Advanced Master Goat Nutrition

All Goats - Inventory: 2007

CO-OP
Graph 22. Goat Slaughter - United States

Graph 24. Distribution of Goat Inventory by Type of Goat - United States
Goat Basics

• Domesticated before cattle and sheep
• Arid, semi-tropical, mountainous regions
• 460 million worldwide
• 4.5 million tons of milk
• 1.2 million tons of meat

Goat Basics

• Bucks, does, kids, doelings, & wethers
• Related to deer, elk, antelope, & giraffe
Goat Nutrition Basics

- Browsers
- Ruminants
- Prehensile lips
- Lower incisors & upper dental pad
- Upper & lower molars
Goat Diet Preferences

<table>
<thead>
<tr>
<th>Forage type (Forage Preference by Herbivores)</th>
<th>Cattle</th>
<th>Sheep</th>
<th>Goats</th>
<th>Horses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grasses (Pastures)</td>
<td>70%</td>
<td>60%</td>
<td>20%</td>
<td>90%</td>
</tr>
<tr>
<td>Forbs (Weeds)</td>
<td>20%</td>
<td>30%</td>
<td>20%</td>
<td>4%</td>
</tr>
<tr>
<td>Browse (Shrubs)</td>
<td>10%</td>
<td>10%</td>
<td>60%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Ruminant Digestion

- Goats use forages to produce a high-quality source of vitamins, minerals, energy and protein in the form of meat and milk
- They are ruminants
- Ruminants ruminate – chew the cud
- Microbes in their digestive system ferment cellulose
  - Not present in non-ruminants (humans, pigs)
Caloric density

- 1 lb chips = 2.4 lbs corn = 6.15 lbs hay
Comparative Capacity of the GI Tract

![Bar Chart]

- Man
- Pig
- Cattle
- Sheep & Goats
- Horse

Cellulose

![Cellulose Diagram]
Cellulose

Ruminant Digestive System

- Primary fermentation vat
- 5-10 gallons (mature goat)
- Contents in 3 layers: liquid, fibrous mat, gas
- Cud-chewing, saliva
Rumen microbes

- Bacteria, protozoa, & fungi
- 150+ species identified
- Five major groups:
  - Fiber fermenting bacteria
  - General purpose bacteria
  - NSC fermenting bacteria
  - Secondary feeders
  - Protozoa

Rumen bacteria (X14,000) Photographs are by courtesy of Dr. J. Cuby
Rumen microbes

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- 150+ species identified
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Ruminant Digestion

- Main source of energy
  - Humans - glucose
  - Goats - volatile fatty acids (VFA)
- The compartments of the ruminant digestive system are:
  - Rumen
  - Reticulum
  - Omasum
  - Abomasum
Rumination process

Diagram showing the rumination process in a goat, with labels for abomasum, omasum, reticulum, rumen, and small intestine.
Grazing/ruminating

Minutes per hour spent

6 AM 6 PM 6 AM

Time Grazing

Time Ruminating

GOAT
Rumen

- Papillae lining
- VFA absorption
  - Acetate, propionate, & butyrate
  - Propionate highest energy content
  - Acetate used in udder to produce milkfat

Molar ratios of VFA: Diet of Hay

- Propionate
- Acetate
- Butyrate
- Other VFA
Rumen papillae

Reticulum folds

Papillae
Papillae

- Smaller fermentation pouch
- Assists in contractions
- Captures foreign objects

Reticulum
Omasum

- “Many plies”
- Absorbs excess water from digesta

Abomasum

- “True” stomach – acid digestion
- Similar to humans, pigs, etc.
Rumen Dysfunctions

- Acidosis
  - Excess grain (starch), insufficient fiber results in overgrowth of lactic acid-producing bacteria, lowered rumen pH
  - Milkfat depression
  - Rumen damage
- Heat Stress
  - Decreased DMI
  - Panting

Rumen acidosis
Rumen acidosis

- Lack of effective fiber
- Overfeeding grain (starch)
- Abrupt diet changes

Rumen modifiers

- Sodium bicarbonate
- Yeast
- Direct-fed microbials
- Ionophores
- Essential oils/plant extracts
Rumen modifiers

- Sodium bicarbonate
  - Not a substitute for management
  - Insignificant compared to saliva production
  - Not palatable

Rumen modifiers

- Sesquicarbonate
- Limestone
- Bentonite
- Mg Oxide*
Yeast

- Culture vs. live yeast
- Enhance intake

DFM

- Direct-fed microbials
- Probiotics
- Typically Lactobacillus species
  - *Dried Enterococcus Faecium Fermentation Product, Dried Lactobacillus Acidophilus Fermentation Product, and Dried Lactobacillus Plantarm Fermentation Product*
Ionophores

• Lasolocid, Monensin Sodium
• Bovatec, Rumensin
• Increases rumen propionate production
• Increases feed efficiency ~10%
• “Free” energy from same diet
• Toxic to equines

Essential oils

• Plant extracts
• Phytonutrients
• Wintergreen, cinnamon, oregano, garlic, clove…
Nutrients

• Energy
  • Most limiting nutrient for goats
  • Sources = forages, cereal grains, fats
  • Limited by inadequate intake, low quality feed, wrong forage:concentrate ratio

• Protein
  • Made up of amino acids
  • “Crude protein” refers to Nitrogen content
  • Soybean meal, legumes forages are high quality sources
Nutrients

- Minerals
  - Essential to body functions
  - Macro and Micro minerals
- Vitamins
  - Fat soluble
  - Water soluble
  - Rumen synthesis
- Water
  - Aids in digestion, waste excretion, control of body temp, growth
  - Goat milk 87-89% water

Phosphorus

- Most known functions
- Energy utilization
- “Fertility mineral”
- Expensive – supplement strategically
**Copper**

- Deficiency causes delayed puberty and poor fertility
- UT Mineral Survey
  - Most TN soils deficient
  - Sulfur antagonist

**Zinc**

- Affects testicular development
- Deficiency causes reduced sperm production, delays maturation of sperm
- Immune system
Manganese

- Energy metabolism
- Deficiency...
  - Do not show heat
  - Decreased conception
  - Increased abortion
  - Low birth weight

Selenium

- Interacts with Vitamin E
- Significantly reduced fertility
- Southeastern soils are deficient
- Retained placentas
- Sperm production, motility
Value of a Mineral Supplement?

- Content (% or ppm) of each mineral
- Feeding rate
- Source (Bioavailability)
  - Inorganic
  - Organic
  - Hydroxy

“Organic” trace minerals

- Attaching an Amino Acid to a mineral source
- Examples: Zinpro-40 and Zinpro 4-Plex
- 4-Plex contains Cobalt, Copper, Manganese and Zinc
- Yeast derived Selenium (Se Methionine)
Forages

Forage Quality

- Forages are the foundation of the goat diet
- Quality = Nutritive value
  - Digestibility
  - Intake
  - Energetic efficiency
Forage Quality

- **Factors:**
  - Plant species
    - Legumes higher in CP, energy, and minerals than grasses
  - Plant maturity
Forage Quality

- Factors:
  - Plant species
    - Legumes higher in CP, energy, and minerals than grasses
  - Plant maturity
  - Weather
    - Sunlight increases digestible carbohydrates
    - Increasing temp increases cell wall formation
  - Processing/storage method
Reproduction

- Seasonal breeders
  - August – February
- Induced ovulators
- 150 day gestation
- Twinning is normal
- Respond to flushing
Reproduction

• Estrogenic compounds
• Phytoestrogens
• Legumes – clover, alfalfa, soybeans
• Reproductive management, herd health more important

Goat Lactation Cycle

1. Transition
2. Early Lactation
3. Late Lactation
4. Dry period
Goat Lactation Cycle

Transition

• Transition from...
  • Pregnant to empty
  • Dry to lactating
  • Low energy to high energy diet
• DMI decreases at kidding
• Gradually increase intake of lactation ration over 7-10 days
Early Lactation

• Peak milk production at 6-9 weeks
• Peak DMI lags behind
• Body reserves make up the deficit
• Goal: consume as much nutrition as possible without disrupting rumen function
• 1 lb grain per 2 lbs milk

 Late Lactation

• Declining milk production allows replenishment of body stores
• Rebreeding can occur once a positive energy balance is regained
• Should end lactation in same body condition as desirable to begin lactation
  • More efficient to add weight now vs. dry period
Dry Period

- 60 days that determine success of next lactation
- Rest & restore rumen and udder
- Maximum fetal growth
- Prepare immune system for kidding, colostrum production
- Ensure adequate body condition to enter lactation
- Avoid high Ca or high K forages
- Adapt to lactation diet

Replacements

- Critical to future success of the enterprise
- Should have greatest genetic potential
- Goal: Grow efficiently from birth, breed, and begin lactating at 12 months of age (dairy)
Replacements

• Colostrum is vital
  • Laxative
  • Nutrition
  • Antibodies

Replacements

• Colostrum is vital
  • Laxative
  • Nutrition
  • Antibodies

• Colostrum supplements
Replacements

- Colostrum is vital
  - Laxative
  - Nutrition
  - Antibodies
- Colostrum supplements
- Milk replacers
  - Provide free choice, cold, via nipple

Table 3. Effects of rearing method and age at weaning on performance ofتسممwise kids.

<table>
<thead>
<tr>
<th>Rearing Method</th>
<th>Artificial</th>
<th>Natural</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at weaning (days)</td>
<td>35.0</td>
<td>70.0</td>
</tr>
<tr>
<td>Birth wt.  (kg)</td>
<td>6.1</td>
<td>3.6</td>
</tr>
<tr>
<td>15 day wt. (kg)</td>
<td>8.8</td>
<td>6.8</td>
</tr>
<tr>
<td>70 day wt. (kg)</td>
<td>13.3</td>
<td>18.0</td>
</tr>
<tr>
<td>Live wt. (kg)</td>
<td>32.0</td>
<td>36.9</td>
</tr>
</tbody>
</table>

Replacements

- Kids are born “pre-ruminants”
- Milk bypasses the rumen, directly into abomasum
- Rumen size & function develop gradually as forage & grains are consumed
Creep feeding

- Physical means of exclusively supplementing kids
- Not the most cost-effective gains
- Eases the burden on the doe

Weaning

- Doeings can be weaned when they reach 2.5X birth weight and
- They are consuming at least 1 ounce of starter feed/hd/d
Post-weaning

- Primary emphasis on rumen development & gut capacity
- Secondary emphasis on rate of gain
  - Avoid fattening
  - Breeding size at 7 months (again, dairy)
- Ionophores, coccidiostats

Feeds vs. Ingredients
Ethanol production

Distiller’s grains
Corn syrup

Corn syrup
Gluten pellets

Oilseeds
Soybean meal

Soyhulls
Soyhull pellets

Product name
Stated purpose
Medication claim
Drug name and inclusion rate
Guaranteed nutrient analysis
Ingredients, largest to smallest
Specific feeding directions
Precautionary statement
Manufacturer's name/address
Item number
Net weight statement
18% Pelleted Goat Starter - RUM

- Monensin for the prevention of coccidiosis
- 18% protein
- Minerals balanced for kids
- Feed continuously as the only ration up to 5 to 6 weeks of age

16% Pelleted Goat Grower - RUM

- Monensin for the prevention of coccidiosis
- 16% protein
- Feed continuously as the only ration to goats 6 weeks of age or older
16% Pelleted Goat Grower - DEC

- Versatile feed for supplementing mature and growing goats
- Deccox for prevention of coccidiosis
- Formulated to be fed at 1 lb/100 lbs BW

16% Coarse Goat Feed

- Non-medicated for use in dairy or meat goats
- Coarse formulation with visible grain
- Provide 1 lb grain per 2 lbs milk produced; no more than half of diet DM as grain
16% Pelleted All Purpose Goat Feed - RUM

- Versatile feed for supplementing mature and growing goats
- Monensin for coccidiosis prevention

16% Pelleted Milk Goat Enhancer

- Multiple sources of soluble protein & high level of NSC to support lactation
- Selenium yeast
- Added vitamin E for udder health & reducing SCC
- Organic Zn for hoof health
- High level of digestible fiber for rumen health, improved milkfat
17% Pelleted Show Goat Grower - RUM

- High energy feed for finishing show goats
- Organic trace minerals
- Direct-fed microbials to aid digestion
- Allows maximum expression of genetic potential

Goat Block

- Convenient self-fed protein, vitamin, and mineral supplement
- Easy to handle 33. lb pressed block
**18% Goat Supplement Bucket**

- Convenient self-fed protein, vitamin, and mineral supplement
- Easy to handle 33.3 lb size

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**Supreme Goat Mineral**

- Premium vitamin & mineral supplement for goats
- Organic trace minerals
- Selenium yeast
- Kelp meal
- ¼ oz/hd/d consumption
Trace Mineral salt?

Diseases Related to Nutrition
Polioencephalomalacia

- PEM
- Thiamine deficiency
- Heavy grain/low fiber
- Thiamine I.V. from veterinarian - not feed additive

Listeriosis

- Sporadic bacterial infection
- “Circling disease”
- Disoriented, facial paralysis, leaning against stationary objects
- Penicillin, dexamethasone per DVM
Footrot

- Similar to cattle
- Control with trimming, footbaths

Urinary Calculi

- Kidney stones
- Related to Ca:P ratio
- Ample fresh, clean water
- Ammonium Chloride
Feeding Equipment

Mineral, Grain, & Hay Feeders

- Feed (forage & purchased) is the largest cost in livestock operations
- Feeders should minimize waste
- Accessible by all ages
- Trough space
- Durable (goat-proof)
- Clean and disinfect
- Portable
Mineral, Grain, & Hay Feeders

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Mineral, Grain, & Hay Feeders

Mineral, Grain, & Hay Feeders
Water Delivery

- Most vital nutrient
- Automatic
- Non-automatic
- Would you drink?

Non-Automatic

- Physically delivered – lots of labor required
- Lower cost initially - potentially higher cost in the long run
Waterers

Automatic Water Delivery

- Minimal manual effort
- Constant supply of fresh water
- Risk of water line breakage
- Higher cost in the short run
Waterers

Waterers
Waterers

Extension Publications

- “Solar Powered Livestock Watering Systems” (PB 1640)
- “Alternative Livestock Watering Systems” (PB 1641).
Nutrition of Large-Breed Dogs

Predator control

- Guard dogs
  - Anatolian,
Predator control

• Guard dogs
  • Anatolian, Pyrenees, Komondor

Predator control

• Guard dogs
  • Anatolian, Pyrenees, Komondor
• Burro
Feeding large-breed dogs

- > 50 lbs mature wt.
- Extremely rapid growth rate
- Most occurring between 3 and 6 months
- Sensitive to deficiencies or excesses

Feeding large-breed dogs

- Developmental orthopedic disease (DOD)
  - Hypertrophic osteodystrophy (HOD)
  - Osteochondrosis (OC)
  - Osteochondritis dissecans (OCD)
  - Retained cartilaginous core
  - Panosteitis
  - Hip dysplasia (HD)
  - Canine elbow dysplasia (CED)
Feeding large-breed dogs

- Hypertrophic osteodystrophy
- Decreased blood flow to metaphysis
- Failure of ossification
- Results in inflammation and necrosis
- Irreversible deformities in bones and joints

Feeding large-breed dogs

- Undernutrition rare
- Overnutrition, imbalances common
- Energy, calcium, phosphorus, vitamin D all play a role
Feeding large-breed dogs

• Energy
  • Overfeeding high-fat, nutrient-dense food
  • Need 3.5-4.0 kcal/g
  • Fat < 15%
  • Protein not an issue

• Calcium
  • Passive absorption until after 6 months
  • Most rapid growth at 3-5 months
  • ~1% in feed
Feeding large-breed dogs

• Phosphorus
  • Better regulated
  • NRC 1.2-1.4:1
  • Improper ratio affects hormonal balance
  • ~ 0.8% in food
  • Resist the temptation to top-dress!

Feeding large-breed dogs

• Vitamin D
  • Required by dogs – must be supplemented in diet
  • Affects Ca & P absorption
Feeding large-breed dogs

- Feeding strategies
  - Use a quality large-breed puppy food
  - Several meals daily
  - Monitor body condition – adjust as needed
  - Transition to adult maintenance food at 12 months
Feeding large-breed dogs