Effects of Prepartum Supplementation of a Rumen Fermentation Enhancer on Subsequent Beef Cow Performance

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Synopsis
Added pounds at weaning is one of the most efficient strategies to increase profits for beef cattle producers. Reducing the dietary cation-anion difference (DCAD) of diets can potentially increase milk production and, thereby, calf weaning weight.

Summary
We determined the effects of a prepartum negative dietary cation-anion difference (DCAD) supplement on subsequent performance of beef cows. Forty-three multiparous cows (1,252±161 lb; average body weight (BW) ± standard deviation) were used in a completely randomized design. Prepartum cows were stratified by breed, body condition score (BCS), and the previous year’s calving date and assigned to one of two treatments: control (CTRL; 3.75 lb/d of 50:50 corn gluten feed [CGF]:soybean meal [SBM] mixture, dry matter (DM) basis) and treatment (BCLR; 1.25 lb/d of an anion source and 2.5 lb/d of 50:50 CGF:SBM mixture, DM basis). Cows had ad libitum access to bermudagrass hay and water. Daily, cows were individually penned and received supplement (CTRL and BCLR were fed for 21.8±9.3 and 24±9.5 d, respectively) until calving. After calving, cows and calves were weighed within 12 h of parturition and blood samples were collected from the cow. Weekly, blood samples were collected from cows, and BW of cows and calves and BCS of cows were recorded. On d 28, 84, and 140 postpartum, milk yield was recorded and milk samples were analyzed to determine energy corrected milk (ECM). Calculated DCAD of CTRL was 212.98 mEq/lb DM whereas BCLR was -587.71 mEq/lb. Cow weight and calf weight was not affected by treatment. The average daily gain (ADG) of cows and calves, and BCS of cows were not different between treatments. Similarly, ECM did not differ between CTRL and BCLR. Supplemental DMI was greater for CTRL than for BCLR Concentrations of plasma calcium and β-hydroxybutyrate (BHBA) did not differ between treatments. Prepartum supplementation of 1.25 lb/d of an anion source to beef cows did not enhance subsequent cow or calf performance.

Introduction
Dairy producers regularly have to consider the calcium concentrations of cows during the transition period. Often, cows mobilize calcium from the bones to provide for milk production. Many researchers have considered decreasing the DCAD of the diets to improve calcium metabolism and, thereby, decrease incidence of calcium related diseases, such as milk fever (Rezac et al., 2014). Extensive research on DCAD in dairy cows has been performed; however, research is limited in beef cattle.

In beef cattle, one of the most financially important aspects to consider is weaning weight. Milk yield of cows is highly related to weaning weight. In dairy cattle, research has shown that reducing the DCAD of diets can increase milk production (DeGroot et al., 2010). Therefore, there is a potential to increase weaning weight of calves, indirectly, by increasing milk yield of cows fed a negative DCAD diet.

Diets with reduced DCAD often have negative effects on DMI (Spears et al., 2011). This leads to issues around the time of parturition whenever the cow is most likely to be in a negative energy balance.

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However, providing cattle with acidified co-products to reduce DCAD has shown promising results. When acidified co-products, such as Bio-Chlor, have been fed to dairy cattle, DMI was not altered and milk production was increased (DeGroot et al., 2010; Weich et al., 2013). The objective of this study was to evaluate the effects of a negative DCAD supplement (Bio-Chlor) on beef cow performance, milk production and subsequent calf performance.

Materials and Methods
The study was conducted at the North Florida Research and Education Center in Marianna, FL. The DCAD balancer (Bio-Chlor) was provided by Church & Dwight Co. (Princeton, NJ). A total of 43 primiparous cows (944±93; lb avg. BW±standard deviation) were used in a completely randomized design. All cows had ad libitum access to bahiagrass hay and water. Cows were stratified by breed, BCS and the previous year’s calving date, and randomly assigned to treatments. Cows were gathered daily to receive one of two treatments:

1. CTRL=3.75 lb/d of a 50:50 corn gluten feed (CGF): soybean meal (SBM) mixture
2. BCLR=2.5 lb/d of a 50:50 CGF:SBM mixture and 1.25 lb/d of Bio-Chlor

A timeline of events can be found in Figure 1. Briefly, cows were weighed and evaluated for BCS for assignment to treatments and cows were fed their respective treatments starting 30 d before their expected calving dates (CTRL and BCLR were fed for 21.8±9.3 and 24±9.5 d, respectively). On the day of parturition (d 0), cows and calves were weighed, cow BCS was recorded, and a blood sample was taken from each cow. Body weight of cows and calves, and blood samples from cows were collected weekly for 140 d post-parturition. Milk yield and samples of the cows was recorded on d 28, 84, and 140.

Blood was analyzed, colorimetrically, for calcium and BHBA. Utilization of BHBA was utilized to evaluate energy balance between treatments. Progesterone was analyzed in the plasma to determine postpartum cycling status. Milk samples were analyzed for protein, fat (to determine ECM), and somatic cell count.

Data were analyzed as a completely randomized design using the MIXED procedure of SAS (SAS Inst. Inc., Cary, NC) with cow as the experimental unit. Repeated measures were used to analyze cow and calf BW, ECM, and BHBA. For these variables, the model included the fixed effects of treatment, day, and treatment × day interactions. Cow was considered subject and the covariance structures were determined by the lowest Akaike Information Criterion. For all other variables, the model included the fixed effect of treatment. Significance was declared at P≤0.05.

Results
Supplemental DMI was greater (P<0.001) for CTRL (3.53±0.068 lb/d) than for BCLR (2.71±0.073 lb/d). There was no treatment × day interaction (P=0.39) on cow BW throughout the experiment; however, an effect of treatment (P=0.02) was observed, with BCLR weighing less than CTRL (Figure 2) cows. No interaction (P=0.59) nor treatment effect (P=0.90) occurred for calf BW (Figure 3). Average daily gain of cows (0.22±0.095 lb) and calves (2.21±0.088 lb) were not different between treatments (P>0.05). Body condition score of cows (4.97±0.05; 1 to 9 scale) was not affected by treatment (P=0.89).

Concentrations of plasma Ca (10.67±0.51 mg·dL\(^{-1}\); Table 1) and BHBA (173.0±9.18 mmol·L\(^{-1}\); Figure 4) did not differ (P>0.05) between treatments. Similarly, ECM did not differ between CTRL and BCLR (P>0.05; Figure 5). There was no effect (P=0.54) of treatment on ECM. Prepartum supplementation of
1.25 lb/d of an anion source to beef cows did not enhance subsequent cow or calf performance.

In general, reduction of DCAD in the diets of dairy cattle increases milk production and prevents disorders such as milk fever. The results observed in this study do not imply the same implications in beef cattle. When beef cows were provided 1.25 lb/d of an anion source (Bio-Chlor), no effects on milk production or subsequent calf production were evident.

**Literature Cited**
Figure 1. Timeline of events.

Figure 2. Effect of Bio-Chlor on cow body weight. Treatment, $P=0.02$; day, $P<0.0001$; Treatment × day, $P=0.59$. 
Figure 3. Effect of Bio-Chlor on calf body weight. Treatment, $P=0.90$; Day, $P<0.0001$; Treatment × day, $P=0.59$.

Figure 4. Effect of Bio-Chlor on plasma beta-hydroxybutyrate (BHBA) concentration. Treatment, $P=0.29$; Treatment × day, $P=0.38$. 
Figure 5. Effects of Bio-Chlor on Energy corrected milk (ECM). Treatment, \( P=0.54 \); Day, \( P<0.0001 \); Treatment × day, \( P=0.55 \).

Table 1. Effect of Bio-Chlor on DCAD\(^1\) and plasma calcium concentration of beef cows

<table>
<thead>
<tr>
<th>Item</th>
<th>Treatment(^2)</th>
<th>SEM(^3)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CTRL</td>
<td>BCLR</td>
<td></td>
</tr>
<tr>
<td>DCAD</td>
<td>213</td>
<td>-588</td>
<td>-</td>
</tr>
<tr>
<td>Plasma calcium, mg/dL</td>
<td>9.96</td>
<td>11.47</td>
<td>0.70</td>
</tr>
</tbody>
</table>

\(^1\)DCAD=Dietary cation-anion difference.
\(^2\)CTRL=3.75 lb/d of a 50:50 corn gluten feed (CGF): Soybean meal (SBM) mixture; BCLR=2.5 lb/d of a 50:50 CGF:SBM mixture and 1.25 lb/d of Bio-Chlor.
\(^3\)Standard error of the mean.