% citrus pulp, 20% wheat middlings, 10% corn, 5% molasses and 0.7% vitamin and mineral premix, 3 d/wk for 144 d prior to slaughter. Herbage mass was measured every 28 d using a disk plate meter in duplicate. Additionally, hand-picked samples were collected every 28 d and analyzed for crude protein and in vitro dry matter digestibility.

Carcass data, and objective lean color values (L*, a*, b*) of the ribeye and external fat were collected at the 12th/13th rib interface and strip loin steaks were collected from the 13th rib of left carcass sides at 24 h postmortem. Steaks were vacuum sealed, and allowed 14 d postmortem aging prior to freezing. Steaks were thawed for 18 h at 39°F, then temperature was monitored during cooking on an open hearth, electric grill to an internal temperature of 160°F (AMSA, 1995). Cooked steaks were then chilled at 37°F for 24 h. Once chilled, six, 0.5 in cores were obtained from each steak parallel to the orientation of the muscle fibers. Each core was sheared once through the center using an Instron Universal Testing Machine with a Warner-Bratzler head.

**Results**

There was no difference (*P > 0.10*) in herbage mass (1,936 ± 132 lb/ac), herbage allowance (1.49 ± 0.09 lbs of forage DM/lb BW), and (ADG; 1.94 ± 0.18 lb/d) when all steers were on pastures. The grain-finished steers had greater (*P = 0.03*) ADG than the grass-finished steers during the finishing phase (Table 1). The herbage mass and allowance for the grass-finished steers during that period was 5,368 lbs/ac and 3.5 lb DM/lb BW, respectively.

Grain-finished steers tended (*P = 0.09*) to have greater adjusted fat thickness but, there was no statistical difference (*P > 0.15*) in hot carcass weight, percentage kidney, pelvic, and heart fat, ribeye area, or USDA yield grade. Obviously, forage is less energy dense than concentrate; this often results in less fat and protein deposition within the animal. Many reports shows grass-finished beef carcasses to have less external fat and smaller ribeye areas (Bowling et al., 1978; Hedrick et al., 1983; Cox et al., 2006) and less internal fat (Bowling et al., 1977; Schroeder et al., 1980; Schaake et al., 1993), than comparable grain-finished carcasses. The low statistical significance for the differences in fatness and muscling from the present study reported in Table 1 is likely due to a low number of animals per treatment (*n = 12*).

Many have reported grass-finished beef carcasses to have lower marbling scores than grain-finished (Reagan et al., 1977; Hedrick et al., 1983; Crouse et al., 1984). This report found no difference (*P = 0.88*; Table 1) for USDA marbling score similar to reports of other authors (Bowling et al., 1977; Sapp et al., 1999; Cox et al., 2006). Though marbling scores were not statistically different, a greater proportion of carcasses from grain-finished steers graded USDA Choice (42 vs. 33%) than grass-finished steers (Table 1).

Carcasses of grain-finished steers had lighter colored ribeyes (greater l* values; *P = 0.02*) and lighter (*P ≤ 0.05*), and less yellow (lower b* values) external fat than carcasses of grass-finished steers (Table 1). All known reports complement the findings in Table 1, that the external fat of grass-finished beef carcasses is more yellow and less white than the external fat of grain-finished beef carcasses due to the β-carotene from forage being deposited within the fat (Yang et al., 2002). Yellow fat is a disadvantage to consumer acceptance of fresh meat at retail (Kerth et al., 2007). Many researchers have reported the lean color of grass-finished beef is darker than the lean color of grain-finished beef (Bidner et al., 1986; Bennett et al., 1995; Baublits et al., 2004; Realini et al., 2004), similar to the results from the current study (Table 1). Lean color is the most important trait relative to a consumer’s purchasing decision of fresh meat at retail, and consumers desire a bright youthful color, which they associate with freshness (Faustman and Cassens, 1990).

The effect of feeding regimen on cooked beef tenderness is somewhat inconclusive. Most reports indicate that steaks from grass-finished
beef carcasses were tougher than comparable samples from grain-finished carcasses (Schroeder et al., 1980; Hedrick et al., 1983; Bennett et al., 1995), though some reported cooked tenderness to be similar (Sapp et al., 1999; French et al., 2000; Cox et al., 2006). The results from the current study in Table 1 show grass-finished strip steaks to have numerically greater (tougher) Warner-Bratzler shear force values than grain-finished steaks, though treatments were not statistically different ($P = 0.26$). Researchers who reported tenderness differences hypothesized some of the following reasons: grass-finished carcasses have less external fat allowing muscles to cold shorten during chilling; many grass-finished cattle will be older than their grain-finished contemporaries, potentially leading to less soluble collagen.

Collectively, the differences in carcass traits may require specific markets to commercialize grass-finished beef in Florida.

**Literature Cited**

**Acknowledgements**
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Table 1. Effect of feeding system on average daily gain and carcass merit of Angus crossbred steers.

<table>
<thead>
<tr>
<th>Trait</th>
<th>Grain-finished</th>
<th>Grass-finished</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of animals</td>
<td>12</td>
<td>12</td>
<td>---</td>
</tr>
<tr>
<td>Average daily gain during finishing, lb</td>
<td>2.06 ± 0.2</td>
<td>1.5 ± 0.2</td>
<td>0.03</td>
</tr>
<tr>
<td>Adj. 12th rib fat thickness, in</td>
<td>0.48 ± 0.03</td>
<td>0.33 ± 0.03</td>
<td>0.09</td>
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<tr>
<td>Ribeye area, in²</td>
<td>12.13 ± 0.43</td>
<td>11.05 ± 0.43</td>
<td>0.22</td>
</tr>
<tr>
<td>Hot carcass wt, lbs</td>
<td>654 ± 12</td>
<td>614.8 ± 12</td>
<td>0.15</td>
</tr>
<tr>
<td>Kidney, pelvic, and heart fat, %</td>
<td>2.3 ± 0.2</td>
<td>1.9 ± 0.2</td>
<td>0.31</td>
</tr>
<tr>
<td>USDA yield grade</td>
<td>2.8 ± 0.2</td>
<td>2.6 ± 0.2</td>
<td>0.40</td>
</tr>
<tr>
<td>Marbling score</td>
<td>Slight 92 ± 21</td>
<td>Slight 87 ± 21</td>
<td>0.88</td>
</tr>
<tr>
<td>USDA Choice, %</td>
<td>42</td>
<td>33</td>
<td>---</td>
</tr>
<tr>
<td>Ribeye lightness (L*)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>36.7 ± 0.7</td>
<td>30.1 ± 0.7</td>
<td>0.02</td>
</tr>
<tr>
<td>Ribeye redness (a*)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>23.4 ± 1.0</td>
<td>24.8 ± 1.0</td>
<td>0.16</td>
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<tr>
<td>Fat lightness (L*)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>77.2 ± 1.1</td>
<td>72.1 ± 1.1</td>
<td>0.04</td>
</tr>
<tr>
<td>Fat yellowness (b*)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>18.6 ± 0.8</td>
<td>23.7 ± 0.8</td>
<td>0.04</td>
</tr>
<tr>
<td>Warner-Bratzler shear force, lbs</td>
<td>8.6 ± 0.7</td>
<td>10.1 ± 0.7</td>
<td>0.26</td>
</tr>
</tbody>
</table>

<sup>a</sup>L* = measure of darkness to lightness (larger value indicates a lighter color); a* = a measure of redness (larger value indicates a redder color); b* = a measure of yellowness (larger value indicates a more yellow color).