Changing Forage Attributes and Storage
Rick Rasby - Beef Specialist
U.S. Hay Production

Source: USDA
Introduction

- Cost of Energy in beef cow rations
- Availability of residues
  - Corn
  - Wheat
  - Soybean stubble
# Daily Feed/Forage Capacity of Beef Cows: Thumb Rules

<table>
<thead>
<tr>
<th>Forage Type</th>
<th>Class of Cattle</th>
<th>Dry Matter Capacity&lt;sup&gt;1&lt;/sup&gt;,%</th>
<th>Dry Matter Capacity&lt;sup&gt;3&lt;/sup&gt; Pounds/hd/da</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low quality forages (&lt;53% TDN; dormant native range, straw, stalks bales)</td>
<td>Dry cow</td>
<td>1.8%</td>
<td>20-22 lb/hd/da</td>
</tr>
<tr>
<td></td>
<td>Lactating cow</td>
<td>2.0%</td>
<td>22-24 lb/hd/da</td>
</tr>
<tr>
<td>Average quality forages (53% to 59% TDN native hay, bromegrass hay, alfalfa)</td>
<td>Dry cow</td>
<td>2.0%</td>
<td>22-24 lb/hd/da</td>
</tr>
<tr>
<td></td>
<td>Lactating cow</td>
<td>2.3%</td>
<td>25-28 lb/hd/da</td>
</tr>
<tr>
<td>High quality forages (&gt;59% TDN; alfalfa, boot-stage hay)</td>
<td>Dry cow</td>
<td>2.5%</td>
<td>28-30 lb/hd/da</td>
</tr>
<tr>
<td></td>
<td>Lactating cow</td>
<td>2.7%</td>
<td>30-33 lb/hd/da</td>
</tr>
<tr>
<td>Green pasture</td>
<td>Dry cow</td>
<td>2.5%</td>
<td>28-30 lb/hd/da</td>
</tr>
<tr>
<td></td>
<td>Lactating cow</td>
<td>2.7%</td>
<td>30-33 lb/hd/da</td>
</tr>
<tr>
<td>Silages</td>
<td>Dry cow</td>
<td>2.5%</td>
<td>28-30 lb/hd/da</td>
</tr>
<tr>
<td></td>
<td>Lactating cow</td>
<td>2.7%</td>
<td>30-33 lb/hd/da</td>
</tr>
</tbody>
</table>

<sup>1</sup> 1100 to 1200 lb cow

<sup>2</sup> Capacity as a percent of body weight

<sup>3</sup> Total daily intake (dry basis)
- Crystallinity is a highly ordered 3-dimensional structure which may impair digestibility.

- For example, crop residues cell wall fiber is highly crystalline cellulose and digests slowly.

- When soaked in NaOH, the cell wall fiber swells and becomes amorphous. Hydrogen bonding is reduced and rate and extent of cellulose digestion increase.
Chemical treatment began in 1880's
- Started with paper making
- Observation of increased cellulose digestibility

- Alkali
- Peroxides
- Ammonia
1. Partial solubilization of hemicellulose
2. Above 5% NaOH some lignin and silica solubilized
3. Disruption of intermolecular hydrogen bonding of cellulose
4. Increased rate of fiber hydration
5. Increased rate of bacterial colonization

Van Soest, Berger
- Crystallinity is a highly ordered 3-dimensional structure which may impair digestibility.

- For example, raw cotton fiber is highly crystalline cellulose and digests slowly.

- When soaked in NaOH, the cotton fiber swells and becomes amorphous. Hydrogen bonding is reduced and rate and extent of cellulose digestion increase.

\[
\text{NH}_3 + \text{H}_2\text{O} \rightarrow \text{H-Bonding}
\]

Enzyme accessible space

Digestibility
Know how. Know now.

Ammonia Treatment
Cell Solubles

Treated residue
Ammoniation of Low Quality Forages

1. **Reaction is temperature dependent.**
   - Temperature above 86° - 1 week
   - Temperature: 59° to 86° - 1 to 4 weeks
   - Temperature: below 59° - 4 to 8 weeks

2. **Forage must be covered/sealed until reaction is complete.**

3. **Leave 3 to 4 inches between bales**

4. **In summer - bale residue when a dew is on it.**
Anhydrous Treatment

- DM intake increased 22% averaged over 21 treated crop residues

- DM digestibility increased 15% averaged over 32 studies

- Usually ~ 33% of the NH$_3$ is retained.

- Temperature, water content, length of reaction time influences effectiveness.
### Effect of Treatment of Straw on Intake and Performance of Gestating Beef Cows

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Daily Straw Intake, lb</th>
<th>Daily Weight Change, lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straw + 7 pounds of alfalfa</td>
<td>14.8</td>
<td>(-)0.27</td>
</tr>
<tr>
<td>Treated Straw + 7 pounds of alfalfa</td>
<td>19.7</td>
<td>0.40</td>
</tr>
<tr>
<td>Treated straw</td>
<td>26.1</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Review of Data

If fed without supplementation - best use for beef cows before calving.

Ward, et al., 1982 NE Beef Cattle Report
## 2013 Budget for Ammoniating Wheat Straw

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost per unit</th>
<th>Total costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat straw, $/t</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Baling, $/bale</td>
<td>13.00</td>
<td>1,092.00</td>
</tr>
<tr>
<td>Labor (blade, move, stack bales) 6 hrs</td>
<td>10.00</td>
<td>60.00</td>
</tr>
<tr>
<td>Machine time and repair, 6 hours</td>
<td>12.00</td>
<td>72.00</td>
</tr>
<tr>
<td>Plastic sheeting, 40' by 100' 6 mil</td>
<td>280.00</td>
<td>280.00</td>
</tr>
<tr>
<td>Labor (cover, seal, application), 4 hrs</td>
<td>10.00</td>
<td>40.00</td>
</tr>
<tr>
<td>Anhydrous ammonia, 3% rate, $/t</td>
<td>770.00</td>
<td>971.00</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>15.00</td>
<td>10.00</td>
</tr>
<tr>
<td><strong>Total cost, $/stack</strong></td>
<td></td>
<td>2,525.00</td>
</tr>
<tr>
<td><strong>Cost, $/t</strong></td>
<td></td>
<td>60.12</td>
</tr>
<tr>
<td><strong>Cost per pound of Energy (TDN)</strong></td>
<td></td>
<td>$0.06</td>
</tr>
</tbody>
</table>

Ammoniating one stack of straw containing 84, 1,000 bales.
Arranged 14 bales long, 3 bale base, 2 bales second level, one on top.
Summary of Ammoniation

1. Process used on low quality forages – ONLY!
2. Bale forage with a dew on it: exp. – Straw summer.
3. Increases digestibility by 15%.
4. Increases dry matter intake by 22%.
5. Increase nitrogen/protein: 3 and 4 most important.
6. Open bag 3 to 4 days before feeding.
7. Handle anhydrous with care.
8. Feed w/o supplementation – cows before calving
   - TDN: 54 to 56 percent
   - Crude Protein – 7.5 to 9 percent
9. Feed w/ supplementation
   - 1st calf heifers – pre and post calving
   - Cows after calving
Storage of WDGS in Silo Bags
Storage of WDGS in a Bunker
• Distillers Solubles Bunker
  • 41:59 ratio of Solubles and Corn Stalks (DM basis)
Beef Extension Page

http://beef.unl.edu

UNIVERSITY OF NEBRASKA-LINCOLN

Beef Extension Page
http://beef.unl.edu

UNL Beef

Drylotting Beef Cows - A Drought Management Strategy
(June 2012) Managing a cow herd in drought conditions is a challenge. A management consideration when weather conditions result in a reduction in forage production in pastures is to relocate some or all cattle. Cows could be relocated to a feedlot that is located off-site or a dry lot or sacrifice area to dry lot cows on-site could be developed. Learn more.

Dry Weather Conditions in Nebraska Panhandle
(June 2012) Most of Nebraska is experiencing dry conditions, but UNL Extension educator Aaron Berger says the panhandle is critically drier than normal. On the Market Journal program (June 3), Berger discussed forage crop progress and feed options for beef cattle operations. Go to the Drought page to view the video.

Replacing Summer Pasture with Feeds for Cows Grazing Pasture and When Pasture is Limited
(June 2012) Managing a cow herd in drought conditions is a challenge. An alternative to dry lotting beef cows in drought conditions or when pasture is expensive or in short supply would be to "substitute" some of the pasture with another feed. This concept means that cows remain in the pasture and another feed is fed as a part of the cow's daily feed consumed. Learn more.

Derivation of a Blended BV
(May 2012) This PDF file provides the derivation for the blending, or index, of Molecular Breeding Values (MBV) with Traditional Expected Progeny Differences (EPD). This approach can be used to develop interim EPD that include MBVs. This derivation is designed to aid organizations (i.e., breed associations) that conduct Genetic Selection Indexes.

Agricultural Research Division
University of Nebraska Extension
Institute of Agriculture and Natural Resources
University of Nebraska–Lincoln

2013 Beef Cattle Report