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
Background

• 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;sub&gt;a&lt;/sub&gt;</td>
<td>29.9&lt;sub&gt;b&lt;/sub&gt;</td>
<td>36.1&lt;sub&gt;b&lt;/sub&gt;</td>
<td>2.72</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>ADG, kg</td>
<td>0.381&lt;sub&gt;a&lt;/sub&gt;</td>
<td>0.507&lt;sub&gt;b&lt;/sub&gt;</td>
<td>0.611&lt;sub&gt;b&lt;/sub&gt;</td>
<td>0.046</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Hay/cow, kg</td>
<td>815&lt;sub&gt;a&lt;/sub&gt;</td>
<td>799&lt;sub&gt;b&lt;/sub&gt;</td>
<td>692&lt;sub&gt;c&lt;/sub&gt;</td>
<td>14.21</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

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

<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>Roll out on ground</th>
<th>PTO processor</th>
<th>Tapered cone feeder</th>
<th>SE</th>
<th>Yr</th>
<th>Trt</th>
<th>Yr × Trt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa mix, kg</td>
<td>61.5</td>
<td>52.5</td>
<td>12.1</td>
<td>9.72</td>
<td>0.09</td>
<td>0.30</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Oat hay, kg</td>
<td>48.4</td>
<td>28.1</td>
<td>90.3</td>
<td></td>
<td></td>
<td></td>
<td></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>Feeding method</th>
<th>Roll out on ground</th>
<th>PTO processor</th>
<th>Tapered cone feeder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td>Hay cost/ cow, $</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>98.58</td>
<td>103.11</td>
<td>89.45</td>
</tr>
<tr>
<td>Hay cost/ 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>Feeder Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cone</td>
</tr>
<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>
</tr>
<tr>
<td>Daily hay waste, kg/cow</td>
<td>0.4&lt;sup&gt;x&lt;/sup&gt;</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>
</tr>
<tr>
<td>Daily hay intake, kg/cow&lt;sup&gt;c&lt;/sup&gt;</td>
<td>11.5</td>
</tr>
<tr>
<td>Intake/cow BW, %</td>
<td>1.8</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 ($P < 0.05$).

Buskirk, et al., 2003
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>32.31a</td>
<td>128.5b</td>
<td>133.59b</td>
<td>77.01c</td>
<td>9.95</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Orts weight, kg</td>
<td>102.9a</td>
<td>36.53b</td>
<td>29.95b</td>
<td>45.07b</td>
<td>10.79</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Waste, % bale wt</td>
<td>5.31a</td>
<td>20.54b</td>
<td>21.04b</td>
<td>12.6c</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></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?