Utilizing Crop Residues in Winter Feeding Systems for Beef Cattle

Ashley Krause and H.A. Lardner
January 20th, 2011
Background

- Winter feeding costs are a major contributor to the overall cost of production for cow-calf producers (Taylor 2007)

- Some studies have suggested that swath grazing can reduce cow costs per day (Karn et al. 2005, McCartney et al. 2004)

- Today renewed interest in utilizing crop residues in beef cow diets because of potential to reduce winter feed costs (McCartney et al. 2006)
Background

- Integration of crop and livestock enterprises may increase diversity

- There has been limited research conducted on winter grazing crop residues (McCartney et al. 2006)
Research Method

- 3-year trial to evaluate the performance and economics of beef cows winter grazing crop residues

- Today I will present year 1 data from 2009
Objectives

- To determine the effect of field grazing crop residue on beef cow performance and reproductive efficiency

- To determine if oat straw/chaff or pea straw/chaff can provide sufficient nutrients for mature pregnant beef cows with supplementation
Objectives

- Characterize the nutritive value and total yield of oat straw/chaff or pea straw/chaff

- Evaluate cow wintering systems economically for total costs and effect on net returns per cow
Experimental Approach

Site Management:

- Each year 35 acres of pea (cv. Performance 40-10) and oat (cv. Baler) were seeded at Termuende Research Ranch, Lanigan, SK.

- Crops were swathed and combined at maturity with a 9600 John Deere combine attached with a modified Whole Buncher straw-chaff collector.

- Residue pile weight averaged 40 lb dry matter.
Crop Residue
Straw/Chaff
Grazing Oat Straw/Chaff Piles
Experimental Approach

- 90 Black Angus cows stratified by age, body weight, body condition, and pregnancy status were randomly allocated to 1 of 3 treatments.

- Cows were allocated feed on a 3 d basis based on environmental conditions, cow body weight, pregnancy status and feed nutrient density (National Research Council’s (1996) Nutrient Requirements of Beef Cattle).

- Rations were formulated using CowBytes® Beef Ration Balancer Program (AAFRD 1999).
Experimental Approach

• Rations formulated to meet maintenance requirements with no net gain or loss of body weight outside of conceptus growth

• Cow body weight adjusted using the following equation: (NRC 1996)

\[
\text{Conceptus weight (kg)} = (\text{CBW} \times 0.01828) \times e^{[(0.02 \times t) - (1.43 \times 10^{-5} \times t \times t)]}
\]

Where: CBW = calf weight at birth
    t = days of pregnancy
Winter Feeding Systems

Each treatment consists of replicate groups (n=3) of cows (n=10)

1. **Dry lot Feeding System (DL)**
   Grass-legume hay was fed as round bales in feeders in drylot pens

2. **Grazing Pea Crop Residue (PEA)**
   Pea straw/chaff residue allocated on a 3 d basis, oat grain fed daily at 0.4-0.6% BW

3. **Grazing Oat Crop Residue (OAT)**
   Oat straw/chaff residue allocated on a 3 d basis, oat grain fed daily at 0.4-0.6% BW
Animal Management and Environmental Data

- Portable windbreaks were provided
- Water was supplied in stock troughs daily (CCAC 1993)
- Daily min and max temperatures, precipitation and wind speed was recorded
Crop Residue & Hay Quality

• Current literature is limited for crop residue quality (McCartney et al. 2006)
• Characterization of nutritive value of oat straw/chaff and pea straw/chaff and mixed hay

• Quality of each feed was determined by analyzing for:
  - Fiber: Neutral detergent fiber & Acid detergent fiber
  - Energy: Total digestible nutrients & Digestible energy
  - Protein: Crude protein
Table 1. Forage quality characteristics analyzed (2009)

<table>
<thead>
<tr>
<th></th>
<th>Grass-legume Hay</th>
<th>Oat Straw/Chaff</th>
<th>Pea Straw/Chaff</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDF(^z) (%) DM</td>
<td>55</td>
<td>74</td>
<td>70</td>
</tr>
<tr>
<td>TDN (%) DM</td>
<td>64</td>
<td>48</td>
<td>47</td>
</tr>
<tr>
<td>DE (Mcal kg(^{-1}) DM)</td>
<td>2.5</td>
<td>2.2</td>
<td>2.1</td>
</tr>
<tr>
<td>CP (%) DM</td>
<td>9.1</td>
<td>3.0</td>
<td>7.5</td>
</tr>
</tbody>
</table>

\(^z\)NDF = Neutral detergent fibre; ADF = acid detergent fibre; TDN = total digestible nutrients; DE = digestible energy; CP = crude protein
<table>
<thead>
<tr>
<th></th>
<th>lb/ acre</th>
<th>Ton/ acre</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crop</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oat</td>
<td>11,404</td>
<td>5.70</td>
</tr>
<tr>
<td>Pea</td>
<td>8,492</td>
<td>4.25</td>
</tr>
<tr>
<td><strong>Straw-Chaff</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oat</td>
<td>1,957</td>
<td>0.98</td>
</tr>
<tr>
<td>Pea</td>
<td>1,085</td>
<td>0.54</td>
</tr>
</tbody>
</table>
Cow Data

1. Body Weight, Body Fat and Condition
   - Cows were weighed 2 consecutive days, and body condition scored and ultrasounded at the start and end of trial
   - Cows also weighed every 21 days throughout the trial

2. Reproductive performance
   - Cows were pregnancy checked prior to start of test
   - Reproductive efficiency data included calf BW, pregnancy rate, calving span, interval, calving pattern as well open and cull rates
Table 3. Effect of winter feeding system on cow body weight (2009)

<table>
<thead>
<tr>
<th></th>
<th>Drylot</th>
<th>Oat Straw/Chaff</th>
<th>Pea Straw/Chaff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start of Trial (lbs)</td>
<td>1387</td>
<td>1396</td>
<td>1378</td>
</tr>
<tr>
<td>62 d (lbs)</td>
<td>1532a</td>
<td>1466b</td>
<td>1400c</td>
</tr>
<tr>
<td>ADG (lbs/d)</td>
<td>2.4a</td>
<td>1.1b</td>
<td>0.4c</td>
</tr>
<tr>
<td>BW change (lbs)</td>
<td>145a</td>
<td>70b</td>
<td>22c</td>
</tr>
</tbody>
</table>

*a–c* Least squares means within a row and with different letters differ (P < 0.05).
Table 4. Effect of winter feeding system on calving data (2009)

<table>
<thead>
<tr>
<th></th>
<th>Drylot</th>
<th>Oat Straw/Chaff</th>
<th>Pea Straw/Chaff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calf Birth Weight (lbs)</td>
<td>90</td>
<td>89</td>
<td>81</td>
</tr>
<tr>
<td>Calving span (d)</td>
<td>72</td>
<td>63</td>
<td>67</td>
</tr>
<tr>
<td>Calving rate</td>
<td>1.0</td>
<td>0.93</td>
<td>0.93</td>
</tr>
</tbody>
</table>

No significant difference was found (P < 0.05)
Estimating Dry Matter Intake

Fall – Oat straw-chaff piles

Spring – Oat straw-chaff residues
Table 5. Estimated dry matter intake per head per day (lb) (2009)

<table>
<thead>
<tr>
<th>Forage type</th>
<th>Mixed Grass-hay</th>
<th>Oat Straw/Chaff</th>
<th>Pea Straw/Chaff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forage type</td>
<td>29</td>
<td>15.5</td>
<td>15</td>
</tr>
<tr>
<td>Oat grain</td>
<td>0.7</td>
<td>5</td>
<td>7</td>
</tr>
</tbody>
</table>
Economic Data

- Economic differences determined for each winter feeding system
- Annual inputs for labour, equipment and feed
- Total cash cost and overhead costs per cow in each feeding system
Table 6. Cow costs per head per day (2009)

<table>
<thead>
<tr>
<th></th>
<th>Drylot</th>
<th>Oat Straw/Chaff</th>
<th>Pea Straw/Chaff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed Costs</td>
<td>$2.27</td>
<td>$0.75</td>
<td>$1.02</td>
</tr>
<tr>
<td>Yardage Costs</td>
<td>$0.47</td>
<td>$0.32</td>
<td>$0.32</td>
</tr>
<tr>
<td>Total Costs</td>
<td>$2.78</td>
<td>$1.07</td>
<td>$1.34</td>
</tr>
</tbody>
</table>
Acknowledgements

- University of Saskatchewan
- Prairie Agriculture Machinery Institute
- Western Beef Development Center
- WBDC Staff, especially Leah Pearce, George Widdifield and Kathy Larson
- Dr. Bart Lardner
- Dr. McKinnon, Dr. Hendrick, Dr. Laarveld
- Alin Freidt and Leah Clark
Thank-you!