Cattle and Horse Nutrition

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Livestock Specialist
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Introduction

- Cattle and Horse Nutrition
  - Nutrients
  - Effects on performance
- Hay
  - Factors that influence quality
  - Hay feeding and how to reduce wastage
- Ration Balancing
- Special Cases
Nutrients

• Cattle and Horses require all classes of nutrients
  – Water
  – Protein
  – Energy
    • Carbohydrates and fats
  – Vitamins and Minerals

• If the animal does not make these then they have to be supplemented through the ration.
Nutrients

• Cattle and Horses do make some of these nutrients
  – Natural foragers
    • Cattle
      – Rumen
    • Horses
      – Hind guts fermenters
Nutrients

• Water
  – Very important as it regulates intake
    • 3:1 ratio in water consumption to feed consumption
  – Required
    • Blood supply
    • Breakdown of nutrients
    • Movement of food through the digestive tract
    • Produce milk
    • Regulate body temperature
Nutrients

• Water
  – Composes 80% of the animals body and death results from loss of 20%
  – Consumption Range
    • Cattle
      – 4 gal to 17 gal
    • Horses
      – 3 gal to 16 gal
  – Wet feedstuffs also contain lots of water
    • Green pastures, silage, wet byproducts
Nutrients

• Factors that influence water intake
  – Weather
  – Age, Size and physiological state
  – Work
Nutrients

• Protein
  – Composed of amino acids
    • Over 20 different types
    • 10 amino acids are required from the diet

• Required
  – Develop all body tissues
  – Enzymes and hormones
  – Milk production
Nutrients

• Energy
  – Carbohydrates
    • Around 75% of dry matter weight of the plant
    • Main source of energy
    • Includes sugars, starches, and cellulose
    • Sources
      – Forages and roughages
        » Primary feed source
        » Lower net energy higher fiber fraction
      – Grains and Starches
        » Supplemental feed source
        » Higher net energy lower Fiber fraction
Nutrients

• Energy
  – Fats
    • Sources of fats
      – Plants and animals
      – Grains that contain oil such as soybeans and corn
    • Contain 2.25 times the energy of carbohydrates
    • Animal storage place for excess energy
      – Storage is used when the animal goes into a negative energy balance
Nutrients

- Energy
  - Fat
    - Used to produce essential fatty acids
    - Essential fatty acids are needed on the production of hormones

- Energy / protein requirements are influenced by
  - Physiologically state/age /size
  - Work
• Minerals
  – Make up small portion but important
  – Required
    • Bone formation
    • Construction of muscles, blood cells, internal organs and enzymes
    • Develop proper immunity to diseases
Nutrients

• **Minerals**
  – Two categories
    • Macro Minerals – required in large amounts
      – Ca, Cl, Mg, P, K, Na, S
    • Micro Minerals or Trace mineral – required in small amounts
      – Co, Cu, F, Fe, I, Mn, Mo, Se, Zn
  – Make up 3 to 5% of the body
  – 75% is Ca and P
    • Teeth and bones
Nutrients

• Vitamins
  – Small portion of the diet but essential for life
  – Required for
    • Normal growth, production and reproduction
    • Fight stress, disease and maintain good health
  – 16 vitamins
    • Water soluble
    • B and C
  – Fat soluble
    • A, D, E and K
Nutrients

• Sources of Vitamins and Minerals
  – The animal
  – Feed stuffs
    • Forages and grains
  – Supplements
    • Bagged blocks
    • Blocks
    • Mix your own
# Nutrient requirements

<table>
<thead>
<tr>
<th>Type of cattle</th>
<th>Lbs of DM</th>
<th>% TDN</th>
<th>% Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200 lb cow mid-pregnancy</td>
<td>21</td>
<td>50</td>
<td>7.1</td>
</tr>
<tr>
<td>1200 lb cow last 1/3 pregnancy</td>
<td>24</td>
<td>54</td>
<td>7.9</td>
</tr>
<tr>
<td>1200 lb cow lactation avg. milk producer</td>
<td>30</td>
<td>58</td>
<td>9.8</td>
</tr>
<tr>
<td>1200 lb cow lactation high milk producer</td>
<td>32</td>
<td>59</td>
<td>10.6</td>
</tr>
<tr>
<td>1120 lb replacement heifer last 1/3 pregnancy</td>
<td>23</td>
<td>58</td>
<td>8.9</td>
</tr>
<tr>
<td>1120 lb lactating heifer – avg. milk producer</td>
<td>27</td>
<td>62</td>
<td>10.4</td>
</tr>
<tr>
<td>500 lb calf gaining 1.5 lbs /day</td>
<td>12.6</td>
<td>64</td>
<td>11.2</td>
</tr>
<tr>
<td>500 lb calf gaining 2.0 lbs/day</td>
<td>12.7</td>
<td>69</td>
<td>12.8</td>
</tr>
<tr>
<td>600 lb calf gaining 1.5 lbs/day</td>
<td>14.4</td>
<td>64</td>
<td>10.6</td>
</tr>
<tr>
<td>600 lb calf gaining 2.0 lbs/day</td>
<td>14.6</td>
<td>69</td>
<td>11.9</td>
</tr>
<tr>
<td>2000 lb mature bull gaining 0.5 lbs /day</td>
<td>40</td>
<td>50</td>
<td>7.0</td>
</tr>
</tbody>
</table>
## Nutrient Requirements

<table>
<thead>
<tr>
<th>Class of Horse</th>
<th>Crude Protein %</th>
<th>Digestible Energy (Mcal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mature Horse Maintenance</td>
<td>7.2</td>
<td>16.4</td>
</tr>
<tr>
<td>Mature Horse Light Work</td>
<td>8.6</td>
<td>20.5</td>
</tr>
<tr>
<td>Mature Horse Moderate Work</td>
<td>8.6</td>
<td>24.6</td>
</tr>
<tr>
<td>Mature Horse Heavy Work</td>
<td>8.6</td>
<td>32.8</td>
</tr>
<tr>
<td>2 yr in training</td>
<td>10.1</td>
<td>26.3</td>
</tr>
<tr>
<td>2 yr Maintenance</td>
<td>9.4</td>
<td>18.8</td>
</tr>
<tr>
<td>Mare Early Lactation</td>
<td>14</td>
<td>28.3</td>
</tr>
</tbody>
</table>
Effects on performance

• Poor nutrition is going to lead to
  – poor performance
  – poor health
  – added stress
  – added expense
Effects on performance

- Poor Performance
  - Reproductive losses
    - reduced conception rate
    - Reduced percent calf crop
    - Longer post partum interval
  - Reduced milk production
    - Reduces calf growth
  - Stressed animals
Effects on performance

• Poor Performance
  – Poor nutrition prior to calving of first calf cows
    • decreased likelihood of rebreeding
    • Increased likelihood of dystocia
    • Poor colostrum quality
      – Increase likelihood of calf death loss
  – Poor health
    • Increase calf death loss
    • Increase nutrition to fight health problems
Effects on Performance

• Poor performance will lead to lost revenue
  – Death loss
  – Less calves for sale
  – Lighter calves for sale
  – Less uniform calf crop
  – Poorer efficiency which means more feed expense
  – More vet expense
## Factors that influence quality

<table>
<thead>
<tr>
<th>Forage Crop</th>
<th>Stage of maturity</th>
<th>NDF%</th>
<th>TDN%</th>
<th>CP%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>Early Vegetative</td>
<td>33</td>
<td>66</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Early Bloom</td>
<td>39.30</td>
<td>60</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Mid Bloom</td>
<td>47.10</td>
<td>58</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Full Bloom</td>
<td>48.80</td>
<td>55</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Late Bloom</td>
<td>53.00</td>
<td>53</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Mature</td>
<td>58.00</td>
<td>50</td>
<td>14</td>
</tr>
</tbody>
</table>

Beef Cattle NRC, 2000
## Factors that influence quality

### Effects of stage of maturity of alfalfa hay at harvest on gains of yearling steers

<table>
<thead>
<tr>
<th>Stage of Maturity</th>
<th>ADG (lbs./d)</th>
<th>Total Gain per steer (lbs.)</th>
<th>Feed/100 lbs. of gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bud</td>
<td>1.07</td>
<td>96</td>
<td>959</td>
</tr>
<tr>
<td>1/10 bloom</td>
<td>0.76</td>
<td>69</td>
<td>1,351</td>
</tr>
<tr>
<td>Full Bloom</td>
<td>0.63</td>
<td>58</td>
<td>1,600</td>
</tr>
<tr>
<td>Seed</td>
<td>0.48</td>
<td>44</td>
<td>2,144</td>
</tr>
</tbody>
</table>

Feeds and Nutrition, 1990
Factors that influence quality

• Damage
  – Fermentation, bleaching, shattering, rain, and etc.
  – Reduce nutritive value of the hay based on severity

• Type of forage
  – Stem versus leaf ratio
  – Legume versus grass
## Factors that influence quality

### Effects of Rain damage on Red Clover Hay

<table>
<thead>
<tr>
<th>Harvesting stage</th>
<th>Good Drying conditions</th>
<th>Poor Dry Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Rain</td>
<td>Rain</td>
</tr>
<tr>
<td>Late bud to first flower</td>
<td>22.4</td>
<td>22.1</td>
</tr>
<tr>
<td>Full to late bloom</td>
<td>15.0</td>
<td>14.9</td>
</tr>
</tbody>
</table>

% DMD (% IVDMD)

<table>
<thead>
<tr>
<th>Harvesting stage</th>
<th>Good Drying conditions</th>
<th>Poor Dry Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Rain</td>
<td>Rain</td>
</tr>
<tr>
<td>Late bud to first flower</td>
<td>75</td>
<td>72</td>
</tr>
<tr>
<td>Full to late bloom</td>
<td>67</td>
<td>63</td>
</tr>
</tbody>
</table>

% NDF

<table>
<thead>
<tr>
<th>Harvesting stage</th>
<th>Good Drying conditions</th>
<th>Poor Dry Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Rain</td>
<td>Rain</td>
</tr>
<tr>
<td>Late bud to first flower</td>
<td>31</td>
<td>37</td>
</tr>
<tr>
<td>Full to late bloom</td>
<td>42</td>
<td>45</td>
</tr>
</tbody>
</table>

Feeds and Nutrition, 1990
Factors that influence quality

<table>
<thead>
<tr>
<th>Feed stuff</th>
<th>NDF (%)</th>
<th>TDN (%)</th>
<th>ME (Mcal/kg)</th>
<th>CP (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fescue K31</td>
<td>67</td>
<td>58</td>
<td>2.10</td>
<td>12.90</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>48.80</td>
<td>55</td>
<td>1.99</td>
<td>17.00</td>
</tr>
<tr>
<td>Red Clover</td>
<td>46.90</td>
<td>55</td>
<td>1.99</td>
<td>15.00</td>
</tr>
<tr>
<td>Timothy</td>
<td>64.20</td>
<td>56</td>
<td>2.02</td>
<td>8.10</td>
</tr>
</tbody>
</table>

Beef Cattle NRC, 2000
Factors that influence quality

Nutritive value of Alfalfa hay at different cuttings

<table>
<thead>
<tr>
<th></th>
<th>1st cutting</th>
<th>2nd cutting</th>
<th>3rd cutting</th>
</tr>
</thead>
<tbody>
<tr>
<td>%CF</td>
<td>30.1</td>
<td>28.5</td>
<td>26.7</td>
</tr>
<tr>
<td>% CP</td>
<td>12.8</td>
<td>14.9</td>
<td>15.2</td>
</tr>
</tbody>
</table>

Feeds and Nutrition, 1990
Hay feeding and how to reduce wastage

Typical forage losses

- Field curing loses  - 26%
- Harvesting  - 14%
- Storage  - 35%
- Feeding  - 30%

Optimum Forage Losses

- Field Curing  - 12%
- Harvesting  - 8%
- Storage  - 5%
- Feeding  - 8%
## Hay feeding and how to reduce wastage

<table>
<thead>
<tr>
<th>Type of Hay</th>
<th>Percent Wasted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square bale in Rack</td>
<td>7%</td>
</tr>
<tr>
<td>Large round bale in rack</td>
<td>9%</td>
</tr>
<tr>
<td>Large round bale without rack</td>
<td>45%</td>
</tr>
</tbody>
</table>

Bell, S. and F. A. Martz., University of Missouri, 1973
### Hay feeding and how to reduce wastage

<table>
<thead>
<tr>
<th>Bale Type</th>
<th>With Rack</th>
<th>Without Rack</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 day</td>
<td>7 day</td>
</tr>
<tr>
<td>Small Square Bales</td>
<td>3.9</td>
<td>4.1</td>
</tr>
<tr>
<td>Large Round Bales</td>
<td>4.9</td>
<td>5.4</td>
</tr>
<tr>
<td>Small Round Bales</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*These bales were spread or unrolled across pasture*

MU Extension Guide Sheet
G4570
Hay feeding and how to reduce wastage

<table>
<thead>
<tr>
<th>Item</th>
<th>Cone</th>
<th>Ring</th>
<th>Trailer</th>
<th>Cradle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily hay waste, lbs/cow</td>
<td>0.88</td>
<td>1.55</td>
<td>3.52</td>
<td>4.18</td>
</tr>
<tr>
<td>Hay Waste, %</td>
<td>3.5</td>
<td>6.1</td>
<td>11.4</td>
<td>14.6</td>
</tr>
</tbody>
</table>

Burskirk et al., 2003

Michigan State University

UNIVERSITY OF MISSOURI Extension
Live. And Learn.
Hay feeding and how to reduce wastage

5.6% wastage

20.7% wastage

21.5% wastage

12.7% wastage

A. J. Sexten, 2011
Oklahoma State University
Hay feeding and how to reduce wastage

• Pros and cons of a Cone feeder
  – Cost
    • Cone feeder $725 to $1000 + shipping vs. ring feeder $120 to $350
      – Cone feeder longer life than other feeders
  – Keeps hay off the ground and saves 10 to 20% hay usage annual
    • Improves quality of hay being fed
  – Heavier and not easily moved by hand
  – May have to change the way you put out hay
Hay feeding and how to reduce wastage

• Should you change your hay feeder
  – Determine what your feeder is wasting
  – Is there a feeder that will reduce that wastage
  – Is it cost effective to move to the feeder that will reduce wastage
## Hay feeding and how to reduce wastage

**Limit Feeding Option: Hay Restriction to Dry Mature Pregnant Cows (50 d)**

<table>
<thead>
<tr>
<th></th>
<th>4 hr</th>
<th>8 hr</th>
<th>12 hr</th>
<th>24 hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hay Intake (lbs)</td>
<td>18.6</td>
<td>24.4</td>
<td>28.3</td>
<td>29.6</td>
</tr>
<tr>
<td>Weight Change</td>
<td>+49</td>
<td>+65</td>
<td>+59</td>
<td>+59</td>
</tr>
</tbody>
</table>

Moderate quality hay

**Limit Feeding Option: Hay Restriction to 3 year old Pregnant Cows (50 d)**

<table>
<thead>
<tr>
<th></th>
<th>4 hr</th>
<th>8 hr</th>
<th>12 hr</th>
<th>24 hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hay intake (lbs)</td>
<td>17.1</td>
<td>23.8</td>
<td>27.5</td>
<td>30.7</td>
</tr>
<tr>
<td>Weight change</td>
<td>+48</td>
<td>+94</td>
<td>+119</td>
<td>+136</td>
</tr>
</tbody>
</table>

Average quality Hay
Hay feeding and how to reduce wastage

• Consideration when feeding hay to cattle
  – Sort cattle based nutrient needs
  – Feed quality of hay based on need
    • Low quality to dry non – lactating cattle
    • High quality to lactating or growing cattle
  – Feed pounds of hay and not numbers of bales
  – Feed hay in small amounts or in feeder
  – Fed well drained areas and move areas around
  – Make them clean it up
Hay feeding and how to reduce wastage

- Space bales 20ft apart
- Use electric fence to fence of unused bales
- Feed bales in bale rings
- Use multiple rings to get better cow consumption
- Move the fence and rings when new bales are needed

Reference: MU Guide G4570 Reducing Losses When Feeding Hay to Beef Cattle
http://extension.missouri.edu/p/G4570
Ration Balancing

• Balance the ration to meet the nutrient requirements of the animal
• Forage testing
• Animal Requirements
  – Growing Animal, finishing animal, Mature animal, gestation, lactating animal
• Formulate the ration to meet the energy and protein requirements
Ration Balancing

• Minerals
  – Provide free choice in block or mineral trough
  – Byproducts are high in phosphorus
  – Increase Magnesium to prevent grass tetany

• Vitamins
  – Most are synthesized in the animal under normal conditions
  – A, D, and E
Ration Balancing

Stage of Production
- Calving to breeding
- Breeding to weaning
- Mid gestation
- Late Gestation

Nutrient requirements
- Highest
- Moderate
- Lowest
- High
Ration Balancing

• Horses
  – Trends are similar to cattle
    • %CP
      – Lower for mature than young horses
      – Increases slightly with work
      – Highest for lactating horses
    • Energy
      – Increases with
        » Work, Youth, and lactation
Ration Balancing

- Horses
  - Minerals
    - Increases at end of pregnancy and lactation
    - Usually deficient in Calcium, Salt, Iodine, other trace elements and adequate in Phosphorous
      - Special mineral supplements are needed usually given in box
      - Vary according to mineral soil content
  - Vitamins
    - Sometimes deficiencies at A, D, E and B occur
    - Green leafy vegetables and sunshine give vitamins needed
Ration Balancing

Body Condition Score 3.5

Body Condition Score 7
Ration Balancing

Body Condition Score 3.5

Body Condition Score 7
Ration Balancing

14.8% CP
28.2% fiber
53.2% TDN
Low fiber
Easily digested

5.1% CP
31.5% fiber
53.7% TDN
Very low protein
decreased digestibility

8.8% CP
32.8% Fiber
46.3% TDN
Low energy

Dr. Tom Troxel
University of Arkansas
Special Cases

• Fescue Toxicity
  – Caused by endophyte that lives in the fescue plant
    • Concentrated in the seed head
  – Symptoms
    • Loosing ends of tails, poor conception rates, low pasture gains, low milk production, heat stress
    • Summer
Special Cases

• Fescue Toxicity
  – Ways to reduce symptoms
    • Moves to warm season pastures in the summer
    • Interseed legumes
    • Supplement with other feed stuffs to dilute effect
    • Graze or cut fescue before it gets to the seed head stage
Special Cases

• Grass Tetany
  – Mg or Ca deficiency
  – More prevalent in older cows in early lactation
    • Less able to mobilize Ca and Mg stores
  – Most frequently occurs in cattle grazing lush immature grasses or small grain pastures
    • High levels of K decrease absorption of Mg
  – High levels of N fertilization have been shown increase the incidence
Special Cases

• Grass Tetany
  – Symptoms
    • Lack of coordination, salivation, excitability,
    • Final stages tetany convulsions and death
  – Treatment
    • Intravenous injections of Ca and Mg Gluconate
Special Cases

• Grass Tetany
  – Prevention
    • Mineral mix containing 8 to 15% Mg and fed at a rate of three to 4 ounces per day
    • Start feeding about a month prior to tetany season
    • Supplement calcium
Nitrate Toxicity Cause

Nitrate $\rightarrow$ Nitrite $\rightarrow$ ammonia $\rightarrow$ Microbial protein

Accumulation $\rightarrow$ Conversion of Hemoglobin to Methemoglobin

Lack of oxygen carrying capacity from lungs to tissues

Urea and NPN supplements
Nitrate inhibits the action of the enzyme which breaks urea down into ammonia, delaying and leveling rumen ammonia supply
Special Cases

Cattle Nitrate Toxicity Symptoms

- Difficult, painful, and rapid breathing
- Muscle tremors
- Incoordination
- Diarrhea
- Frequent Urination
- Dark to chocolate colored blood
- Abortions
- Decreased milk production
- Collapse
- Death
Special Cases

- Nitrate poisoning
  - Accumulates in lower stalks during dry weather
  - Avoid high rates of nitrates
  - Does not dissipate after hay cutting
Special Cases

Field Crops high in Nitrate

- Corn
- Sorghum/Milo

Grasses and weeds high in nitrate

- Johnsongrass
- Pearl Millet
- Sudan Grass
- wild sunflower
- pigeon grass
- pigweed
- Kochia
- thistle
Special Cases

- How to deal with high nitrate feeds
  - Test
    - Extension office spot test
    - Send off to have a test done
      - Defined level
      - Feeding instructions based on the level
  - Making silage
    - Could reduce the level of nitrate 20 to 50%
  - Grazing or not baling the stalks
## Special Cases

<table>
<thead>
<tr>
<th>% NO₃</th>
<th>Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00-0.44</td>
<td>Consider Safe for all classes of cattle</td>
</tr>
</tbody>
</table>
| 0.44-0.66 | Safe for non-pregnant animals  
              Limit to 50% of dry matter                                            |
| 0.66-0.88 | Limit to 50% dry matter                                                   |
| 0.88-1.54 | Limit to 35 to 40% of dry matter                                          |
| 1.54-1.76 | Do not feed to pregnant animals  
              Limit to 25% of the total dry matter in other classes               |
| 1.76 and up | Do not feed                                                             |

Special Cases

• Prussic Acid Poisoning
  – Caused by cyanide in immature or frost damaged leaves
  – More concentrated at heights of 24” or smaller
  – Dissipates during the hay curing process
  – Present only in sorghums and not in pearl millet
Conclusion

• Nutritive value varies between hays and other feedstuffs
• Animal requirements vary
• For Optimum performance
  – Test feed stuffs
  – Formulate ration to meet animal requirements
  – Evaluate your animals performance
Conclusion

• Provide an healthy low stress environment for the animal so animals can perform at optimum
• Hay is an expensive commodity so try to find economically viable ways to improve hay utilization and reduce wastage
• Manage your nutrient resources so that the special cases don’t happen
References

• Feed and Nutrition, 1990
• Beef Cattle NRC, 2000
• Understanding your Forage Test. Eldon Cole, Lawrence County MU EXT Livestock Specialist
• Sniffen, C.J. and L.E. Chase, 1981, Cornell University
• MU Guide G4570 Reducing Losses When Feeding Hay to Beef Cattle http://extension.missouri.edu/p/G4570
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Questions

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