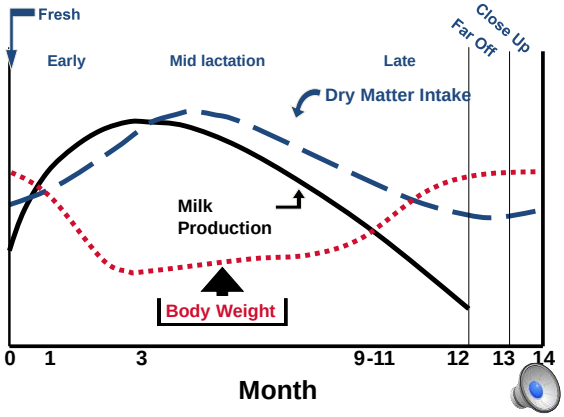
Dairy Nutrition

- Considerations
  - Nutrient requirements
  - Nutrient content of feeds
    - Sampling for accuracy
  - Processing of feeds
  - Cost of feed
    - Availability
    - Contracting
  - Management style
  - Data evaluation

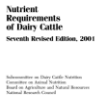
Understanding Dairy Nutrition

- Nutrients
- Dietary formulation
  - Sampling feed ingredients
- Feeding management
- Cow observation



Nutrient Requirements (NRC)

- ❖Nutrient needs of animal
  - •Based on body weight, milk production, milk fat content, pregnancy and growth
- ❖Feed tables with "book" values
  - •Nutrient content of feeds



http://www.nap.edu/catalog.php?record_id=9825#toc

Milk Rules of Thumb

- Peak
  - 30 to 70 days postpartum
    - Second month on DHI test
      - Heifers (1st lactation) possibly later
  - Peak times 200 equals lactation total potential
    - Example: 100 # X 200 = 20,000#
- Persistency
  - 1st lactation cows drop 6% per month after peak
  - Older cows drop 9% per month after peak

Nutrition Based on Dry Matter

Dry matter = as fed x % dry matter

Dry matter % = $\frac{\text{dry matter}}{\text{as fed}}$ x 100%

Dry matter intake is always less than as fed intake!

Dry Matter Intake Guides

Dry Cows: **(B.W. x .0185)**

23 pounds of DM for maintenance (1250#)

Milk Cows:

(.0185 x B.W.) + (.305 x lb 4% FCM)

4% FCM = (0.4 X lb Milk) + (15 X lb Fat)

1 lb of DM ↑ milk yield 2 - 2.5 lb

NRC Dry Matter Intake
lb DMI per day

4% FCM Milk Yield (lb)	880 lb BW	1,100 lb BW	1,320 lb BW	1,540 lb BW
44	32	35	38	40
66	39	43	46	49
88	48	51	53	55
110	NA	59	62	63
132	NA	NA	71	74

Changes in Nutrient Requirements

Body Wt + Milk (3.5%)	NEL (Mcal)	CP (lb)	Ca (lb)
1400 lb BW	10.12	0.932	0.057
1400 lb BW + 60 lb/d	10.12 + 18.6 = **28.72**	0.932 + 5.04 = **5.972**	0.057 + 0.18 = **0.237**
1400 lb BW + 150 lb/d	0.12 + 46.5 **56.62**	.932 + 12.6 **13.532**	0.057 + 0.45 **0.507**

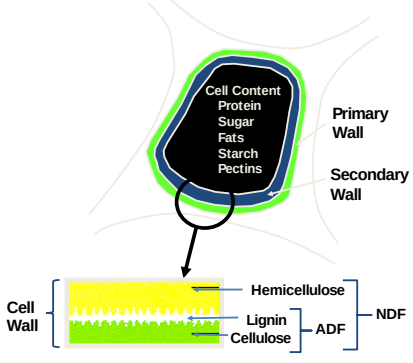
Dilution of Maintenance Costs (% of nutrient for milk)

Body Wt + Milk (3.5%)	NEL (Mcal)	CP (lb)	Ca (lb)
1400 lb BW	10.12	0.932	0.057
1400 lb BW + 60 lb/d	28.72 **64.8%**	5.972 **84.4%**	0.237 **75.9%**
1400 lb BW + 150 lb/d	56.62 **82.1%**	13.532 **93.1%**	0.507 **88.8%**

Energy Sources

- **Carbohydrates (Fermentable)**
  - **Fiber (Cell wall)**
    - **Cellulose, hemicellulose**
  - **Non-Fiber (Cell contents)**
    - **Starch, sugars**
- **Fats and Oils (Not fermentable)**

Diagram of a plant cell showing cell wall structure



ADF

(Acid Detergent Fiber)

* **Lignin and cellulose**
* **Cell wall of the plant**
* **Digestibility is lower**
* **Increases as plant matures**
* **Predicts energy level**

NDF

(Neutral Detergent Fiber)

* **Total cell wall**
* **ADF + hemicellulose**
* **Modest digestibility**
* **Dry matter intake control**
* **Increases as plant matures**

Total Digestible Nutrients (TDN) Expressed as % or lb

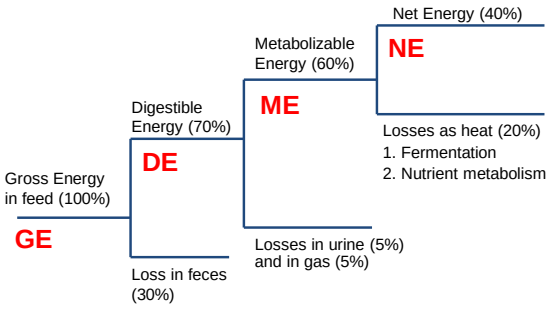
- Older system; moving to each "nutrient" needs

- Digestible Protein (70%)
- Digestible Crude Fiber (30 - 40%)
- Digestible Nitrogen Free Extract (80%)
- Digestible Ether Extract (60 - 80%) X 2.25

Net Energy Basis
Expressed as Mcal/lb

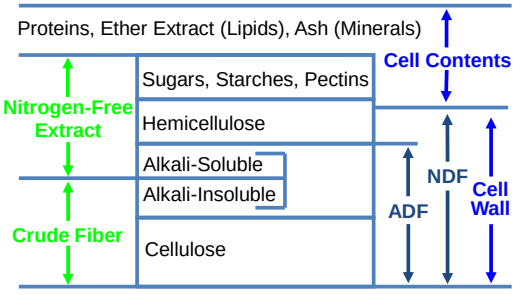
- Net Energy Maintenance NE_M
- Net Energy Lactation NE_L
- Net Energy Growth NE_G

Partitioning of ration (60% Alfalfa & 40% Corn) energy and losses in a lactating cow



Net energy system

Forage Analysis



Forage analysis showing Crude Fiber (Green) versus Van Soest (Yellow)

Protein

Total Crude Protein

- CP = Nitrogen (N) x 6.25
- 100 lb CP = 16 lb N
- 100 / 16 = 6.25
- Example: Alfalfa hay =
  3% N x 6.25 = 18.75% CP

Available Protein

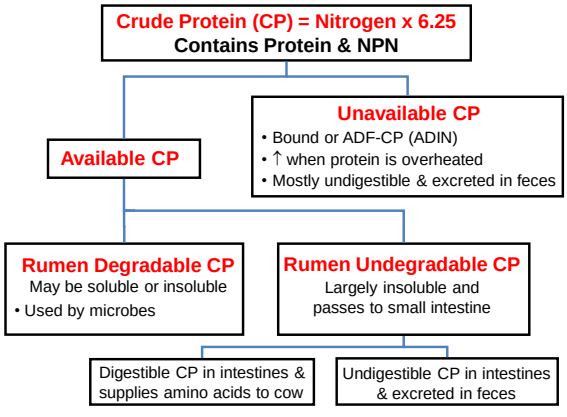
- Protein available for digestion
- Should be 90% or more of CP
- Less than 90% CP available indicates:
  - Heat damage
  - Excessive maturity at harvest

Unavailable Protein

- Protein unavailable for digestion
- Should be less than 10% of CP
- If greater than 10% of CP indicates:
  - Heat damage
    - Malliard Reaction
    - Carmelized protein
      - Pay attention to distillers grains and other heated protein sources
  - Bound protein
  - ADF-N (ADIN)

Avoid Heating & Carmelization in Silages

- Proper stage of maturity
- Correct moisture content
  - Oxygen-limiting (45 - 50%)
  - Conventional (55 - 60%)
  - Bunkers & bags (65 - 70%)
- Length of chop
- A tight silo or pack well
- Fill rapidly
- Seal if needed



Nonprotein Nitrogen (NPN)

- N not in a protein
- True protein is N in a long chain of amino acids
- NPN must be incorporated into microbial protein to be beneficial
- Examples of NPN
  - Urea
  - Monoammonium phosphate
  - Free amino acids

Sources

- Some slides adapted from Dairy Nutrition & Management (ANSCI 200/492), University of Illinois at Urbana-Champaign, Dr. Mike Hutjens