

UNIVERSITY OF MISSOURI  
Extension


# Livestock and Hay Nutrition

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# Outline

- Nutrients
- Hay test
- Animal Requirements
- Supplements



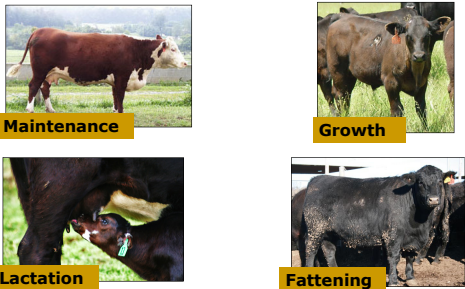
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# Introduction

- Poor nutrition leads to losses in several areas
  - Reproduction
  - Performance
  - Health
  - Possible Income
- Having a understanding of nutrition will help in assessing needs

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# Stage of Production




Maintenance      Growth  
Lactation      Fattening

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# Classes of Nutrients

- Water
- Protein
- Carbohydrates
- Fats
- Minerals
- Vitamins



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# 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

UNIVERSITY OF MISSOURI Extension **Water**  
The *MOST* Important Nutrient

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

Daily high temperature (F)	Daily water intake (gallons/day)
50	5
60	10
70	15
80	20
90	25
100	30

UNIVERSITY OF MISSOURI Extension **Protein**

- Composed of Amino Acids
  - 20 aa's that are essential
  - Build muscle, bone, hair, skin
- Requirements vary on different classes of livestock

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- Main source of energy
- Sugar, Starch, Cellulose
- Needs vary based on age and pregnancy status of animal

UNIVERSITY OF MISSOURI Extension **...Carbs**

- Forages
  - Lower energy
  - More fiber
- Grains
  - Supplements
  - Higher energy

UNIVERSITY OF MISSOURI Extension **Fats**

- Stored excess energy
- 2.25 x more energy than carbohydrates
- Are essential in need for production of hormones

UNIVERSITY OF MISSOURI Extension **Minerals**

- Used in bone, muscles, organs, cells
  - Structure
  - Function
- Deficiency **can** lead to poor performance and/or health issues

UNIVERSITY OF MISSOURI Extension **Minerals**

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

UNIVERSITY OF MISSOURI Extension **Essential Minerals**

<ul style="list-style-type: none"> <li>• Macro                             <ul style="list-style-type: none"> <li>- Ca-*</li> <li>- Cl</li> <li>- Mg- springtime</li> <li>- P-*</li> <li>- K</li> <li>- Na</li> <li>- S</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Micro                             <ul style="list-style-type: none"> <li>- Co</li> <li>- Cu- usually low</li> <li>- F</li> <li>- Fe</li> <li>- I</li> <li>- Mn</li> <li>- Se - usually low</li> <li>- Mo</li> <li>- Zn- usually low</li> </ul> </li> </ul>
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UNIVERSITY OF MISSOURI Extension **Vitamins**

- Used in the normal body processes of growth, reproduction, and maintenance
- Provide ability to fight disease and maintain good health.

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- **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.

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- **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

UNIVERSITY OF MISSOURI Extension **Sources of Mineral**

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

UNIVERSITY OF MISSOURI Extension **Conventional Nutrition**

Ration Balancing

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

Animal Needs

- Protein
- Energy
- Lipids (fats)
- Minerals
- Vitamins

UNIVERSITY OF MISSOURI Extension **Pasture/Hay Nutrition**

Ration Balancing

Pasture/Hay → Animal Needs

- Protein
- Energy
- Lipids (fats)
- Minerals
- Vitamins

FORAGE...as harvested

DRY MATTER

WATER

CELL CONTENTS Highly Digestible

- Sugars
- Starches
- Some proteins
- Other carbohydrates
- NPN
- 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

**Are all forages equal?**



UNIVERSITY OF MISSOURI Extension **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

UNIVERSITY OF MISSOURI Extension **What to Look At**

- **Dry Matter (DM)**
  - Intake is determined using DM
  - Compare different hay for purchase
    - 1200 lbs x .92 = 1,080 lbs
    - 1200 lbs x .85 = 935 lbs
- **Crude Protein (CP)**
  - Indicator of quality
  - Fescue may be adequate
  - Needed for rumen microbe function

UNIVERSITY OF MISSOURI Extension **...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

UNIVERSITY OF MISSOURI Extension **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

UNIVERSITY OF MISSOURI Extension **What makes good hay?**

- Protein
  - USDA Grass Hay Guidelines

Quality	% Crude Protein
Premium	> 13
Good	9-13
Fair	5-9
Utility	< 5

UNIVERSITY OF MISSOURI Extension **... What makes good hay?**

- Energy (TDN)

Quality	% TDN
Excellent	> 58
Good	55-57
Fair	52-54
Poor	< 51

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UNIVERSITY OF MISSOURI Extension **Determine Intake**

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

UNIVERSITY OF MISSOURI Extension **Intake**

- Protein : Estimated Intake

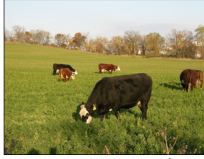
Quality	% CP	Dry Cows	Lactating Cows	Growing Cattle
Intake % of BW				
High	> 12	2.3	2.7	3.0
Medium	8-11	2.0	2.2	2.4
Low	< 7	1.5	1.7	1.9

Table 19. Nutrient Requirements of Breeding Cattle

Wt (lb)	Gain <sup>a</sup> (lb)	Daily DM (lb)	Daily TDN (lb)	NEm (Mcal)	TDN (%)	Energy in Diet DM (Mcal/lb)	NEg (Mcal/lb)	Total Protein Daily (lb)	Calcium in Diet DM (%)	Phos. in Diet DM (%)	Vit. A <sup>4</sup> Daily (1000's IU)
<b>Fragrant yearling heifers—Last third of pregnancy</b>											
700	0.9	15.3	8.5	7.95	55.4	0.52	NA <sup>a</sup>	1.3	8.4	0.27	0.20
700	1.4	15.8	9.6	7.95	60.3	0.60	0.34	1.4	9.0	0.33	0.21
700	1.9	15.8	10.6	7.95	67.0	0.70	0.43	1.5	9.8	0.33	0.21
800	0.9	16.8	9.2	8.56	54.8	0.51	NA	1.4	8.2	0.28	0.20
800	1.4	17.4	10.4	8.56	59.6	0.59	0.33	1.5	8.8	0.33	0.21
800	1.9	17.5	11.6	8.56	66.1	0.69	0.42	1.6	9.3	0.35	0.21
900	0.9	18.3	9.9	9.15	54.3	0.51	NA	1.5	8.1	0.26	0.20
900	1.4	19.0	11.3	9.15	59.1	0.58	0.32	1.6	8.5	0.30	0.21
900	1.9	19.2	12.5	9.15	65.4	0.68	0.41	1.7	9.0	0.32	0.21
<b>Dry pregnant mature cows—Middle third of pregnancy</b>											
900	0.0	16.7	8.2	7.00	48.8	0.42	NA	1.2	7.0	0.18	0.18
1100	0.0	19.5	9.5	8.13	48.8	0.42	NA	1.4	7.0	0.19	0.19
1300	0.0	22.0	10.8	9.22	48.8	0.42	NA	1.5	6.8	0.20	0.20
<b>Dry pregnant mature cows—Last third of pregnancy</b>											
900	0.9	18.2	9.8	9.15	54.0	0.50	NA	1.5	8.0	0.27	0.21
1000	0.9	19.6	10.3	9.72	53.6	0.50	NA	1.6	7.9	0.26	0.20
1200	0.9	22.3	11.8	10.83	52.9	0.49	NA	1.7	7.8	0.26	0.21
1400	0.9	24.9	13.1	11.90	52.5	0.48	NA	1.9	7.6	0.26	0.21
<b>Two-year-old heifers nursing calves—First 3-4 months postpartum—10 lbs milk/day</b>											
700	0.5	15.9	10.3	9.20 <sup>b</sup>	63.1	0.67	0.40	1.8 <sup>b</sup>	11.3	0.36	0.24
800	0.5	17.6	11.2	9.81 <sup>b</sup>	63.8	0.66	0.39	1.9 <sup>b</sup>	10.8	0.34	0.24
900	0.5	19.2	12.0	10.40 <sup>b</sup>	62.7	0.64	0.37	2.0 <sup>b</sup>	10.4	0.32	0.23
1000	0.5	20.8	12.9	10.98 <sup>b</sup>	61.9	0.62	0.36	2.1 <sup>b</sup>	10.0	0.31	0.23
<b>Cows nursing calves—Average milking ability—First 3-4 months postpartum—10 lbs milk/day</b>											
900	0.0	18.8	10.8	10.40 <sup>b</sup>	57.3	0.55	NA	1.9 <sup>b</sup>	9.9	0.28	0.22
1100	0.0	21.6	12.1	11.54 <sup>b</sup>	56.0	0.54	NA	2.0 <sup>b</sup>	9.4	0.27	0.22
1300	0.0	24.3	13.4	12.63 <sup>b</sup>	55.1	0.52	NA	2.2 <sup>b</sup>	9.1	0.27	0.22
<b>Cows nursing calves—superior milking ability—First 3-4 months postpartum—20 lbs milk/day</b>											
900	0.0	18.7	13.1	13.81 <sup>b</sup>	69.8	0.74	NA	2.4 <sup>b</sup>	12.9	0.41	0.28
1100	0.0	22.3	14.3	14.94 <sup>b</sup>	65.2	0.67	NA	2.6 <sup>b</sup>	11.9	0.38	0.27


UNIVERSITY OF MISSOURI Extension **Dry Cows**

- Intake: 1.8 – 2.0% of BW
- CP : 7-8% DM
- TDN : 49-53% DM
- Requirements increase from 1<sup>st</sup> to 3<sup>rd</sup> term of pregnancy




UNIVERSITY OF MISSOURI Extension **Lactating Cows: Average (10 lbs./Day)**

- Intake: 2.0-2.5% of BW
- CP: 9.0- 10.0 % DM
- TDN: 55-57 % DM




UNIVERSITY OF MISSOURI Extension **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




UNIVERSITY OF MISSOURI Extension **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



UNIVERSITY OF MISSOURI Extension **Growing Calves**

- Intake: 2.5% of BW
- CP: 11.0- 13.0 % DM
- TDN: 62-67 % DM



Class: F Sample: 41781 Type: Grass Hay Desc: 1ST CUTTING FESCUE HAY

Test	As Fed	Dry Matter	Comments
NIR MOISTURE	14.8%	0%	
NIR DRY MATTER	85.01	100.0%	
NIR PROTEIN	12.70	14.94%	
NIR ACP	12.70	14.94%	
NIR % PROTEIN SOLUBILITY	27.85	27.85%	
NIR FAT	1.33	1.56%	
NIR ADP	36.75	43.23%	
NIR ADICP	.98	1.15%	
NIR aNDP	53.80	63.29%	
NDPD48 (% of DM)	38.88	38.88%	
NIR NDFCP	4.31	5.07%	
NIR LIGNIN	7.47	8.78%	
NIR ASH	6.52	7.67%	
NIR CALC NEL	46.57	54.69 MCAL/cwt	
NIR CALC NEM	43.03	50.61 MCAL/cwt	
NIR CALC NEM	21.52	25.32 MCAL/cwt	
NIR DMI	1.61	1.9%	
NIR RFV	81.17	81.17 RFV	
RELATIVE FEED QUALITY (RFQ)	76.68	76.68 RFQ	
NIR EST. CALCIUM	.51	.6%	
NIR EST. PHOSPHORUS	.15	.18%	
NIR EST. MAGNESIUM	.12	.14%	
NIR EST. POTASSIUM	1.33	1.57%	
OMDC CALCULATIONS			OHIO STATE BQA.
NIR CALC TDN	43.96	51.72%	
NIR CALC NEL	44.17	51.95 MCAL/cwt	
NIR CALC NEM	39.72	46.72 MCAL/cwt	
NIR CALC NEM	18.46	21.71 MCAL/cwt	
NIR CALC NFC	14.66	17.24%	
MOLD		%	NOT DETECTED

Warning: Feedstuff sample from varieties with enhanced nutrient characteristics must be submitted for wet chemistry to accurately determine nutrient content.  
Comments:

UNIVERSITY OF MISSOURI Extension **Does it meet needs?**

- 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!

UNIVERSITY OF MISSOURI Extension **Horse Requirements**

Body Wt.	Feed (lb)	Protein (%)	TDN (%)	Ca (%)	P (%)
Mature Horse at Rest					
1100	13.1	10	69	.34	.26
Mature Horse at Light Work					
1100	17.5	10	69	.25	.18
Mature Horse at Medium Work					
1100	22.9	10	69	.20	.15
Mare, Last 90 day of Pregnancy					
1100	13.7	11.5	69	.45	.35
Mare, Peak Lactation					
1100	22.1	13.1	69	.60	.45

UNIVERSITY OF MISSOURI Extension **Cautions with Horses**

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

UNIVERSITY OF MISSOURI Extension **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

UNIVERSITY OF MISSOURI Extension **Common By-Products**

Feedstuff	CP (%)	TDN (%)
Corn	9.8	88
Corn Gluten Feed	22	80
Dried Distillers Grain	30	95
Hominy Feed	11	89
Rice Bran	14	71
Soy Hulls	13	77
Wheat Midds	18	80

2013 Beef Magazine Feed Composition Tables

UNIVERSITY OF MISSOURI Extension **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.

UNIVERSITY OF MISSOURI Extension **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.

UNIVERSITY OF MISSOURI Extension **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

University of Kentucky

UNIVERSITY OF MISSOURI Extension **Ionophores**

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

Univ. of Wisconsin

UNIVERSITY OF MISSOURI Extension **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**

Nitrate (NO <sub>3</sub> ) % DM	Recommendations For Feeding
0.0 - 0.44	Safe to feed in all situations.
0.44 - 0.66	Safe for non-pregnant animals. 50% of diet dry matter for pregnant animals.
0.66 - 0.88	Limit to 50% of diet dry matter.
0.88 - 1.54	Limit to 35-40% of diet dry matter. Avoid feeding to pregnant animals.
1.54 - 1.76	Limit to 25% of diet dry matter. Avoid feeding to pregnant animals.
over 1.76	<b>DO NOT FEED</b>

UNIVERSITY OF MISSOURI Extension **Thank You**

by Leigh Rubin

"Well, it may be greener on the other side, but on the downside, it's also chewy and flavorless."