Recent nutritional strategies to enhance reproductive performance of heifers – A summary of Range Cattle REC studies

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Philippe Moriel, PhD - Assistant Professor
Range Cattle Research & Education Center
University of Florida, Ona, FL

Why anticipate puberty?


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Study 1

Frequency of energy supplementation to beef heifers


Introduction

- Increased intake of low-quality forages by protein supplementation (Köster et al., 1996; Kunkle et al., 2000)
  - Not adequate energy intake by the animal (Bowman and Sanson, 1996)

- Replacement Beef Heifers
  - 55% TDN and 8.5% CP (NRC, 1996)
  - ADG ≥ 1 lb/day

- Supplemental energy is required (Caton and Dhuyvetter, 1997)
Introduction

- Supplementation Frequency
  - Typical strategy to decrease costs of production (labor, fuel, and equipment)

- Protein supplementation frequencies for cattle grazing low-quality forages
  - Did not alter cattle performance (Kunkle et al., 2000)

Introduction

- Materials and Methods
  - 48 Brahman x Angus heifers
    - Initial BW = 531 ± 22 lb
    - Age = 294 ± 16 days
  - Stratified by BW and age
    - Randomly assigned
    - 1 of 16 pens (3 heads/pen)
  - Treatments randomly assigned to pens (3X or Daily)
  - Week 1 to 8 = Developing phase
  - Week 9 to 18 = Breeding season
### Forage dry matter intake, lb/day

![Bar chart showing forage dry matter intake, lb/day.](chart1)

- **Supp x Day**: $P < 0.0001; \text{SEM} = 0.09$

### NEg intake, Mcal/d

![Bar chart showing NEg intake, Mcal/d.](chart2)

- **Supp x Forage**: $P = 0.20$
- **Supp**: $P = 0.03; \text{SEM} = 0.03$

### Overall average daily gain, lb/day

![Bar chart showing overall average daily gain, lb/day.](chart3)

- **Supp x Forage**: $P = 0.68$
- **Supp**: $P = 0.53; \text{SEM} = 0.02$

Glucose, mg/dL

Both | Only daily | Supp x day: $P < 0.0001$; SEM = 2.90
---|---|---
3x | 100 | 80.9 | 80.9 | 76.7
Daily | 70.6 | 76.3 | 76.7
Conclusion

- Regardless forage quality, an increased frequency of energy supplementation led to:
  - Less variation on blood metabolites
  - Greater puberty achievement in development replacement beef heifers.

Study 2

Calf management systems for early-weaned heifers

Enhanced reproductive performance of EW primiparous cows


Metabolic Imprinting

“…early adaptations to a nutritional stress/stimulus permanently change the physiology and metabolism of the organism and continue to be expressed even in the absence of the stimulus/stress that initiated them…”


“Metabolic Programming”

“Metabolic Imprinting”

DNA Methylation

Histone Modifications
Metabolic imprinting study - Animals

- Brahman x British crossbred heifers (n = 40 and 38 in year 1 and 2)
  - Age = 72 ± 13 days
  - BW = 196 ± 35 lb
- Stratified by weight and age
- 4 treatments
  - 2 pens/trt annually

Treatments – Jan (d 0) to Jul (d 180)

<table>
<thead>
<tr>
<th>Jan d 0</th>
<th>Feb d 30</th>
<th>Mar d 60</th>
<th>Apr d 90</th>
<th>May d 120</th>
<th>Jun d 150</th>
<th>Jul d 180</th>
</tr>
</thead>
<tbody>
<tr>
<td>NW</td>
<td>BAHAGRASS + COWS + NO SUPPLEMENTATION</td>
<td>Early weaning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EW180</td>
<td>FEEDLOT + 3.5% BW HIGH-CONCENTRATE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EW90</td>
<td>FEEDLOT + 3.5% BW HIGH-CONC.</td>
<td>BAHAGRASS + 1.0% BW SUPP.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>EWWRG</td>
<td>WYGRASS + 1.0% BW SUPP.</td>
<td>BAHAGRASS + 1.0% BW SUPP.</td>
<td></td>
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</tbody>
</table>
Breeding season
1 bull per treatment

Treatments - Jul (d 180) to calving

<table>
<thead>
<tr>
<th>Normal weaning</th>
<th>Jul d 180</th>
<th>Oct d 270</th>
<th>Dec d 330</th>
<th>Feb d 390</th>
</tr>
</thead>
<tbody>
<tr>
<td>NW</td>
<td>BAHAGRASS + 1.5 % BW SUPP</td>
<td>BAHAGRASS + 1.5 % BW SUPP</td>
<td>BAHAGRASS + 1.5 % BW SUPP</td>
<td>BAHAGRASS + 1.5 % BW SUPP</td>
</tr>
<tr>
<td>EW180</td>
<td>BAHAGRASS + 1.5 % BW SUPP</td>
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</tr>
</tbody>
</table>

Results
Accumulative puberty rate, % of total heifers

Day of the study

Trt x time: \( P < 0.0001 \)

Breeding season

Age (day) and body weight (lb) at puberty

\( P = 0.001 \)

\( P = 0.11 \)
Summary - Heifers

- EW + Ryegrass grazing and EW + high-concentrate
  - Similar or greater growth performance than NW

- EW + high-concentrate diet
  - Greater percentage of EW90 heifers cycling before the breeding season compared to NW heifers despite similar BW gain

Study 3
Should I mix cottonseed meal with Sugarcane molasses in a slurry form, or offer them separately to beef heifers?

Sugarcane Molasses

- Commercially available molasses-based liquid supplements usually rely on NPN to increase CP concentrations (Pate et al., 1995).
- Adding cottonseed meal (CSM) to molasses-urea mixture improved growth performance of younger cows compared with an isonitrogenous, isocaloric molasses-urea supplement (Pate et al., 1990).
- Currently, the mixing of dry feeds with molasses is performed manually or through relatively expensive equipment that are not widely spread among cow-calf operations.

Objective

- Compare two sugarcane molasses feeding systems on measures of performance of replacement beef heifers
  - Slurry: cottonseed meal thoroughly mixed into molasses
  - Cottonseed meal provided in a concrete bunk, separate from molasses

Materials and methods

- 48 Brangus crossbred heifers
  Weight = 520 ± 10 lb; Age = 335 ± 5 days
- 12 bahiagrass pastures (4 heifers/pasture)
  - 70 lb of blackstrap molasses and 14 lb of cottonseed meal for 70 days
  - Mondays and Thursdays
Results

<table>
<thead>
<tr>
<th>Item</th>
<th>Treatment</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight, lb</td>
<td>SLU  SEP</td>
<td></td>
</tr>
<tr>
<td>day 0</td>
<td>515  513</td>
<td>12.6  0.74  0.98</td>
</tr>
<tr>
<td>day 35</td>
<td>524  522</td>
<td></td>
</tr>
<tr>
<td>day 70</td>
<td>546  540</td>
<td></td>
</tr>
<tr>
<td>ADG, lb/d</td>
<td>SLU  SEP</td>
<td></td>
</tr>
<tr>
<td>day 0 to 35</td>
<td>0.09  0.18  0.095  0.41  -</td>
<td></td>
</tr>
<tr>
<td>day 35 to 70</td>
<td>0.66  0.53  0.096  0.27  -</td>
<td></td>
</tr>
<tr>
<td>day 0 to 70</td>
<td>0.37  0.35  0.066  0.82  -</td>
<td></td>
</tr>
<tr>
<td>Percentage of mature weight on day 70</td>
<td>45.4  45.0  1.23  0.76  -</td>
<td></td>
</tr>
<tr>
<td>Overall pubertal heifers, %</td>
<td>18.9  7.8  5.79  0.10  0.89</td>
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</tr>
<tr>
<td>Overall pregnancy, %</td>
<td>51.2  47.9  11.4  0.81  -</td>
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</tr>
</tbody>
</table>

Results

Summary

1. Cottonseed meal and molasses could be offered separately rather than in a slurry form without affecting growth and reproductive performance of grazing replacement beef heifers.

2. By providing cottonseed meal and molasses separately, cow-calf operations should be able to reduce labor and further lower feed costs leading to greater profitability compared to providing cottonseed meal and molasses in a slurry form.
Thank you

Philipe Moreira
pmoriel@ufl.edu
863-735-1314