Basics of Sheep and Goat Nutrition

Dr. Alison Crane
K-State Sheep and Meat Goat Extension Specialist, Assistant Professor
General

- Faulty nutrition plays one of the largest roles in failed reproduction and lamb death from birth to weaning.
- Sheep production is:
  - The efficiency of converting feed resources (pasture, forage, or grain) into products of economical value (meat, wool, or milk).
- Feed is the largest cost associated with livestock production.
But, what is nutrition?

The sum of the processes by which an animal takes in and assimilates the nutrients in feeds.
Digestive System
Nutrients

- Water
- Energy:
  - Carbohydrates
- Protein
- Vitamins
- Minerals
Water

- Water is extremely important to the animal’s health and performance
  - coolant
  - transporter
  - acts in chemical reactions

- For every 4 lbs of DM consumed, 1-1.5 gallons of water should be consumed
  - typical ewe water consumption: 0.72 in winter, 2.2 summer
Energy

- **Digestible Energy (DE; Mcal)**
  - Basis for energy requirements
  - Maintenance, Lactation, and Growth
- **Metabolizable Energy (ME; Mcal)**
  - ME = 82% of DE
- **Total Digestible Nutrients (TDN; % or lbs.)**
  - 1 lb. TDN = 2 Mcal of DE
Energy

- Most important nutrient
  - Inadequate energy limits performance more than any other nutritional deficiency

- Supplied through:
  - Carbohydrates (grains), fat, and excess protein (inefficient)
Protein

- Dietary protein → ruminal microorganisms → microbial protein → amino acids
- This is important because:
  - **Quantity is most often more important than quality!!!**
    - Microbial protein is commonly adequate, however with low quality forage, additional protein might be required
- Overfeeding protein is expensive!
Protein (Amino Acids)

- Essential
  - Arginine
  - Histidine
  - Isoleucine, Leucine, Lysine
  - Methionine
  - Phenylalanine
  - Threonine
  - Tryptophan
  - Valine

- Non-Essential
  - Alanine, Aspartic Acid
  - Citrulline
  - Cysteine
  - Glutamic Acid
  - Glycine
  - Proline
  - Serine
  - Tyrosine
Nitrogen

- Nitrogen (% or lbs)
  - Important when considering feeding urea

- Crude Protein (CP, % or lbs)
  - Nitrogen x 6.25
  - Common terminology referring to nitrogen content of the diet
Nitrate Poisoning

- Drought stricken, frost damaged, or heavily fertilized fields may contain forages with high nitrate levels
  - Need to be tested!
  - 1-3% potassium nitrate indicates that feeds should be blended
  - Can be deadly!
Urea Supplementation

- Most inexpensive form of Nitrogen
- N is converted to microbial protein

Recommendations:
- 1% of the total ration
- 3% of concentrate portion
- No more than 1/3 of total N
- Do not use for young lambs or creep
- Needs to be adequately mixed
- Avoid allowing “binge feeding”
### Vitamins

- All sheep require vitamins A, D, and E
- Lambs may require B complex- before rumen development
- Vitamin C synthesized by body tissues

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Requirement</th>
<th>Deficiency</th>
<th>Toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>21 IU/lb live weight Green forages- Beta-carotene Grains poor</td>
<td>Growth retardation, retained placenta, repro failure, night blindness, dead lambs</td>
<td>Not likely</td>
</tr>
<tr>
<td></td>
<td>252 IU/lb BW Sun-cured hay, Grains poor</td>
<td>Rickets</td>
<td>Not likely</td>
</tr>
<tr>
<td></td>
<td>9-10 IU/lb of diet Injection of E or Selenium, alfalfa</td>
<td>White Muscle Disease Stiff legs, arched back, tucked-up Corn contributes</td>
<td>Not likely</td>
</tr>
<tr>
<td>B Complex</td>
<td>Not required in diet, synthesized in rumen</td>
<td>PEM in early weaned and feedlot lambs on high concentrate diets, treat with Thiamin injection. Symptoms: Down on side, paddling, stargazing</td>
<td></td>
</tr>
</tbody>
</table>
### Sixteen essential minerals:
- Salt, Calcium, Phosphorus, Magnesium, Potassium, Sulfur, Copper

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Requirement</th>
<th>Deficiency</th>
<th>Toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salt</td>
<td>0.5-1.0% of diet</td>
<td>Feed/water intake, production, chewing wood/dirt</td>
<td>Death possible, but not likely</td>
</tr>
<tr>
<td>Calcium</td>
<td>0.2-0.82% of diet</td>
<td>Rickets, tetany, urinary calculi</td>
<td>Not likely, deficient in o/minerals</td>
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<tr>
<td>Phosphorus</td>
<td>0.16-0.38% of diet, 2:1 ratio, most grains excess</td>
<td>Rickets, slow growth, decreased appetite</td>
<td>Urinary calculi</td>
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<tr>
<td>Magnesium</td>
<td>0.12-0.18% of diet</td>
<td>Skeleton, tetany, frothy mouth, falling on side, death- Spring grazing ewes</td>
<td>Not likely</td>
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<tr>
<td>Potassium (Grass Tetany)</td>
<td>0.50-0.80% of diet</td>
<td>Listlessness, stiffness, convulsions, death</td>
<td>3% of diet (DM) causes depression of Mg absorption</td>
</tr>
<tr>
<td>Sulfur</td>
<td>0.14-0.26% of diet</td>
<td>Loss of appetite, reduce gain, wool growth, shed</td>
<td>0.4% of diet, decree intake-tie up CU, Mb</td>
</tr>
<tr>
<td>Copper</td>
<td>7-11 ppm, most feeds adequate, but can be tied up</td>
<td>Decreased immune status, swayback, stringy wool, infertility</td>
<td>25 ppm, RBCs splice, death! Do not use mineral salts for other species</td>
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## Target Body Condition Scores

<table>
<thead>
<tr>
<th>Stage of Production</th>
<th>Target BCS</th>
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<tbody>
<tr>
<td>Dry Ewe</td>
<td>1.5 to 2.0</td>
</tr>
<tr>
<td>Breeding</td>
<td>2.5 to 3.0</td>
</tr>
<tr>
<td>Early Gestation</td>
<td>2.0 to 2.5</td>
</tr>
<tr>
<td>Late Gestation*</td>
<td>2.5 to 3.0</td>
</tr>
<tr>
<td>Early Lactation*</td>
<td>3.0 to 3.5</td>
</tr>
<tr>
<td>Late Lactation, Weaning</td>
<td>2.0 to 2.5</td>
</tr>
</tbody>
</table>

*Add 0.5 to BCS for ewes expecting or nursing twins.

10-12% change in BW required to change BCS 1.0 units.
Adjustments for Nutrient Requirements

- Old and yearling ewes may need higher energy ration
- Lambing rate will affect nutrient demand
- Most of what we will talk about today assumes a 150 lb. ewe
Body Condition Scoring

- Over and under nutrition are not accurately determined by body weight's
- Body Condition Scoring (BCS) estimates external fat cover
- BCS:
  - Scale: 0-5
  - 0 = extremely thin
  - 5 = extremely fat
Target BCS

Target Body Condition Score

Body Condition Score

Stage of Production

Dry Breeding Gestation Early Gestation Late Gestation Early Lactation Late Lactation
Ewe Diets, Production Stage
Ewe Diets, Twins

Maintenance Flushing 1st 15 wks gestation Last 5 wks gestation Early Lactation Late Lactation

TDN (#/d) 0 0.5 1 1.5 2 2.5 3 3.5 4 4.5

150% lambing 200% lambing
Proper Management Can Prevent

- **Pregnancy Toxemia (Ketosis):** Caused by rapid fat mobilization during late pregnancy
  - Most common in over- or under-conditioned ewes
  - Also commonly affects does with triplets or quads
  - Glucose (oral, sub q, or i.v.) is the usual treatment

- **Milk Fever:** can occur pre-partum or post-partum
  - Symptoms similar to pregnancy toxemia
  - Response to calcium therapy (oral or i.v.) is the definitive indicator
Adjustments/ Terms

- Adjustments
  - Old and yearling ewes may need higher energy rations
  - Lambing rate will affect nutrient demand

- Terms:
  - Dry Matter (DM): Removal of water from feed
    - Values for balancing rations are always presented in DM form
  - As Fed (AF): Feed with the water remaining
  - Ad Libitum: Unrestricted access to feed
  - Limited Intake: Daily feeding or limiting intake by providing salt
    - 25-50% of supplement
Overall Intake

Voluntary dry matter intake is relatively high:
Sheep: 2.5 to 4.0% of body weight
Goats: 3.0 to 5.0% of body weight
Cattle: 1.5 to 3.0% of body weight
Creep Feed

- Offer free choice creep feed within the first 7 days of life
- Feed should be (increase gain)
  - Highly palatable
  - Higher fat
- Can also offer free choice alfalfa
Creep Feed

- Increases weight gain
- 90% ground shelled corn, 10% SBM, Aureomycin, ammonium chloride (0.5%), and TM salt (0.5%)
  - Replace corn with sorghum grain, ½ wheat or barley, or oats (1.25 to 1.0)
- 12-14% CP
- Start with meal form, replace with cracked or rolled grain after 30 days.
Creep Feed Example

1. 18 to 21% CP
2. Higher fat – Young lambs are in an energy dependent stage of growth
3. Ammonium Chloride to acidify urine and help prevent urinary calculi
Growing and Finishing Lambs

- Wean as early as 60 days or as late as 120 days.
- Sold for slaughter at 130 – 140 lbs.
  - 0.15 to 0.25 in. backfat and YG less than 3.0
- Diets can range from predominately forage to predominately grain.
  - Adjust to grain ration over 2 – 3 wks
## Growing/Finishing Lamb Rations

<table>
<thead>
<tr>
<th>Period</th>
<th>Corn</th>
<th>Hay</th>
<th>SBM</th>
<th>Mollasses</th>
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<td>Up to 70 lbs.</td>
<td>49</td>
<td>33</td>
<td>10.5</td>
<td>5</td>
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<tr>
<td>70 – 90 lbs</td>
<td>59</td>
<td>23</td>
<td>10.5</td>
<td>5</td>
</tr>
<tr>
<td>90 lbs and up</td>
<td>69</td>
<td>13</td>
<td>10.5</td>
<td>5</td>
</tr>
</tbody>
</table>

- 1% Dicalcium phosphate
- 1% TM salt + Selenium
- 0.5% Ammonium chloride
Show Feed

- Similar protein but with lower fat
  - Older lambs in a protein dependent stage of growth
- Generally textured with heavy molasses to increase consumption during hot summer months
- Requires transition period from creep to show feed
  - May sort steam flaked corn
  - Or anything of a differing particle size
Show Feed Example

Guaranteed Analysis

Medicated Active Drug Ingredient:
Lasalocid..................................................30 grams per ton
For the prevention of Concidiosis caused by
Eimeria ovina, Eimeria canalis, Eimeria ovinoidalis
(Eimeria ninakohlyakimovae,
Eimeria parva and Eimeria intricata in sheep
maintained in confinement.

Crude Protein, not less than..............19.0%
(this includes not more than 1.5% equivalent crude
protein from non-protein nitrogen)
Crude Fat, not less than....................2.5%
Crude Fiber, not more than......12.0%
Calcium, Min .............................0.85%
Calcium, Max .........................1.3%
Phosphorus, Min .........................0.4%
Salt, Min...........................................0.55%
Salt, Max.................................1.0%
Selenin, Min ............................0.39 ppm
Vitamin A, Min .........................2,500 IU/lb

Ingredients

Steam flaked corn, steam flaked barley, steam flaked
oats, linseed pellets, soybean meal, sunflower meal,
canola meal, wheat middlings, soy hulls, cottonseed
hulls, alfalfa meal, fish meal, molasses products,
calcium carbonate, salt, ammonium chloride, sodium
bentonite, potassium chloride, magnesium sulfate,
potassium sulfate, ferrous sulfate, cobalt carbonate,
zinc oxide, ethylenediamine dihydriodide, maganous
oxide, sodium selenite, Vitamin E supplement,
Proponic Acid (a preservative), Vitamin A acetate,
Vitamin D supplement, menadione,
dimethylpyrimidinol bisulfite (source of Vitamin K
activity), niacin, riboflavin, calcium pantothenate,
Vitamin B12 supplement, choline chloride,
ethoxyquin (a preservative), propionic acid, water,
ammonium hydroxide, sorbic acid, benzoic acid,
phosphoric acid, propylparaben, methylparaben, and
BHA.
Urinary Calculi

- Ca:P Imbalance
- Phosphorus content
  - Be leery of products with > 0.50% Min
  - Urinary calculi common in males on creep feed with an imbalance of Ca and P
Medicated or Non-medicated

- If you want to increase ADG and FE, medicated
  - Lasalocid (Bovatec®) or Monensin (Rumensin®)
    - Ionophore
    - Coccidiocide
    - Reduces gram-positive bacteria in the rumen
      - Improves nitrogen utilization
      - Increase propionate production
    - Increases Hot Carcass Weight and Mature Weights by 2-3%
  - Decoquinate (Deccox®)
    - Coccidiostat
    - Improved feed efficiency
Feed Processing and Additives

- Grind, crack, roll, or flake to allow uniform mixing
- All ingredients should be of similar particle size
- Cost usually dictates the amount of feed processing

<table>
<thead>
<tr>
<th>Animal</th>
<th>Additive</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamb</td>
<td>Chlorotetracycline</td>
<td>Gain, feed efficiency, enterotoxemia</td>
</tr>
<tr>
<td>Lamb</td>
<td>Decoquinate</td>
<td>Coccidiosis</td>
</tr>
<tr>
<td>Lamb</td>
<td>Ammonium Chloride</td>
<td>Urinary Calculi</td>
</tr>
<tr>
<td>Sheep</td>
<td>Oxytetracycline</td>
<td>Gain, feed efficiency, scours, prevention and treatment, enterotoxemia</td>
</tr>
<tr>
<td>Sheep</td>
<td>Lasalocid</td>
<td>Coccidiosis</td>
</tr>
<tr>
<td>Sheep</td>
<td>Thiabendazole</td>
<td>Roundworms</td>
</tr>
<tr>
<td>Breeding ewes</td>
<td>Chlorotetracycline</td>
<td>Vibrionic Abortion</td>
</tr>
</tbody>
</table>
Feeding the Ewe

- Grass hay or pasture during the first 3-4 months of gestation
- Alfalfa hay during the last 1-2 months
- Concentrate to balance
  - Feed to an adequate body condition score
- Offer free choice mineral
General Management

- Begins long before lambing/kidding season
- Early management of the ewe flock
  - Prevention throughout gestation
  - During and following parturition
- Ewe management has a direct influence on the lambs and their prosperity
Joining and Timing

- Joining duration:
  - The number of days ewes are exposed to rams
  - Ewes cycle every 17 days
- Recommended:
  - In-season
    - No longer than 34 days (2 cycles)
  - Out of season
    - Teased (14 d)
    - With rams for 34 days
Ewe Management

- Ewes in higher Condition Score (CS) at joining:
  - Conceive more lambs
  - Higher reproductive rate (measured as fetuses/100 ewes joined)

- Ovulation rate at joining:
  - Largely determined by ewe condition at joining
  - Condition of a ewe on the day of joining
    - More reliable predictor of reproductive rate than changes in condition prior to joining
  - Ewes should be in CS 3+ at day 17 of joining (end of first cycle)
Ewe Management

- Reproductive rate increases with increasing ewe CS
  - Linear between CS 1.5 and 4.5
  - Average response:
    - About 20 extra lambs per 100 ewes for each additional CS at joining

- Response in ewe reproductive rate to increased ewe CS at joining
  - Much greater than previously thought
Ewe Management

- Higher reproductive rate
  - Due to fewer open/dry ewes and more ewes conceiving twins
    - At CS 3
      - Should be no > 10% dry ewes in most Merino-based flocks
      - Less than 5% dry ewes in cross-bred flocks
  - In flocks scanning around 150%
    - More than 50% of ewes carry twins, less than 5% will be dry
Response in reproductive/pregnancy rate varies for different flocks

- Key factors affecting the responsiveness of flocks:
  - Genetics
  - Time of lambing (In-season vs. Out-of-season)
    - Later lambing most responsive

- Knowing flock’s response is important in making decisions about feeding ewes leading up to joining
  - Critical to understand the responsiveness of your flock's reproductive rate to increased ewe CS at joining
Ewe Management

- Whether your ewe flock is responsive (+30 lambs/CS)
- OR
- Less responsive (+10 lambs/CS) to improving CS at joining:
  - Can affect the profitability of ewe management options approaching joining by $1 to $3 per ewe
    - Depending on the value of extra lambs
Overall Management

- Establishing the link between ewe CS at joining and subsequent lambing performance for your flock will help with future management decisions
  - Feeding
  - Profitability
  - Prevent common health issues
    - Toxemia
    - Milk Fever
    - Dystocia
Ration Balancing Software

- [Https://msusheepration.montana.edu/](https://msusheepration.montana.edu/)
## Maintenance Ewe Rations

<table>
<thead>
<tr>
<th></th>
<th>Hay</th>
<th>Corn Silage</th>
<th>Haylage</th>
<th>Straw</th>
<th>Grain</th>
<th>SBM</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>3.0</td>
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<tr>
<td>2</td>
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## Flushing Ewe Rations

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<tbody>
<tr>
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## Early Gestation (wk 1-15) Ewe Rations

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<tr>
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# Late Gestation (wk 16-20) Ewe Rations

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# Early Lactation (wk 1-6) Ewe Rations

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<tr>
<td>3</td>
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## Late Lactation (wk 7-10) Ewe Rations

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<tr>
<td>3</td>
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<td>8.0</td>
<td>1.0</td>
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</tr>
</tbody>
</table>
EAT LAMB, WEAR WOOL

Because the West wasn’t won on Beef or Salad....

- 1493 - First sheep, Columbus
- 1521 - Sheep from Mexico to SW U.S.
- 1541 - First sheep drive (5,000)
- 1845 - First cattle drive (1,000)

(Kansas Historical Society; Sheep and Man, M. L. Ryder)