Livestock and Hay Nutrition

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Outline

• Nutrients

• Hay test

• Animal Requirements

• Supplements
• Poor nutrition leads to loses in several areas
  – Reproduction
  – Performance
  – Health
  – Possible Income

• Having a understanding of nutrition will help in assessing needs
Stage of Production

- Maintenance
- Growth
- Lactation
- Fattening
Classes of Nutrients

- Water
- Protein
- Carbohydrates
- Fats
- Minerals
- Vitamins
Water
The MOST Important Nutrient

- Average intake 5 – 10% of BW
- For a 1000 lb cow = 50 – 100 lb water/day
- or 6 – 12 gallons/day
Water
The MOST Important Nutrient

• Intake is affected by temperature
  • Ambient temperature
    • Cold may reduce water intake
    • Heat stress may increase intake
Protein

• Composed of Amino Acids
  – 20 aa’s that are essential
  – Build muscle, bone, hair, skin

• Requirements vary on different classes of livestock
Carbohydrates

- Main source of energy
- Sugar, Starch, Cellulose
- Needs vary based on age and pregnancy status of animal
• Forages
  – Lower energy
  – More fiber

• Grains
  – Supplements
  – Higher energy
Fats

• Stored excess energy

• 2.25 x more energy than carbohydrates

• Are essential in need for production of hormones
Minerals

- Used in bone, muscles, organs, cells
  - Structure
  - Function

- Deficiency can lead to poor performance and/or health issues
Minerals

- Salt
  - Most forages are low in sodium (Na)
    - Supplementing with common white or red salt (either loose or block) is cheap, easy insurance
Essential Minerals

- Marco
  - Ca-
  - Cl
  - Mg - springtime
  - P-
  - K
  - Na
  - S

- Micro
  - Co
  - Cu - usually low
  - F
  - Fe
  - I
  - Mn
  - Se - usually low
  - Mo
  - Zn - usually low
Vitamins

- Used in the normal body processes of growth, reproduction, and maintenance

- Provide ability to fight disease and maintain good health.
• **Vitamin A**

• Vitamin A is not found in hay. Hay contains the Vitamin A precursor Beta-Carotene that is converted to Vitamin A by the animal.

• Beta-Carotene is present in green plants but is not stable once forages have been harvested.
• **Vitamin D**

  Normally, cattle receive adequate vitamin D from exposure to direct sunlight or from consumption of three to four pounds of sun-cured forages daily.

• **Vitamin E**

  Most rations fed to beef cattle in Missouri are adequate in vitamin E

  Can be supplemented as a precaution
Sources of Mineral

- Forages
- Grains
- Supplements
  - Bag
  - Block
  - Custom Mix
Ration Balancing

Forage(s)
Grain(s)
Oilseed Meal(s)
ByProduct(s)
Mineral(s)
Vitamin(s)

Animal Needs
Protein
Energy
Lipids (fats)
Minerals
Vitamins
Pasture/Hay Nutrition

Ration Balancing

Pasture/Hay → Animal Needs
Protein
Energy
Lipids (fats)
Minerals
Vitamins
Are all forages equal?

FORAGE...as harvested

DRY MATTER

WATER

CELL CONTENTS

Highly Digestible

Sugars
Starches
Other carbohydrates
NPN
Some proteins
Fats

CELL WALLS or NEUTRAL DETERGENT FIBER (NDF)

“Roughage”, or “bulk”, Intake decreases as this component increases.

CELL WALL SOLUBLES

Digestible

Hemicellulose

ACID DETERGENT FIBER (ADF)

Slowly digestible, energy decreases as this component increases.

Cellulose

Slowly digestible

Lignin

Not digestible
Test Data

- Dry Matter %
- Crude Protein %
- Available Protein %
- Adjusted Crude Protein %
- Acid Detergent Fiber %
- Neutral Detergent Fiber %
- Total Digestible Nutrients %

- Relative Feed Value
- Net Energy Lactation mCal/lb
- Net Energy Gain mCal/lb
- Net Energy Maintenance mCal/lb
- Qualitative Nitrate %
- Minerals % or ppm
What to Look At

- **Dry Matter (DM)**
  - Intake is determined using DM
  - Compare different hay for purchase
    - $1200 \text{ lbs} \times .92 = 1080 \text{ lbs}$
    - $1200 \text{ lbs} \times .85 = 935 \text{ lbs}$

- **Crude Protein (CP)**
  - Indicator of quality
  - Fescue may be adequate
  - Needed for rumen microbe function
What to Look At

- Acid Detergent Fiber (ADF)
  - Single best indicator of forage digestion

- Neutral Detergent Fiber (NDF)
  - Single best indicator of intake
  - Intake % BW = 120 ÷ NDF

- Total Digestible Nutrients (TDN)
  - Estimate of energy in hay
  - Use to compare like forages
  - Determined using ADF and NDF
Relative Values

- Relative Feed Value
  - Combination NDF and ADF

- Relative Forage Quality
  - Combination NDF and ADF
  - Simulated Digestion

- Useful to compare similar hays for purchase or to rank inventory
What makes good hay?

- **Protein**
  - USDA Grass Hay Guidelines

<table>
<thead>
<tr>
<th>Quality</th>
<th>% Crude Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premium</td>
<td>&gt; 13</td>
</tr>
<tr>
<td>Good</td>
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</tr>
<tr>
<td>Fair</td>
<td>5-9</td>
</tr>
<tr>
<td>Utility</td>
<td>&lt; 5</td>
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</table>
... What makes good hay?

- Energy (TDN)

<table>
<thead>
<tr>
<th>Quality</th>
<th>% TDN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>&gt; 58</td>
</tr>
<tr>
<td>Good</td>
<td>55-57</td>
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<tr>
<td>Fair</td>
<td>52-54</td>
</tr>
<tr>
<td>Poor</td>
<td>&lt; 51</td>
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</table>
Determine Intake

- Important when allocating hay

- Using NDF
  - $120 / \text{NDF}\% = \% \text{Body Weight of Dry Matter Intake}$
  - $120 / 60\% \text{ NDF} = 2\% \text{ BW DMI}$
  - $1,200 \text{ lb. cow} \times 0.02 = 24 \text{ lbs. DM/Day}$
### Protein: Estimated Intake

<table>
<thead>
<tr>
<th>Quality</th>
<th>% CP</th>
<th>Dry Cows</th>
<th>Lactating Cows</th>
<th>Growing Cattle</th>
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<tbody>
<tr>
<td>High</td>
<td>&gt; 12</td>
<td>2.3</td>
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<td>1.5</td>
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<tr>
<td>Table 19. Nutrient Requirements of Breeding Cattle</td>
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<tr>
<td><strong>Wt</strong> (lbs)</td>
<td><strong>Gain</strong> (lbs)</td>
<td><strong>Daily DM</strong> (lbs)</td>
<td><strong>Daily TDN</strong> (lbs)</td>
<td><strong>NEm (Mcal)</strong></td>
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<td>700</td>
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<td>19.0</td>
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<td>Dry pregnant mature cows—Middle third of pregnancy</td>
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<td>Two-year-old heifers nursing calves—First 3-4 months postpartum—10 lbs milk/day</td>
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<td>15.9</td>
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<td>9.20†</td>
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<td>17.6</td>
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<td>Cows nursing calves—Average milking ability—First 3-4 months postpartum—10 lbs milk/day</td>
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<tr>
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<td>0.0</td>
<td>18.8</td>
<td>10.8</td>
<td>10.40†</td>
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<td>12.1</td>
<td>11.54†</td>
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<td>Cows nursing calves—superior milking ability—First 3-4 months postpartum—20 lb milk/day</td>
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<tr>
<td>1100</td>
<td>0.0</td>
<td>22.3</td>
<td>14.5</td>
<td>14.94†</td>
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</tbody>
</table>
Dry Cows

- Intake: 1.8 – 2.0% of BW
- CP: 7-8% DM
- TDN: 49-53% DM
- Requirements increase from 1st to 3rd term of pregnancy
Lactating Cows: Average (10 lbs./Day)

- Intake: 2.0-2.5% of BW
- CP: 9.0-10.0 % DM
- TDN: 55-57 % DM
Lactating Cows: High (20 lbs./Day)

- Intake: 2.2-2.7% of BW
- CP: 11.0- 13.0 % DM
- TDN: 62-67 % DM
- Needs increase as milk production increases
First Calf Heifers
Average (10 lbs/Day)

- Intake: 2.0-2.5% of BW
- CP: 10.0- 11.5 % DM
- TDN: 62-65 % DM
- Increased requirements needed for growth during lactation
Growing Calves

• Intake: 2.5% of BW

• CP: 11.0-13.0 % DM

• TDN: 62-67 % DM
<table>
<thead>
<tr>
<th>Test</th>
<th>As Fed</th>
<th>Dry Matter</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIR MOISTURE</td>
<td>14.99%</td>
<td>.0 %</td>
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<tr>
<td>NIR DRY MATTER</td>
<td>85.01%</td>
<td>100.0 %</td>
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<tr>
<td>NIR PROTEIN</td>
<td>12.70%</td>
<td>14.94 %</td>
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<tr>
<td>NIR ACP</td>
<td>12.70%</td>
<td>14.94 %</td>
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</tr>
<tr>
<td>NIR % PROTEIN SOLUBILITY</td>
<td>27.85%</td>
<td>27.85 %</td>
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<tr>
<td>NIR FAT</td>
<td>1.33%</td>
<td>1.56 %</td>
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<tr>
<td>NIR ADF</td>
<td>36.75%</td>
<td>43.23 %</td>
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<tr>
<td>NIR ADICP</td>
<td>.98%</td>
<td>1.15 %</td>
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<td>NIR aNDF</td>
<td>53.80%</td>
<td>63.29 %</td>
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<td>NDFD48 (% of DM)</td>
<td>38.88%</td>
<td>38.88 %</td>
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<td>NIR NDICP</td>
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<td>5.07 %</td>
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<td>NIR LIGNIN</td>
<td>7.47%</td>
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<tr>
<td>NIR ASH</td>
<td>6.52%</td>
<td>7.67 %</td>
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<tr>
<td>NIR CALC NEL</td>
<td>46.67%</td>
<td>54.89 MCAL/cwt</td>
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<td>NIR CALC NEM</td>
<td>43.03%</td>
<td>50.61 MCAL/cwt</td>
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<td>NIR CALC NEG</td>
<td>21.52%</td>
<td>25.32 MCAL/cwt</td>
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<tr>
<td>NIR DMI</td>
<td>1.61%</td>
<td>1.9 %</td>
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<tr>
<td>NIR RFV</td>
<td>81.17%</td>
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<td>RELATIVE FEED QUALITY (RFQ)</td>
<td>76.68%</td>
<td>76.68 RFQ</td>
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<tr>
<td>NIR EST. CALCIUM</td>
<td>.51%</td>
<td>.6 %</td>
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<tr>
<td>NIR EST. PHOSPHORUS</td>
<td>.15%</td>
<td>.18 %</td>
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<td>NIR EST. MAGNESIUM</td>
<td>.12%</td>
<td>.14 %</td>
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<td>NIR EST. POTASSIUM</td>
<td>1.33%</td>
<td>1.57 %</td>
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<td>QARD LC CALCULATIONS</td>
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<tr>
<td>NIR CALC TDN</td>
<td>43.96%</td>
<td>51.72 %</td>
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<td>NIR CALC NEL</td>
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<td>51.95 MCAL/cwt</td>
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<td>NIR CALC NEM</td>
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<td>NIR CALC NFC</td>
<td>14.66%</td>
<td>17.24 %</td>
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</tbody>
</table>

Warning: Feedstuff samples from varieties with enhanced nutrient characteristics must be submitted for wet chemistry to accurately determine nutrient contents.

Comments:
• Fescue Hay
  – CP: 15 %
  – TDN: 51.72 %

• Meets Needs?
  – Lactating Cow: Lacks Energy
  – First Calf Heifers: Lacks Energy
  – Growing Cattle: Lacks Energy
  – Dry Cow: YES!
<table>
<thead>
<tr>
<th>Body Wt.</th>
<th>Feed (lb)</th>
<th>Protein (%)</th>
<th>TDN (%)</th>
<th>Ca (%)</th>
<th>P (%)</th>
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</thead>
<tbody>
<tr>
<td>Mature Horse at Rest</td>
<td>1100</td>
<td>13.1</td>
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<td>69</td>
<td>.34</td>
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<td>Mature Horse at Light Work</td>
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<td>10</td>
<td>69</td>
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<td>Mature Horse at Medium Work</td>
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<td>10</td>
<td>69</td>
<td>.20</td>
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<td>Mare, Last 90 day of Pregnancy</td>
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<td>13.7</td>
<td>11.5</td>
<td>69</td>
<td>.45</td>
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<td>Mare, Peak Lactation</td>
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<td>22.1</td>
<td>13.1</td>
<td>69</td>
<td>.60</td>
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</table>
Cautions with Horses

- Blister Beetles in Alfalfa
- Poisonous Plants
- Issues with endophyte in fescue
Supplementation

- 1 lb of high starch, low protein supplement reduces forage intake by .5-1 lb

- High protein (30% CP) and high fiber (12% CP) supplements can increase forage intake
  - Added protein stimulates rumen function
## Common By-Products

<table>
<thead>
<tr>
<th>Feedstuff</th>
<th>CP (%)</th>
<th>TDN (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
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<tr>
<td>Corn Gluten Feed</td>
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<tr>
<td>Dried Distillers Grain</td>
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<tr>
<td>Hominy Feed</td>
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<td>89</td>
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<tr>
<td>Rice Bran</td>
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<td>71</td>
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<tr>
<td>Soy Hulls</td>
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<td>77</td>
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<tr>
<td>Wheat Midds</td>
<td>18</td>
<td>80</td>
</tr>
</tbody>
</table>

2013 Beef Magazine Feed Composition Tables
Supplementation

• Lactating Cow (1300 lb.)
  - Needs 24.3 lbs. DM, 2.2 lbs. CP, 13.4 lbs. TDN

• Hay: 88% DM, 8% CP, 52% TDN
  - 27.6 lbs. as-fed, 1.94 lbs CP, 13.37 lbs. TDN

• CP: 2.2 - 1.94 = 0.26 lbs.

• TDN: 13.4 - 12.67 = 0.73 lbs.
Supplementation

• Supplement with Distillers Grains
  • .90 DM, .30 CP, .95 TDN

• CP
  • .26 lb. / .30 CP / .90 DM = 0.96 lbs.

• TDN
  • 0.73 lb. / .95 TDN / .90 DM = .85 lbs.
Ionophores

• Modifies rumen environment
  – Increase use of VFAs and reduces protein degradation
  – Toxic to horses

• Rumensin (Monensin)
  – Only ionophore approved for mature cows
  – Increase efficiency of cattle
    • Up to 10% less intake for maintenance
Ionophores

- Lasalocid (Bovatec)
  - Not approved for mature cows
  - Improved rate of gain for cattle on forage by up to 10%
Ionophores

• Feed at least 1 lb of supplement
  – if feeding in grain (Rumensin)

• Feed up to 200 mg/day
  – 50 mg low quality
  – 100 mg average quality
  – 150-200 mg high quality
# Feeding Guidelines for Forages Containing Varying Levels of Nitrate

<table>
<thead>
<tr>
<th>Nitrate (NO₃) % DM</th>
<th>Recommendations For Feeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 0.44</td>
<td>Safe to feed in all situations.</td>
</tr>
<tr>
<td>0.44 - 0.66</td>
<td>Safe for non-pregnant animals. 50% of diet dry matter for pregnant animals.</td>
</tr>
<tr>
<td>0.66 - 0.88</td>
<td>Limit to 50% of diet dry matter.</td>
</tr>
<tr>
<td>0.88 - 1.54</td>
<td>Limit to 35-40% of diet dry matter. Avoid feeding to pregnant animals.</td>
</tr>
<tr>
<td>1.54 - 1.76</td>
<td>Limit to 25% of diet dry matter. Avoid feeding to pregnant animals.</td>
</tr>
<tr>
<td>over 1.76</td>
<td>DO NOT FEED</td>
</tr>
</tbody>
</table>
"Well, it may be greener on the other side, but on the downside, it's also chewy and flavorless."