Feeding goats is the single largest expense behind the purchase cost of the animals. Can be as high as 60% of the total expenses for the year. Contrary to popular belief goats will not just eat anything. Animals receiving an inadequate diet will not perform to their genetic potential.

**Nutrient Requirements for Goats**
- Water
- Energy
- Protein
- Fats
- Minerals
- Vitamins

Though the cheapest of the nutrients it is commonly the most overlooked.
- Intake (need) varies by...
  - Moisture in feed

Goats should be given free choice to clean fresh water at all times.
- A mature goat will consume between ¾ to 1 ½ gallons per day.
- As temperatures increase over 70 degrees water intake will climb substantially.
- If water intake is decreased feed intake will also be decreased.

**Other Factors Important in Assessing Animal Needs**
- Weight
- Maturity
- Sex
- Body Condition
- Goals
  - Market
  - Breeding
  - Showing
  - Pet

These animals have different needs.
Factors Affecting Requirements

- The most common factors affecting nutritional requirements are:
  - 1) Maintenance
  - 2) Growth
  - 3) Pregnancy Status
  - 4) Lactation-Milking
  - 5) Level of Activity
  - 6) Environmental Conditions

Animal Requirements

- In ration balancing we use percentages, but...
- Animals need to eat the proper amount of nutrients
- Monitor feed intake and intake content of feeds. Poor quality feeds can limit intake.
- Don’t be misled by percentages...

Requirements: Mature Does
Maintenance, 110 vs. 132 lb

<table>
<thead>
<tr>
<th>Body Weight (lb)</th>
<th>Feed Intake (lb/day)</th>
<th>Energy as TDN (lb/day)</th>
<th>Energy as % LUN (%)</th>
<th>Protein (b/day)</th>
<th>Protein (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>2.2</td>
<td>1.17</td>
<td>53</td>
<td>0.15</td>
<td>6.8</td>
</tr>
<tr>
<td>132</td>
<td>3.2</td>
<td>1.32</td>
<td>41</td>
<td>0.17</td>
<td>5.3</td>
</tr>
</tbody>
</table>

Source: Nutrient Requirements of Small Ruminants (NRC 2006)

Important Points

- Smaller does eat less, therefore require feeds higher in protein and energy on a percentage basis than larger does.

Nutrition of Newborn Kids

- Colostrum – first milk produced by doe
- Within first hour after birth; gut closure at 6 hr
- Contains passive immunity

Important Points

- The highest nutrient requirement time for the doe is late pregnancy.
- This is different than with the ewe and the cow.
- Watch feed intake carefully with pregnant does.
- Don’t let does get too fat.
Important points
- Percent protein and energy required in the diet are lower for larger animals.
- Total pounds of protein and energy required by the animal are higher for larger goats.
- Higher amounts of protein and energy are required for higher rates of gain (both on a percentage basis and as total pounds).

Sources of protein

<table>
<thead>
<tr>
<th>Highest</th>
<th>Moderate</th>
<th>Lowest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein meals (46-52%)</td>
<td>Alfalfa and other legumes (13-21%)</td>
<td>Grass hay (10-12%)</td>
</tr>
<tr>
<td>Fish meal (66%)</td>
<td>Cereal grains (8-14%)</td>
<td>Poor quality hay (&lt;10%)</td>
</tr>
<tr>
<td>Urea (NPN) (288%)</td>
<td></td>
<td>Straw (3-5%)</td>
</tr>
</tbody>
</table>

Technical Notes on Protein Requirements
- Not all proteins are created equal.
- Different protein sources (feeds) influence amount of protein required in the diet.
- To accurately balance rations, protein source needs to be considered.

Grass/Clover Hay

<table>
<thead>
<tr>
<th></th>
<th>LOW-PROTEIN (5.89%CP)</th>
<th>MID-PROTEIN (9.11%CP)</th>
<th>HIGH-PROTEIN (12.67%CP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRUDE PROTEIN</td>
<td>6.9</td>
<td>9.9</td>
<td>12.5</td>
</tr>
<tr>
<td>% OF SAMPLES</td>
<td>64</td>
<td>28</td>
<td>8</td>
</tr>
<tr>
<td>TOTAL DIGESTIBLE NUTRIENTS (%)</td>
<td>56</td>
<td>58</td>
<td>60</td>
</tr>
</tbody>
</table>

Pasture Grasses

<table>
<thead>
<tr>
<th>MATURITY</th>
<th>CP</th>
<th>TDN</th>
</tr>
</thead>
<tbody>
<tr>
<td>VEG-BOOT</td>
<td>&gt;18</td>
<td>70-85</td>
</tr>
<tr>
<td>BOOT-EARLY HEAD</td>
<td>13-18</td>
<td>65-70</td>
</tr>
<tr>
<td>HEAD-MILK</td>
<td>8-12</td>
<td>60-65</td>
</tr>
<tr>
<td>DOUGH</td>
<td>&lt;8</td>
<td>&lt;60</td>
</tr>
</tbody>
</table>

Clover and other legumes have high nutrients pre-bloom, lower post-bloom.

Hay Values

Test your hay!
Protein

- Most expensive of the nutrients to supply
- Protein assists in building muscle
  - Composed of amino acids.
  - Bypass or escape protein increases protein efficiency.
  - Quantity more important than quality.
  - Excess protein is not stored in the body. It will be used inefficiently as energy.
  - Excess N is an environmental concern.

Energy

- Needed in the most amount.
- Usually the most limiting nutrient.
- Excess is stored as fat.
- Expressed as...
  - TDN – total digestible nutrients (%)
  - ME – metabolizable energy (mcal)
  - NE for maintenance, growth, lactation, and fiber production (mcal)

Other Nutrient Sources

- Minerals are provided through feeds & supplement mixes (loose or blocks)
- Especially check for selenium and copper included
- Grass hay also contributes some protein, energy, and minerals to the diet
Sources of Energy---Fats

- A byproduct of packing plants, and poultry processing plants.
- Commercial feed mixes will contain 1-7% animal fat.
- Animal fat in the feed reduces the dustiness of the feed.
- Often treated with antioxidants to prevent the feed from becoming rancid in storage.
- Beef and dairy rations can contain up to 5% while swine rations may have up to 20%.

Minerals

**Macro Mineral Requirements**

<table>
<thead>
<tr>
<th>Mineral</th>
<th>% of Diet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>0.20 - 0.80</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.20 - 0.40</td>
</tr>
<tr>
<td>Potassium</td>
<td>0.50 - 0.80</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.12 - 0.18</td>
</tr>
<tr>
<td>Sodium</td>
<td>0.09 - 0.18</td>
</tr>
<tr>
<td>Sulfur</td>
<td>0.14 - 0.26</td>
</tr>
</tbody>
</table>

Minerals

**Micro mineral Requirements**

**Trace Mineral Supplements**

- A complete goat mineral, trace mineralized salt with selenium, should be offered free choice year-round.
- Trace minerals are involved in vital processes & functions in the body.

<table>
<thead>
<tr>
<th>Mineral</th>
<th>PPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>10 – 20</td>
</tr>
<tr>
<td>Zinc</td>
<td>20 – 33</td>
</tr>
<tr>
<td>Iron</td>
<td>30 – 50</td>
</tr>
<tr>
<td>Manganese</td>
<td>20 – 40</td>
</tr>
<tr>
<td>Iodine</td>
<td>0.10 – 0.80</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>0.50 – 1.0</td>
</tr>
<tr>
<td>Cobalt &amp; Selenium</td>
<td>0.10 – 0.20</td>
</tr>
</tbody>
</table>

Vitamins

- Usually not a problem on green pasture
- Vitamins A and E should be supplemented with hay
- Most mineral mixes have A, D and E added at sufficient levels
- Don’t buy more than a three-month supply of minerals because vitamins will degrade

Pasture in Peak Growing Season

- Vegetative growth, sufficient quantity
- Meets requirements for
  - Protein
  - Energy
  - Vitamins
- Usually low cost feed mineral supplement
- Goats prefer browse to grass

Steps to effective grazing management

- Graze to desired stubble height
- Allow adequate rest periods for grass regrowth
- Don’t regraze pastures until your key species has reached the desired height
Feed

- Low quality grass hay will not meet nutrient requirements of pregnant, lactating, or growing goats.
- Supplementation.
- Clean, fresh water available at all times.
- Weigh feed to know how much you’re feeding.

Roughage

- Should be primary source of feed intake.
- Maintains healthy rumen function.
- Less problems when sheep and goats are forage-fed.
- Minimum amount of roughage is ½ lb. per 100 lbs. of body weight.

Practical feeding recommendations for pregnant and lactating females

- Goal: feed proper amount and balance of nutrients.
- Quantity (lbs) more important than quality (%).
- Make forage the main part of the diet.

Balance ration (proper way)
- By hand (math)
  - Simultaneous equations (Algebra)
  - Pearson Square
- Use computer program
  - http://www.sheepandgoat.com/software.html#ration
- Use spreadsheet
- Web-based ration balancing
  - http://www.luresext.edu/goats/research/nutr_calc.htm

Feed by “rule of thumb”

Pearson Square

Male Adult Buck (DMI = 3.5%)

\[
\begin{array}{c|c|c|c}
\text{Male Adult Buck} & 64 & 6 & 30 \\
\hline
8 & 6/36 = 16.7 \% \text{ SBM} & 30/36 = 83.3 \% \text{ Hay} & 36
\end{array}
\]

Feed according to “rules of thumb”

Forage

- Feed 3 to 4 lbs. of grass hay (or pasture) during early and mid gestation.
- Feed 4 to 5 lbs. of average quality hay (or pasture) during late gestation.
- During late gestation, you may need to supplement Ca if feeding a grass hay (don’t depend on free choice minerals).
- Save alfalfa hay for lactation when the female’s nutritional needs are the highest.
- Feed poor quality hay prior to and after weaning.

Bigger amounts for big females and smaller amounts for smaller females.
Feeding according to “rules of thumb”

**Concentrate/grain**
- No grain during early and mid pregnancy.
- Feed ½ to 1 lb. of grain per day to females during late gestation.
- Start with a ¼ lb. of grain and gradually increase amount of grain in diet.
- May need to feed more if you expect a birthing percentage greater than 200%.
- Grain can substitute for some of the hay in the ration, but be CAREFUL.

**After parturition**
- Plenty of water. Warm water in winter.
- Forage for the first few days.
- Take about a week to get the doe on full feed.

Changing Feed
- Any changes should be done slowly
- Changing type or amount feed takes time
- Introduce new feeds ¼ lb/day
- Rumen microbes need time to adapt
- Feed at the same time each day
- Feed twice per day

Health risks related to kidding

**Influenced by nutrition and feeding:**
- Pregnancy toxemia
- Milk fever
- Vaginal prolapse
- Abortion
- White muscle disease

**Risk factors**
- Inadequate nutrition
- Insufficient energy density
- Multiple fetuses
- High energy demand by fetuses
- Obesity
  - Fat mobilization → toxic ketone bodies
- Poor body condition
- Lack of exercise
- Stress
- Environment
- Severe weather conditions

Pregnancy toxemia
Low blood glucose, ketosis, twin lamb disease, lambing paralysis, sleeping ewe sickness

Milk fever
Low blood calcium, hypocalcemia, parturient paresis

**Risk factors**
- Fetal demands for calcium
- Demands for colostrum production.
  - Calcium deficiency
  - Overfeeding calcium
- Stress, especially nutritional
White muscle disease
nutritional muscular dystrophy, stiff lamb disease, muscular hypertrophy

**Deficiency of selenium and/or vitamin E**
- New born lambs, kids
- Sudden exercise may trigger condition

**Symptoms**
- Skeletal – treat with vit E/Se shot
- Mild stiffness to obvious pain upon walking
- Inability to stand
- Slight pain
- Hunched-up appearance
- Cardiac
  - Pneumonia
  - Difficulty breathing
  - Foul nasal discharge
  - Fever
  - Irregular and elevated heart and respiratory rates.

**Skeletal**
- Treat with vit E/Se shot
- Mild stiffness to obvious pain upon walking
- Inability to stand
- Slight pain
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**Cardiac**
- Pneumonia
- Difficulty breathing
- Foul nasal discharge
- Fever
- Irregular and elevated heart and respiratory rates.

**Body Condition Scoring (BCS)**
- Doe body condition score as kidding trims an effect on total pounds of kid weaned per doe
- Does with a body condition score of 9 to 1 at kidding lose fewer offspring and wean more pounds of kid than those with a condition score of 2.5 or less

**Additional tips for feeding**
- Weigh feed.
- Don’t rely on free choice minerals.
- Include Bovatec®, Rumensin® or Deccox® in ration to prevent coccidiosis. **They are toxic to equines**
- Feed whole grains.
- Split feedings if you’re feeding a lot of grain.
- Separate animals into groups according to their nutritional needs.
- Feed and manage ewe lambs/doelings Separate from mature females.
- Aim for moderate body condition scores.

**Flushing**
- Feed breeding age goats extra protein and/or energy 30 days before & after introduction of bucks
- Improves fertility & increases conception and multiple births
- Dependent on quantity and quality of available forage and condition of does

**Summary**
- Identify nutritional needs of animal
- Remember that nutritional needs change throughout the production cycle
- Match animal requirements to nutrient value of feeds
- Use body condition score to fine tune nutrition program
- Always have mineral and fresh water available
Questions?