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Corn Residue Quality throughout the Grazing Season

Shelby E. Gardine  
*University of Nebraska-Lincoln, sgardine2@unl.edu*

Gavin L. Harsh  
*University of Nebraska - Lincoln, gharsh_20@hotmail.com*

Robert G. Bondurant  
*University of Nebraska-Lincoln, robby.bondurant@unl.edu*

Jana L. Gramkow  
*University of Nebraska - Lincoln*

Andrea K. Watson  
*University of Nebraska-Lincoln, awatson3@unl.edu*

*See next page for additional authors*

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Authors
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Summary with Implications
Changes in in vitro organic matter digestibility and digestible organic matter of corn residue were evaluated throughout the fall grazing and spring grazing seasons. In vitro organic matter digestibility and digestible organic matter were greatest at the beginning of fall grazing and declined over time. Slight weathering resulted in lower quality corn residue available at the beginning of spring grazing compared to the beginning of fall grazing. The in vitro organic matter digestibility of available residue declined 21% over the fall grazing season and 51% throughout the spring grazing season. As the availability of nutrients declines over time, adjustments in feeding management or rotational grazing may be necessary to meet energy requirements of grazing cattle.

Introduction
With the conversion of much grassland to cropland, supply of traditional forage resources has been challenged. However, an increase in acres being planted for corn production has resulted in greater availability of corn residue, which can be a valuable feed resource for grazing situations. Over time, corn residue quality will vary due to selective grazing of the higher quality plant parts (husk and leaves) and weathering. Characterizing a corn residue field for nutrient quality throughout a grazing period is important because adjustments in feeding management or rotational grazing may be necessary to meet the nutrient requirements of animals grazing the field.

Therefore, the direct objective of this study was to determine diet quality of a corn residue field throughout fall and spring grazing periods. A secondary objective was to evaluate the effects of crop rotation on subsequent corn residue quality.

Procedures
Corn plant samples
An irrigated cornfield located at the Eastern Nebraska Research and Extension Center (ENREC) was utilized in the study. The field consisted of 2 sections with different crop rotations: 1) corn-corn rotation and 2) corn-soybean rotation. Three treatments (fall grazed, spring grazed, and non-grazed) with four replications of each treatment have been applied to the field annually. Ten consecutive whole corn plant samples harvested above the anchor root were collected from each field replication prior to grain harvest. Plant samples were separated into individual plant parts (leaf, sheath, husk) and weighed for DM. Plant parts were then composited within replication and analyzed for in vitro organic matter digestibility (IVOMD), digestible organic matter (DOM), and starch.

Corn residue diet samples
Following grain harvest of the corn field, cow-calf pairs grazed the fall grazed (November to February) and the spring (March) field replications at a stocking rate of 1.4 and 0.5 acres per cow-calf pair, respectively. To determine changes in forage quality throughout each grazing period, 6 ruminally fistulated steers were allowed to graze the field replications at the initiation and completion of each grazing season. Prior to sampling, rumen contents were removed from each steer. Fistulated steers were then transferred to the corn residue field where 3 steers per replication were allowed to graze. After approximately 30 minutes of grazing, freshly consumed feed was collected from each steer’s rumen and placed in a cooler for later analysis. Former rumen contents were returned to the rumen. Collected samples were analyzed for in vitro organic matter digestibility (IVOMD) using the Tilley and Terry method, which was modified with the inclusion of 1 gram of urea to the buffer. The IVOMD values were also adjusted using in vivo corn residue and grass hay standards. Digestible organic matter (DOM) was then calculated by multiplying the IVOMD and percent organic matter of the original residue sample. A starch analysis (Megazyme Total Starch Assay, Megazyme International Ireland Ltd., Ireland) was conducted to determine the percentage of grain within diet samples.

All data were analyzed using the mixed procedure of SAS. Corn plant data included treatment (spring and fall grazed), crop rotation, and plant part (husk, leaf blade, and leaf sheath) as fixed effects. Data from corn residue diet samples included treatment (spring and fall) and time (beginning and end of grazing season) as fixed effects.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Fall grazed</th>
<th>Spring grazed</th>
<th>Non-grazed</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Husk</td>
<td>5.8</td>
<td>6.1</td>
<td>5.3</td>
<td>0.32</td>
<td>0.22</td>
</tr>
<tr>
<td>Leaf</td>
<td>17.6</td>
<td>18.2</td>
<td>16.9</td>
<td>1.04</td>
<td>0.68</td>
</tr>
<tr>
<td>Sheath</td>
<td>8.6</td>
<td>8.7</td>
<td>8.2</td>
<td>0.49</td>
<td>0.77</td>
</tr>
<tr>
<td>Cob</td>
<td>9.1</td>
<td>9.4</td>
<td>8.5</td>
<td>0.39</td>
<td>0.31</td>
</tr>
</tbody>
</table>

1 Treatments were due to timing of cattle grazing residue 2 years prior to these samples being collected. Ten plants were collected from each of 4 replications per treatment.

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Table 2. In vitro organic matter digestibility and digestible organic matter of corn plant samples by area

<table>
<thead>
<tr>
<th>Item</th>
<th>Area</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVOMD, %</td>
<td>C-2B</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C-2C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.0</td>
<td>0.96</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.2</td>
<td>0.95</td>
</tr>
</tbody>
</table>

1Area that was in a corn-soybean rotation
2Area that was in a corn-corn rotation
3Digestible organic matter (as a % of dry matter); calculated as OM content (%) × IVOMD (%)
4Digestible organic matter (as a % of DM); calculated as OM content (%) × IVOMD (%)

Table 3. In vitro organic matter digestibility and digestible organic matter of corn plant parts

<table>
<thead>
<tr>
<th>Item</th>
<th>Husk</th>
<th>Leaf Blade</th>
<th>Leaf Sheath</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVOMD, %</td>
<td>60.0</td>
<td>39.7</td>
<td>32.7</td>
<td>0.6</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td></td>
<td>58.1</td>
<td>33.7</td>
<td>30.3</td>
<td>0.6</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

1In vitro organic matter digestibility
2Digestible organic matter (as a % of dry matter); calculated as OM content (%) × IVOMD (%)
3Means within a row with unique superscripts differ (P < 0.05)

Table 4. In vitro organic matter digestibility and digestible organic matter of corn residue diet samples by treatment and time

<table>
<thead>
<tr>
<th>Item</th>
<th>Fall</th>
<th>Spring</th>
<th>SEM</th>
<th>Trt</th>
<th>Time</th>
<th>Int.</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVOMD, %</td>
<td>62.1</td>
<td>48.9</td>
<td>29.0</td>
<td>3.0</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td></td>
<td>58.5</td>
<td>40.0</td>
<td>53.5</td>
<td>25.7</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>0.04</td>
</tr>
</tbody>
</table>

1Treatments are due to timing of grazing (fall or spring) and timing of sample collection (at the beginning or end of grazing).
2Trt= fixed effect of treatment; Time= fixed effect of time; Int. = treatment × time interaction
3In vitro organic matter digestibility
4Digestible organic matter (as a % of DM); calculated as OM content (%) × IVOMD (%); adjusted for ash content of saliva
5Means within a row with unique superscripts differ (P < 0.05)

Results

The energy content of a corn residue field provides to grazing cattle is greatest at the beginning of the fall grazing season. However, as cattle selectively consume the higher digestible plant parts and weathering deteriorates the corn residue, the field provides less and less energy to the cattle. Characterizing a field for its nutrient profile is important during the grazing season. As the availability of nutrients declines over time, adjusting feeding management or utilizing rotational grazing may be necessary to continue to meet energy requirements of the grazing cattle.

Conclusion

The energy content of a corn residue field provides to grazing cattle is greatest at the beginning of the fall grazing season. However, as cattle selectively consume the higher digestible plant parts and weathering deteriorates the corn residue, the field provides less and less energy to the cattle. Characterizing a field for its nutrient profile is important during the grazing season. As the availability of nutrients declines over time, adjusting feeding management or utilizing rotational grazing may be necessary to continue to meet energy requirements of the grazing cattle.