Evaluation of Brown Midrib Corn Silage for Growing and Backgrounding Beef Steers

F. Henry Hilscher
Curtis J. Bittner
John N. Anderson
Galen E. Erickson

Summary with Implications

A growing study evaluated three corn silage hybrids for growing crossbred steers. The three hybrids were: a standard corn silage hybrid which served as the control, a brown midrib hybrid, and an experimental brown midrib hybrid with a softer endosperm. Intake, ADG, and ending BW were greater for steers fed either brown midrib silage compared to control, but not different between the brown midrib or experimental brown midrib silage. While brown midrib hybrids had greater DMI and ADG, there was no difference in F:G between all three treatments. Feeding brown midrib hybrids as corn silage at 80% of the diet DM likely improved ruminal digestion, which allowed for greater DMI and ADG but without improving F:G.

Introduction

Feeding corn silage allows cattle feeders to take advantage of the entire corn plant at a time of maximum quality and tonnage as well as secure substantial quantities of roughage/grain inventory (2013 Nebraska Beef Cattle Report, pp. 74–75). Incorporating corn silage based growing diets containing 80% corn silage in combination with distillers grains has been shown as a potentially economical and efficient way to grow steers prior to the finishing phase (2011 Nebraska Beef Cattle Report, pp. 16–17). However, in corn silage growing diets, gut fill and fiber digestion limit DMI and thus ADG. The brown midrib (bm3) mutation has been shown in previous research to lower lignin concentrations and improve fiber digestibility. Unfortunately, little research has been done in beef growing diets for corn silage incorporating the bm3 trait. Research is needed on growth performance as a result of increased fiber digestion due to bm3 within corn silage.

Therefore, the objective of this experiment was to determine the effect of feeding two bm3 corn silage hybrids on growing steer performance.

Table 1. Diet (DM basis) fed to growing steers.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Treatment¹</th>
<th>BM3</th>
<th>BM3-EXP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control corn silage</td>
<td>80.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>BM3 corn silage</td>
<td>-</td>
<td>80.0</td>
<td>-</td>
</tr>
<tr>
<td>BM3-EXP corn silage</td>
<td>-</td>
<td>-</td>
<td>80.0</td>
</tr>
<tr>
<td>Modified distillers grains plus solubles</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>Supplement²</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

¹ Treatments were control (CON; hybrid-TMR2R270), a bm3 hybrid (BM3; hybrid-F1557952), and an experimental bm3 hybrid (BM3-EXP; hybrid-F15578XT) with a softer endosperm
² Supplement consisted of 3.0% Fine ground corn, 0.916% limestone, 0.574% urea, 0.125% tallow, 0.30% salt, 0.05% trace mineral package (10% Mg, 6% Zn, 4.5% Fe, 2% Mn, 0.05% Cu, 0.3% I, and 0.05% Zn), 0.05% Vitamin A-D-E package (1,500 IU of vit.A, 3,000 IU of vit.D, 3.7 IU of vit.E) as percentages of the final diet (DM basis). Supplement was formulated to provide 200 mg/ steer of Rumensin® daily.

Procedure

Three hybrids of corn silage were grown and harvested at the Eastern Nebraska Research and Extension Center (ENREC) near Mead, NE. The three hybrids were a standard corn silage hybrid which served as the control (CON; hybrid-TMR2R270), a bm3 hybrid with the brown midrib trait (BM3; hybrid-F1557952), and an experimental bm3 hybrid (BM3-EXP; hybrid-F15578XT) with a greater proportion of softer endosperm. Silage was harvested from 9/11/15 through 9/16/15 and stored in concrete wall bunkers until the initiation of the trial. Bunker samples were sampled for DM and fermentation analysis 28 d after harvesting to ensure proper ensiling. All feeds were sampled weekly for DM, and monthly composites analyzed for nutrients.

A 76-day growing study was conducted utilizing 216 yearling crossbred steers (initial BW = 714 ± 22 lb). All steers were limit-fed a common diet consisting of 50% alfalfa hay and 50% SweetBran® at 2% of BW for five days prior to trial initiation to minimize gut fill. Following five days of limit feeding, steers were weighed for two consecutive days. Initial BW was calculated by averaging the two-day weights. Cattle were implanted with Ralgro® during initial processing. Cattle were stratified by BW and assigned randomly to pens with 12 head per pen. Pens were assigned randomly to one of three treatments, with 6 replications per treatment.

The three treatments (Table 1) were set up in a generalized randomized block design. All diets included 15% modified distillers grains plus solubles (MDGS) and 5% supplement. Rumensin was added in the supplement to supply 200 mg/steer daily. The remainder of the diet consisted of 80% corn silage of 1 of the three hybrids (CON, BM3 or BM3-EXP). Ending BW was collected similar to initial BW with steers limit-fed at 2% of BW for five days and weighed for two consecutive days.

Performance data (BW, DMI, ADG, and G:F) were analyzed using the MIXED procedure of SAS (SAS Institute, Inc., Cary, N.C.) with pen serving as the experimental unit. Block was included in the model as a fixed effect. One steer died during the study on the BM3 treatment due to pneumonia and was removed from the data.

Results

Corn silage was targeted to be harvested at 35% DM. However, after fermentation, DM declined slightly (Table 2). The fermentation analysis of the three
corn silage hybrids indicated that proper fermentation did occur as pH was below
3.9, as well as having total acids greater than
7.3%. The starch percentage and the sugar
(water soluble carbohydrates) percentage
remained consistent across all three silage
hydrs. The ADF and lignin concentra-
tions were numerically lower in both the
BM3 and BM3-EXP compared to the CON,
as expected.

Ending BW was greater (P < 0.01)
for steers fed the BM3 and BM3-EXP
compared to the CON, but not different
between the two bm3 varieties (Table 3).
Steers fed both BM3 and BM3-EXP had
greater (P < 0.01) DMI and ADG compared
to the steers on the CON treatment, but
DMI and ADG were not different between
steers in the BM3 or BM3-EXP treatments.
While BM3 and BM3-EXP had greater
DMI and ADG, there were no differences
(P = 0.26) in F:G between the three silage
treatments.

Conclusions

Feeding corn silage hybrids with the
bm3 trait at 80% of the diet DM resulted in
greater ending BW, DMI and ADG when
compared to a control corn silage without the
bm3 trait. Increased gain when feeding
corn silage with the bm3 trait lead to
heavier BW out of the growing program or
entering the feedlot, which could be advan-
tageous in reducing total feed costs.

F. Henry Hilscher, graduate student
Curtis J. Bittner, research technician
Galen E. Erickson, professor, Animal
Science, University of Nebraska, Lincoln
Neb.
John N. Anderson, Mycogen Seeds,
Indianapolis Ind.

Table 2. Nutrient and fermentation analysis of silage hybrids

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>CON Mean</th>
<th>CON CV</th>
<th>BM3 Mean</th>
<th>BM3 CV</th>
<th>BM3-EXP Mean</th>
<th>BM3-EXP CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>31.9</td>
<td>6.4</td>
<td>32.4</td>
<td>5.3</td>
<td>33.0</td>
<td>6.9</td>
</tr>
<tr>
<td>CP</td>
<td>8.6</td>
<td>3.4</td>
<td>9.6</td>
<td>7.8</td>
<td>9.1</td>
<td>3.9</td>
</tr>
<tr>
<td>NDF, %</td>
<td>40.9</td>
<td>4.3</td>
<td>41.0</td>
<td>4.4</td>
<td>39.0</td>
<td>3.6</td>
</tr>
<tr>
<td>ADF, %</td>
<td>27.1</td>
<td>2.5</td>
<td>26.7</td>
<td>2.2</td>
<td>23.6</td>
<td>3.0</td>
</tr>
<tr>
<td>Lignin, %</td>
<td>4.3</td>
<td>27.5</td>
<td>3.7</td>
<td>24.2</td>
<td>2.81</td>
<td>34.6</td>
</tr>
<tr>
<td>Starch, %</td>
<td>31.0</td>
<td>8.8</td>
<td>32.0</td>
<td>8.9</td>
<td>30.8</td>
<td>6.7</td>
</tr>
<tr>
<td>Sugar, %</td>
<td>2.3</td>
<td>28.1</td>
<td>2.4</td>
<td>37.8</td>
<td>2.8</td>
<td>22.4</td>
</tr>
<tr>
<td>pH</td>
<td>3.89</td>
<td>2.5</td>
<td>3.86</td>
<td>1.9</td>
<td>3.81</td>
<td>6.3</td>
</tr>
<tr>
<td>Lactic Acid, %</td>
<td>5.6</td>
<td>17.1</td>
<td>6.2</td>
<td>16.6</td>
<td>6.0</td>
<td>15.6</td>
</tr>
<tr>
<td>Acetic acid, %</td>
<td>1.4</td>
<td>31.2</td>
<td>1.6</td>
<td>30.9</td>
<td>1.5</td>
<td>34.4</td>
</tr>
<tr>
<td>Propionic acid, %</td>
<td>0.34</td>
<td>40.3</td>
<td>0.43</td>
<td>48.7</td>
<td>0.46</td>
<td>0.54</td>
</tr>
<tr>
<td>Butyric acid, %</td>
<td>&lt;0.01</td>
<td>0.0</td>
<td>&lt;0.01</td>
<td>0.0</td>
<td>&lt;0.01</td>
<td>0.0</td>
</tr>
<tr>
<td>Total acids, %</td>
<td>7.3</td>
<td>10.4</td>
<td>8.2</td>
<td>11.0</td>
<td>7.9</td>
<td>10.8</td>
</tr>
</tbody>
</table>

1 Hybrids were control (CON; hybrid-TMR2R720), a bm3 hybrid (BM3; hybrid-F15579S2), and an experimental bm3 hybrid
   (BM3-EXP; hybrid-F15578XT) with a softer endosperm
2 DM was calculated using weekly samples and oven dried for 48 h at 600 C. All other nutrient assays are based on monthly com-
   posites of weekly samples taken during the finishing trial, and analyzed at Dairy One Labs (Ithaca, NY).
3 C.V. = coefficient of variation and is calculated by dividing the standard deviation by the mean and is expressed as a percentage.

Table 3. Effects of feeding two different bm3 corn silage hybrids on growing steer performance.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Treatments</th>
<th>CON</th>
<th>BM3</th>
<th>BM3-EXP</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial BW, lb</td>
<td>714</td>
<td>713</td>
<td>714</td>
<td>0.7</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>Ending BW, lb</td>
<td>989</td>
<td>1035</td>
<td>1032</td>
<td>4.9</td>
<td>&lt; 0.01</td>
<td></td>
</tr>
<tr>
<td>DMI, lb/d</td>
<td>21.2</td>
<td>24.0</td>
<td>24.1</td>
<td>0.2</td>
<td>&lt; 0.01</td>
<td></td>
</tr>
<tr>
<td>ADG, lb</td>
<td>3.62</td>
<td>4.23</td>
<td>4.19</td>
<td>0.06</td>
<td>&lt; 0.01</td>
<td></td>
</tr>
<tr>
<td>Feed:Gain2</td>
<td>5.86</td>
<td>5.67</td>
<td>5.74</td>
<td>-</td>
<td>0.26</td>
<td></td>
</tr>
</tbody>
</table>

- Means with different superscripts differ (P < 0.05).
1 Treatments were control (CON; hybrid-TMR2R720), a bm3 hybrid (BM3; hybrid-F15579S2), and an experimental bm3 hybrid
   (BM3-EXP; hybrid-F15578XT) with a softer endosperm.
2 Feed:Gain was analyzed as gain to feed, the reciprocal of feed gain.