Effects of Modified Distillers Grains and Corn Ratios as Supplements in Diets Varying in Forage Quality on Performance of Growing Beef Steers

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Summary with Implications

Distillers grains (DG) have been intensively used for beef production, but prices relative to corn vary such that it may be beneficial to displace a portion of DG with corn in certain circumstances. Four ratios of supplemental energy (40% of diet DM) from modified distillers grains and corn (100:0, 80:20, 60:40, and 40:60) were supplemented in one of 3 forage diets (56% of diet DM) and evaluated for performance. Forages were high (brome hay + sorghum silage) or low quality. Low quality forages were corn residue baled through conventional rake and bale, or by disengaging the spreader on the combine and baling the tailings (easy bale). Steers fed the high quality forage had greater ADG due to greater DMI, but similar F:G as both residue forage diets, which were not different. Decreasing the ratio of modified DG:corn linearly decreased ADG and resulted in poorer F:G.

Introduction

Ethanol production in the US increased from 6.1 billion gallons in 2007 to 13.5 billion gallons in 2014. Since then, corn residue and distillers grains (DG) have been intensively used for beef production. Corn residue is composed of plant parts with distinct digestibilities, with the husk being the most digestible, followed by leaf blade, cob and lastly stem (2015 Nebraska Beef Cattle Report, pp. 59-61). The proportion of plant parts in the window to be baled plays an important role on performance, since it determines the digestibility of forage consumed by the animal.

In the past, DG was included in ruminant diets due to its low price, but the increasing export demand in recent years has raised the price. However, it is not known if corn can displace a portion of DG as supplemental energy in forage diets for growing steers. We hypothesize that corn may replace 60% of distillers grains without negatively impacting performance because DG will still meet the protein requirements of the steers. The objective of this research was to determine the effects of displacing the supplemental energy from modified DG in diets of different forage qualities on performance of growing beef steers.

Procedure

The experiment was conducted at the University of Nebraska—Lincoln Eastern Nebraska Research and Extension Center near Mead, Neb. One hundred twenty individually fed crossbred beef steers (initial BW = 620 ± 32 lb) were used in a randomized complete block design with 3 forage types (HQ, CB, and EZB) and four MDG:corn ratios (100:0, 80:20, 60:40, and 40:60). Orthogonal comparisons across MDG levels were analyzed to determine linear, quadratic or cubic trends for varying MDG:corn ratios in the diet. Interactions between supplemental energy ratios and forage type were also tested. Data were considered statistically significant when \( P < 0.05 \).

Results

No interactions (linear or quadratic; \( P > 0.32 \)) were observed between forage quality and ratio of MDG:corn supplementation for ADG and F:G. A significant quadratic interaction (\( P < 0.01 \)) was observed for DMI (data not shown). The differences in DMI across ratios were small within each forage quality. However, the interaction was due to a quadratic increase, then decrease in DMI as MDG was replaced with corn within the HQ diets (range in DMI from 18.7 to 20.6 lb / d). For steers fed EZB, a cubic response to ratio of MDG:corn was observed with DMI of 12.2, 11.0, 12.2, and

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10.5 observed as MDG:corn ratio decreased from 100:0 to 40:60, suggesting simply that intakes varied as MDG:corn differed. No difference in DMI was observed due to ratio of MDG:corn within CB diets. Performance due to main effects of either ratio of MDG:corn or forage quality are presented. The HQ forage increased ending BW by 12.7% (P < 0.01), ADG by 60.0% (P < 0.01) and DMI by 62.73% (P < 0.01) compared to the low quality forages (Table 2). There were no differences between the two corn residue forages for ending BW and ADG. Feeding EZB treatment decreased DMI compared to CB. As expected, husk proportion was increased by the EZB method, being 14.45 vs. 9.53% for EZB and CB, respectively. But, the proportion of stem + cob (the parts of the plant with lowest digestibilities) was actually slightly greater for the EZB (55.9 vs. 51.6% Stem + cob for EZB and CB, respectively; Table 3) which can explain the lack of difference between the low quality forages on performance. However, the F:G ratio was not affected by type of forage (P = 0.92) despite changes in DMI and ADG.

There was a linear decrease in ending BW (P < 0.01) and ADG (P < 0.01) as MDG was displaced with corn (Table 4).
Similarly, the F:G ratio increased linearly \((P = 0.03)\) and DMI \((P = 0.09)\) tended to decrease linearly as MDG inclusion decreased in the diet and corn increased. The F:G response to ratio of MDG:corn was not quadratic \((P = 0.58)\) even though F:G was similar at 100:0 and 80:20 ratios and then F:G increased as corn replaced more MDG. When wet distillers grains or dry distillers grains were evaluated at two different inclusions (15 or 30% in the diet) with grass hay and sorghum silage based diets, the highest distillers inclusion improved ending BW, ADG and F:G ratio regardless of the form of distillers grains fed \((2011\ Nebraska\ Beef\ Cattle\ Report,\ pp.\ 20-21)\). Another trial \((2011\ Nebraska\ Beef\ Cattle\ Report,\ pp.\ 24-25)\) evaluated the performance of growing steers grazing smooth bromegrass supplemented with dry distillers grains at 0.6% of BW per day and supplementation increased ADG by 1.4 lb / d compared to non-supplemented cattle. The improved performance of cattle supplemented distillers grains can be attributed to the energy from fat and rumen undegradable protein of the distillers grains \((2006\ Nebraska\ Beef\ Cattle\ Report,\ pp.\ 27-29)\). In the current study, steers fed the 40:60 ratio of MDG:corn should have met their metabolizable protein requirements, suggesting that the response in ADG and F:G is due to energy differences between MDG and corn, and not a protein requirement response. The 40% inclusion of modified distillers grains resulted in greater performance compared to the other levels.

**Conclusions**

As expected, the high quality forage increased steer performance compared to the two corn residue bailing methods. However, while it was expected that the easy bale treatment would result in improved residue quality, there was no difference between the easy bale and conventional rake and bale systems for average daily gain or feed efficiency. Additionally, when distillers grains was displaced with dry-rolled corn, cattle performance decreased.

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**Table 4. Effects of MDG level on cattle performance**

<table>
<thead>
<tr>
<th>Item</th>
<th>MDG Level1</th>
<th>SEM</th>
<th>P-value</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100</td>
<td>80</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>Initial BW, lb</td>
<td>620</td>
<td>620</td>
<td>620</td>
<td>620</td>
</tr>
<tr>
<td>Ending BW, lb</td>
<td>813</td>
<td>804</td>
<td>799</td>
<td>784</td>
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<tr>
<td>DMI, lb/d</td>
<td>14.78</td>
<td>14.42</td>
<td>14.71</td>
<td>13.88</td>
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<tr>
<td>ADG, lb</td>
<td>2.27</td>
<td>2.17</td>
<td>2.11</td>
<td>1.93</td>
</tr>
<tr>
<td>F:G2</td>
<td>6.54</td>
<td>6.54</td>
<td>6.90</td>
<td>7.19</td>
</tr>
</tbody>
</table>

1 Percent modified distillers grains (MDG) in the supplement.
2 Analyzed as G:F, the reciprocal of feed conversion (F:G).