Advanced Master Goat Nutrition

[Image of goats]

All Goats - Inventory: 2007

[Map of the United States with goats' distribution marked]
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

**Forage Preference by Herbivores**

<table>
<thead>
<tr>
<th>Forage type</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

Cellulose
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. H. Kudo
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
Grazing/ruminating

Minutes per hour spent

Time Grazing

Time Ruminating

6 AM 6 PM 6 AM
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

- Acetate
- Propionate
- Butyrate
- Other VFA

Rumen papillae

Reticulum folds
Papillae

Papillae
Reticulum

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

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

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

Figure 1. Sequence of events associated with the induction of acute ruminal lactic acidosis (52).
Rumen modifiers

- Sodium bicarbonate
- Yeast
- Direct-fed microbialis
- Ionophores
- Essential oils/plant extracts

- 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
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

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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

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**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
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
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
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
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
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- Colostrum supplements

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Replacements

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

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| Table 2. Effects of rearing method and age at weaning on performance of Damascus kids. |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
| Rearing Method                  | Artificial      | Natural         | Artificial      | Natural         |
| Age at Weaning (days)           | 35.0            | 75.0            | 35.0            | 75.0            |
| Birth Wt. (kg)                  | 4.1             | 3.9             | 4.0             | 4.8             |
| 25 day Wt. (kg)                 | 8.8             | 9.8             | 15.1            | 16.4            |
| 75 day Wt. (kg)                 | 12.1            | 15.0            | 14.2            | 17.1            |
| Final Wt. (kg)                  | 35.0            | 36.0            | 35.1            | 36.2            |
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

- Doelings 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**

**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 33.3 lb pressed block

18% Goat Supplement Bucket

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

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

Trace Mineral salt?

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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

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

[Image of goats drinking water]

Waterers

[Image of a dog drinking water]

7/29/2015
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,

• 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)

- 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
Feeding large-breed dogs

- Calcium
  - Passive absorption until after 6 months
  - Most rapid growth at 3-5 months
  - ~1% in feed

- 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

entry hole

Feeding large-breed dogs