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on dry matter depending on two
1) physiological stage of the

animal (pregnant, lactating, growing) and (2) forage quality. Urea and other non-protein nitrogen can be utilized by the microorganism of the rumen to produce microbial protein, which is a source of nitrogen for the host animal.

Energy requirements of ruminants mostly come from the fermentation of fibrous carbohydrates in the rumen and the rest comes from starch and fats. Energy is measured by total digestible nutrients (TDN), digestible energy (DE) and net energy (NE) system. TDN accounts only for loss of energy in feces whereas net energy accounts for energy lost in feces, urine, gases, and the work of digestion. Energy is required for maintenance, growth, production and reproduction.

Vitamins are very important nutrients in the diet. All of the vitamin B complex and vitamin K are produced in the rumen, and the body manufactures vitamin C. Therefore, only vitamins A, D and E are of concern in ruminant nutrition and should be supplemented in the ration.

Minerals of major concern are calcium, phosphorus and sodium chloride (salt). It is recommended that these minerals be mixed with the concentrate mix. The calcium to phosphorus ratio in the ration should be kept at 2:1. A good mineral mix will contain equal parts of salt and dicalcium phosphate. Trace mineralized salt may be used for trace mineral supplementation at .5% of grain mix. Certain trace minerals such as copper and selenium should be supplemented not only for their nutritional contributions to the animal, but also for enhancing the immune system in goats.

Water supply is critical for livestock, either in confinements or on pasture. Clean water should be available in each pen indoors or on each paddock or pasture outdoors. The water intake of goats may vary depending on the season of the year or ambient temperature. Goats, like

Goats have a special interest in garden products and they can be effectively incorporated into their diet. Rape, kale or beets commonly are added to the diet of the animals. Under controlled feeding, these animals adapt well to by-products and surplus feeds including discarded produce. Some surplus or damaged produce like carrots, artichokes and turnips should be used with caution.

Cabbage contains goitrogens, which may interfere with thyroid hormones and should be limited to 30 percent of total dry matter intake. Beets are very palatable to goats and up to 1 kg DM per day can be consumed without any problems. Avoid feeding clippings from rhododendron or prunings from cherry, apricot or peach trees because when wilted, they may be toxic to goats. Sweetpotato forage and its mixture with grasses provide an inexpensive source of nitrogen in the diet of growing goats.

Pastures

Pasture is the lowest cost feed if grazing is permitted (Fig. 3). There is no need for harvesting, storage or feeding. However, pastures need to be limed, fertilized and clipped on a routine basis. Utilizing pastures as a major

fencing to subdivide the pasture into paddocks for rotation. For proper fencing and subdividing the pasture; please see Gay et al. (2003).

Dry Forages

Dry forages added to high concentrate diets can increase rumen buffering capacity and, therefore, optimize rumen fermentation and improve animal performance. Dry forages are hays, pelleted forages and some by-products such as straws and hulls.

Grass hay usually is of a lesser quality and feeding value than legume hay. Goats tend to eat pelleted and chopped hay more than long hay. The stage of maturity of forage cut for hay can influence its feeding quality.

Legumes (alfalfa, clover) and grass (bermuda and bahia) are good sources of hay for goats; however, endophyte infected fescue should be used with caution. Feeding better quality hay allows lowering the protein content of the grain mix fed and thus the feed cost. Factors influencing quality of hay include: 1) date of the

consumed at higher than 15-20% of the diet (McCrary, 1998).

High protein feeds are alfalfa hay, alfalfa meal or cubes, and other high protein concentrates such as oil seed by-product meals (cottonseed, peanut, soybean, etc.) that may be more economical, especially for mixed rations. Corn gluten meal has a poor balance of amino acids, whereas fishmeal and heat-treated soybean meal provide a good and beneficial source of protein. Urea is a non-protein nitrogen that is efficiently used by microorganisms of the rumen during fermentation and protein synthesis. When used correctly in goat feeds, urea can provide an excellent cost effective source of N. Urea feeding should be limited to not more than 25 percent of required protein in the ration of nursing does. Urea does not provide energy in the ration; therefore, it should be included only with adequate soluble carbohydrates. Ratio of N (nitrogen) to S (sulfur) in the diet should be monitored and maintained at 10-12:1 when feeding urea. Its use with low quality forages is not recommended unless adequate time for adaptation and other sources of readily available

20 times a day and 350 services seem to be possible in a limited breeding season.

Providing good quality hay and 2 lbs. of concentrate mix containing 14-16% protein and adequate amounts of minerals and vitamins are essential. The grain mix should contain 2000 to 3000 IU of vitamin A and 600 (IU) of vitamin D. Plenty of water and trace mineralized salt in loose form should be provided ad libitum.

Post-breeding Season

The herd sire should be removed from the herd no later than mid-January unless you are breeding year-round. You may start reducing his allowance from two to one pound of grain mix per day as early as November, depending on the animal's condition. If good quality hay is provided, the animal does not need additional supplement mix. However, if hay is of poor quality, provide one pound of grain (16% crude protein) for maintenance requirements.

Kids

The first three days after birth are the most critical days in the life of a newborn kid. You

When yearlings are bred, they can be placed with pregnant does.

Pregnant Does

Meat goats require a little more attention at least 4-6 weeks prior to the next kidding. A good pasture, hay or silage as well as .5 to1 lb. of 12% protein grain mix will be sufficient. Do not use alfalfa as a sole source of forage during this period. Alfalfa contains a high calcium-to-phosphorus ratio which is not desirable for late pregnant does. Does should be kept in good flesh but not fat during this period.

Nursing Does

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For example, if a group of kids have average

and should be gradually introduced in the goat's diet. Goats tend to eat less silage when compared to green or pelleted forages. Supplying hay with silage is advisable to reduce digestive and metabolic problems and improve intake.

Many factors can influence supplement consumption by individual animals including

states had lower serum copper than those raised in Southeastern and Midwestern states.

In some states copper levels in soil may be sufficient; however, other minerals such as molybdenum or sulfur may reduce its availability. Also soil copper levels may vary from location to location within a state. Therefore it is recommended to check your soil mineral level for copper, molybdenum and sulfur.

Copper deficiency symptoms vary depending on the severity of the condition. Symptoms may be exhibited as frequent staph lesions on the body, a thin and faded hair coat, bald tail tips, twisting and bending of the front legs, spinal cord injuries or even anemia. Generally, the immune system breaks down due to hypocupric conditions and animals become vulnerable to diseases and parasites. Although most symptoms of copper deficiency may be reversible by feeding adequate copper, other symptoms in young kids such as swayback (caused by deficient pregnant does), and spinal cord injuries are not reversible. Research on feeding high levels of copper to goats has indicated that goats are much more tolerant to high levels of copper than sheep or cattle (Solaiman et al., 2001). Feeding levels as high as 100 mg copper per day actually improved daily weight gain and immune functions in goats (Table 5, Solaiman et al., 2004), and these findings confirm previous recommendations of other producers and goat experts.

Table 5. Effect of Cu (mg) supplementation on growth performtoms in
young kids such as swayback (caused by

some, like alfalfa, are also high in molybdenum. Applying 1.5 to 3 pounds of copper per acre as organic compounds such as copper EDTA, copper lignisulfonates, or copper polyflavonoids can increase soil copper levels for a long time.

Selenium also can be deficient depending on the region of the country. The Dakotas are rich in selenium and selenium toxicity may occur; however, most other places including California and Southeast may be Se deficient. Selenium injections are used for pregnant does toward the end of the pregnancy and young kids at birth. For dosage and directions, I recommend consulting with your veterinarian. Selenium or copper can be toxic if overdosed.

References

Bransby, D., S. Solaiman, C. Shoemaker and S. Sladden. 2006. Goat production from annual ryegrass in Alabama. In: Proceedings, Annual Forage and Grassland Congress meeting.

Coleby, P. 2001. Natural Goat Care. Acres USA, Austin, Texas.

Gay, S.W., S. R. Smith and G. E. Groover. 2003. Planning fencing systems for controlled grazing.Virginia Cooperative Extension, Publication 442- 130.

McCrary, Q. 1998. Effect of feeding whole cottonseed on reproductive performance in goats. M.S. Thesis. Tuskegee University, Tuskegee, AL.

All inquiries should be addressed to:
Dr. Sandra G. Solaiman
105 Milbank Hall
Tuskegee University
Tuskegee, AL 36088
Phone: (334) 727-8401
Fax: (334) 727-8552
ssolaim@tuskegee.edu

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NRC. 2007. Nutrient Requirements of Sheep, Goats, Cervids and Camelids. National Academy Press. Washington D.C.

Solaiman, S. G., M. A. Maloney, M. A. Qureshi, G. Davis, and G. D'Andrea. 2001. Effects of high copper supplements on performance, health, plasma copper and enzymes in goats. Small Ruminant Res. 41:127-139.

Solaiman, S. G.,T. Craig Jr., G. Reddy, C. E. Shoemaker, and G. F.W. Haenlein. 2004**.** Effects of supra-nutritional Cu levels on growth, rumen fermentation and immune responses of goat kids. Pp. 136-144 in Proceedings of 22nd Workshop on Macro and Trace Elements. First volume, M. Anke, G. Flachowsky, K. Kisters, U. Schafer, H. Schenkel, M. Seifert and M. Stoeppler, eds. Friedrich Schiller Univ., Jena, Germany.

Solaiman, S. G., D. Bransby, C. Kerth, B. Blagburn, R. Noble and C. Shoemaker. 2006a. A sustainable year- round forage system for goat production in the Southern U.S. Final Report, Project # LS02-141, Southern SARE.

Solaiman, S. G, C. E. Shoemaker,W. R. Jones and C. R. Kerth. 2006b.The effect of high level of Cu on serum lipid profile and carcass characteristics in goat kids. J. Anim. Sci. 84:171-177.

George Washington Carver
Agricultural Experiment Station
Tuskegee University
Tuskegee, Alabama