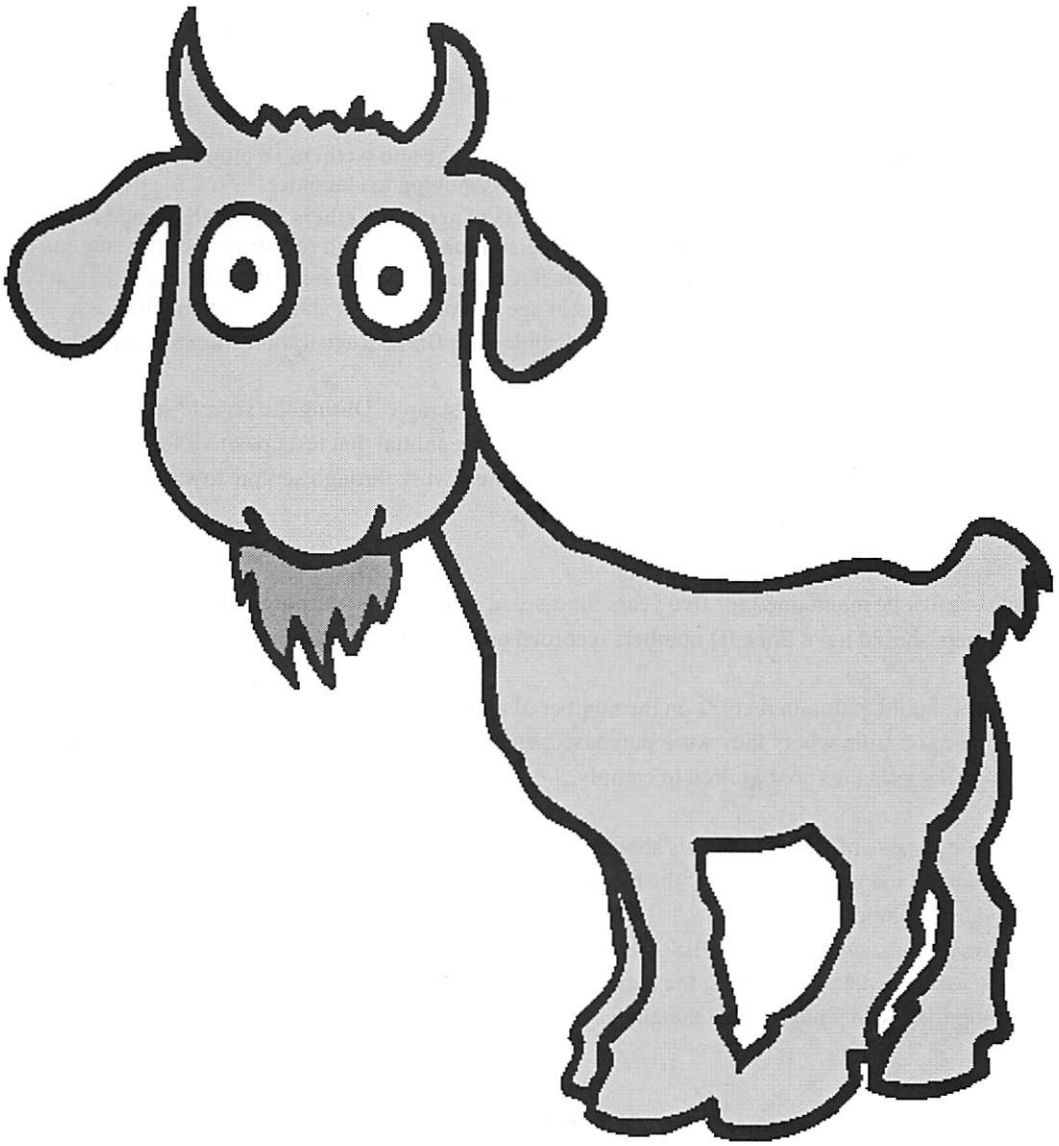
Got Goats?

A Day Discussing Goats and Goat Health

Signe G. Balch, DVM, DPhil
presented by Bijou Goatkeepers • Black Forest, CO • February 22, 2014



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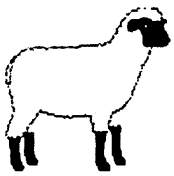
Colorado Department of Agriculture Fact Sheet

Scrapie Surveillance: Tagging Sheep and Goats

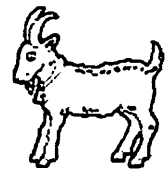
In an effort to eradicate scrapie in the United States, USDA requires sheep and goats to have flock identification ear tags that list their flock of origin. Enforcement of these rules are now in effect as the tags are readily available to producers.



Animals required to have flock ID tags:

Sheep

- All sheep sexually intact regardless of age and wethers 18 months of age and older upon change of ownership or cull animals 18 mo. or older moving to slaughter.
- All sheep sexually intact regardless of age and wethers 18months of age and older for show or exhibition.
- All breeding sheep regardless of age



Goats

- All goats sexually intact regardless of age and wethers 18 months of age and older upon change of ownership or cull animals moving to slaughter.
- All goats sexually intact regardless of age and wethers 18 months of age and older for show or exhibition and do not have a registration tattoo with registration or the tattoo is illegible.
- Due to scrapie found in goats in Colorado, all commercial goats sexually intact regardless of age and wethers 18 months of age and older not in slaughter channels.

**Registered meat and dairy goats may use tattoos that are legible with Breed Registration Numbers until they are sent to slaughter when a flock ID tag will be required.

Cull breeding sheep and goats destined for slaughter will be tested for scrapie. During the scrapie surveillance program, the ID tags will be collected to accompany the test sample and used to trace an animal that tests positive for scrapie back to its infected flock. Flocks/herds will be counseled individually to help owners work through scrapie toward eradication. All exposed goats are at risk. All exposed genetically susceptible sheep are at risk.

Keeping Records

Records on purchases must be maintained for five years for disease investigation purposes. When selling sheep and goats at the livestock market, owners should have flock ID numbers recorded on the market check-in document.

Buyers

Sheep and goat buyers should maintain records on the number of animals acquired; the date of acquisition; the name, address and phone number of the person from whom they were purchased; and their flock of origin ID numbers. Livestock barns tagging sheep and goats with their flock ID tags are required to comply.

Sellers

Individuals who sell or dispose of sheep and goats should maintain records of the number of animals sold and disposed; the date of sale; the name, address and phone number of the buyer or person who acquired the animals; and the flocks of origin ID numbers and their individual numbers.

To obtain tags, owners must contact the APHIS Area Veterinary Services at (303) 231-5385 for a flock identification number. APHIS will also assist owners in ordering the tags, which are provided at no cost. Sale barns will also be assigned a flock ID number and will be supplied with white or blue metal tags to identify sheep.

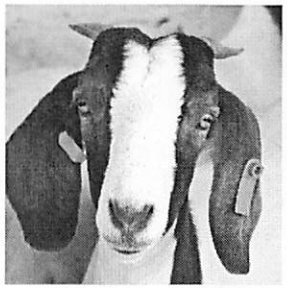
Contacts:

Animal Industry
Colorado Department of Agriculture
(303) 239-4161

U.S. Department of Agriculture
APHIS Area Veterinary Services
(303) 231-5385

Updated 1/14/09

Is official ID needed when leaving the farm?



12 MONTHS AND OLDER

ALL ANIMALS NEED ID when they leave the farm for any reason.

YOUNGER THAN 12 MONTHS

MOST NEED ID unless they are neutered or are going directly to a slaughter establishment.

A livestock market, auction, or private home or farm is NOT a slaughter establishment.

DO NOT

Use your flock tags on another person's animals

Receive animals without official identification

IF IN DOUBT, USE ID!

FOR FREE IDENTIFICATION TAGS:

Call 1-866-USDA-TAG (1-866-873-2824)

FOR MORE WISCONSIN IMPORT INFORMATION:

Wisconsin Department of Agriculture,
Trade & Consumer Protection
animalmovement.datcp.wi.gov.
608-224-4874

ADMINISTRATIVE CODE:

- legis.wisconsin.gov/rsb/code/atcp/atcp010.pdf

ADDITIONAL ONLINE RESOURCES ON SHEEP AND GOAT DISEASES:

Scrapie

- eradicatescrapie.org
- aphis.usda.gov/animal_health/index.shtml
- sheepindustrynews.com/scrapie_guide

Johne's disease

- johnes.org
- johnesdisease.org

Other sites for information

- sheepandgoat.com
- sheepusa.org

Wisconsin Department of Agriculture,
Trade & Consumer Protection
Division of Animal Health
datcp.wi.gov

USDA

United States Department of Agriculture
Animal & Plant Health Inspection Service:
Safeguarding American Agriculture

This material was made possible, in part, by a cooperative agreement from the United States Department of Agriculture's Animal & Plant Health Inspection Service (APHIS). It may not necessarily express APHIS' view.

DAH-068.indd (9/2012)

Official Individual Identification Requirements

for Sheep and Goats in Wisconsin

Wisconsin Department of Agriculture, Trade & Consumer Protection

Why is official individual identification important?

There are three primary reasons that official individual identification (ID) should be maintained.

1. In most cases, such identification is required by Wisconsin state law to move sheep and goats from the source farm.
2. Identification and maintaining records for at least five years is an essential component in keeping a flock/herd and premises safe from disease.
3. Successful disease control instills confidence in consumers about Wisconsin sheep and goats and the products they generate.

Official identification of animals allows for rapid identification of animals and premises exposed to diseases such as scrapie and tuberculosis to minimize negative effects of disease on individual animals, flocks/herds, and producers.

When do Wisconsin sheep and goats need official identification?

All sheep and goats in Wisconsin need official identification when they are being moved to or from your farm and are 12 months of age or older. This includes, but is not limited to, movement to markets, fairs, other farms, exhibitions, and even transport to veterinary clinics and other states.

Sheep or goats younger than 12 months require identification when they are being moved to or from your farm, unless they are neutered or going *directly* to a slaughter establishment.

What if I bring sheep or goats into Wisconsin from another state?

All sheep and goats brought into Wisconsin require official identification. They must also have a valid certificate of veterinary inspection unless they are going directly to slaughter. Contact DATCP for any additional requirements. Visit our website at animalmovement.datcp.wi.gov.

Only ONE of the following official forms of identification is required.

Ear Tags (official ear tags have U.S. shield)

- Metal or plastic scrapie ear tag with flock ID and management number

- Metal or plastic "serial" ear tag that has numbers and letters

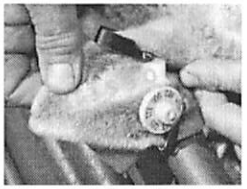
- For sale to slaughter, a blue metal or plastic ear tag that has numbers and one of the following statements "SLAUGHTER ONLY" or "MEAT" is acceptable, but not required

Official USDA RFID Tag

- 15 digit number beginning with "840"

Legible Tattoos

Breed association or registration tattoo with management number accompanied by registration papers in owner's name



OR

Flock ID along with a unique management number

USDA Approved Implanted Microchips

Accompanied by electronic reader AND one of the following:

- Registration papers in owner's name

OR

- Certificate of veterinary inspection with implant number

What if I send sheep or goats out of Wisconsin to another state?

All sheep and goats moving *out* of Wisconsin must be identified as required for movement *in* Wisconsin. Additionally, the USDA requires a certificate of veterinary inspection for sheep and goats not moving in slaughter channels. Contact the destination state for any additional requirements. Visit our website at animalmovement.datcp.wi.gov.

What is not considered to be official individual identification?

The following are **NOT** considered official individual identification:

- Farm management ID tags that do not include flock ID
- Animal names

PENNSTATE

Dairy Goat Nutrition: Feeding for Two

(How to properly feed the goat and her rumen)

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Department of Veterinary Science
Penn State University

Introduction

Feed costs account for more than 55% of dairy goat production costs. As a result, many producers have become engrossed in reducing costs to feed a goat per day rather than optimizing their feeding efficiency. *The cheapest ration is not usually the most production-efficient ration.* This statement may sound like a contradiction, but relates to the understanding of how the goat and her rumen interact from a nutrient requirement perspective. The dairy goat, like other ruminant animals including the cow and sheep, has a unique digestive tract that allows the animal to consume and utilize fibrous foods which otherwise would be unavailable to nonruminant animals. This ability is the result of a symbiotic (i.e., mutually beneficial) relationship between the goat and billions of microorganisms that inhabit the rumen or pregastric compartment. Bacteria and protozoa that inhabit the rumen have the capability to ferment material, which would be indigestible to the goat alone, and produce end products used to produce high quality products such as meat, milk and mohair. Dairy goat producers need to take full advantage of this goat-rumen interrelationship in order to produce milk most efficiently. In addition, feeding both the goat and rumen properly will result in a healthier animal overall. If you are not taking advantage of the rumen, then you might as well be feeding pigs! The focus of this presentation is to acquaint you with a conceptual approach to nutrient requirements of the dairy goat and her rumen and how they are appropriately met in an effort to produce milk as efficiently as possible.

Applied Rumen Anatomy

The rumen is actually only one chamber of a complex, bacterial fermentation system located before the true digestive stomach compartment. This is in contrast to the bacterial fermentation system located after the stomach as found in horses. Bacterial fermentation is a digestive process where bacteria living in the digestive tract partially breakdown complex dietary ingredients to produce end products, which can be used by the host animal to meet its nutrient needs. We may be more familiar with bacterial fermentation as the process by which beer and wine are produced. In addition to fermentation end products, the host animal obtains most of its dietary protein needs from the digestion of bacteria growing in its digestive tract. This bacterial digestion occurs only in ruminant animals since the fermentation process comes before the stomach.

The reticulum is a smaller fermentation compartment, in front of and intimately associated with the ruminal compartment. The reticulum is primarily responsible for assisting in rumination contractions and distributing feed within the reticulo-rumen. The rumen is the primary fermentation vat, being between 5 to 10 gallons in volume in a mature goat. Muscular contractions aid in the constant mixing of feed materials with bacteria laden fluids to promote fermentation and in regurgitation of feed materials, which results in particle size reduction from chewing and copious amounts of saliva production. Bicarbonate in saliva is primarily responsible for maintaining only a slightly acid pH in the rumen, given the tremendous amount of acids being produced during fermentation. Also as a result of the continuous fermentation process, rumen temperature is slightly greater than the goat's and can contribute to helping maintain normal body temperature during cold weather or making the goat more uncomfortable during hot weather. The rumen has a specialized lining that contains many finger-like projections called papillae, which absorb end products of fermentation, volatile fatty acids (VFAs). These VFAs, namely acetate, propionate, and butyrate, are available to the goat to be used for production of glucose (propionate), fat (acetate, butyrate) or oxidized for energy. This rumen lining can be easily damaged by severe or prolonged declines in rumen pH, a result of excessive grain or insufficient fiber feeding.

When the rumen is appropriately fed, it will contain a small gas cap, middle fibrous mat layer, and a lower liquid layer. The gas cap consists of carbon dioxide and methane, both end products of fermentation and prevent exposure of bacteria to oxygen. The fibrous mat layer is composed of long dietary fiber material that helps stimulate rumination and ruminal contractions. Dietary fiber of sufficient length (> 1 inch) to form the mat layer is termed effective fiber. The tremendous number of bacteria found in the rumen are distributed within the fibrous mat and liquid layers. Besides the type of raw material the microorganism requires for metabolism, reproductive rate also determines where the organism will be found in the rumen. Bacteria and protozoa that do not reproduce quickly in relation to rate of passage through the rumen must attach to fibrous material if they are to remain in the rumen. When effective fiber is not adequately provided, these microorganisms will be wiped out of the rumen and will result in abnormal fermentations and potentially digestive upsets and off-feed situations.

The third ruminal chamber is the omasum, which is approximately the size of a volleyball and located on the right side of the goat. The omasum is responsible for regulating particle passage rate from the rumen and water absorption from ingesta. Under normal rumen conditions, particles greater than 2 mm in size do not leave the rumen. Very little other information is known about this organ. When large fiber particles or whole corn kernels are found in the manure, this is a good indication of improper rumen function and should be evaluated. The abomasum, or fourth rumen chamber, is similar to our own stomach. Digestive enzymes and hydrochloric acid are secreted which initiate breakdown of complex proteins and starches for further digestion in the small intestine.

Rumen Microbiology

Over 150 different species of microorganisms have been identified in the rumen. These organisms range from bacteria, the most abundant, to protozoa, fungi, and viruses. Although there is a wide variety of bacteria found in the rumen, they can be loosely grouped into five major categories (Table 1). A basic understanding of nutrient and environmental requirements of these different microbial groups is necessary to fully appreciate how feeding programs may impact on rumen health. Substrates, nutrient requirements, fermentation end products, and pH tolerance are shown for these different microbial groups (Table 1). One important concept to glean from this table is the observation that fiber fermentation (i.e., the bacterial breakdown of plant cell wall) occurs only at higher pH levels.

A healthy rumen is one that has a balanced interaction between all the special groups of bacteria. In abnormal rumen environments, usually one group of bacteria has overwhelmed all other groups and dominates fermentation activity. For example, rumen acidosis is the result of feeding too much grain (sugars and starches), which allows the starch digesters to overwhelm the rumen environment and eliminate fiber fermentation. Reduced dietary amounts of either effective or total fiber reduces rumination activity and salivary buffering resulting in acidic conditions impeding fiber fermentation. In addition, with loss of the rumen mat, fiber fermenting bacteria will be washed out of the rumen. This is the crux of the problem in dairy goat feeding, providing sufficient grain to support milk production without excessive amounts which suppress fiber fermentation, milk fat test, and rumen activity.

Nutrient Requirements: Goat and Rumen

All living organisms require essential nutrients to support their metabolic processes, which keeps them alive. General classification of required nutrients include: water, the most essential, energy, protein, minerals, and vitamins. Minerals can be further subdivided into macrominerals and microminerals based on the daily amounts required. Vitamins are separated into fat or water soluble sources. Daily amounts of these essential nutrients required are based on the physiologic state of the doe (e.g., maintenance, growth, lactation, pregnancy) and environmental conditions. Bacteria have similar requirements for maintenance and growth (i.e., reproduction).

Table 1. Characteristics of the different categories of microorganisms found in an anaerobic fermentation system.[1]

Class of Organism	Primary Substrate	Specific Requirements	Primary Endproduct	pH Tolerance
Fiber Fermenting Bacteria	Cellulose, Hemicellulose, Pectins	Ammonia Iso-acids Cofactors	Acetate Succinate Formate, CO_2	Neutral 6.2-6.8
General Purpose Bacteria	Cellulose Starch	Ammonia Amino Acids	Propionate, Succinate, Butyrate Ammonia	Acid 5.5-6.6
Nonstructural CHO Bacteria	Starch Sugars	Amino Acids Ammonia	Propionate Lactate Butyrate Ammonia	Acid 5.0-6.6
Secondary Feeders	Succinate, Lactate Fermentation Endproducts	Amino Acids	Ammonia Iso-acids Propionate	Neutral 6.2-6.8
Protozoa	Sugars, Starch Bacteria	Amino Acids	Acetate Propionate Ammonia	Neutral 6.2-6.8
Methane Producing Bacteria	CO_2, H_2 Formate	Coenzyme M Ammonia	Methane	Neutral 6.2-6.8

[1]Adapted from Chase, L.E. and C.J. Sniffen, Cornell University.

Differences between the dairy goat and microbes are seen in where they derive their nutrients (Table 2). The dairy goat derives a majority of her energy and protein from microbial end products or the microbes themselves. Bacteria contain approximately 60% protein, which is of high quality and digestibility. In other words, the more we make the bugs grow in the rumen system, the less additional more expensive feedstuffs we need to provide the doe. Microbial protein production alone can support up to 50 lbs of milk production in the dairy cow. The first goal of a dairy goat feeding program should be to maximize microbial protein production and then secondly, meet additional nutrient requirements over-and-above those not met by microbial fermentation end products. This type of feeding approach would theoretically be the most economical and efficient.

Bacteria require a number of essential nutrients for the synthesis of protein, similar to that of the doe. However unlike the doe, bacteria can use a greater variety of potential nitrogen sources to synthesize amino acids, the building blocks of proteins. In addition, bacteria can synthesize both essential and nonessential amino acids unlike the doe, which needs to be supplied with preformed essential amino acids. Figure 1 presents an overview of the processes required to synthesize microbial protein.

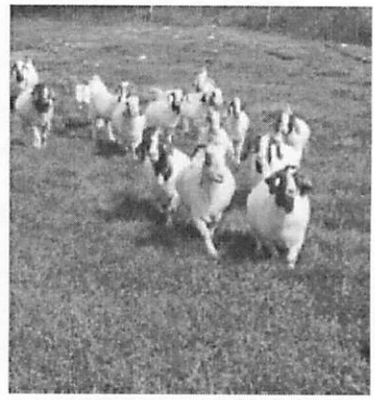
Microbial protein production is a function of dietary ingredients, which can be broken down (i.e., degraded or fermented) in the rumen by the microbes. If any of the required building blocks are in limited supply, microbial protein production will be determined by the availability of the most limiting substrate. In many goat rations based on low quality forages, energy (ATP) and protein are in limited supply. Ammonia (NH_3) may be provided from nonprotein nitrogen sources, amino acids, peptides, or proteins where utilization of a nitrogen source is dependent upon the specific population of bacteria. For example, fiber fermenting bacteria can only use NH_3 as their nitrogen source. Energy production (generation of ATP) will be dependent Table 2. Substances that supply essential nutrient needs for the dairy goat and rumen microbial population.

NUTRIENT	GOAT	BACTERIA
Energy	VFA's Glucose	Complex Carbohydrates Sugars, Starches, Amino Acids
Protein	Amino Acids Microbial Protein	Ammonia, Amino Acids, Peptides
Minerals	Dietary	Dietary
Vitamins	Dietary Bacterial	Dietary Synthesized

Manitoba GOAT Association

GOATS AND THEIR NUTRITION

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 concetrates), 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

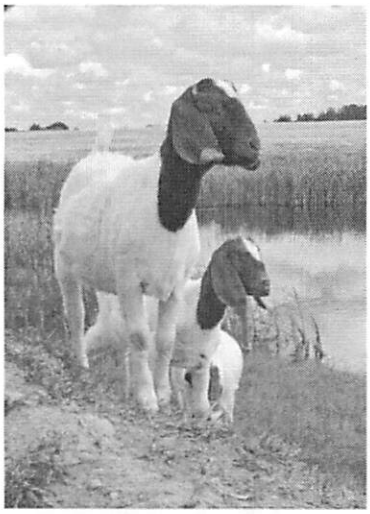
Proteins are digested and broken down into amino acids and are eventually absorbed in the small intestine. Those amino acids are building blocks for body proteins (muscles). The rumen plays a major role in breaking down consumed protein into bacterial protein through bacterial fermentation. Feeds like 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.

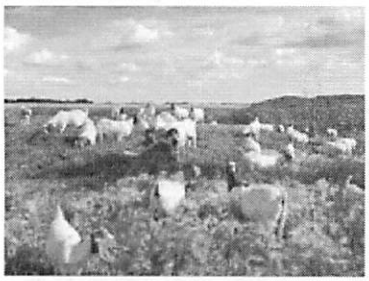
The protein requirements are higher during growth (kids), milk synthesis (lactation), and mohair growth. Producers may need to supplement protein sometimes during the year, especially in late fall or winter. It is very important for a commercial goat operation to do cost-effective rationing as proteins 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.

Manitoba GOAT Association

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.

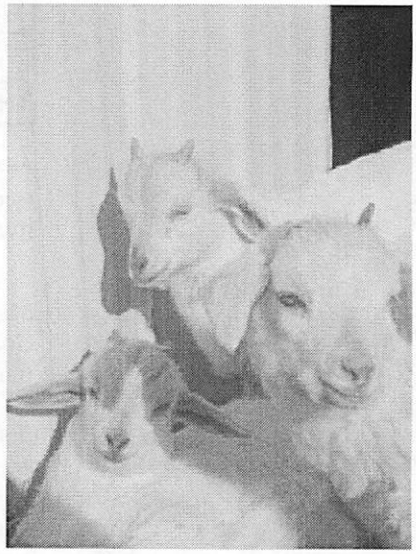
Acceptable Quantity of Macro and Microminerals in a Goat's Diet

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.

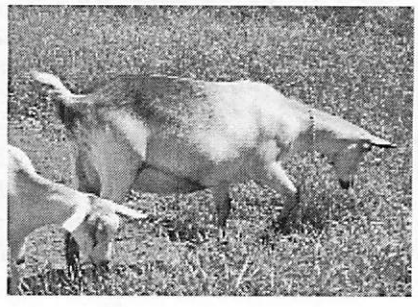
Rotational Grazing

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.

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Manitoba

COVERING NEW GROUND
MANITOBA AGRICULTURAL SUSTAINABILITY INITIATIVE

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.

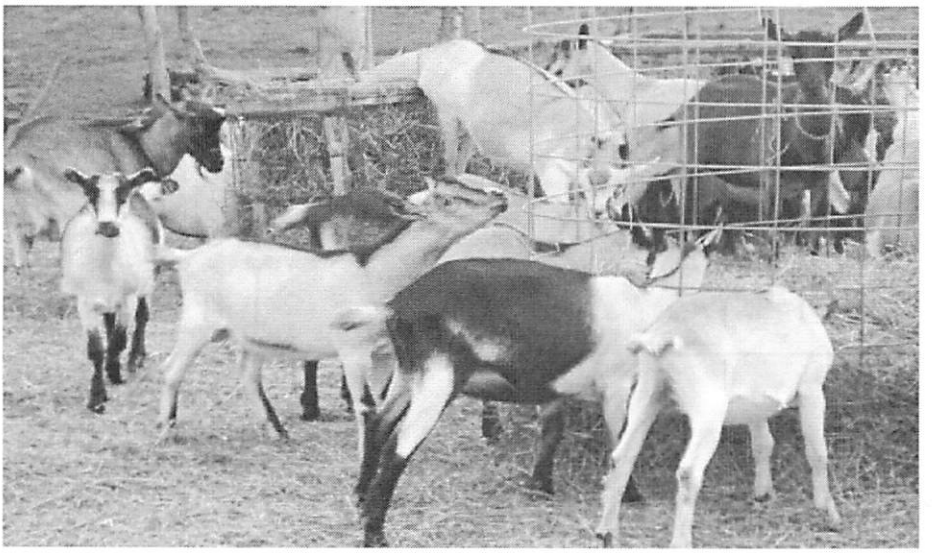
Acidosis, Enterotoxemia and Founder
A sudden increase or excessive feeding of grains can also cause a few more problems to the doe. Lactic acid content of the rumen can increase at toxic levels (***acidosis***) due to feeding of starches that exceed need. Acidosis can cause vasoconstriction of blood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

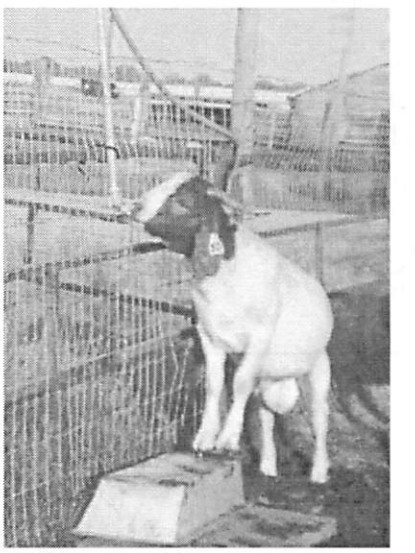
High levels of starches in the diet also speed up the bacterial growth in the intestines (***Enterotoxemia***). The rapid bacterial growth means more endotoxin production and death occurs quickly. This usually happens with rapidly growing kids. Vaccination can prevent this disease.

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): www.dpi.nsw.gov.au/primefacts





Body Condition Scoring of Goats

Body condition scoring (BCS) is a quick, easy method of describing how thin or fat goats are, using a numerical score from 1 to 5. A goat may be given a half score, such as 2.5, if it is between BCS 2 and BCS 3. Assigning a BCS cannot be done by looking at the goat, one must feel for muscle and fat cover. An appropriate BCS range for goats is from BCS 2 to BCS 4, as seen on the reverse side. Goats that are too thin (BCS 1) may have nutritional or health problems reducing productivity. Overly fat goats (BCS 5) have reduced fertility, increased birthing problems, and health problems.

BCS is commonly assessed in the loin area. Feel the amount of tissue covering the ends of the spinous and transverse processes of the vertebrae. Feel any loin muscle and fat filling the space between the backbone and horizontal bones. In very thin goats the bones can feel "sharp." As the animal gains condition, the thicker tissue covering makes the bone ends feel more rounded and smooth.

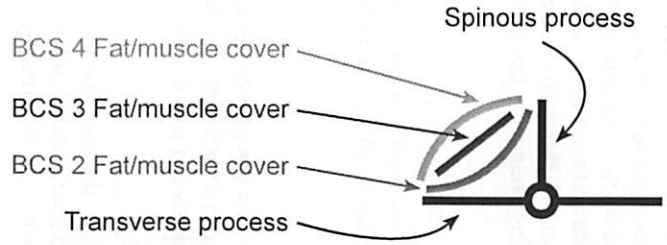
Recommendations

Does

- BCS between 2.5 to 3.5 at breeding
- BCS of 3 to 3.5 prior to wintering and prior to kidding (Does may drop 0.5 or more in BCS during lactation, regaining condition after weaning with sufficient nutrition.)

Bucks

- BCS 3 to 3.5 prior to the breeding season



http://www2.luresext.edu/goats/research/bcshowto.html

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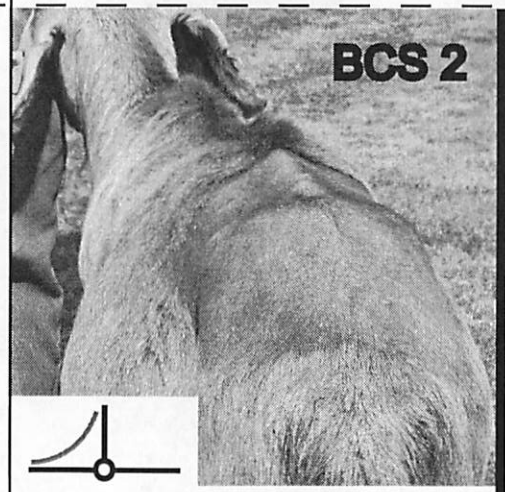
Fold on dotted line to make front/back BCS scorecard.



BCS 2 - Spinous process is felt as a ridge. A depression is felt between the spinous and transverse processes. Little muscle and fat can be felt. If bone ends are sharp and individual vertebrae felt, the BCS is 1.

BCS 3 - Spinous process does not feel like a ridge, but smooth with small ripples indicating the bones. Area between spinous and transverse processes is filled with muscle and fat cover and felt as a straight or slightly bowed out slope.

BCS 4 - Spinous process feels smooth but not buried in tissue. Individual bones are difficult to feel. Area between the spinous and transverse processes feels full and rounded. If bones are buried in tissue and not felt, the BCS is 5.

Colorado State University

Hay Forage Analysis

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Integrated Livestock Management

What Is a Hay Forage Analysis?

Hay Forage Analysis provides the nutrient content of the hay that you are feeding to your animals.

- **Forage Nutrient Content Varies Between**
  - Seasons
  - Geographic Locations
  - Cuttings
  - Storage Conditions.

By knowing the nutrient content of the hay, you can better manage the nutrition of your animals for better health and productivity

Why Should I Perform a Hay Forage Analysis?

Nutrient requirements of livestock vary with age, use, season, and production status. Forages generally make up the primary feed for most livestock.

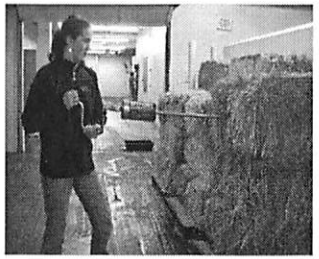
- Knowing the **ENERGY** and **PROTEIN** content of forages is important to provide optimum nutrition for your animals.
- Forage analysis can determine **MINERAL LEVELS** in the forages.
- **Different areas of the country** have different availability of minerals in the soil and thus result in forages that may or may not meet the requirements of the animal for specific minerals.
- Knowing the nutrient content of your forages, allows you to better **tailor additional supplements** to meet the needs of your animals

How Do I Collect Hay for Forage Analysis

The most important aspect of collecting a hay sample for forage analysis is obtaining a representative sample of the entire lot of hay. This means randomly sampling several bales and obtaining a representative sample from each bale. While it is possible to simply grab some hay from several bales, this often results in a composite sample that is not representative of the hay because of over representing stems versus leaves. This is particularly true with alfalfa or alfalfa-mix hays. In addition, hand grab samples tend to collect forage from the exterior of the bale where the nutrient content of the forage may be affected by exposure to the environment.

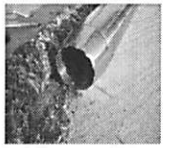
Core Hay Samples

Core Samples are the preferred method of sampling hay for forage nutrient analysis. Quality hay core probes are made of a sturdy metal tube with a sharpened or serrated end to cut through the hay when obtaining the core. The length of the probe should be at least 14 inches and 18 to 24 inches is preferred. The probe diameter should be between 3/8 and 3/4 inches. This will provide about ½ pound of hay from 20 samples. The purpose is to collect a representative sample of stems and leaves.



Obtaining A Core Hay Sample For Analysis

- Sample each "lot" or cutting of hay separately.
- Obtain core samples from at least **20 bales** selected at **random** throughout the entire lot. If there are less than 20 bales, take multiple cores from all of the bales until you have 20 core samples.
- Collect core samples from the side of the bale that is most resistant to puncture.
  - **Square Bales:** Sample from the small ends.
  - **Round Bales:** Sample from the side.
- Drive the entire probe into each bale.
- Empty the core chamber into the collection canister (multi-bore probes) or into your collection bag (single-bore probes) between each bale.
- Collect the sample into a **1 Quart Ziploc Bag**.
- Squeeze out the air and seal the bag.
- **Label** the bag accordingly.
- Send the sample to the lab the same day as collection or as soon as possible.



StarQualitySamplers.com

Where Can I Get a Forage Sample Probe?

Hay core probes are available from multiple sources. Information on several quality hay core probes is available at the **National Forage Testing Association.**

http://www.foragetesting.org

- **Colorado Hay Probe:** Nasco - http://www.enasco.com
- **Penn State Forage Sampler:** Nasco - http://www.enasco.com
- **AMS Hay & Forage Probe:** http://www.ams-samplers.com/
- **Best Harvest Hay Sampler Probe:** http://bestharveststore.com/11.html
- **Star Forage Sampler:** http://www.starqualitysamplers.com/forage.php
- **Hart Forage Sampler:** Hart Machine Company, 1216 SW Hart St, Madras, OR 97741, 541-475-3107

Where Do I Send Hay for Forage Analysis

There are many laboratories across the country that perform forage nutrient analysis. The first way to ensure a quality analysis is to utilize a laboratory that is certified by The National Forage Testing Association (NFTA, http://www.foragetesting.org/). Certification means that this laboratory meats specific quality testing standards and demonstrates proficiency and accuracy for reporting percent dry matter, crude protein, acid detergent fiber, and neutral detergent fiber. A list of certified labs can be obtained from the NFTA web site.

Wet Chemistry or NIR Analysis?

There are two general methods typically used for forage nutrient analysis, **Near Infrared Reflectance Spectroscopy (NIR or NIRS)**, and **Wet Chemistry**. While NIR analysis is less expensive, this method is not considered as accurate as wet chemistry. NIR may be suitable for determining basic nutrient analysis including DM, CP, ADF, and NDF. It is often not suitable for accurate determination of mineral levels in feeds

What Do the Forage Analysis Results Mean?

- **Percent Dry Matter (DM):** The percent of the forage that is not water. For hay, this is typically around 87-95%. Feeds with a lower DM require higher as fed intake to deliver the same amount of nutrients.
- **Crude Protein (CP):** An estimate of the protein content based on total nitrogen of the feed and reported as a percentage. A normal range in hay is 6 to 20% on a DM basis.
- **Neutral Detergent Fiber (NDF):** Measure of the fiber in the feed consisting of hemicelluloses, cellulose, and lignin. These are the carbohydrates that make up the cell wall and structure of the plant material. NDF predicts voluntary intake. As NDF increases, there is more fiber to the forage which takes longer to digest and thus decreases voluntary intake. A normal range in hay is 30 to 60% on a DM basis.
- **Acid Detergent Fiber (ADF):** A measure of the cellulose and lignin and leaves out the more digestible hemicelluloses. ADF is a predictor of digestibility of the hay. As ADF increases, digestibility decreases. A normal range in hay is 25 to 45% on a DM basis.
- **Relative Feed Value (RFV):** A calculated ranking of the feed based on digestibility (ADF) and intake (NDF). The higher the RFV, the better the forage. RFV is primarily used for evaluating alfalfa hay for dairy cattle. It will routinely give a low value for grass hays and does not accurately reflect their feed value. This is because grass hays tend to have a higher NDF (limits total feed intake) than alfalfa but at the same time, they have a lower lignin concentration and thus their fiber is more digestible. What this does in the RFV calculation is under estimate feed intake and energy value of grass hay, thus under estimating the RFV relative to alfalfa hay.
- **Nonstructural Carbohydrates (NSC):** The easily digestible carbohydrates in the plant including starches and sugars. This is the primary carbohydrate energy source of the feed.
- **Crude Fat:** The amount of fat and other ether soluble components of the forage. Fat provides about 2.25 times as much energy per gram compared to carbohydrates and protein. However, high fat content (>5%) in the total diet can adversely affect forestomach function.
- **Total Digestible Nutrients (TDN):** TDN provides an overall estimate of the available energy density of the feed. It is the sum of the digestible protein, digestible NSC, digestible NDF, and 2.25 times the digestible fat.
- **Minerals:** Minerals are critical for the structure and function of tissues in the body. Too little (deficiency) or too much (toxicity) of these minerals can result in poor growth, poor production, or clinical disease. Mineral content of feed can vary greatly with geographic area. It is good to evaluate some of the important minerals in a feed sample to help select an appropriate supplementation to match with the hay that you are feeding

Veterinary Teaching Hospital
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PENNSTATE

Common Nutritional and Metabolic Diseases of Goats

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Introduction

Goats, like any other living animal, must consume feed containing essential nutrients to support body functions (maintenance and activity) as well as various productive functions (growth, pregnancy, lactation). Essential nutrients include a wide array of chemical elements and molecules, which can not be sufficiently synthesized by the body to support daily functions. Essential nutrients include water, energy, amino acids (protein), minerals and vitamins. Minerals include macrominerals (calcium, phosphorus, magnesium, potassium, sodium, chloride, sulfur) and micro- (trace) minerals (cobalt, copper, iodine, iron, manganese, selenium, zinc). Similarly, vitamins include the fat-soluble (A, D, E, K) and water-soluble (B-vitamin complex, C) groupings. Most mammals, including goats, can synthesize their own vitamin C and thereby do not require additional dietary supplementation. Also ruminant animals can obtain needed K and B-complex vitamins from bacterial synthesis in the rumen or intestinal tract. The science of nutrition studies essential nutrient requirements for various animal species, including humans, to maintain proper health, support productive activities and prevent disease.

All essential nutrients are required within some optimum amount on a daily or semi-regular basis to support body functions. If intake of any given nutrient is significantly below daily needs for a sufficient period of time then nutritional deficiency disease can occur. Toxicity disease results when a nutrient is in excess of requirements. Clinical signs resulting from a nutritional deficiency or toxicity disease will depend upon the nutrient in question. Many nutrients are associated with specific disease processes, but there is much overlap across nutrients. The bottom line is all essential nutrients can cause disease associated with either deficient or excessive intake. Essential nutrients vary considerably in their inherent propensity to induce a disease state. Detailed information relative to specific nutrient deficiency or toxicity disease can be found in any basic animal nutrition textbook. This presentation will address specific nutritional diseases commonly encountered in raising and managing goats.

Pregnancy Toxaemia / Ketosis / Fatty Liver Disease

Commonly known as pregnancy disease, pregnancy ketosis or twin lamb/kid disease. Pregnancy toxemia is a metabolic disease of goats and sheep commonly occurring in the last six weeks of gestation in does with multiple fetuses. A similar syndrome occurs in early lactation in heavily lactating does (see next section). Factors important in the development of the disease are: (1) presence of two or more fetuses; (2) undernourishment during late pregnancy when the fetuses have the most rapid growth and (3) addition of stress such as severe weather, sudden changes in feed or other disease or transportation upon the previous factors. The mortality rate is high in affected animals. Most information available comes from studies in sheep. Through recognition of early signs and symptoms and avoidance of predisposing factors, pregnancy toxemia can be reduced to a sporadic condition.

Clinical Signs. Disease course varies but generally develops over three to ten days. A more sudden onset is usually associated with a sudden stress or poor producer observation. Appetite is poor or absent, with decreased consumption of grain observed first. Does separate from the herd, lag behind and become depressed and gaunt. Other signs of predisposing disease may also be present. Producers vigilant when hand feeding does will easily recognize these animals.

Clinical signs are those observed with involvement of the central nervous system. Initially, the animal tends to separate from others. There is mild depression. Evidence of blindness develops, the animal runs into objects, shows little or no reaction when approached, and wanders aimlessly. Dullness and depression become progressively severe. There is reluctance to move. Eventually they go down in sternal or lateral recumbency and show little or no response to their environment. The does become comatose and eventually die. Occasionally, animals may show a short period or intermittent periods of hypersensitivity, due possibly to ketone-induced magnesium deficiency. There may be quivering, twitching of the ears, muzzle or eyelids or spasms of certain muscles. Incoordination may be evident. Recumbent animals may have convulsive paddling movements.

Chewing, teeth grinding or vigorous licking movements may be seen. Mild scouring may be present. A snuffling respiration due to excessive nasal secretion may be common. Drooling of saliva is also seen. Temperature and pulse are within normal limits. Respiration is usually normal until the later stages when it may become labored. Ketones may be detected in the urine using diagnostic strips or smelled on the breath (sweet acetone smell). Diseases that may look similar to pregnancy toxemia include polioencephalomalacia, hypocalcaemia, toxic mastitis (if near or after kidding), grain overload, listeriosis and lead poisoning.

Causes. The primary cause of pregnancy toxemia is a lack of glucose as an energy source. This results from either poor nutrition, excessive demand from multiple fetuses or some combination. As pregnancy progresses, an increasing demand is on the available blood glucose supply of the doe due to rapid fetal development. The principal source of energy to the fetus is glucose and utilization by the fetus occurs at the detriment of the mother. Glucose requirements during late pregnancy are increased 70-80% over nonpregnant state since more than 60% of fetal growth occurs during the last 40 days of pregnancy. Blood sugar levels decrease as pregnancy progresses (hypoglycemia) from a normal 35-45 mg per 100 ml blood to 20-25 mg per 100 ml blood in late pregnancy. Pregnancy toxemia may develop when levels decrease to about 18 mg per 100 ml blood. The severity of hypoglycemia will be directly affected by undernourishment of the mother or by increased requirements of the fetus(es).

As the glucose supply diminishes from increasing fetal demands and decreased glucose production due to undernourishment, energy requirements must be derived from alternative sources. The pregnant does is primarily using body fat for an energy source. Fats can not cross the placenta, and thereby do not provide energy for the developing fetus. Amino acids from proteins can be made into glucose and are a primary source when doe nutrition is inadequate. As the doe breaks down more fat as an energy source, the resultant fatty acids can overwhelm the liver's capacity to metabolize them. This results in excessive ketone bodies, acetone, acetoacetate and beta-hydroxybutyrate, and fatty infiltration of the liver (fatty liver disease).

Fatty infiltration of the liver is recognized on post mortem findings of an enlarged pale yellow to orange colored liver.

As ketosis increases, bicarbonate level in the blood decreases and acidosis may result. When the bicarbonate level declines sufficiently, the animal will become comatose. During the later stages of pregnancy toxemia, water consumption decreases, urine output is decreased and kidney function is impaired. The blood sugar level may increase severely (hyperglycemia) during the late stages of the disease as a result of the response of the adrenal glands to stress.

Circumstances causing severe hypoglycemia will usually result in pregnancy toxemia. Under-nourishment of the doe may not meet the demands for glucose production. Level of nutrition should be increasing as pregnancy progresses so that the doe will be able to provide fetal requirements. The doe should be gaining weight during pregnancy. A gradual onset of undernourishment, as would be seen if the feed intake was not increased during pregnancy, may be tolerated by the doe and toxemia may not develop. However, if the animal is starved for several days, pregnancy toxemia may develop readily. Sudden changes in weather, infections or transport may result in periods of inappetence and may trigger pregnancy toxemia.

Treatment. The following are the important areas to address in treating pregnancy toxemia.

Glucose Replacement. Does in the very early stages of pregnancy toxemia may respond to oral administration of propylene glycol (60 ml twice daily) for at least 3 days. In addition to oral glucose precursors, especially for all does beyond the very early stages of the disease, intravenous glucose administration for 1 or more treatments, depending upon response, will be required. Insulin may be used with these treatments for better utilization of glucose (consult your veterinarian). During later stages of the disease, glucose administration may be ineffective or detrimental because the blood glucose levels may be very high.

Address Dehydration, Acid-Base Balance. During the later stages of the disease, acidosis and dehydration may be important factors. Intravenous administration of large volumes of electrolyte solutions with sodium bicarbonate may be important. Corticosteroids may not be effective in the later stages unless given at dosages utilized to combat endotoxic shock.

Reducing Glucose Demand. Developing fetuses are inducing the glucose drain on the doe. A decision will need to be made regarding the relative importance of kid versus doe survivability. Abortion is the preferred method as it is more affordable and less stressful to the doe. If the kids are more than 2 to 3 days premature, they will be unlikely to survive but are already at great risk of death in a severely ill doe. Consult your veterinarian about this procedure. Before a caesarian section is performed, the doe should be stabilized using appropriate fluid therapy.

This is a disease that needs to be prevented rather than treated. It is generally a management disease and should be initially investigated as a herd level problem rather than an individual sick goat. If one doe is clinically ill, many more in the herd are likely at risk.

Prevention. An adequate nutritional level throughout the pregnancy will prevent pregnancy toxemia. Protein and energy levels during the last 30-40 days of pregnancy should meet the doe's maintenance requirements as well as the growth requirements of the fetuses. Dietary protein content for late pregnancy should be between 12 and 15% of dry matter. Dietary energy content can be increased by feeding 1-2 lbs of a cereal grain-based supplement. Management during late pregnancy should be directed at avoiding appetite problems in the animals. Avoid sudden feed changes, diminish stresses of severe weather, delay or avoid transportation and prevent concurrent disease problems.

Doe body condition score entering into late gestation is important. Does that are very thin (< 2.5) have little fat or muscle reserves to draw upon and are then at increased risk despite a good ration. Very fat does (> 4.0) will readily use body fat reserves in late gestation but also experience decreased voluntary intakes, thus predisposing them to formation of ketone bodies that further suppress appetite.

Lactational Ketosis / Fatty Liver Disease

Similar to the disease process described for pregnancy toxemia, dietary glucose deficiency occurring during peak milk production can result in a ketotic state in heavily lactating dairy goats. This is generally not a disease problem in sheep or non-dairy breed goats.

Clinical Signs. Lactating does will initially reduce milk production. Refusal of grain and further reductions in milk production will ensue. Does will rapidly lose body condition during early lactation. Body temperature, pulse rate and respiratory pattern will be within normal limits. Rumen activity may diminish. In severe cases, neurologic signs (nervous ketosis) similar to those described for pregnancy toxemia will be observed.

Causes. Glucose demand to support lactose (milk sugar) production by the mammary gland tremendously increases the does requirement for dietary glucose precursors. Sugars and starches primarily in cereal grains are the predominate sources of glucose precursors. As lactation is initiated, dry matter intake starts at it's lowest level on the day of kidding and then slowly increases. However, milk production by the mammary gland increases glucose demand more rapidly than accounted for by dietary intake. This results in a period of negative energy balance, resulting in body weight loss to support lactation. If grains are increased in the diet too rapidly, a condition of acidosis might result (see lactic acidosis).

To compensate for the reduced glucose availability, the doe will mobilize body protein and reserve fat to meet increased energy and glucose needs. Excessive body fat mobilization results in large amounts of fatty acids being delivered to the liver for processing. The liver can only metabolize a fraction of the fat delivered and in the face of low blood glucose concentrations, will generate excessive amounts of ketone bodies. Fatty acids not metabolized to ketone bodies will be synthesized back into fat and stored in liver cells. Excessive liver fat storage will result in associated fatty liver disease.

Treatment. Similar to pregnancy toxemia, glucose supplementation in the form of intravenous dosing followed by 3 days of oral propylene glycol is needed. Repeat treatments

may be necessary for full recovery. Corticosteroid therapy is also used to stimulate the doe's ability to generate glucose from amino acids. In refractory cases, insulin therapy in conjunction with glucose infusions may be necessary. Supportive therapy to stimulate intake and dietary modification to increase glucose availability are also warranted.

Prevention. Good supportive care following kidding and appropriate dietary management of the early lactation doe are important. Recently kidded does should be managed carefully to ensure adequate opportunity to eat a well-balanced diet without any obstacles. Recently kidded does may be more timid and reluctant to compete for food. Observe does carefully for any indications of other postparturient disease problems that may negatively impact appetite. Ensure the early lactation diet has higher protein and energy content, but is not excessive in grain. Gradually increase grain over the first 2 weeks of lactation.

Body condition score of the late pregnant doe is again critical. Does should enter lactation with some body reserve, but not excessive. Heavy body condition does will not only have more fat reserves to mobilize and be more susceptible to fatty liver disease, but their intake will be reduced. Excessively thin does will not have the nutrient reserves to support good lactational production.

Periparturient Hypocalcemia (Milk Fever)

Hypocalcemia (low blood calcium concentration) is a disease commonly seen in dairy cattle on or immediately following calving. Sheep can experience hypocalcemia during late pregnancy associated with rapid calcium loss to the developing fetus for bone mineralization. Other species can experience hypocalcemia at or near the time of peak lactation (lactational eclampsia). Based on limited information available regarding goats, it seems dairy breed goats are potentially prone to all three manifestations of hypocalcemia.

Clinical Signs. Initially the doe is ataxic, nervous and hyperactive. The doe is hyperirritable and may show muscle twitching of the lips, eyelids and ears. Trembling or twitching of other muscles of the body may also occur. Convulsions may develop. The doe quickly becomes sternally recumbent and laterally recumbent in the final stages. The head may be turned back to the flank. Less severely affected does (subclinical hypocalcemia) show lethargy, poor appetite and poor milk production.

Affected does stop eating and their ears and skin are cold to the touch. Body temperature will initially be slightly elevated, but will decline to subnormal in a short period of time. Pupils are dilated and respond very slowly or not at all to a flashlight being shone directly at them. Sometimes the hind legs are splayed out behind the doe. The heart is very hard to hear or feel and beats rapidly and weakly. Death follows bloat, regurgitation of rumen contents and aspiration.

The disease course can be as short as a few hours or occur over a couple of days. Occasionally it may occur as "sudden death"; the doe is found dead in the morning. Serum calcium levels are decreased, usually less than 6 mg/dl (normal 8 - 12 mg/dl). To help in diagnosing hypocalcemia in a sudden death case, fluid from eye chambers obtained during a postmortem examination can be analyzed for calcium concentration up to 48 hours after death. Hypocalcemia may look like other diseases and the doe must be examined by a veterinarian in order to differentiate from polioencephalomalacia, advanced grain overload, toxic mastitis, lead poisoning and listeriosis. Hypocalcemia is often a secondary complicating factor with pregnancy toxemia and ketosis.

Causes. Much research has been done on hypocalcemia in dairy cows and this information is often extrapolated to dairy goats. Dairy cows experience a decline in blood calcium concentration on the day of calving, associated with colostrum production and reduced intake. If the normal homeostatic system is dysfunctional, blood calcium concentration will remain low following calving and result in milk fever syndrome. It is thought that either high calcium intake during pregnancy or high cationic diets (high in potassium, sodium, calcium) suppress the homeostatic system. In contrast, sheep experience hypocalcemia during late pregnancy as a result of insufficient dietary calcium to meet fetal needs. Insufficient calcium intake during late pregnancy or early lactation will require the body to mobilize calcium from bones to meet the need. If the hormonal mechanisms are not properly prepared, mobilization will be delayed and low blood calcium concentration will result. The dairy goat capable of heavy lactation and pregnant with multiple fetuses seems a prime candidate for hypocalcemia at any of the time periods seen with other species.

Treatment. Clinical cases of hypocalcaemia are usually treated with careful intravenous calcium borogluconate solution infusions. This may be followed by subcutaneous injections of calcium solutions as well as oral supplements. Less severely affected does can be treated with just subcutaneous solutions. Response to intravenous treatment should be dramatic. The doe usually starts to shiver and brightens up by the time treatment is finished. If she does not, it may be the diagnosis is incorrect or is complicated by another disease. It is important that intravenous treatment only be given in the face of strong clinical evidence of disease. Calcium can easily cause death if given intravenously to an animal with normal calcium levels. Following intravenous or subcutaneous injections, dietary intake of calcium should be increased with use of alfalfa hay or calcium-based mineral supplements.

Prevention. Without good scientific evidence describing the mechanism responsible for hypocalcemia in dairy goats, it is difficult to define specific feeding recommendations. It would seem prudent to maintain appropriate dietary calcium and phosphorus content in late pregnancy to support fetal bone development, but not to supplement to excess. Dietary potassium should be monitored in an attempt to maintain a level below 2%. Dietary magnesium should also be monitored and maintained according to dietary potassium (see next section on hypomagnesemia). Once into lactation, dietary calcium and phosphorus content should be increased to a level to support milk production capacity. Alfalfa hay can provide this. Cereal crop forages such as wheat or oat hay are very low in calcium (0.15% and 0.24% dry matter (DM) basis respectively) as opposed to alfalfa hay (1.4% DM) and should be avoided unless the ration is balanced with other calcium sources.

Use of anionic salts (minerals high in chloride and sulfur) has been advocated for dairy cattle in preventing milk fever. This requires specialized feed ingredients to be fed and close monitoring as well as controlling dietary potassium content. In using anionic salts, the goal is to induce a state of compensated metabolic acidosis, which stimulates calcium absorption and mobilization. To achieve the desired effect, one must ensure the animal is appropriately acidified. Urine pH measurements are used for this purpose. In general, anionic salt feeds are not very palatable and can reduce feed intake. This is an undesirable effect. Also these products are only to be fed for a brief period of 10-14 days immediately prior to calving. At present, there seems to be little information to support use of such a control method in goats. In selected situations where hypocalcemia is a serious problem, then with veterinary guidance, this approach may be warranted.

Hypomagnesemia (Grass Tetany, Lactation Tetany, Milk Tetany)

Hypomagnesemia is a common problem in beef cattle on spring pasture, but sporadically seen is dairy cattle and small ruminants. Many clinical syndromes have been identified relative to disease circumstances, but all have hypomagnesemia in common. Lactating does on spring pasture are susceptible (Grass tetany or Lactation tetany) as well as growing kids on milk replacer (Milk tetany).

Clinical Signs. Hypomagnesemia (low blood magnesium concentration) usually occurs in early lactation and results in a life threatening disease process characterized by severe tetanic muscle spasms. Affected animals initially show ataxia, stiffness and hyperexcitability. This rapidly progresses into recumbency and paddling. All muscles are overstimulated resulting in extreme leg stiffness and observed muscle spasms. This is very different from the paralytic muscle weakness of hypocalcemia. Convulsions may be triggered by some stimuli including predator attacks, severe weather changes, transportation and other stressors.

Causes. Magnesium is inefficiently absorbed from the rumen. Dietary levels of potassium and excessive calcium can interfere with magnesium absorption. Potassium is especially of concern relative to magnesium absorption. Magnesium also plays a role in maintenance of blood calcium concentrations and hypomagnesemia can induce hypocalcemia. Besides mineral interactions, differences exist between grasses and legumes as to magnesium content. Grasses contain less magnesium than legumes and when growing rapidly in cooler conditions (lush spring pasture), magnesium availability is greatly reduced. Goats like other ruminants, have little ability to manage blood magnesium concentrations if dietary levels or absorption are depressed. The combination of low intake coupled with greater losses during early lactation result in the clinical syndrome.

Treatment. Like hypocalcemia, hypomagnesemia must be treated as an emergency situation. Intravenous administration of combined magnesium and calcium solutions is necessary. This may be followed by subcutaneous injections of magnesium sulfate solutions as well as oral magnesium supplementation. Response to intravenous therapy is rapid, but may be short-lived. Repeat treatments may be necessary. Subcutaneous and oral supplements are useful in preventing relapses.

Prevention. Appropriate dietary supplementation of magnesium from late pregnancy through early lactation is needed. Dietary magnesium should be increased to account for high dietary potassium, up to a point. Dietary magnesium should not exceed 0.4% of dry matter. A suggested ratio of dietary potassium to magnesium of 4:1 is suggested. Magnesium can be supplemented in mineral mixes, but it is unpalatable. Mixing 1 part magnesium oxide, 1 part trace mineral salt and 1 part soybean meal or other palatable feed has been shown to be effective in maintaining good magnesium intakes and preventing disease problems.

Lactic Acidosis (Grain Overload)

Clinical Signs. Simple indigestion may be the first indication of a lactic acidosis problem. Any goat eating solid feed containing concentrate is potentially susceptible to ruminal acidosis. In mild to moderate cases the goat will back off feed, especially grain, usually only for one feeding. One may observe a slug feeding behavior where does eat well one day, then back off and repeat the cycle. More chronic acidosis problems will manifest as variable appetite, depressed milk fat and chronic laminitis. Toes grow abnormally fast with "rings". Acute laminitis shows up as painful feet. The quality of the horn is poor and flaky. Goats may be lame and prone to foot abscesses. In some cases, diarrhea will be present, smelling acidic and yellow in color. With more severe acute lactic acidosis, protozoa and bacteria die, rumen becomes static and the goat becomes depressed and dehydrated. The rumen is fluid filled and "sloshy". Acute lactic acidosis may result in death within hours or days. In very severe cases, there is no diarrhea because of total gut stasis. The goat may appear "drunk" and ataxic. Acute acidotic goats will be recumbent and look very similar to milk fever, i.e. cold with dilated pupils. Rumen examination (pH and examination of flora) need to be done to confirm a diagnosis.

Causes. The rumen ecosystem is comprised of more than 200 species of bacteria, protozoa, fungi and viruses. Bacterial species span the range of substrate fermented and end product formation. Lactic acid is one of many potential fermentation end products generated by sugar and starch fermenting bacteria. In normal rumen conditions, production of lactic acid is counterbalanced by its consumption by lactate fermenting bacteria. Lactic acid is a potentially deleterious product in the rumen as it will reduce pH to a point of suppressing bacteria responsible for fiber fermentation. Most bacteria in the rumen are pH sensitive, not being able to survive below pH of 6.0. In situations where excessive sugar or starch is consumed, lactic acid will be overproduced and accumulate, thus inducing a severe decline in rumen pH. As the rumen pH declines, Lactobacillus bacteria will start to proliferate generating more lactic acid. The animal becomes acidotic and loses fluids to the rumen, becoming dehydrated.

The rumen system in best maintained on a consistent dietary regimen. Dramatic changes in dietary forage to concentrate ratio, total amount of concentrate fed and concentrate fermentability will be conducive to lactic acidosis situation. Fiber (e.g. hay or silage) is important in the diet as it stimulates the goat to chew, thus producing alkaline saliva serving to buffer the rumen. Diets with minimal fiber or chopped too finely are more at risk of lactic acidosis.

Treatment. With mild to moderate cases, symptomatic therapy along with a reduction in grain feeding may suffice. In severe acute cases treatment is heroic, intensive supportive care and surgical emptying of the rumen (rumenotomy). Supportive therapy includes intravenous and oral fluids, rumen transfaunation (rumen juice from a healthy animal), alkalinizing solutions for the rumen (only done with caution), antibiotics and nursing care. Even if one recovers an affected goat, secondary problems related to bacterial and fungal infections of the liver and

Urolithiasis Prevention Recommendations:

- **Provide Fresh, Clean, Warm Water at ALL times**
  - Cold water can decrease intake during the winter
  - Make sure water does not freeze in the winter
- **Provide Electrolyte water along with fresh water**
  - Use a commercial electrolyte mix
  - As a substitute for a commercial electrolyte mix, you can use a combination of non-iodized table salt and lite salt
    - 15g table salt and 15g lite salt per gallon of water
- **Increase salt (NaCl) Intake:**
  - Helps for all forms of urolithiasis
  - Use non-iodized salt
  - Free choice White Salt block
  - 2-5% Dry Matter Intake (DMI)
  - 0.4 to 1 g/kg BW/dy
  - Mixed with feed pellets or dissolved in water and sprayed on the hay.
- **Remove any Alfalfa hay from the diet and change to**
  - Oat Hay or
  - Grass Hay
  - Believed to be most important for calcium based crystals by reducing calcium excretion and amino acid metabolism to oxalate.
- **Decrease Phosphorus Intake**
  - Most important for struvite urolithiasis
  - No More than
    - 0.25 to 0.3% DMI
    - 50 to 60 mg/kg BW/dy
- **Restrict additional grain feeding**
  - Decreases phosphorus intake and may help control struvite crystals
- **Consider feeding a commercial feed**
  - Purina Lamb Show Ration
    - 0.5% NH_4Cl (urine acidifier)
    - 0.5% NaCl (increases water intake)
    - Without Antibiotics
- **Urine Acidifiers**
  - Urine acidification can help dissolve struvite crystals and stones.
  - The salts used in urine acidification also result in an increase in water consumption that can help dilute the urine and decrease crystal and stone formation.
  - Ammonium Chloride (NH_4Cl)
    - 0.5 to 1% DMI
    - 100 to 200 mg/kg BW/dy
    - Divide into at least two doses per day

- Poor palatability. May be mixed with grain or mixed in Karo syrup or molasses and administered orally. Also can be dissolved in water and sprayed on hay
- Dissolve 200g NH_4Cl with 500ml water and then mix with 500ml molasses (final concentration 200mg/ml). Administer at 0.25 to 0.5 ml/kg twice daily orally.

- Uroeze Powder or Tablets
  - Canine prescription urinary acidifier
  - Flavored palatable amino acid base
  - 400 mg NH_4Cl per ¼ teaspoon, or tablet
  - Start at ¼ tsp or 1 tablet per 10 lb BW q12 hr and then titrate to a urine pH of 6-6.5.
- Bio-Chlor
  - More palatable than ammonium chloride
  - Mix with grain or other feed
  - 50 lb bag about $15
  - Feed at 0.05 to 0.15 lb per 100 lb BW per day
    - 0.5-1.5 g/kg/dy
    - This is about 0.15 to 0.25 lb per head per day for adult sheep and goats
  - Alternative Solution
    - Dissolve 500g BioChlor (use a food scale) into 750 ml (about 3 cups) water and then add 250 ml (about 1 cup) molasses. This will give a total volume of about 1 liter (32 oz) of solution with a concentration of about 0.5g/ml.
    - Administer 1ml/kg body weight orally twice daily for an 8-10 day period once per month.
- Monitor Urine pH
  - Goal between 5.5-6.5
  - This pH will readily dissolve Struvite stones. It will have little or no effect on dissolving other stones. That is one reason why the mineral analysis of the stones can be helpful.
  - Severe metabolic acidosis and death can occur when the urine pH approaches 5
  - Purchase some pH paper that will read in the 5 to 8 range or wider to check urine pH while the animal is on treatment. The urine pH should fall below 6.5 but remain above 5.0. If the pH is >6.5, increase the amount administered. If the pH is near 5 or <5, decrease the amount.

APHIS Info Sheet

Veterinary Services
Centers for Epidemiology and Animal Health

VS

May 2008

Caprine Arthritis Encephalitis Virus

Figure 1. Could the weight loss and rear limb weakness in this goat be due to CAEV?

What is caprine arthritis encephalitis?

Caprine arthritis encephalitis is a viral disease of goats that is caused by the caprine arthritis encephalitis virus (CAEV). CAEV is a lentivirus, and one of several lentiviruses in the family Retroviridae. Other retroviruses are human immunodeficiency virus, which causes AIDS in humans; maedi-visna virus of sheep; bovine leukosis virus of cows; avian leukosis virus of chickens; and simian immunodeficiency virus of monkeys.

What diseases are caused by CAEV?

The multisystem diseases caused by CAEV infection are: arthritis, pneumonia, mastitis, weight loss (all of which are more common in does and bucks), and encephalitis (more common in kids).

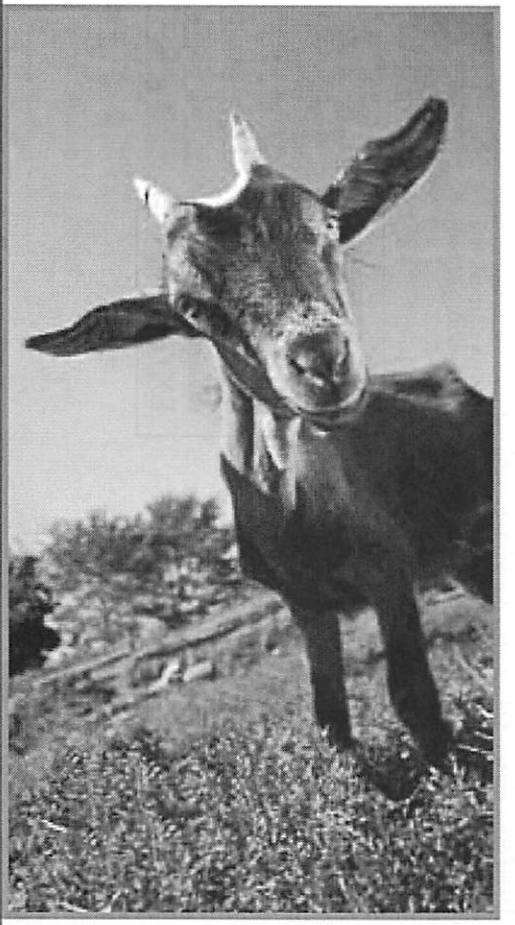
What are some clinical signs that a herd may be affected by CAEV?

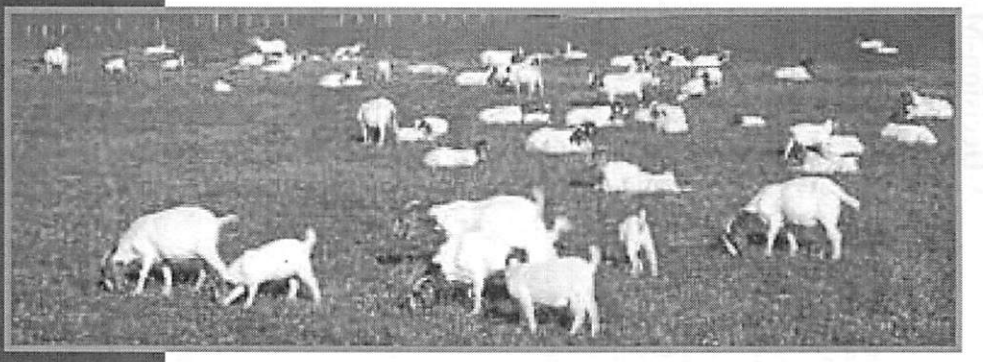
A high percentage of CAEV-infected goats will not become symptomatic. For those goats that do become symptomatic, the clinical signs of CAEV infection vary, depending on the type of disease that is present. Arthritis is common in sexually mature goats. Goats will become lame either suddenly or more slowly, and the lameness will become progressively worse. The knee joints or carpal joints will become distended. Goats will lose body condition and develop a rough hair coat, which may be due in part to decreased competitiveness at the feed bunk. Labored breathing due to pneumonia may be present in both mature goats and kids. The mastitis is referred to as "indurative mastitis" due to the deposition of vast quantities of connective tissue in the udder as part of the immune response. During and after the kidding period, the udder will be firm and swollen, hence the term "hard udder." Milk production will be low or completely absent. In a recent study of CAEV infection in a Passeirer Gebirgsziege goat herd in Germany, weight loss was one of the most common signs.

Figure 2. Swollen knee joints and paralysis, typical of a goat affected by CAEV.

Are the clinical signs different in kids versus mature goats?

Yes. Encephalomyelitis, inflammation of the tissues in the brain and brain stem, is common in kids 2 to 4 months old. Initially, affected kids will be lame, the gait will be wobbly and misdirected, and correct placement of the hind limbs and feet will become difficult. As the disease progresses, paralysis of both limbs on one side of the body, or paralysis of all four limbs will occur. Standing will become impossible, so the goats may lie on their sides and paddle in the bedding. Other signs are depression, walking in circles, head twitch, head tilt, exaggerated upward tilt of the head, exaggerated sideward tilt of the head, and muscle tremors.





Johne's Disease Q&A

for Goat Owners

Sorting Through the Information on Sheep and Goat Parasite Control:

A Decision-Making Support Tool

(Version: 1.0)

This decision-making support tool is designed to help sheep and goat producers sort through the large amount of information available on controlling sheep and goat parasites and to make decisions about specific management options that are relevant to their farm operation. It is not intended to replace your veterinarian with regard to diagnosis of parasitism or specifics of drug use. This information is organized in a "decision tree" or "flow chart" approach where answering one question leads to another question or various management options. Each section of the flow chart is basically organized in the format of Class of animal→ Time of year→ Degree of management flexibility (or availability of resources at the farm level). In some cases, you will be referred to external references or resources providing additional information on selected topics (e.g., the FAMACHA© system or using certain plants in control of parasitism).

This material is also available on the Internet as an interactive, computer-based module (http://vet.osu.edu/extension/decision-tree). This allows us more flexibility to use pictures and diagrams as well as to link to other resources on this topic. We apologize for the fine print in the charts in this document, but we did this to keep the information confined to one page per class of animal and make it more suitable for your review and use. In the following pages you will find a glossary that may help you in understanding the information in the flow charts. Because most people will need an effective dewormer as part of their overall parasite control program, you will also find a chart that helps you determine how to know which product will work on your farm. Next you will find a flow chart that is an overview of the decision-making support tool that shows how it is organized, and lastly are five individual flow charts for the typical classes of sheep or goats we find on most farms.

We value your input and suggestions on how this information might be better organized or how helpful it might be to you or others. Please contact:

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THE OHIO STATE UNIVERSITY EXTENSION

Training materials

The American Consortium for Small Ruminant Parasite Control and some of its individual members have developed instructional curriculum and other resources for use in training people in the small ruminant industry in the use of the FAMACHA© system and other integrated parasite management practices. Some of the resources are in the process of being updated by the consortium.

CD-ROM

Smart Drenching and FAMACHA®: Integrated Training for Sustainable Control of Gastrointestinal Nematodes in Small Ruminants; Southern Consortium for Small Ruminant Parasite Control [2008]. *Contact Dr. Seyedmehdi Mobini to get CD.*

Flash Presentation

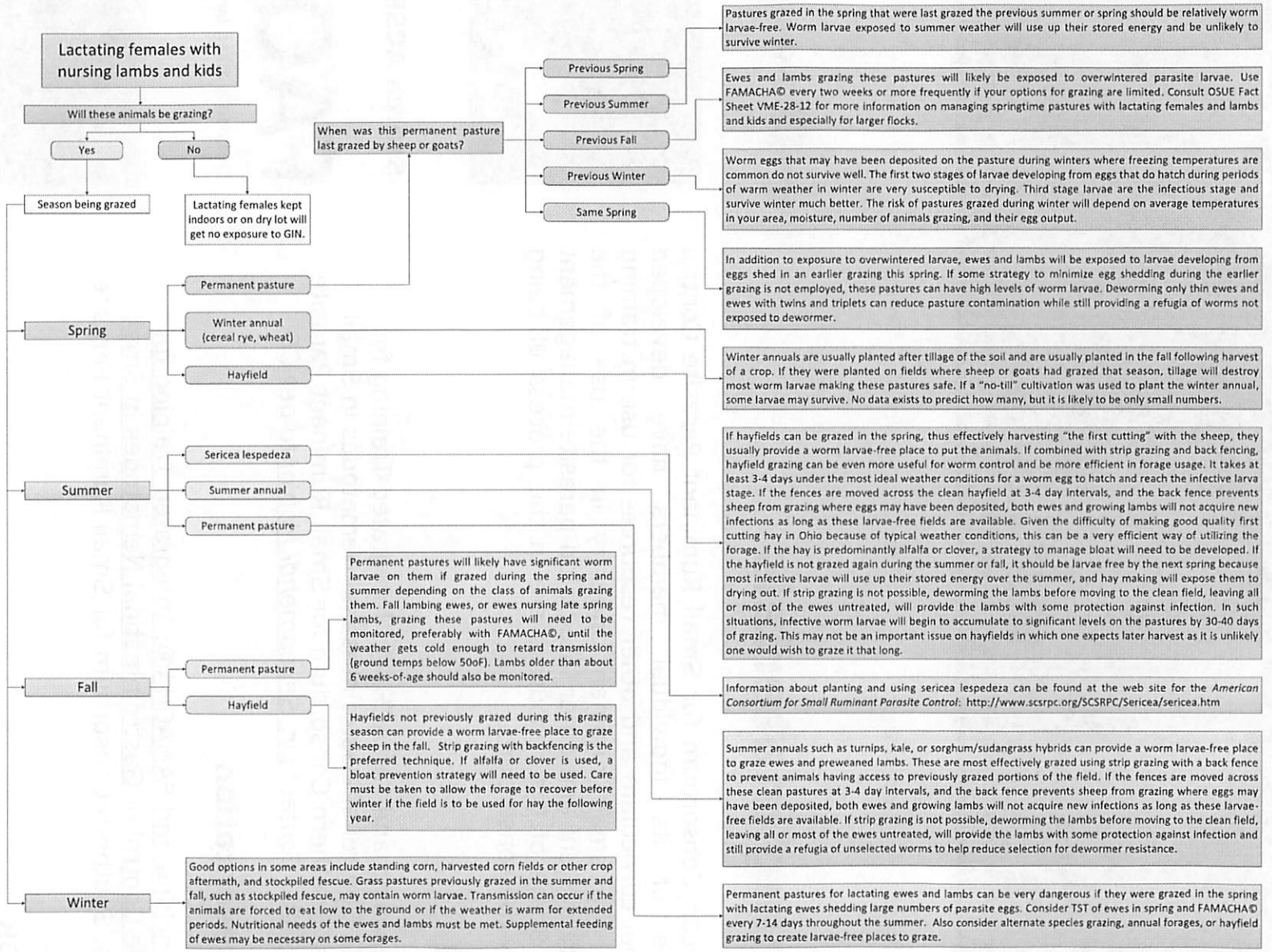
Smart Drenching and FAMACHA®: Integrated Training for Sustainable Control of Gastrointestinal Nematodes in Small Ruminants. Southern Consortium for Small Ruminant Parasite Control.

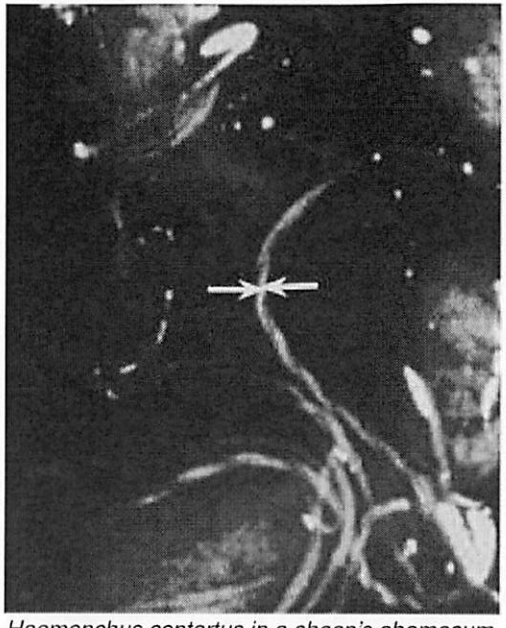
Notebook

wormx.org

Search ACSRPC

FAQs
Frequently asked questions


Lactating females with nursing lambs and kids
Will these animals be grazing?
Yes
No
Season being grazed
Lactating females kept indoors or on dry lot will get no exposure to GIN.
When was this permanent pasture last grazed by sheep or goats?
Previous Spring
Previous Summer
Previous Fall
Previous Winter
Same Spring
Pastures grazed in the spring that were last grazed the previous summer or spring should be relatively worm larvae-free. Worm larvae exposed to summer weather will use up their stored energy and be unlikely to survive winter.
Ewes and lambs grazing these pastures will likely be exposed to overwintered parasite larvae. Use FAMACHA© every two weeks or more frequently if your options for grazing are limited. Consult OSUE Fact Sheet VME-28-12 for more information on managing springtime pastures with lactating females and lambs and kids and especially for larger flocks.
Worm eggs that may have been deposited on the pasture during winters where freezing temperatures are common do not survive well. The first two stages of larvae developing from eggs that do hatch during periods of warm weather in winter are very susceptible to drying. Third stage larvae are the infectious stage and survive winter much better. The risk of pastures grazed during winter will depend on average temperatures in your area, moisture, number of animals grazing, and their egg output.
In addition to exposure to overwintered larvae, ewes and lambs will be exposed to larvae developing from eggs shed in an earlier grazing this spring. If some strategy to minimize egg shedding during the earlier grazing is not employed, these pastures can have high levels of worm larvae. Deworming only thin ewes and ewes with twins and triplets can reduce pasture contamination while still providing a refugia of worms not exposed to dewormer.
Spring
Permanent pasture
Winter annual (cereal rye, wheat)
Hayfield
Winter annuals are usually planted after tillage of the soil and are usually planted in the fall following harvest of a crop. If they were planted on fields where sheep or goats had grazed that season, tillage will destroy most worm larvae making these pastures safe. If a "no-till" cultivation was used to plant the winter annual, some larvae may survive. No data exists to predict how many, but it is likely to be only small numbers.
If hayfields can be grazed in the spring, thus effectively harvesting "the first cutting" with the sheep, they usually provide a worm larvae-free place to put the animals. If combined with strip grazing and back fencing, hayfield grazing can be even more useful for worm control and be more efficient in forage usage. It takes at least 3-4 days under the most ideal weather conditions for a worm egg to hatch and reach the infective larva stage. If the fences are moved across the clean hayfield at 3-4 day intervals, and the back fence prevents sheep from grazing where eggs may have been deposited, both ewes and growing lambs will not acquire new infections as long as these larvae-free fields are available. Given the difficulty of making good quality first cutting hay in Ohio because of typical weather conditions, this can be a very efficient way of utilizing the forage. If the hay is predominantly alfalfa or clover, a strategy to manage bloat will need to be developed. If the hayfield is not grazed again during the summer or fall, it should be larvae free by the next spring because most infective larvae will use up their stored energy over the summer, and hay making will expose them to drying out. If strip grazing is not possible, deworming the lambs before moving to the clean field, leaving all or most of the ewes untreated, will provide the lambs with some protection against infection. In such situations, infective worm larvae will begin to accumulate to significant levels on the pastures by 30-40 days of grazing. This may not be an important issue on hayfields in which one expects later harvest as it is unlikely one would wish to graze it that long.
Summer
Sericea lespedeza
Summer annual
Permanent pasture
Information about planting and using sericea lespedeza can be found at the web site for the *American Consortium for Small Ruminant Parasite Control*: http://www.scsrpc.org/SCSRPC/Sericea/sericea.htm
Summer annuals such as turnips, kale, or sorghum/sudangrass hybrids can provide a worm larvae-free place to graze ewes and preweaned lambs. These are most effectively grazed using strip grazing with a back fence to prevent animals having access to previously grazed portions of the field. If the fences are moved across these clean pastures at 3-4 day intervals, and the back fence prevents sheep from grazing where eggs may have been deposited, both ewes and growing lambs will not acquire new infections as long as these larvae-free fields are available. If strip grazing is not possible, deworming the lambs before moving to the clean field, leaving all or most of the ewes untreated, will provide the lambs with some protection against infection and still provide a refugia of unselected worms to help reduce selection for dewormer resistance.
Fall
Permanent pasture
Hayfield
Permanent pastures will likely have significant worm larvae on them if grazed during the spring and summer depending on the class of animals grazing them. Fall lambing ewes, or ewes nursing late spring lambs, grazing these pastures will need to be monitored, preferably with FAMACHA©, until the weather gets cold enough to retard transmission (ground temps below 50oF). Lambs older than about 6 weeks-of-age should also be monitored.
Hayfields not previously grazed during this grazing season can provide a worm larvae-free place to graze sheep in the fall. Strip grazing with backfencing is the preferred technique. If alfalfa or clover is used, a bloat prevention strategy will need to be used. Care must be taken to allow the forage to recover before winter if the field is to be used for hay the following year.
Permanent pastures for lactating ewes and lambs can be very dangerous if they were grazed in the spring with lactating ewes shedding large numbers of parasite eggs. Consider TST of ewes in spring and FAMACHA© every 7-14 days throughout the summer. Also consider alternate species grazing, annual forages, or hayfield grazing to create larvae-free places to graze.
Winter
Good options in some areas include standing corn, harvested corn fields or other crop aftermath, and stockpiled fescue. Grass pastures previously grazed in the summer and fall, such as stockpiled fescue, may contain worm larvae. Transmission can occur if the animals are forced to eat low to the ground or if the weather is warm for extended periods. Nutritional needs of the ewes and lambs must be met. Supplemental feeding of ewes may be necessary on some forages.



Haemonchus contortus in a sheep's abomasum.

Successful management of sheep and goat parasites will involve a combination of management practices that decrease transmission, and intelligent use of dewormers. This brochure outlines several key features of how to control worms in small ruminants.

This Brochure was prepared through the Southern Region USDA Program on Sustainable Agriculture Research and Education (SARE) Program entitled "Novel Methods for Sustainable Control of Gastrointestinal Nematodes in Small Ruminants"

Collaborating Institutions
Fort Valley State University
College of Agriculture, Home Economics, and Allied Programs
Fort Valley, GA

University of Georgia
College of Veterinary Medicine
Athens, GA

Louisiana State University
School of Veterinary Medicine
Baton Rouge, LA

USDA-ARS, STARS
Brookville, FL

USDA-ARS
Booneville, AR

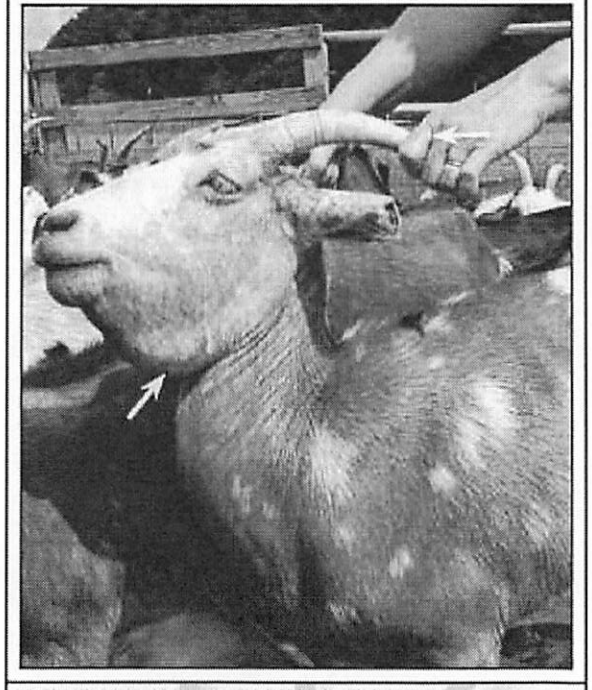
Danish Center for Experimental Parasitology
The Royal Veterinary and Agricultural University
Frederiksberg, Denmark

University of Puerto Rico
Mayaguez, PR

Onderstepoort Veterinary Institute,
Private Bag X06
Onderstepoort, South Africa

Visit our web site for more information at
www.scsrpc.org

The Problem:
RESISTANCE TO DEWORMERS IS ON THE RISE



"Bottle jaw" signals a serious problem.

The Solution:
SMART DRENCHING

Smart Drenching for Sheep and Goats

Gastrointestinal nematodes (worms) are a major threat to grazing sheep and goats in the United States. The 2 most important worms are Haemonchus contortus (barbor pole worm) and Trichostrongylus colubriformis (bankrupt worm). Periparturient females, kids and lambs in their first grazing season are especially vulnerable to worms.

Clinical Signs of Parasitism

- Untriftiness
- Rough hair coat
- Pasty to watery feces
- Bottle jaw (edema under the jaw)
- Pale membranes in inner eyelid (below)

Resistance to all dewormers is increasing in the worm population, so a newer, smarter approach to worm control is needed. The concept of "smart drenching"* addresses ways producers can use dewormers (drenches) more selectively and effectively. The primary goal of "smart drenching" is to balance production needs with the need to preserve the efficacy of available dewormers for as long as possible.

•Thanks to Dr. Des Hennessy, McMaster Laboratory, CSIRO Animal Production, Blacktown Australia, for use of the term, "smart drenching".

Components of Smart Drenching

1. Find out which dewormers work by performing a fecal egg count reduction test or a DrenchRite larval developmental assay.

2. Weigh each animal prior to deworming them. Sheep are drenched on a body weight basis similar to cattle. Double the cattle/sheep dose when deworming goats for all dewormers (except levamisole). Use levamisole at 1.5 times the cattle/sheep dose in goats.

3. Deliver the dewormer over the tongue in the back of the throat with a drench tip or drench gun.

4. Withhold feed 12-24 hours prior to drenching with benzimidazoles (white dewormers such as fenbendazole and albendazole), ivermectin, doramectrin, and moxidectin.

5. Benzimidazole efficacy is greatly enhanced by repeating the drench 12 hours after the first dose.

6. Simultaneously use 2 classes of dewormers if resistance is suspected.

7. Drench only the animals that need treatment! This step reduces dewormer use. Most importantly, untreated animals harbor worms that have been subjected to less selection pressure for drug resistance. These worms will stay more vulnerable to dewormers.

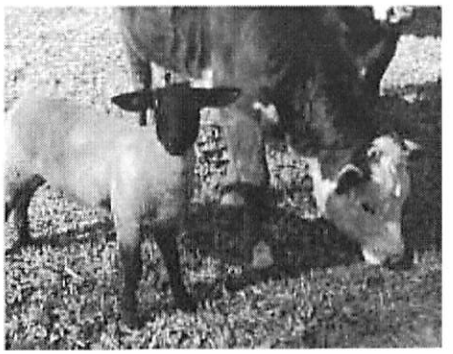
The FAMACHA© System was developed in South Africa to identify severely parasitized sheep and goats. A laminated color chart that shows 5 consecutive grades of conjunctival pallor ranging from 1 (red color; not anemic) to 5 (very pale) is used to score the animals. Only the animals in the palest categories are drenched. This approach decreases the use of dewormers, and allows the producer to identify animals that need frequent deworming to survive.

Stopping the Parasite Life Cycle through Pasture Management

1. Remove small ruminants from pastures for 3-6 months to allow worm larvae on pasture to die off.

2. Alternate or co-graze pastures with horses or adult cattle.

3. Maintain stocking rates of no more than 6-8 small ruminants per acre.



REQUIREMENTS FOR USE

- ELDU is permitted only by or under the supervision of a veterinarian.
- ELDU is allowed only for FDA approved animal and human drugs.
- A valid Veterinarian/Client/Patient Relationship is a prerequisite for all ELDU.
- ELDU for therapeutic purposes only (animal's health is suffering or threatened). Not drugs for production use.
- Rules apply to dosage form drugs and drugs administered in water. ELDU in feed is prohibited.
- ELDU is not permitted if it results in violative food residue, or any residue which may present a risk to public health.
- FDA prohibition of a specific ELDU precludes such use.†

* RECORD REQUIREMENTS

- Identify the animals, either as individuals or a group.
- Animal species treated.
- Numbers of animals treated.
- Conditions being treated.
- The established name of the drug and active ingredient.
- Dosage prescribed or used.
- Duration of treatment.
- Specified withdrawal, withholding, or discard time(s), if applicable, for meat, milk, eggs, or animal-derived food.
- Keep records for 2 years.
- FDA may have access to these records to estimate risk to public health.

* * LABEL REQUIREMENTS

- Name and address of the prescribing veterinarian.
- Established name of the drug.
- Any specified directions for use including the class/species or identification of the animal or herd, flock, pen, lot, or other group; the dosage frequency, and route of administration; and the duration of therapy.
- Any cautionary statements.
- Your specified withdrawal, withholding, or discard time for meat, milk, eggs, or any other food.

EXTRALABEL DRUG USE (ELDU)

An Informational Outline of the Animal Medicinal Drug Use Clarification Act (AMDUCA)

If you have questions about the regulations call the Food and Drug Administration, Center for Veterinary Medicine at (240) 276-9200

American Veterinary Medical Association
1931 N. Meacham Rd., Suite 100
Schaumburg, IL 601 73-4360
www.avma.org

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EXTRALABEL DRUG USE ALGORITHM

YOU MADE A CAREFUL DIAGNOSIS IN THE PRESENCE OF A VALID VETERINARIAN/CLIENT/PATIENT RELATIONSHIP.
YOU ARE CONTEMPLATING EXTRALABEL DRUG USE. YOU MUST ASK YOURSELF....
ARE THE ANIMALS TO BE TREATED AS FOOD ANIMALS?

YES

DOES A DRUG LABELED FOR FOOD ANIMALS EXIST WHICH FULFILLS ALL OF THE FOLLOWING:

- CONTAINS THE NEEDED INGREDIENT,
- IN THE PROPER DOSAGE FORM,
- LABELED FOR THE INDICATION,
- AND IS CLINICALLY EFFECTIVE?

YES

YOU MUST USE THIS DRUG PER LABEL, AS EXTRALABEL DRUG USE IS UNNECESSARY. OBSERVE LABEL DIRECTIONS AND WITHDRAWAL TIME.

NO

IS THERE A DRUG APPROVED FOR FOOD ANIMALS WHICH COULD BE USED EXTRALABELLY?

YES

PROCEED WITH EXTRALABEL USE OF FOOD ANIMAL DRUG. ESTABLISH EXTENDED WITHDRAWAL TIME. ENSURE FOOD SAFETY. MAINTAIN REQUIRED RECORDS.* LABEL DRUG APPROPRIATELY.**

NO

IS THERE A HUMAN DRUG OR DRUG APPROVED FOR NON-FOOD ANIMALS WHICH COULD BE USED EXTRALABELLY?

YES

IS THERE ADEQUATE SCIENTIFIC INFORMATION AVAILABLE TO DETERMINE A WITHDRAWAL TIME?

YES

PROCEED WITH EXTRALABEL USE OF HUMAN OR NON-FOOD ANIMAL DRUG. ESTABLISH EXTENDED WITHDRAWAL TIME. ENSURE FOOD SAFETY. MAINTAIN REQUIRED RECORDS.* LABEL DRUG APPROPRIATELY.**

NO

DRUG MUST NOT BE USED, OR TREATED ANIMAL MUST NOT ENTER FOOD SUPPLY.

NO

IF COMPOUNDING OF APPROVED DRUGS WILL PREVENT ANIMAL PAIN AND SUFFERING, REFER TO FDA COMPLIANCE POLICY GUIDE FOR COMPOUNDING GUIDANCE.***

NO

THERE ARE FEW RESTRICTIONS ON EXTRALABEL USE IN NON-FOOD ANIMALS.
DOES AN ANIMAL DRUG EXIST WHICH FULFILLS ALL OF THE FOLLOWING:

- CONTAINS THE NEEDED INGREDIENT,
- IN THE PROPER DOSAGE FORM,
- LABELED FOR THE INDICATION,
- AND IS CLINICALLY EFFECTIVE?

YES

USE THIS DRUG PER LABEL, AS EXTRALABEL DRUG USE IS UNNECESSARY.

NO

PROCEED WITH EXTRALABEL USE OF AN ANIMAL DRUG, IF AVAILABLE. MAINTAIN REQUIRED RECORDS.* LABEL DRUG APPROPRIATELY.**

OR

HUMAN DRUG

IN NON-FOOD ANIMALS YOU MAY USE A HUMAN DRUG EXTRALABELLY, EVEN WHEN AN ANIMAL DRUG EXISTS. ECONOMIC REASONS ARE VALID.
MAINTAIN REQUIRED RECORDS.*
LABEL DRUG APPROPRIATELY.**

OR

†Drugs Prohibited for *Extralabel* Use in Food Animals
(Current as of April 5, 2012. Check for updates on the FDA Web site at www.fda.gov/cvm)

- Chloramphenicol
- Clenbuterol
- Diethylstilbestrol (DES)
- Dimetridazole
- Ipronidazole
- Other Nitroimidazoles
- Furazolidone, Nitrofurazone, other Nitrofurans
- Sulfonamide drugs in lactating dairy cows (except approved use of sulfadimethoxine, sulfabromomethazine, and sulfaethoxypyridazine).
- Fluoroquinolones
- Glycopeptides (example: vancomycin)
- Phenylbutazone in female dairy cattle 20 months of age or older.
- Adamantane and neuraminidase inhibitor classes of drugs that are approved for treating or preventing influenza A are prohibited therapy in chickens, turkeys, and ducks.
- Cephalosporin (excluding cephapirin) in cattle, swine, chickens, or turkeys
  - Using cephalosporin drugs at unapproved dose levels, frequencies, durations or routes of administration is prohibited;
  - Using cephalosporin drugs in cattle, swine, chickens or turkeys that are not approved for use in that species (e.g., cephalosporin drugs intended for humans or companion animals);
  - Using cephalosporin drugs for disease prevention.

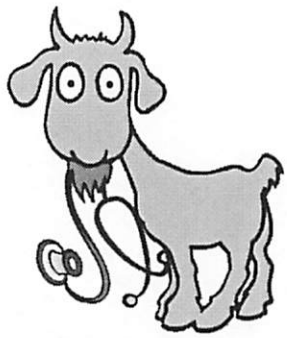
* and ** - See record and label requirements. *** - Compounding of bulk drugs is illegal.

On Farm Drug Use Worksheet

FARM/OWNER:

Herd:

Date	Animal Name/ID	Drug Used	Amount	Route of administration (IM IV SQ T)	Location	Meat / Milk Withdrawal (Days)	



ON-FARM VETERINARY MEDICAL KIT

This is a list of supplies and basic medications that is recommended for your on-farm vet kit. While there are certainly many additional items that you may have, these are ones thata most field veterinarians feel are the necissities. Download and print this list and post it in your barn for reference.

ITEM	USES	FOUND AT
Thermometer (quick-reading digital)		Pharmacy
Activated Charcoal	oral use after toxin injestion	Vet/Farm Supply
Dosing Syringe	administration of oral meds or fluids	Vet/Farm Supply
Foal Stomach Tube* (*only after veterinary instruction)	relieving choke, giving quantities of oral meds like mineral oil	Vet/Farm Supply
Colostrum or colstrum replacer	for oral use in crias needing colostrum	Online suppliers
14 or 16 French red rubber catheter	tube feeding crias	Vet/Farm Supply
Catheter tip syringe or plastic bottle	" " "	Vet/Farm Supply
Syringes w/needles (3,6,12 mL syringes) (18,20 gauge needles)	vaccinations and injectable meds	Vet/Farm Supply
Stethoscope	monitor heart rate/gastric motility/ Lung sounds	Vet Supply/Pharmacy
Procaine Penicillin G (refrigerate)	antibiotic	Vet/Farm supply
Naxcel*/Excenel (see note below)	antibiotic	Prescription only
Banamine injectable	inflammation/pain	Prescription only
Sucralfate (Carafate)	ulcer med (1gram/50#,2-4x/day)	Vet Supply
Ivomec/Dectomax	de-wormer	Vet/Farm Supply
Safeguard (fenbendazole)	de-wormer	Vet/Farm Supply
CD/T (refrigerate)	Clostridium perfingens Types C&D plus tetanus toxoid vaccination	Vet/Farm Supply

ITEM	USES	FOUND AT
B-Complex injectable	Vitamin B deficiency	Vet/Farm Supply
Thiamine injectable	Thiamine deficiency	Prescription
Vitamin A&D injectable	for Vitamin D deficiency	Vet/Farm Supply
Vitamine E injectable	for Viatmain E deficiency	Vet/Farm Supply
BoSe injectable	for Selenium deficiency	Prescription only
Epinephrine injectable (1:1000)	Anaphylactic shock	Prescription Only
Antibiotic spray	cuts and abrasions	Vet/Farm Supply
Antibiotic eye ointment	eye infections or injuries	Pharmacy
Blood stop powder	toenails trimmed too close	Vet/Farm Supply
Betadine or anti-bacterial solution	cleaning superficial wounds	Vet/Farm Supply
Isopropyl (rubbing) alcohol	Antiseptic	Pharmacy
Kaopectate	Diarrhea	Pharmacy
Super glue	closing wounds	Pharmacy
Gauze pads (sterile 4x4 or 3x3 in sealed bag)		Pharmacy
Telfa pads (non-adherent wound dressing)		Pharmacy
Roll gauze (cling)		Pharmacy
Roll cotton		Pharmacy
Waterproof medical tape		Pharmacy
Vet wrap	holding gauze/cotton in place;	Vet/Farm Supply
ScissorSplints (various sizes)	stabilization of fracture or other unstable musculoskeletal injury (luxation) can manufacture with PVC pipe; broom handles work well; canine splints are available through vet supply houses and will work for smaller ruminants.	Vet Supply

*Excenel:The Excenel does not need to be refrigerated. The Naxcel can also be stored at room temperature unti it is reconstituted; once reconstituted, it should be kept refrigerated and has a short shelf life (1 week)