Introduction to Equine Nutrition

Dr. Martin Adams
Annual Cost of Horse Ownership

Nutrition $1,200
Health Care $600
Hoof Care $450
Other $750
Total $3,000
Horse Years versus Human Years

- First four horse years = 6.5 human years each
- Subsequent horse years = 2.5 human years each
- 1 human year = 6.5 horse years
- 2 human years = 13 horse years
- 5 human years = 28.5 horse years
- 15 human years = 53.5 horse years
- 24 human years = 76 horse years
- 30 human years = 91 horse years
Dietary Requirements of the Horse

- Water - most important nutrient
- Energy - carbohydrate, fat and protein
- Fat - vegetable oil and animal fat
- Protein - plant and animal sources
- Minerals - major and minor
- Vitamins - fat-soluble and water-soluble
- Forage - hay and pasture
Water

- Horse can survive only 5 days without water but 25 days without feed
- Best water intake occurs at 45-65° F
- Salt, electrolyte and excessive protein consumption increases water intake
- Restriction leads to dehydration, inability to sweat, impaction colic, decreased work (4%), death (15%)
Water

• Needed for all body functions: digestion, waste elimination, body temperature regulation
• Requirement depends on size, metabolic status, activity, environment, diet
• Normal maintenance needs are 1 gallon/100 lbs. BW/day, performance or lactating horses need 15-40 gallons/day
Energy

• Not a nutrient, estimated from animal studies
• Measured in kilocalories (Kcal) or megacalories (Mcal) of digestible energy (DE)
• Excess energy (or grain) results in:
  – DOD (Developmental Orthopedic Disease)
  – Colic - Founder - Laminitis
  – Obesity - Reduced Performance
Energy

- Provides fuel for maintenance, growth, pregnancy, lactation, work

- Lack of energy results in:
  - Reduced growth
  - Weight loss
  - Lack of stamina or reduced performance
  - Underweight foals
  - Reduced milk production
  - Decreased conception rate
Calories

- calorie (cal) = amount of heat required to heat 1 g of water 1º Celsius
- Calorie or Kcal = 1,000 calories
- Mcal = 1,000,000 calories or 1,000 kcal
- 1 Mcal = 1,000 Kcal = 1,000,000 cal
<table>
<thead>
<tr>
<th>Body Weight</th>
<th>DE (Mcal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>12.3</td>
</tr>
<tr>
<td>900</td>
<td>13.6</td>
</tr>
<tr>
<td>1000</td>
<td>15.0</td>
</tr>
<tr>
<td>1100</td>
<td>16.4</td>
</tr>
<tr>
<td>1200</td>
<td>17.0</td>
</tr>
</tbody>
</table>
Digestible Energy (DE) Requirements for Work

- Light Work - Maintenance DE x 1.25
  - pleasure, hunter/hack, trail riding
- Moderate Work - Maintenance DE x 1.5
  - cutting, barrel racing, jumping, reining
- Intense Work - Maintenance DE x 2.0
  - race training, polo, eventing
Carbohydrates

- Major source of energy in diet
- Non-structural - plant cell contents - sugars and starches - broken down in small intestine into glucose
- Structural - fiber - plant wall - cellulose and hemicellulose - fermented in large intestine into glucose and other sugars
- Roughages - high fiber, low starch, low DE
- Grains - low fiber, high starch, high DE
Fat

• Source of essential fatty acids (EFA) needed for hormones and cell membranes - linolenic acid (omega-3) and linoleic acid (omega-6)
• Contains more calories per unit (2.25X) than carbohydrates or protein, high energy density
• Unsaturated fats improve skin and hair condition, helps hair shedding and “bloom”
• High fat diets improve short-term and long-term performance
Examples of Collective Feed Ingredients for Roughage Products

**Good Quality Sources:**
- Beet Pulp
- Soybean Hulls
- Dried Citrus Pulp
- Dried Apple Pectin Pulp
- Alfalfa Meal

**Poor Quality Sources:**
- Peanut Hulls
- Oat Hulls
- Ground Straw
- Cottonseed Hulls
- Rice Hulls
- Rice Mill Feed
Selection of Horse Feed

- Collective terms - least cost formula that can change ingredients
- Collective terms hide “low calorie” roughage product ingredients
- Fixed formulas - no collective terms, lists specific ingredients
- Choose one with no “low calorie” roughage products
Protein

- Composed of essential and nonessential amino acids
- Needed for growth in young horses, fetal tissue development, milk protein synthesis, body tissue repair
- Major component of muscle, skin, hair, hooves, ligaments, bone, enzymes, hormones
- Inadequate protein or lysine will limit growth
Dietary Protein Requirements of Horses (as fed basis)

- Nursing Foal: 16%
- Weanling: 13%
- Yearling: 11.3%
- Long Yearling: 10.1%
- Long Yearling (training): 10.8%
- Mature Horse (no work): 7.2%
- Mature Horse (light work): 8.8%
- Mature Horse (mod. work): 9.4%
- Mature Horse (intense work): 10.3%
- Stallion (breeding): 8.6%
- Pregnant Mare (1st 9, 8-9, 11 mos.): 8.9%, 9.0%, 9.5%
- Nursing Mare (1st 3, 2nd 3 mos.): 12%, 10%
Minerals

- Needed for bone and teeth development, blood formation, electrolyte balance, fetal development, reproductive function, milk production
- Macrominerals - calcium, phosphorus, potassium, sodium, chloride, magnesium, sulfur
- Microminerals - copper, zinc, cobalt, iodine, iron, manganese, selenium
Vitamins

- Necessary for many metabolic reactions in body, especially involving energy metabolism
- Fat soluble - A, D, E and K
- Water soluble - B vitamins and C
- Requirements affected by age, activity level, health, diet
- B vitamins and K synthesized in hindgut
- Toxicity most likely with vitamins A and D
**Digestive System of Horse**

- Mouth
- Esophagus (4-5 ft.)
- Stomach (8-10 qt.)
- Small Intestine (70 ft., 68 qt.)
  - Duodenum, Jejunum, Ileum
- Large Intestine (26 ft., 134 qt.)
  - Cecum, Large Colon, Small Colon, Rectum
Digestive Capacity of GI Tract

- Large Colon: 38%
- Cecum: 15%
- Small Intestine: 30%
- Stomach: 8%
- Small Colon: 9%
Equine Nutrient Digestion

- Monogastric herbivore - simple stomach, eats plants
- Hindgut fermenter - digestion of fiber in LI
- Digestion and absorption of nonfibrous feed ingredients (protein, fat, sugar, starch, water, vitamins, minerals) in stomach and SI - FOREGUT
- Digestion and fermentation of fibrous feed ingredients (cellulose and hemicellulose) in cecum and large colon by bacteria and absorption of VFA, water, ammonia, minerals, vitamins - HINDGUT
Digestive Capacity of Foregut and Hindgut

- Foregut: 38%
- Hindgut: 62%
Forage

• Baled hay, hay cubes, chopped hay and pasture (long-stemmed fiber, 1-1.5 inch min. length) - grass, legume, and mixed
• Needed for proper digestive function
• Inadequate roughage can lead to cribbing, mane and tail chewing, manure consumption
• Feed 1-1.5% of body weight daily
• Poor quality increases risk of impaction colic
Hay Selection

- Fresh smell - free of dust and mold
- Leafy - high leaf to stem ratio
- Clean - free of weeds, dirt, trash, mold
- Color - bright green (short storage time)
- Maximum 42% ADF (dry matter basis)
- 8-14% crude protein
Pasture Management

- Stocking rate is 2 acres per horse
- Overgrazing leads to pasture destruction and weed establishment
- Use soil analysis to determine fertilizer needs
- Weed control measures include grazing management, mowing and herbicides
- Don’t graze under 4 inches, graze at 4 to 8 inches, mow/clip at 12 inches
**Recommended Daily Grain and Forage Levels for Horses (% BW)**

<table>
<thead>
<tr>
<th>Class</th>
<th>Grain</th>
<th>Forage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>0-0.5</td>
<td>1.5-2.0</td>
</tr>
<tr>
<td>Light Work</td>
<td>0.5-0.75</td>
<td>1.0-1.5</td>
</tr>
<tr>
<td>Moderate Work</td>
<td>0.75-1.0</td>
<td>1.0-1.5</td>
</tr>
<tr>
<td>Intense Work</td>
<td>1.0-1.5</td>
<td>1.0-1.5</td>
</tr>
</tbody>
</table>
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</thead>
<tbody>
<tr>
<td>Pregnant Mare</td>
<td>0.5-1.0</td>
<td>1.5-1.5</td>
</tr>
<tr>
<td>Lactation-Early</td>
<td>1.0-1.5</td>
<td>1.0-1.5</td>
</tr>
<tr>
<td>Nursing Foal</td>
<td>0.5</td>
<td>Free-Choice</td>
</tr>
<tr>
<td>Weanling</td>
<td>1.0-1.5</td>
<td>1-1.5</td>
</tr>
<tr>
<td>Yearling</td>
<td>0.5-1.0</td>
<td>1.0-1.5</td>
</tr>
</tbody>
</table>
Complete Feeding Program

• Water
• Forage (hay, hay cubes, chopped hay, pasture)
• Feed (grain or concentrate) - provides balance of nutrients
• Mineral/Vitamin Supplement (balances mineral and vitamin levels of forage)
• Most horses unable to maintain body weight on all-forage diet, energy density too low, maximum feed intake is 2.5-3.0% BW
Types of Horse Feed

- Sweet or Textured - consist of whole or processed grains mixed with molasses, some ingredients may be pelleted
- Pelleted - ingredients are ground, mixed, heated with steam and forced through a die
- Extruded - ingredients are ground, mixed, pressure-cooked and forced through a die
- Complete - fed as sole diet, 12-30% crude fiber, pellets and cubes
# Densities of Different Feeds

<table>
<thead>
<tr>
<th>Feed</th>
<th>Pounds/Quart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat Bran</td>
<td>0.5</td>
</tr>
<tr>
<td>Beet Pulp</td>
<td>0.6</td>
</tr>
<tr>
<td>Whole Oats</td>
<td>1.0</td>
</tr>
<tr>
<td>Sweet Feed</td>
<td>1.4</td>
</tr>
<tr>
<td>Pelleted Feed</td>
<td>1.6</td>
</tr>
<tr>
<td>Whole Corn</td>
<td>1.7</td>
</tr>
</tbody>
</table>
Feed Additives

- Probiotics - beneficial bacteria in gut, reduced diarrhea, increased feed efficiency
- Yeast culture - increased fiber and protein digestion, greater phosphorus absorption
- Organic/chelated/proteinated minerals - greater absorption for faster growth rate, increased conception rate, improved immune response and faster hoof growth
- Vegetable oil - source of EFA, improved coat condition, greater hoof flexibility and less cracking
- Digestive enzymes - derived from fungal culture that breakdown starch, protein and fat
- Yucca schidigera - plant compound that binds ammonia in blood and manure
- MTB-100 - mycotoxin binder
- Bio-Mos - bacteria binder
Body Condition Scoring

- 1-3 Poor - Thin
- 4 Can see ribs, vertebral ridge evident
- 5 Back flat, can’t see ribs, but can feel them
- 6 Crease down back, fat deposits
- 7-9 Fleshy - Extremely fat
Feeding Example for 1100-lb. Horse at Light Work

- DE Required - 20.5 Mcal per day
- Available Hay - 10% protein and 0.85 Mcal/lb DE
- Feeding 14 pounds daily of hay - provides 12 Mcal DE
- Need to feed:
  - 5 pounds of Triple Crown 10 or
    (10% protein, 10% fat, 1.7 Mcal/lb DE)
  - 5.7 pounds of Legends 10 or
    (10% protein, 6% fat, 1.5 Mcal/lb DE)
  - 6.4 pounds of Reliance 10
    (10% protein, 3% fat, 1.35 Mcal/lb DE)
Feeding Example for 1100-lb. Horse at Moderate Work

- DE Required - 24.6 Mcal per day
- Available Hay - 10% protein and 0.85 Mcal/lb DE
- Feeding 14 pounds daily of hay - provides 12 Mcal DE
- Need to feed:
- 7.4 pounds of Triple Crown 10 or
  (10% protein, 10% fat, 1.7 Mcal/lb DE)
- 8.4 pounds of Legends 10 or
  (10% protein, 6% fat, 1.5 Mcal/lb DE)
- 9.3 pounds of Reliance 10
  (10% protein, 3% fat, 1.35 Mcal/lb DE)
Feeding Example for 1100-lb. Horse at Intense Work

- DE Required - 32.8 Mcal per day
- Available Hay - 10% protein and 0.85 Mcal/lb DE
- Feeding 14 pounds daily of hay - provides 12 Mcal DE
- Need to feed:
  - 12.2 pounds of Triple Crown 10 or
    (10% protein, 10% fat, 1.7 Mcal/lb DE)
  - 13.9 pounds of Legends 10 or
    (10% protein, 6% fat, 1.5 Mcal/lb DE)
  - 15.4 pounds of Reliance 10
    (10% protein, 3% fat, 1.35 Mcal/lb DE)
Feeding Guidelines

- Feed horses individually and observe for abnormal eating behavior
- Maintain constant growth rates and body weight: use weight tapes or body condition scoring on monthly basis
- Have clean fresh water, 45-65º F, available at all times
Feeding Guidelines

- Feed at regular intervals, 2X to 3X daily, no more than 0.5% of body weight per feeding (5 lbs. for 1,000 lb. horse)
- Prevent rapid consumption of large amounts of grain - slow down eating rate
- Feed by weight and not by volume: know the weight of hay and grain fed
- Don’t increase grain > 1 lb. per day
Feeding Guidelines

• Feed good quality hay (max. 42% ADF on DM basis, free of weeds, mold and dust) or other forage at min. 1% BW daily

• For “complete” feeds (Senior, Complete, High Fiber, Maturity, Racing Formula, Low Starch, Growth) feed min. 0.5% BW daily in forage

• Follow grain feeding directions for body weight, class, activity and forage type
Feeding Guidelines

• Store feed in cool, dry area, off the ground, protected from insects/rodents
• Make all feed changes (hay and grain) gradually, over a 7-10 day period
• Follow sound parasite control, vaccination & dentistry programs
• Use high fat feed or fat supplement for hard keepers
Feeding Guidelines

• Provide free-choice access to mineral supplement (EquiMin)
• Provide daily exercise or turnout, prevent 24-hour stall confinement
• For easy keepers or overweight horses (feeding < 0.5% of body wt. daily) use a concentrated supplement (Triple Crown Lite)
Triple Crown Horse Feeds

- Premium ingredients
- High fat - 5 feeds with 10% fat
- For maintenance, breeding, growth, lactation and performance needs
- Equimix technology
  - Yeast culture
  - Organic trace minerals
  - Probiotics
  - Flax seed
  - Digestive enzymes
  - Yucca extract
  - Bio-Mos
  - MTB-100
  - Kelp meal
  - Rice bran
Legends Horse Feeds

- 10%, 12%, 14% and 16% protein levels
- For maintenance, breeding, growth, lactation and performance needs
- Textured and pelleted fixed formulas
- 6% & 10% fat levels
- Yeast culture
- Lysine and biotin
- Organic minerals
Reliance Horse Feeds

- 10% and 12% protein levels
- 3% fat
- No fillers
- Textured and pelleted fixed formulas
- Meets maintenance and light work needs