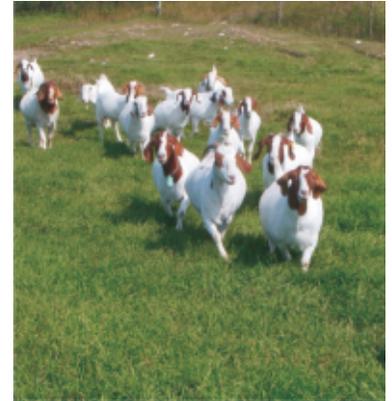


Introduction

Goats are efficient browsers and prefer eating brushy plants along with some other woody and weedy plants found on the ranges. Goats are able to digest a large variety of fibre and roughage. The nutrient requirements of goats are determined by age, sex, breed, production system (dairy or meat), body size, climate and physiological stage. Feeding strategies should be able to meet energy, protein, mineral, and vitamin needs depending on the condition of the goats. Goats do not depend on intensive feeding systems except some supplemental feeding during growth, lactation, pregnancy and winter. Of course, when goats are in lactation for an extended period of time (i.e., 10 months), they will require supplemental feeding on a higher plane of nutrition (e.g., dairy quality second cut alfalfa hay and grain ration).

Goats belong to the small ruminant group of animals and have no upper incisor or canine teeth but a dental pad instead. The rumen is the largest part of four stomach compartments with the capacity of roughly 2-6 pounds. Some bacteria and protozoa are normal habitants of the rumen which break down plant food into volatile fatty acids along with vitamins and amino acids.

The daily feed intake of goats ranges from 3-4% of body weight as expressed in pounds (dry matter/head/day). The daily feed intake is influenced by body weight, % of dry matter in the feeds eaten (12-35% in forages, 86-92% in hays and concentrates), palatability, and physiological stage of the goats (growth, pregnancy, and lactation).



Essential Nutrients

Carbohydrates

Sugars, starches (found in grains) and fibre (cellulose) are the carbohydrates that convert into volatile fatty acids (energy) by rumen flora (beneficial bacteria). Normal goat diet (browse, forbs, and grasses) is high in cellulose and requires digestion by rumen flora to be converted into energy. Fresh pastures and young plants may have highly digestible fibre and provide high energy compared to older plants. Higher energy levels come from lower fibre feeds. Energy is represented as total digestible energy (%TDN) in feed analysis reports. It is important to supply half of the goat ration in the form of hay or pasture to avoid high energy related problems. Maintain at least 12% crude fibre in the diet.

Energy requirements for different physiological stages -- maintenance, pregnancy, lactation and growth -- vary. The maintenance requirement for energy remains the same for most goats except dairy kids; they require 21% energy higher than the average. It is important to feed high-energy rations at the time of breeding, late gestation and lactation. Lactating does have the highest energy demand.

Proteins

Proteins are digested and broken down into amino acids and are eventually absorbed in the small intestine. Those amino acids are building blocks for body proteins (muscles). The rumen plays a major role in breaking down consumed protein into bacterial protein through bacterial fermentation. Feeds like forages, hays, pellets (alfalfa), barley, peas (screenings, whole, split), corn, oats, distilled grains and meals (soybean, canola, cottonseed meals) are common sources of protein for goat rationing.

The protein requirements are higher during growth (kids), milk synthesis (lactation), and mohair growth. Producers may need to supplement protein sometimes during the year, especially in late fall or winter. It is very important for a commercial goat operation to do cost-effective rationing as proteins can be an expensive feed ingredient. Good quality hay does not need much protein supplement for goats. If the hay has about 12-13% protein content then provide ½ lb of protein source in the form of corn, barley, peas or oats (with 20% protein in total). In case the hay is of average quality, add one pound of protein as supplement.

WATER

Insufficient water intake will depress a goat's performance earlier, and more severely, than any other dietary insufficiency. Adequate water is the paramount management concern. Goats should be consuming more water with high protein ration feedings. Decent water quality, not just quantity, is a must.



Nutrient Requirements of Mature Does			
Production Stage	Nutrient Requirements, dry matter basis		
	DMI, % of BW	% CP	% TDN
Maintenance	1.8 - 2.4	7	53
Early gestation	2.4 - 3.0	9 - 10	53
Late gestation	2.4 - 3.0	13 - 14	53
Lactation	2.8 - 4.6	12 - 17	53 - 66

Nutrient Requirements for Selected Groups of Growing Kids			
Production Stage	Nutrient Requirements, dry matter basis		
	DMI, % of BW	% CP	% TDN
25 kg dairy doelings and castrates, gaining 100 – 150 g/hd/day	3.3 - 3.8	12	67
25 kg boer doelings and castrates, gaining 100 – 150 g/hd/day	3 - 3.4	15 - 17	67
25 kg intact dairy males, gaining - 100 g/hd/day - 150 g/hd/day	3.2 - 3.7	10 15	67 86
25 kg intact boer males, gaining 100 – 150 g/hd/day	3.3 - 3.7	15	67

Adapted from Nutrient Requirements of Small Ruminants. National Research Council, 2007. Actual requirements will vary depending on breed, productivity and environment. DMI—dry matter intake, BW—body weight, CP—crude protein, TDN—total digestible nutrients.

Minerals and Vitamins

Goats need certain minerals and vitamins for their maintenance as well as proper functioning of their physiological systems. Feeding of fat soluble vitamins (A, D, E, K) must be insured in a goat's diet due to its inability to make these vitamins. Rumen flora can make vitamin B in enough quantities needed for goat metabolism. Vitamin C is essential for the immune system to work efficiently.

Minerals can be classified as macro and micro minerals. Calcium, phosphorus, magnesium, sodium, potassium, sulfur and chlorides are a few of the macrominerals needed in a goat's diet. Microminerals usually supplemented in goat rations are iron, copper, cobalt, manganese, zinc, iodine, selenium, molybdenum, and others. Feed tags report microminerals as parts per million (ppm) and macrominerals on a percentage basis.

Feeding of calcium and phosphorus (2:1 ratio) is recommended for better structural and bone strength, while other minerals are necessary for other systems like nervous and reproductive. Minerals should be added into the feed keeping in mind the quality of forages as some forages can be high in some of the minerals and low in others. Free choice supply of loose minerals and salts always works well. If the supplied minerals include enough salts then the producer should be careful in providing separate free choice salt.

It is important to feed enough copper (10-80 ppm) to goats as they have a tendency to be copper deficient. High levels of molybdenum in a goat's diet can easily offset the copper levels in the body. Goats are not sensitive to copper, whereas in sheep even 20 ppm of copper can be very toxic. Selenium (0.1-3 ppm) is another mineral required for goats. Most of the soils in Manitoba are deficient in selenium, and forages from those soils may need selenium supplementation in the form of mineral supplements.

Fats

Fats can also be a source of energy for goats. Goats do consume some amount of fats while browsing. Excess energy produced by carbohydrates is stored in the form of fat especially around internal organs. The stored fat in the body is used during high energy needs, especially the lactation period. Supplying fats may not be a cost-effective idea for goat production.

Acceptable Quantity of Macro and Microminerals in a Goat's Diet

Macrominerals (%)		Macrominerals (ppm)	
Calcium (Ca)	0.3-0.8	Iron (Fe)	50-1000
Phosphorus (P)	0.25-0.4	Copper (Cu)	10-80
Sodium (Na)	0.2	Cobalt (Co)	0.1-10
Potassium (K)	0.8-2.0	Zinc (Zn)	40-500
Chloride (Cl)	0.2	Manganese (Mn)	0.1-3
Sulfur (S)	0.2-0.32	Selenium (Se)	0.1-3
Magnesium (Mg)	0.18-0.4	Molybdenum (Mo)	0.1-3
		Iodine (I)	0.5-50

Source: "Introduction to Goat Nutrition", Steve Hart, Langston University.

Rotational Grazing

Rotational grazing by goats is best accomplished by dividing (fencing) the farm or ranch into a number of smaller pastures and thereafter controlling goat movement to/from these lesser units across time. Stocking density refers to the number of goats per pasture and is usually expressed as number of mature goats/acre. Stocking densities may be adjusted to reflect herd characteristics (age, size, lactation status, etc.), but, in any case, for a given pasture size, the greater the stocking density, the shorter the grazing duration required to defoliate the forage down to the proper stubble height (which varies by major types of plants being grazed).

For extensively managed rotation schemes (usually larger acreages, more arid environments, with many species of browse plants), the stocking rate can vary widely; 1 mature goat /2-5 acres are typical. The duration of grazing each pasture is primarily dependent on the grazing density chosen; 6 to 12 week periods are commonly used. The frequency (timing) of grazing pastures can be adjusted to "rest" them for various intervals so as to allow sufficient time for proper recovery of the forage plants. For intensively managed rotation schemes (usually found on relatively small operations in humid areas) stocking rates may average 2-3 mature goats/acre/grazing season. Grazing durations of 5-7 days may be used in conjunction with stocking rates ranging from 10 to 50 goats/acre. Note that grazing frequencies should be chosen to promote the necessary regeneration of plant root reserves.



Nutrition for Newborns (Kids)

It is crucial that kids nurse their mothers (does) in the first 8 hours of their life to consume colostrum at a minimum rate of 10-20% of their body weight, preferably within 2-3 hours after birth. Colostrum contains vitamins and antibodies that will save kids from many diseases including enterotoxaemia and tetanus. Kids born as twins and triplets may need supplementation of colostrum fostered from other high-producing does and even cows. Extra colostrum from high producing does with dead kids can be stored in the freezer. It is not recommended to thaw frozen colostrum in a microwave or on high heat as this would possibly denature the nutrients. Thawing at room temperature is all it takes.



Replacement kids should stay with their milking mothers for as long a period as possible. Early weaning of replacement kids can leave them undernourished and will have a detrimental effect on their production potential.



Nutritional Health Problems

Pregnancy Toxemia (Ketosis or Twins disease)

Does with a body condition score of 4 carrying twins or triplets need high energy diets during their last trimester to cover the needs of the fetuses. Malnutrition during the last weeks of pregnancy leads to the breakdown of body fat reserves that secrete ketones. Due to lack of energy the glucose concentration in the brain decreases and nervous signs appear. At this stage the doe seldom survives. Autolysis of dead fetuses produces toxins causing whole body toxemia of the doe and eventually death. Treatment is usually unsuccessful. Intravenous injection of 5% Dextrose can be helpful in the early stages. However proper feeding of does during pregnancy can prevent pregnancy toxemia.

Urinary Calculi

Excessive feeding of grain to males, particularly castrated males, can block the urinary tracts with calcium phosphate calculi. The calcium phosphate ratio in a goat's diet should be at 1:1 or 2:1.

Acidosis, Enterotoxemia and Founder

A sudden increase or excessive feeding of grains can also cause a few more problems to the doe. Lactic acid content of the rumen can increase at toxic levels (*acidosis*) due to feeding of starches that exceed need. Acidosis can cause vasoconstriction of blood vessels around hooves (*Founder*).

High levels of starches in the diet also speed up the bacterial growth in the intestines (*Enterotoxemia*). The rapid bacterial growth means more endotoxin production and death occurs quickly. This usually happens with rapidly growing kids. Vaccination can prevent this disease.

Polioencephalomalacia is another disease caused by high levels of grain feeding accompanied by stress. Thiamine deficiency is the main cause of this problem.

Additional Resources

Langston University Goat Research website: www2.luresext.edu/goats/index.htm

MAFRI Goat web page: www.gov.mb.ca/agriculture/livestock

Merck Veterinary Manual: www.merchvetmanual.com

North, Robert & John Seaman. Goat Health (Prime facts):

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