Forage Sampling, Analysis and What the Results Mean

Dale A. Blasi

Animal Science Extension Agent Update
Eastern Kansas
November 15, 2011
What is Involved With Collecting a Forage Sample?
What is Involved With Collecting a Forage Sample?

- Time and dedication towards collecting a sample that represents the forage being tested!
- Testing apparatus – Many flavors available!
Developing a Sampling Protocol
The Sampling Protocol should describe:

• Method of forage collection
• Key forage species
• Key sampling areas
• During transition periods, sampling should occur every 2 weeks
• Monthly during forage dormancy
When Do You Sample?

Forages should be sampled as close to the time of feeding or sale as possible
Definition of a Forage Lot

• A forage lot consisting either of hay or silage is defined as forage taken from the same:
  • Location
  • Farm, or field using the same cutting (within a 48-hour period) at the same stage of maturity; and is similar in the amount of grass, weeds, or rain damage.
Select Uniform Lots of Hay

<table>
<thead>
<tr>
<th>Lot #</th>
<th>Hay field 1st cut</th>
<th>Hay field 2nd cut</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grass infested</td>
<td>Pure Rain Damage</td>
</tr>
<tr>
<td>1</td>
<td>Pure</td>
<td>Pure No Rain</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Grass infested</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Pure Rain Damage</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Pure No Rain</td>
<td></td>
</tr>
</tbody>
</table>
Segregate Each Lot as It Is Harvested and Stored

• When segregating by quality, a better job can be done nutritionally by feeding according to specific animal production requirements
  – i.e. Identity preservation

• This will greatly facilitate access so that it may be retrieved as needed
Sampling Different Bale Types
Large Round Bales

• Select a minimum of 10 bales from each lot to be sampled.
• Core sample at least two different locations on each side of bale
• Bales should be probed from the sides, not the ends.
<table>
<thead>
<tr>
<th>Forage Type</th>
<th>Precision of Average Crude Protein Estimate, %</th>
<th>Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>99%</td>
</tr>
<tr>
<td>1st Cutting Alfalfa</td>
<td>± 1</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>± .5</td>
<td>76</td>
</tr>
<tr>
<td>3rd Cutting Alfalfa</td>
<td>± 1</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>± .5</td>
<td>47</td>
</tr>
<tr>
<td>Prairie Hay</td>
<td>± 1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>± .5</td>
<td>15</td>
</tr>
<tr>
<td>Sorghum-Sudan Hay</td>
<td>± 1</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>± .5</td>
<td>28</td>
</tr>
</tbody>
</table>
Variation in Crude Protein Content of Cane Hay - Preliminary Results

Preliminary data represents 25 similar bales at each location.

<table>
<thead>
<tr>
<th>Location of Sampling</th>
<th>% Crude Protein Content</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
</tr>
<tr>
<td>Cowley</td>
<td>13</td>
</tr>
<tr>
<td>Pratt</td>
<td>12</td>
</tr>
<tr>
<td>Saline</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Average</td>
</tr>
<tr>
<td>Cowley</td>
<td>9</td>
</tr>
<tr>
<td>Pratt</td>
<td>8</td>
</tr>
<tr>
<td>Saline</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
</tr>
<tr>
<td>Cowley</td>
<td>5</td>
</tr>
<tr>
<td>Pratt</td>
<td>6</td>
</tr>
<tr>
<td>Saline</td>
<td>7</td>
</tr>
</tbody>
</table>

Preliminary data represents 25 similar bales at each location.
Conventional Square Bales

- Randomly select 15 – 20 bales from each lot of hay.
- Insert probe into center end of each bale.
- Drill at least 18” deep in loose bales, 12 – 15” in tight bales.
- DO NOT submit a flake of hay or use the “Grab” sample
Silage and Haylage

- Sampling may be done at harvest but another should be conducted post-fermentation.
- To sample ensiled material from storage, collect a minimum 2-pound sample from various locations on the “face” of the silage pile.
- Dump contents on clean floor and subsample.
- Seal in a plastic bag and store immediately in a freezer.
Forage Analysis
Sample #: 45676
Sample: Forage Mike Becker Hoffman
Other ID: Wheat Straw & Soybeans

Kansas State University+
Attn: Dale Blasi
229 Weber Hall
Manhattan, KS 66506

<table>
<thead>
<tr>
<th>ANALYSIS</th>
<th>Dry Basis</th>
<th>As Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture</td>
<td>8.99</td>
<td>%</td>
</tr>
<tr>
<td>Dry Matter</td>
<td>91.01</td>
<td>%</td>
</tr>
<tr>
<td>Protein, Crude</td>
<td>11.50</td>
<td>10.47</td>
</tr>
<tr>
<td>ADF-Acid Detergent Fiber</td>
<td>40.32</td>
<td>36.70</td>
</tr>
<tr>
<td>NEL: Net Energy-Lactation</td>
<td>0.52</td>
<td>0.47</td>
</tr>
<tr>
<td>NEG: Net Energy-Gain</td>
<td>0.22</td>
<td>0.20</td>
</tr>
<tr>
<td>NEM: Net Energy-Maintenance</td>
<td>0.54</td>
<td>0.50</td>
</tr>
<tr>
<td>TDN: Total Digestible Nutrients</td>
<td>51.32</td>
<td>46.71</td>
</tr>
<tr>
<td>Calcium</td>
<td>1.64</td>
<td>1.49</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.18</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Date Received: 11/04/2011
Date Reported: 11/08/2011
Total Fee: 18.00
Net Energy of Native Range
Calculated from ADF

• %TDN = 88.9 - (0.779 × ADF)
• ME (Mcal/kg) = (TDN% × 0.044) × 0.82
• NEm (Mcal/lb) = (1.37 × ME) – (.138 × ME²) + (.0105 × ME³) – 1.12 / 2.204
• NEg (Mcal/lb) = (1.42 × ME) – (.174 × ME²) + (.0122 × ME³) – 1.65 / 2.204

NRC (1996)
### Feed Library

**Producer:** KSU Winter Ranch Mgt Seminar

<table>
<thead>
<tr>
<th>Library: Feedmil</th>
<th>Save</th>
<th>Restore</th>
<th>Delete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Limit library name to 8 spaces.**

<table>
<thead>
<tr>
<th>Select # Feeds</th>
<th>Feedstuff</th>
<th>lb/unit</th>
<th>$/unit</th>
<th>Units</th>
<th>Inventory</th>
<th>* DM</th>
<th>* TDN</th>
<th>* NE m</th>
<th>* NE g</th>
<th>* CP</th>
<th>% DIP</th>
<th>% of CP</th>
<th>% Solubility</th>
<th>% of CP</th>
<th>% NDF</th>
<th>% ADF</th>
<th>% e NDF</th>
<th>% of NDF</th>
<th>NFC</th>
<th>% Salt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water</td>
<td>8.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
What do the Results of a Forage Test Mean?
Effective Supplementation Programs

• Must have an estimate of:
  – Feed value of basal forage
  – Quantity of forage an animal can consume
  – Nutritional needs of the animal
Growth vs. Quality

- Digestibility
- Nutrient Content
- Lignin/Fiber

Spring | Summer | Fall
## Nutrient Availability of Forage Components

<table>
<thead>
<tr>
<th>Forage Fraction</th>
<th>Component</th>
<th>Nutrient Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell Contents</td>
<td>Soluble sugars</td>
<td>Complete</td>
</tr>
<tr>
<td></td>
<td>Pectin</td>
<td>Complete</td>
</tr>
<tr>
<td></td>
<td>Soluble Protein</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Lipids</td>
<td>High</td>
</tr>
<tr>
<td>Cell Wall Elements</td>
<td>Hemicellulose</td>
<td>Partial</td>
</tr>
<tr>
<td></td>
<td>Cellulose</td>
<td>Partial</td>
</tr>
<tr>
<td></td>
<td>Lignin</td>
<td>Indigestible</td>
</tr>
<tr>
<td></td>
<td>Silica</td>
<td>Indigestible</td>
</tr>
</tbody>
</table>

(Van Soest, 1983)
Forage Dry Matter Intake

• Function of:
  - Fermentation rate
  - Rate of particle size reduction
  - Rate of particle passage rate
# Forage Quality and Cattle Intake

## Dry Matter Intake

<table>
<thead>
<tr>
<th>Forage Quality</th>
<th>(% of body weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>2.5 to 3.0%</td>
</tr>
<tr>
<td>Medium</td>
<td>2.0%</td>
</tr>
<tr>
<td>Poor</td>
<td>1.0 to 1.5%</td>
</tr>
</tbody>
</table>
% Crude Protein Content of Native Grass Hay by Harvest Date, 1997

Crude Protein content, %

Collection Date

Butler
Cowley
Marion

Knowledge for Life
Crude Protein of Native Range

Crude Protein, % of DM

Date

Montgomery et al. (2002)
Minimum Crude Protein to Support a 2.0 lb ADG

Montgomery et al. (2002)
% ADF of Native Range

Montgomery et al. (2002)
Maximum ADF to support a 2.0 lb ADG

Montgomery et al. (2002)
Predicted ADG based on ADF

ADG, lb

Date

18-Apr 8-May 28-May 17-Jun 7-Jul 27-Jul 16-Aug

Montgomery et al. (2002)
METHODS TO ESTIMATE GRAZING ANIMAL DIET SELECTION
• **HAND CLIPPING**
  – Does not account for animal selectivity
  – Generally 2% higher CP, 3-5% higher digestibility
  – Forage availability also a factor

• **CANNULATED ANIMALS**
  – Esophageal / Ruminal
  – High maintenance/labor required
METHODS OF DETERMINING FORAGE QUALITY

• HAND CLIPPING
  – Does not account for animal selectivity
  – Generally 2% higher CP, 3-5% higher digestibility
  – Forage availability also a factor

• CANNULATED ANIMALS
  – Esophageal / Ruminal
  – High maintenance/labor required

• FECAL ANALYSIS
The Extent of Forage Selectivity of an Animal can vary by:

• Species of animal
• Available plants
• Stage of maturity
• Intensity of grazing
• Weather conditions
How Livestock Graze

• Consume the most palatable plant first
• Consume the most palatable plant part first
• Consume disproportionately more tall than short
• Graze convenient areas
Esophageal vs. hand-clipped samples of Smooth Bromegrass across season
KSU Forage Task Force
Crop Residue Project

Counties that have participated in Crop Residue Study
KSU Crop Residue Project Sampling Protocol

• Sample fields every two weeks during the grazing season
• At each sampling period, four replicates were collected from the grazed and ungrazed area.
• Each replicate shall consist of a 12 foot row
Nutritional Evaluation of Grazed Kansas Corn and Sorghum Crop Residues

www.ksubeef.org
Summary Points

• The bigger the lot sampled, more samples will need to be collected.

• Collect many samples, mix well and subsample an aliquot.

• Choose sample sites carefully when sampling a silo, field or pasture.

• Sample silage as opposed to fresh.

• Send to lab as quickly as possible.
Wrap Up Comments

• The results returned to you from a forage testing laboratory are the best information available to predict animal performance.

• A good sample is one that represents the entire lot of feed that was sampled.
Dale A. Blasi
Kansas State University
dblasi@ksu.edu