

Chapter 9

Goat Nutrition

Justin McDaniel and Brian Freking

After the purchase price of the animals, feed is the single largest cost associated with raising goats, typically accounting for 60 percent or more of total production costs. Nutrition exerts a very large influence on flock reproduction, milk production, and kid growth. Late-gestation and lactation are the most critical periods for doe nutrition, with lactation placing the highest nutritional demands on does.

Nutrition levels largely determine growth rates in kids. Kids with higher growth potential have higher nutritional needs, especially for protein. Because of their unique physiology, meat goats do not fatten like cattle or sheep, and weight gain rates are often smaller. Nevertheless, many people still believe that goats eat and do well on anything from newspapers to tin cans. Attempting to manage and feed goats with such a belief will not lead to successful meat goat production. Animals receiving inadequate diets are more prone to disease and will fail to reach their genetic potential.

Goats require energy, protein, vitamins, minerals, fiber, and water. Energy (calories) is usually the most limiting nutrient, whereas protein is the most expensive. Deficiencies, excesses, and imbalances of vitamins and minerals can limit animal performance and lead to various health problems. Fiber is necessary to maintain a healthy rumen environment and prevent digestive upsets. Water is the cheapest feed ingredient, yet often the most neglected.

Many factors affect the nutritional requirements of small ruminants: maintenance, growth, pregnancy, lactation, fiber production, activity, and environment. To feed them adequately, animals should be grouped according to their nutritional needs. As a general rule of thumb, goats will consume 2 to 4 percent of their body weight on a dry matter basis in feed. The exact percentage varies according to the size (weight) of the animal, with smaller animals needing a higher intake (percentage-wise) to maintain their weight. Maintenance requirements increase as the animals' activity level increases. For example, a goat that has to travel a farther distance for feed and water will have a higher maintenance requirement than animals in a feedlot. Goats grazing very hilly pastures will have higher nutritional requirements than goats on level pastures of the same quality because they will expend more energy to gather feed on difficult terrain. Environmental

conditions also affect maintenance requirements. In cold and severe weather, goats require more feed to maintain body heat. The added stresses of pregnancy, lactation, and growth further increase nutrient requirements. Table 9-1 shows some of the factors that affect nutrient requirements.

A goat's nutritional requirements can be met by feeding a variety of feedstuffs. Feed ingredients can substitute for one another as long as the animals' nutritional requirements are being met. Small ruminant feeding programs should take into account animal requirements, feed availability, and the costs of nutrients.

Pasture, Forbs, and Browse

Pasture, forbs, and browse are usually the primary and most economical source of nutrients for goats, and in some cases, pasture is all these small ruminants need to meet their nutritional requirements. Pasture tends to be high in energy and protein when it is in a vegetative (green and growing) state. However, it can have high moisture content, and sometimes it may be difficult for high-producing animals to eat enough grass to meet their nutrient requirements.

Grass tetany (lack of magnesium) can occur when goats in early lactation are grazing lush, leafy small grain; annual ryegrass; or grass/legume mix pastures. Under those conditions, it is advisable to provide a mineral mix that contains 5 to 10 percent magnesium.

As pasture plants mature, palatability and digest-

Table 9-1. Nutrient requirements of various classes.

Goats	Percent Protein (CP)	Percent Energy (TDN)
Bucks	11	60
Dry Doe	10	55
Late Gestation	11	60
Lactation		
Avg. Milk	11	60
High Milk	14	65
Weanling	14	68
Yearlings	12	65

ibility decline, so it is important to rotate pastures to keep plants in a vegetative state. During the early part of the grazing season, browse (woody plants, vines, and brush) and forbs (weeds) tend to be higher in protein and energy than ordinary pasture. In some situations where brush control in rough areas is the primary purpose of keeping goats, less productive animals can be roughed through and forced to work on brushy areas. If their body condition deteriorates, these animals can then be grazed on better quality pastures. Once a desirable body condition is achieved, the same animals can again be used to control brush. Goats are natural browsers and have the unique ability to select plants when they are at their most nutritious state. Goats that browse have fewer problems with internal parasites.

Hay

Hay is the primary source of nutrients for goats during the winter or nongrazing season (Figure 9-1). Hay varies tremendously in quality, and the only way to know the nutritional content is to have the hay analyzed by a forage testing laboratory. The samples can be brought to the local county Extension office to be sent for analysis. Typical costs range from \$6 to \$12 dollars per sample. Hay tends to be a moderate source of protein and energy for goats.

Legume hays such as alfalfa, clover, and lespedeza tend to be higher in protein, vitamins, and minerals, especially calcium, than grass hays. The energy, as well as the protein content of hay, depends on the maturity of the forage when it was harvested for forage. Proper curing and storage is also necessary to maintain nutritional quality of hay.



Figure 9-1. Hay can be used as a nutrient supplement during nongrazing seasons.

Concentrates

Feeding concentrates to provide the nutrients that forage alone cannot provide is often necessary, particularly with high-producing animals (Figure 9-2). Times and situations also occur where concentrates are a more economical source of nutrients. Creep feeding and supplemental feeding of kids has been shown to increase growth weight, but should only be done to the extent that it increases profit.



Figure 9-2. Concentrates can help supplement forage nutrients.

Two types of concentrate feeds can be used:

- Energy Feeds
- Protein Feeds

Energy Feeds

Energy feeds include feeds that are typically cereal grains such as corn, barley, wheat, oats, milo, and rye. Processing grains for goats is not necessary unless the animals are less than six weeks of age and lack a functioning rumen. One of the problems with feeding a lot of cereal grains is that they are high in phosphorus content, but low in calcium. Feeding a diet that is high in phosphorus and low in calcium can cause urinary calculi (kidney stones) in wethers and intact males. Inadequate calcium can also lead to milk fever (hypocalcemia) in pregnant or lactating does.

Protein Feeds

Protein feeds contain high levels of protein (greater than 15 percent) and may be of animal or plant origin. They include soybean meal and cottonseed meal. Some meat and bone meals are available on the market, but ruminant-derived meat and bone meal cannot (by law) be fed to other ruminants, including goats. Protein quantity is generally more important than protein quality in ruminant livestock since the microorganisms in the rumen manufacture their own body protein. Livestock do not store excess protein; it is burned as energy or eliminated (as nitrogen) by the kidneys. Since parasites often cause blood loss in goats, higher levels of protein in the diet may enable the animal to mount a greater immune response to parasites.

By-product feeds, such as soy hulls, wheat middlings, corn gluten feed, or dried distillers grains may contain high levels of various nutrients and can be incorporated into small ruminant diets if they are cost effective. Because of their unstable nutrient content, by-product feeds should be tested to ensure that they do not contain high levels of sulfur or other potentially harmful chemicals.

Many feed companies offer complete goat feeds that are either pelleted or textured, and are balanced for the needs of the animals in a particular production class. Pelleted rations have an advantage in that the animals cannot sort feed ingredients. While complete sheep feeds have been available for many years, it has only been in recent years that meat goat rations have been introduced to the market place. Complete feeds typically come in 50 pound sacks and tend to be much more expensive than home-made concentrate rations, but do ensure that the feed is balanced correctly.

Vitamins and Minerals

Goats require many minerals. The most important minerals are salt, calcium, and phosphorus. The ratio of calcium to phosphorus should be kept around 2:1 to prevent urinary calculi. Vitamins also are needed in small amounts. Small ruminants require vitamins A, D, and E, whereas vitamin K and all the B vitamins are manufactured in the rumen. A free-choice, salt-vitamin-mineral premix should be made available to goats at all times, unless a premix has been incorporated into the grain ration or TMR (total mixed ration). At a minimum, does should be fed free-choice mineral during late gestation and lactation. Either a loose mineral or mineral block may be offered. Force-feeding minerals and vitamins is

actually better than offering it free choice since animals often will not consume minerals according to their needs.

Goats appear to have a much higher tolerance for copper in their diets compared to sheep, therefore producers are recommended not to use feeds and/or premixes that contain copper if the goats are commingled with sheep. Pelleted supplements are available that contain vitamins and minerals, and high levels of protein (34 to 40 percent). These supplements can easily be combined with whole grains or by-product feeds to create a balanced concentrate ration. Coccidiostats and antibiotics can also be added to the mineral mix or supplement. Rumensin® (monensin) is FDA approved for goats. Deccox® is also approved as a coccidiostat for goats.

Water

Goats should have ad libitum (free-choice) access to clean, fresh water at all times. A mature animal will consume between 3/4 to 1 1/2 gallons of water per day. Water requirements and intake increase greatly during late gestation and during lactation. Water requirements increase substantially when environmental temperatures rise above 70°F and decline with very cold environmental temperatures. An animal's nutrient requirements will increase if it has to consume cold water during cold weather. Rain, dew, and snowfall may dramatically decrease free water intake. Inadequate water intake can cause various health problems. In addition, water and feed intake are positively correlated, meaning that the more feed goats eat, the more water that they need. Producers should use common sense when providing water. Because of kids' playful natures and their tendency to climb, they can fall into large troughs. If a large trough is used, large rocks should be placed in it so the kids can climb out should they fall in.

Body Condition

Producers should be concerned with the body condition of their breeding animals. The term body condition refers to the fleshing of an animal. Does should not be allowed to become too thin or too fat. Failure in reproduction, low twinning rates, and low weaning rates will result if does are too thin. Overly fat does can suffer pregnancy difficulties.

Simply looking at an animal to determine its body condition can easily be misleading. Rather, animals should be touched and evaluated in a chute. The easiest areas to feel and touch to determine the body condition of an animal are the rib areas, on ei-

ther side of the spine. By running a hand over those areas and pressing down with a few fingers, the producer is able to determine the amount of fat covering the ribs.

Other areas to monitor are the shoulders, the tail head, the pins, the hooks, the edge of the loins, and the backbone. Practice makes perfect, so using the animals helps the producer get a feel for it. An easy way to start is to select a few animals that are over conditioned and some others that are thin to help identify extreme cases. Then the producer can introduce a small group of animals and compare their condition to the animals having extreme body condition. The producer should develop an eye and a touch for the condition of the animals and strive to maintain a moderate amount of condition on the goats. If the backbone and ribs can easily be seen, the goats are most probably undernourished. When body condition starts to decrease, supplemental feed is usually needed or the animals need to be moved to a higher quality pasture. Waiting until goats become thin to start improving their feeding regime may lead to large production losses.

Producers should also be concerned with the body condition of the breeding bucks. Bucks will have reduced fertility if they are too thin. On the other hand, if bucks are overfed and become too fat, they may have no desire to breed does.

Flushing

Flushing means increasing the level of feed offered to breeding does, mostly energy feeds, starting about one month prior to the introduction of

the bucks, to increase body weight, ovulation rate, and hopefully litter size. Increasing the level of energy offered to does should continue throughout the breeding season and for approximately 30 to 40 days after removing the bucks, for adequate implantation of the fetuses in the uterus. Body condition is used to determine whether flushing will benefit breeding does. Does in extremely good body condition tend not to respond to flushing. On the other hand, does that are in relatively poor condition because of summer pastures of poor quality, high worm loads, or late kidding of twins or triplets respond favorably to flushing by improving their body condition.

Flushing can be accomplished by moving breeding does to a lush nutritious pasture three- to four-weeks prior to the introduction of the bucks. This cost-effective flushing method is underutilized when and where forage is abundant. Another method is feeding 1/2 pound per day of a high-energy supplement. Corn is the grain of choice for flushing; whole cottonseed is another low-cost, high-energy supplement. With the goal being to increase intake and body weight, breeding does should be grouped according to their body condition and fed accordingly to first improve their body condition, then to maintain it.

References

Schoenian S. (2003). An Introduction to Feeding Small Ruminants. Maryland Cooperative Extension. Maryland Small Ruminant Page. <http://www.sheepandgoat.com>