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ALABAMA A&M AND AUBURN UNIVERSITIES

Nutritional Management of Meat Goats

Introduction

The meat goat sector is currently the largest of the goat industry in the United States. The increased demand for goat meat is a result of a rise in immigrant and ethnic group populations. Primarily located in the Southwest and Southeast, the meat goat sector has shown promise of expansion over the past decade, and it continues to emerge as an alternative animal production system for small and limited resource farmers.

Meat goat breeds in the United States include the Spanish and the Boer. The Spanish goat, sometimes called brush or meat goat, is a mixed breed with widely varying colors and markings. Though relatively small (75 pounds at maturity), Spanish goats are highly prolific and can survive with little care. The Boer goat, originally from the Eastern Cape Province of South Africa, is also prolific with a kidding rate of 200 percent being common. Because of their extended breeding season, Boer goats produce three kiddings every two years. Boer goats, introduced into the United States in 1993, are white with a red-horned head and Roman nose. Mature bucks weigh 240 to 380 pounds and mature does weigh 200 to 265 pounds.

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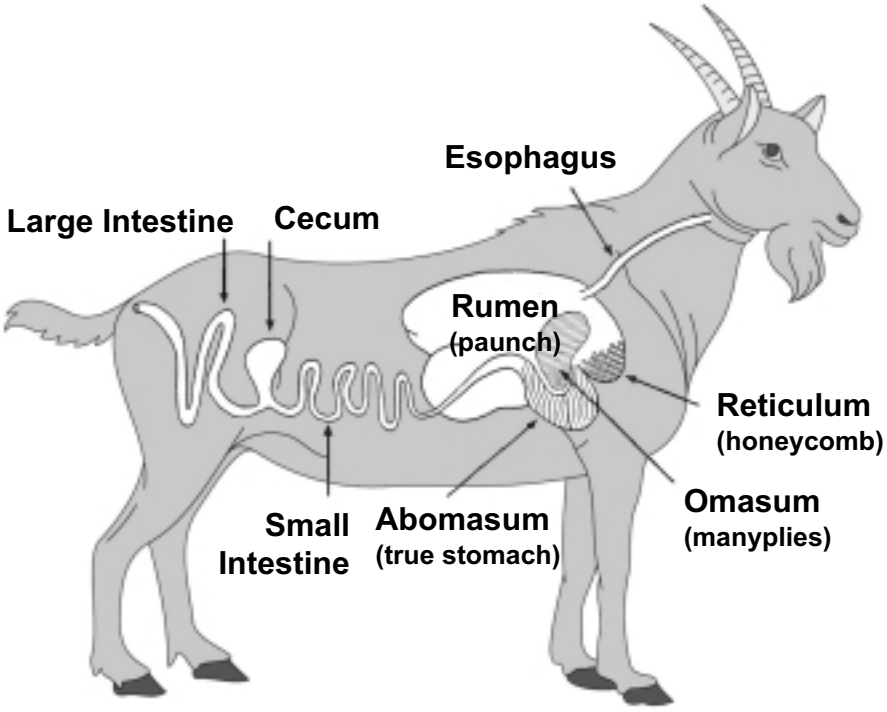
Because no market exists for grain-finished goats, producers in the United States take advantage of low-quality forages and roughages to provide a product in high demand. In fact, one of the advantages of goat meat production is that farmers can produce goats without intensive feeding strategies or systems because of the goats' unique ability to digest large quantities of fiber or roughage.

Digestive System

Mature goats are ruminant animals. Their digestive tracts, which are similar to those of cattle, sheep, and deer, consist of the mouth, esophagus, four stomach compartments, small intestine, and large intestine. Following is a brief description



The digestive tract of goats.

of the anatomy and physiology of the mouth and the stomach compartments of goats.

Mouth: Like other ruminant animals, goats have no upper incisor or canine teeth. They depend on the dental pad in front of the hard palate, lower incisor teeth, lips, and tongue to take food into their mouths.

Rumen: This is the largest of the four stomach compartments of ruminant animals. The capacity of the rumen of goats ranges from 3 to 6 gallons depending on the type of feed. This compartment, also known as the paunch, contains many microorganisms (bacteria and protozoa) that supply enzymes to breakdown fiber and other feed parts. The conversion of the cellulose of feeds to volatile fatty acids (acetic, propionic, and butyric acids) is the result of microbiological activities in the rumen. These volatile fatty acids are absorbed through the rumen wall and provide up to 80 percent of the total energy requirements of the animal. Microbial digestion in the rumen is the basic reason why ruminant animals effectively utilize fibrous feeds and are maintained primarily on roughages.

Rumen microorganisms also convert components of the feed to useful products such as the essential amino acids, the B complex vitamins, and vitamin K. Finally, the microorganisms themselves are digested farther in the digestive tract.

Reticulum: This compartment, also known as the hardware stomach or honeycomb, is located just below the entrance of the esophagus into the stomach. The reticulum is part of the rumen separated only by an overflow connection, the rumino-reticular fold. The capacity of the reticulum of goats ranges from 0.25 to 0.50 gallons.

Omasum: This compartment, also known as the manyplies, consists of many folds or layers of tissue that grind up feed ingesta and remove some of the water from the feed. The capacity of the omasum of goats is approximately 0.25 gallons.

Abomasum: This compartment is more often considered the true stomach of ruminant animals. It functions similarly to human stomachs. It contains hydrochloric acid and digestive enzymes that breakdown feed particles before they enter the small intestine. The capacity of the abomasum of goats is approximately one gallon.

As partially digested feed enters the small intestine, enzymes produced and secreted by the pancreas and small intestinal mucosa further breakdown feed nutrients into simple compounds that are absorbed into the bloodstream. Undigested feed and unabsorbed nutrients leaving the small intestine pass into the large intestine. The functions of the large intestine include absorption of water and further digestion of feed materials by the microorganisms present in this area. The 100-foot-long intestinal canal of goats has a capacity to hold 3 gallons.

When a goat kid is born, the rumen is small and the abomasum is the largest of the four stomach compartments. The rumen of a goat kid represents about 30 percent of the total stomach area, while the abomasum represents about 70 percent. Hence, digestion in the goat kid is like that of a monogastric animal. In the suckling goat kid, closure of the esophageal groove ensures that milk is channeled directly to the abomasum, instead of entering the rumen, reticulum, and omasum. When the suckling goat kid starts to eat vegetation (first or second week of life), the rumen, reticulum, and omasum gradually develop in size and function.

Nutrients

Energy: Age, body size, growth, level of activity, pregnancy, lactation, and environment all affect the energy requirements of goats. Carbohydrates and fats supply most of the energy requirements of the animal body. Much of the goat's energy comes from the breakdown of cellulose in roughages and the breakdown of starch and fat in concentrates. Energy deficiency in goats results in reduced growth or weight loss, reduced reproductive performance, reduced milk or fiber production, and reduced resistance to infectious diseases and internal parasites.

Protein: Protein consists of amino acids that are the basic units of all body cells. The goat's body requires protein for growth, reproduction, milk production, disease resistance, and general maintenance. Mature goats, like other ruminant animals, rely on rumen microorganisms to synthesize essential amino acids. Rumen microbes can utilize either nitrogen (N) of feed origin or nonprotein nitrogen (NPN) to synthesize amino acids and protein to meet the requirements of the host animal. Microbial protein and undigested feed protein reaching the small intestine are broken down to amino acids that are absorbed and utilized by goats. Protein deficiencies in the diet of goats result in depleted stores in muscles, retarded fetal development, low birth weights, reduced growth, and depressed milk production.

Vitamins: Vitamins are organic compounds required in small amounts by the goat's body. Because all the B vitamins and vitamin K are synthesized by microorganisms in the rumen and vitamin C is synthesized in body tissues, mature goats require only dietary sources of the fat-soluble vitamins A, D, and E. During the grazing season, goats can obtain sufficient fat-soluble vitamins from green pastures and plenty of sunlight. Goats can also store an adequate supply of these vitamins to maintain production for 3 to 4 months.

Symptoms of vitamin A deficiency are associated with abnormal bone development, low resistance to infections, night blindness, and birth of abnormal kids. Vitamin D deficiency results in bone abnormalities, such as rickets, in kids. Vitamin E, a biological antioxidant, is added to the diet of young nursing kids to prevent nutritional muscular dystrophy. Selenium, which has a sparing effect on the vitamin E requirement, is also effective in preventing nutritional muscular dystrophy in young kids.

Minerals: Many minerals (inorganic elements) are required by the goat. The major or macrominerals of concern are common salt (NaCl), calcium (Ca), phosphorus (P), magnesium (Mg), potassium (K), and sulfur (S). The trace or microminerals involved in goat nutrition are cobalt (Co), copper (Cu), molybdenum (Mo), fluorine (F), iodine (I), iron (Fe), manganese (Mn), selenium (Se), and zinc (Zn). In goat feeding, most minerals are usually added to mixed feeds. It is also recommended that the Ca: P ratio be kept at approximately 2:1.

Specific information on the symptoms of mineral deficiencies and toxicities in goats is scarce. However, these symptoms appear to be similar to those in sheep. Some symptoms of mineral deficiencies in goats include reduced feed intake, depressed

Goats put the bite on brush. (Photo courtesy of the Forest Service, USDA)

milk production, and retarded growth and abnormal bone development in young kids.

Water: Water is the least expensive nutrient and the largest component of live plant and animal tissue. Environmental factors, age, growth, pregnancy, lactation, and level of activity affect the water requirements of goats. Goats obtain water from their feed, as well as from drinking water, snow, and dew. Because water carries out important body functions, an adequate supply of fresh, clean water is critical to goats during their entire life cycle.

For more information on the recommended dietary nutrient allowances, obtain a copy of the National Research Council report titled *Nutrient Requirements of Goats*, Number 15, 1981. This NRC report can be obtained from the National Academy Press, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

Feedstuffs

Goats prefer to eat browse (brushy plants) and can efficiently digest coarse, fibrous feeds. Hence, goats will consume and effectively utilize a wide variety of woody and weedy plant species found on ranges.

Meat goats are raised primarily on unimproved pastures and rangelands. Meat goats do not need extra feed if they are grazing on land areas with a variety of brush, weeds, and grass. Additional feed, however, may be needed in periods of drought or in winter. The types and amounts of supplemental feed are also dictated by the functions of the goats.

Goats prefer woody and weedy plant species. (Photo courtesy of the Agricultural Research Service, USDA)

Aside from pasture and brush lands, dry roughages and forages are the most economical feeds for meat goats. The use of good quality hays as supplemental feed for grazing meat goats can compensate for extremely poor pasture or range conditions while supporting the profit margins. Legume hays such as alfalfa and clover are preferred to grass hays, such as bromegrass, orchardgrass, and timothy, because they are much higher in protein and a variety of minerals. Good quality legume hay or a mixed legume and grass hay provide an excellent source of highly digestible nutrients.

The cutting date is the single most important factor affecting hay quality. As the stage of maturity of the forage crop increases, the protein content decreases and the fiber content increases. Good quality hays are those that have been cut earlier and have more leaves and tender stems. If pasture or range conditions become adverse and supplemental hay is of poor quality, provide supplemental concentrates for maximum performance. Cereal grains such as corn, oats, barley, and wheat, are the common energy ingredients of concentrate mixtures for goats. Oil meals such as cottonseed meal and soybean meal are probably the most widely used sources of protein for goats. Commercial supplements containing other nutrients such as minerals in addition to protein may be preferable to one of the oil meals.

Because the cost of grain and meal mixtures is usually high, feeding supplemental concentrates to meat goats is advised only during critical periods of their life cycle. The profit margins do not support intensive feeding strategies using expensive feeds.

Feeding

Kids: Newborn kids should be allowed to nurse their dams to obtain colostrum (first milk). Colostrum contains antibodies that protect young kids against diseases. At birth, kids are able to absorb these antibodies effectively. However, the ability to absorb colostral antibodies decreases within the first 36 to 48 hours of life. To greatly increase the chances of survival, kids should receive colostrum immediately after birth.

Early forage consumption will lead to early rumen development. To encourage young kids to consume solid feed at about 2 to 3 weeks of age, fine hay can be offered. Young kids receiving adequate amounts of milk from their dams do well on good pasture or range. If pasture or range conditions are poor, however, kids should have access to good quality hay plus about 0.75 pounds of a grain mixture daily.

Kids weaned at about 3 to 4 months should be suitable for slaughter off grass. With the increased population of immigrant and ethnic groups, particularly Hispanics, the cabrito, or weaned kid, has become very popular.

Replacements: After 4 to 6 months of age, replacement does and bucks can do well on good pasture or good quality hay alone. A daily allotment of 0.5 pounds of a concentrate mixture should lead to ample growth. If the pasture or hay is of poor quality, however, replacement animals may require 1 to 1.5 pounds of concentrate per day. If properly fed, replacement goats will be large enough to breed as yearlings.

Young kids receiving adequate amounts of milk from their dams do well on good pasture or range.

If grass is short, a good quality mixed legume and grass hay is good for feeding.

Does: Feeding does during a dry period is important for development of the unborn kids and for obtaining proper body condition of the does for adequate nutrition of the newborn kids. The unborn kid develops 70 percent of its birth weight during the dry period (last 6 weeks of pregnancy). During this period, does can be maintained on good range or pasture, with only mineral supplementation needed, particularly salt and phosphorus. However, if grass is short, a good quality mixed legume and grass hay are good for feeding. If pasture and hay are poor quality, provide supplemental feeds such as goat range cubes at the rate of 0.5 to 0.75 pound per head per day. A doe should be in good flesh but not fat at time of kidding.

Lactating does on good quality range or pasture may require daily supplementation of 0.5 to 0.75 pounds of grain mixture or range cubes that contain approximately 20 percent protein. If the quality of range feed is poor, a higher protein supplement may be needed at the rate of 0.25 pound per head per day.

Bucks: Young bucks should be fed in the same manner as replacement does, but they will require more feed because of their size. Bucks that are not breeding can do well on good pasture or good quality hay alone. Supplemental grain or concentrates should be fed according to the condition of the pasture and the bucks. During the breeding season, however, grain or supplement should be provided at the rate of 0.3 to 0.5 pound per head per day. If the bucks become too fat or inactive, grain can be withdrawn.

Rotational grazing should be practiced to improve the pastures and help control internal parasites. Discard moldy feeds, and make any changes in the diet gradually.

Nutritional Diseases

Enterotoxemia: This condition, also known as overeating disease, is a toxic reaction to *Clostridium perfringens* types C and D. Enterotoxemia is caused by excessive feeding of concentrates to animals not accustomed to such feeds and sudden access or change to highly palatable feed. All kids should be given a toxoid vaccination at about one month of age, followed by a second dose two weeks later and booster doses every year. All does should be given a yearly booster toxoid about 3 to 4 weeks before kidding.

Urolithiasis: This condition, also known as urinary calculi, is characterized by the formation of inorganic masses, known as calculi, in any part of the urinary tract. When a high phosphorus level develops in the blood and urine, magnesium and ammonium phosphate precipitate to form a calculus. This calculus can pass easily through the urethra of does but not so easily through the urethra of bucks. Obstruction to the outflow of urine often results in rupture of the urethra or

bladder. Keep the calcium-phosphorus ratio at approximately 2:1.

Ketosis: This condition, also known as pregnancy disease, is characterized by an increased concentration of ketone bodies in the body tissues and fluids. Ketosis occurs when the energy requirements are met by way of lipid metabolism within the liver, resulting in an increased production of ketones (acetoacetic acid and β-hydroxybutyric acid). The condition, which usually appears in the last 30 days of pregnancy, is caused by a decreased blood glucose level due to increasing fetal demand and undernourishment. Ketosis rarely occurs in meat goats. Nevertheless, as a form of prevention, make certain that goats have clean, fresh water at all times.

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Julio E. Correa, *Extension Animal Scientist,* Associate Professor, Food and Animal Sciences, Alabama A&M University

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For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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