ANALYSIS OF PASTURE SYSTEMS TO MAXIMIZE THE PROFITABILITY AND SUSTAINABILITY OF GRASS-FED BEEF PRODUCTION

Basu Deb Bhandari
Graduate Research Assistant
Louisiana State University
101 Martin D. Woodin Hall
Baton Rouge, LA 70803
Phone: (225) 578-2728
E-mail: bbhand3@tigers.lsu.edu

Jeffrey Gillespie
Martin D. Woodin Endowed Professor
Department of Agricultural Economics and Agribusiness
Louisiana State University Agricultural Center
111 Martin D. Woodin Hall
Baton Rouge, LA 70803 - 5604
Phone: (225) 578-2759
E-mail: JGillespie@agcenter.lsu.edu

Guillermo Scaglia
Associate Professor
Iberia Research Station
Louisiana State University Agricultural Center
603 LSU Bridge Road Jeanerette, LA 70544 - 0466
Phone: (337) 276-5527
E-mail: GScaglia@agcenter.lsu.edu

Jim Wang
Professor
Department of Plant, Environmental and Soil Sciences
Louisiana State University Agricultural Center
313 M. B. Sturgis
Baton Rouge, LA 70803
Phone: (225) 578-1360
E-mail: JJwang@agcenter.lsu.edu

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**Abstract**

Three different pasture combinations of grass-fed beef production were evaluated for profitability and sustainability in the Gulf Coast Region. Systems 1 and 2 yielded higher profit than System 3. System 3 produced the lowest greenhouse gas impact. A trade-off was found between profitability and greenhouse gas impact among the systems.

**Introduction**

- Grass-fed beef has a growing niche that coincides with increased health and animal welfare concerns, as well as environmental perspectives (Fanatico et al. 1999; DeRamus 2004; Lozier et al. 2005; McCluskey et al. 2005).
- Production of grass-fed beef is considered to be not only a sustainable agricultural practice, but it also has animal welfare implications (Fanatico et al. 1999). DeRamus (2004) reported that grass-finished beef production helped in improving nutrition cycling and soil and water conservation, and reducing dependence on non-renewable resources.
- Umberger et al. (2002) found that 23% of consumers were willing to pay a $3.00/kg premium for grass-fed beef. Cox et al. (2006) reported 33% preferred forage-fed beef and were willing to pay premiums of $2.38-8.56/kg. Prevat et al. (2000) also reported a segment of U.S. consumers that preferred grass-fed beef.
- Gerrish (2006) found that selection of the highest energy pasture was crucial for grass-finished beef production. Of three grazing systems tested by Comerford et al. (2009) to evaluate animal performance and economics, animal performance did not differ by system, but net return did differ.
- The beef industry is important to the U.S. Gulf Coast Region. This region has abundant forage resources during most of the year. Bermudagrass, ryegrass, and wheat are the most common monocultures in this region. This region has potential for grass-fed beef production. Realizing the increasing importance of grass-fed beef production and the potential of this region to produce this, this study was designed to analyze the profitability of grass-fed beef production in three different combinations of pasture systems.

**Results and Discussion**

**Table 1. Revenue, Expenses and Profit by Treatment (Dollars per Animal)**

<table>
<thead>
<tr>
<th>Activities</th>
<th>System 1</th>
<th>System 2</th>
<th>System 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steer Income</td>
<td>1327.83</td>
<td>1333.67</td>
<td>1315.06</td>
</tr>
<tr>
<td>Hay Income</td>
<td>833.24</td>
<td>669.81</td>
<td>474.35</td>
</tr>
<tr>
<td>Total Income</td>
<td>2161.07</td>
<td>2003.48</td>
<td>1789.41</td>
</tr>
<tr>
<td>Fertilizer Cost</td>
<td>238.37</td>
<td>173.50</td>
<td>157.80</td>
</tr>
<tr>
<td>Pesticide Cost</td>
<td>48.72</td>
<td>45.80</td>
<td>56.69</td>
</tr>
<tr>
<td>Livestock Cost</td>
<td>610.72</td>
<td>612.91</td>
<td>613.35</td>
</tr>
<tr>
<td>Other Cost</td>
<td>8.96</td>
<td>7.91</td>
<td>7.41</td>
</tr>
<tr>
<td>Seed Cost</td>
<td>8.52</td>
<td>144.28</td>
<td>204.11</td>
</tr>
<tr>
<td>Minerals and Medicine</td>
<td>17.17</td>
<td>19.71</td>
<td>17.52</td>
</tr>
<tr>
<td>Repair &amp; Maintenance</td>
<td>78.56</td>
<td>59.24</td>
<td>50.85</td>
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<tr>
<td>Interest Cost</td>
<td>64.67</td>
<td>48.43</td>
<td>46.59</td>
</tr>
<tr>
<td>Total Direct Cost</td>
<td>1183.70</td>
<td>1162.00</td>
<td>1199.57</td>
</tr>
<tr>
<td>Return over Total Direct</td>
<td>977.30</td>
<td>844.37</td>
<td>599.74</td>
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<tr>
<td>Fixed Cost</td>
<td>218.15</td>
<td>172.98</td>
<td>150.35</td>
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<tr>
<td>Total Expenditures</td>
<td>1401.89</td>
<td>1335.07</td>
<td>1350.00</td>
</tr>
<tr>
<td>Return over Specified</td>
<td>759.07</td>
<td>671.30</td>
<td>439.31</td>
</tr>
<tr>
<td>Land Rent</td>
<td>82.17</td>
<td>74.17</td>
<td>72.01</td>
</tr>
<tr>
<td>Residual Return</td>
<td>676.67</td>
<td>597.06</td>
<td>367.26</td>
</tr>
</tbody>
</table>

Notes:
- Superscripts a, b, and c indicate the means differ from those of Systems 1, 2, and 3, respectively at p ≤ 0.01.
- Residual Return = Total Return - Direct Expense - Fixed Expense - Land Expense

**Experimental Data and Analytical Techniques**

- The system experiment was conducted at the Iberia Research Station (IBS) in Jeanerette, LA, from 2009-2010 to 2011-2012. Three pasture systems were managed in different sub-paddocks. 54 Fall-borne steers were blocked at weaning by weight into 9 groups (6 steers/group). Each group was randomly assigned to 1 of the 3 treatments, each of which was replicated 3 times. During 6-8 week periods, animals were fed hay produced in the paddocks allocated to the system/replication group. Portable shades were available for animals in each pasture. They were moved with animals when needed.
- Detailed cost, input, and output records were kept for each steer group. Thus, there were 9 sets of records per year, for a total of 27 sets of records for the 3 years.
- Differences in fixed costs, variable costs, returns, and net returns among the treatments were determined using a mixed model with fixed treatments, and year as a fixed repeated measure effect. The Kenward-Roger Degrees of Freedom method was used.
- Soil samples were collected, and analyzed by soil scientists. Net global warming potential (GWP) in kg of CO2 equivalent for each treatment was determined similar to that conducted by Liebig et al. (2010), which included nitrogen fertilizer production and application (N2), CH4 emission from enteric fermentation (EF), change in soil organic C (SOC), the atmospheric CH4 flux, and the N2O flux. Since the experiment was run for only 3 years, change in soil carbon was barely noticeable. Therefore, we used CO2 flux instead of change in soil carbon for the GWP calculation. Carbon prices that would entice farmers to switch management practices (treatments) were determined.

**Conclusions**

From an economic point of view, Systems 1 and 2 are more profitable than System 3. There is no conclusive evidence that bermudagrass/ryegrass combinations differ in profitability as compared to bermudagrass, ryegrass, rye, dallgrass and clover mix combinations. From a GWP point of view, System 1 produced the highest CO2 equivalent GWP while System 2 produced the lowest. If reduced CO2 equivalent emission were valued at $0.06/kg, then Systems 1 and 3 would be economically equivalent. If System 3 versus System 2, System 3 had $232 lower total net profit and 1644 kg lower CO2 equivalent GWP than System 2. If reduced CO2 equivalent emission were valued at $0.14/kg, then Systems 2 and 3 would be economically equivalent.

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**References**