Effects of Round Bale Feeding Methods on Hay Waste and Animal Performance

November 6, 2012
Eastern KS. ASI Agent Update
Austin Sexten, PT. Co. ANR Agent
Harvested feed is the largest cost contributor to maintaining a profitable beef cattle herd (Miller et al., 2001)

Large round bales are the most common form of packaging harvested hay (Belyea et al. 1985)
Background

• Concerns
  – Hay waste

  – Costs
    • Hay
    • Equipment
    • Labor/time
Objectives

- Evaluate popular types of hay feeding methods and their effects on hay waste and cow performance
- Determine how different feeder types effect hay waste and feeding behavior of animals
- Discuss alternative methods of feeding hay to reduce waste
Popular hay feeding methods

• Ground unrolling
  – Fast
  – All animals can access feed at once
  – “Bed and Breakfast”
Popular hay feeding methods

- PTO- Driven Bale Processor
  - Decreases particle length
    - Increased digestibility?
    - Increased $K_p$
    - Difficult to eat
  - Reduced feeding time
  - Cost: $8,000-15,000
Popular hay feeding methods

• Bale Feeder
  – Many types
  
  – Affordable
    • $150-1000
  
  – Can put out many days worth of feed
  
  – No trampling
Effect of hay feeding methods on cow performance, hay waste, and wintering cost

• Materials and methods
  – 360 crossbred cows
    • 610 kg
  – Three year study
    • Alfalfa mix
    • Oat hay
  – 4 replicates /method
    • 2.02 ha dry lot
    • 59 d

Landbolm, et al., 2007
Effect of hay feeding methods on cow performance

<table>
<thead>
<tr>
<th>Item</th>
<th>Roll out on ground</th>
<th>PTO processor</th>
<th>Tapered cone feeder</th>
<th>SE</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>BW gain, kg</td>
<td>22.5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>29.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>36.1&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.72</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>ADG, kg</td>
<td>0.381&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.507&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.611&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.046</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Hay/cow, kg</td>
<td>815&lt;sup&gt;a&lt;/sup&gt;</td>
<td>799&lt;sup&gt;b&lt;/sup&gt;</td>
<td>692&lt;sup&gt;c&lt;/sup&gt;</td>
<td>14.21</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

<sup>a-c</sup>Values with unlike superscripts differ significantly (<i>P</i> < 0.05)

<sup>d</sup>Values are hay/cow, kg from year 1

Landbolm, et al., 2007
## Quantitative analysis of feeding area waste for each feeding method

<table>
<thead>
<tr>
<th>Item</th>
<th>Feeding method</th>
<th>P- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Roll out on ground</td>
<td></td>
</tr>
<tr>
<td>Alfalfa mix, kg</td>
<td>61.5</td>
<td>52.5</td>
</tr>
<tr>
<td>Oat hay, kg</td>
<td>48.4</td>
<td>28.1</td>
</tr>
</tbody>
</table>

Landbolm, et al., 2007
Three-year economic analysis comparing hay feeding methods for a 100 head cow herd

<table>
<thead>
<tr>
<th>Item</th>
<th>Roll out on ground</th>
<th>PTO processor</th>
<th>Tapered cone feeder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hay cost/ cow, $</td>
<td>98.58</td>
<td>103.11</td>
<td>89.45</td>
</tr>
<tr>
<td>Total non-hay expense per cow, $</td>
<td>10.44</td>
<td>23.90</td>
<td>10.81</td>
</tr>
<tr>
<td>Total cost per cow, $</td>
<td>109.02</td>
<td>127.01</td>
<td>100.26</td>
</tr>
</tbody>
</table>

Landbolm, et al., 2007
Implications

• Tapered cone bale feeder was superior winter hay feeding method
  – Reduced waste
  – Decreased amount of hay per cow
  – Decreased wintering cost per cow
What are the effects of different feeder types?

• Does design effect hay waste?

• Does design effect DMI?

• Does design effect cow behavior?
Large round bale feeder design affects hay utilization and beef cow behavior

- Materials and methods
  - 4 Feeder types
  - Dry, pregnant beef cows (n=160)
    - 631 ± 78 kg
  - 8 pens
    - 2 replicates for each feeder type

Buskirk, et al., 2003
Large round bale feeder design affects on hay utilization

<table>
<thead>
<tr>
<th>Item</th>
<th>Cone</th>
<th>Ring</th>
<th>Trailer</th>
<th>Cradle</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily hay disappearance, kg/cow&lt;sup&gt;a&lt;/sup&gt;</td>
<td>12.0&lt;sup&gt;x&lt;/sup&gt;</td>
<td>12.1&lt;sup&gt;x&lt;/sup&gt;</td>
<td>13.9&lt;sup&gt;y&lt;/sup&gt;</td>
<td>12.9&lt;sup&gt;xy&lt;/sup&gt;</td>
<td>0.4</td>
</tr>
<tr>
<td>Daily hay waste, kg/cow</td>
<td>0.4&lt;sup&gt;x&lt;/sup&gt;</td>
<td>0.7&lt;sup&gt;y&lt;/sup&gt;</td>
<td>1.6&lt;sup&gt;z&lt;/sup&gt;</td>
<td>1.9&lt;sup&gt;z&lt;/sup&gt;</td>
<td>0.1</td>
</tr>
<tr>
<td>Hay waste, %&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.5&lt;sup&gt;x&lt;/sup&gt;</td>
<td>6.1&lt;sup&gt;x&lt;/sup&gt;</td>
<td>11.4&lt;sup&gt;y&lt;/sup&gt;</td>
<td>14.6&lt;sup&gt;y&lt;/sup&gt;</td>
<td>0.8</td>
</tr>
<tr>
<td>Daily hay intake, kg/cow&lt;sup&gt;c&lt;/sup&gt;</td>
<td>11.5</td>
<td>11.4</td>
<td>12.3</td>
<td>11.0</td>
<td>0.4</td>
</tr>
<tr>
<td>Intake/cow BW, %</td>
<td>1.8</td>
<td>1.8</td>
<td>2.0</td>
<td>1.8</td>
<td>0.1</td>
</tr>
</tbody>
</table>

<sup>a</sup>Hay fed less residual hay at the end of the period.
<sup>b</sup>Hay waste as a percentage of hay disappearance.
<sup>c</sup>Hay disappearance less hay waste.

<sup>x,y,z</sup>Within a row, least squares means without a common superscript letter differ ($P < 0.05$).

Buskirk, et al., 2003
Effect of feeder type on feeding behavior and dry matter waste

<table>
<thead>
<tr>
<th>Item</th>
<th>Cone</th>
<th>Ring</th>
<th>Trailer</th>
<th>Cradle</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agonistic interactions/h</td>
<td>10.9(x)</td>
<td>7.4(x)</td>
<td>13.6(x)</td>
<td>30.7(y)</td>
<td>3.2</td>
</tr>
<tr>
<td>Frequency of entrances, No./h</td>
<td>6.3(x)</td>
<td>8.0(x)</td>
<td>8.3(x)</td>
<td>29.8(y)</td>
<td>3.3</td>
</tr>
<tr>
<td>Daily DM waste, kg(^a)</td>
<td>9.5(x)</td>
<td>14.5(x)</td>
<td>26.6(y)</td>
<td>50.0(z)</td>
<td>2.8</td>
</tr>
</tbody>
</table>

\(^a\)Daily DM waste during simultaneous behavior data collection.

\(^{xyz}\)Within a row, least squares means without a common superscript letter differ \((P < 0.05)\).
Implications

• Feed losses significantly influenced by feeder type
  – Cone = Ring < Trailer < Cradle

• Feeder design affected the animal behavior
Effects of Bale Feeder Type on Hay Waste, Intake, and Performance of Beef Cattle

Materials and Methods

Feeder Treatments

- Modified Cone (MODC)
- $525.00
- 136.2 kg
- 54.6 cm apron
- 9 feeding stations
Materials and Methods

Feeder Treatments

- Open bottom steel ring (OBSR)
- $100.00
- 45.4 kg
- Open bottom
- 6 Feeding stations
Materials and Methods
Feeder Treatments

- Polyethylene Pipe (POLY)
- $209.00
- 45.4 kg
- Open bottom
- 6 Feeding stations
Materials and Methods

Feeder Treatments

- Sheeted bottom steel ring (RING)
- $300.00
- 100.8 kg
- 55.9 cm solid apron
- 16 feeding stations
Results
# Effect of Feeder Design on Waste and DMI

## Hay Waste

<table>
<thead>
<tr>
<th>Item</th>
<th>MODC</th>
<th>OBSR</th>
<th>POLY</th>
<th>RING</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total waste, kg</td>
<td>32.31(^a)</td>
<td>128.5(^b)</td>
<td>133.59(^b)</td>
<td>77.01(^c)</td>
<td>9.95</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Orts weight, kg</td>
<td>102.9(^a)</td>
<td>36.53(^b)</td>
<td>29.95(^b)</td>
<td>45.07(^b)</td>
<td>10.79</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Waste, % bale wt</td>
<td>5.31(^a)</td>
<td>20.54(^b)</td>
<td>21.04(^b)</td>
<td>12.6(^c)</td>
<td>1.62</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

\(^a,b,c\)Means within a row with uncommon superscript differ (P < 0.05)

## Dry Matter intake

<table>
<thead>
<tr>
<th>Item</th>
<th>MODC</th>
<th>OBSR</th>
<th>POLY</th>
<th>RING</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMI, kg/hd/d</td>
<td>8.37</td>
<td>8.19</td>
<td>8.43</td>
<td>8.75</td>
<td>0.24</td>
<td>0.12</td>
</tr>
<tr>
<td>DMI, % BW</td>
<td>1.70</td>
<td>1.67</td>
<td>1.72</td>
<td>1.78</td>
<td>0.05</td>
<td>0.12</td>
</tr>
</tbody>
</table>
Implications

• MODC was most efficient design
  – Less waste = longer feeding period = less hay used annually
• Sheeted bottom results in less waste
• Feeder design didn’t affect DMI
Ad libitum access to feeders?

- Feeding losses
  - 12-25%
    - (Belyea et al. 1985)
- Feeding to meet cow requirements
  - Decrease
    - Cost
    - Hay waste
    - Overconsumption
    - Manure production
- How?
## Ad libitum access to feeders?

<table>
<thead>
<tr>
<th>Item</th>
<th>Access Time, h</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>DMI, lb</td>
<td>21.2</td>
<td>24.4</td>
</tr>
<tr>
<td>Hay waste, lb*</td>
<td>0.8</td>
<td>4.2</td>
</tr>
<tr>
<td>BW change, lb</td>
<td>27.3</td>
<td>36.5</td>
</tr>
</tbody>
</table>

*Expressed as a % of DMI
Adapted from Jaderburg et al., 2011
Implications

• Limiting access time results in:
  – Acceptable performance
  – Decreased DMI
  – Decreased hay waste
  – Decreased overall costs due to:
    • Less hay needed
    • Less labor needed
Concluding Remarks

- Round bale feeding method effects
  - Hay waste
  - DMI
  - Cow behavior
  - Cow performance
  - Overall feeding cost

- Feeding method is ranch specific
Concluding Remarks

• Sheeting height matters
  – Calves vs. Cows

• Consider commercial name vs. visual appraisal of feeder

• Other feeding options
  – Bale grazing
  – Hot wire bunks


Questions?