Basic Goat Production for Kentucky

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COOPERATIVE EXTENSION

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UNIVERSITY OF KENTUCKY
College of Agriculture
Introduction

Goat production has increased dramatically in Kentucky, with a growth rate of over 500% between 1997 and 2002 according to the Census of Agriculture. This growth has predominantly been through an increase in the number of small goat farms around the state as producers started diversifying their farms through the state agriculture diversity program, run through the Governor’s Office of Agriculture Policy and funded through the tobacco settlement. Many of these producers are learning that goats are not like other livestock. Because of this many producers find it frustrating and discouraging their first few years as goat producers.

Goats have specific problems in the areas of health and nutrition that can become overwhelming if people are not properly prepared before starting a goat operation. This publication is designed to provide basic information needed for new goat producers and to be utilized as a reference for the more experienced goat producer. The publication will cover basic information on genetics and selection as well as proper record keeping for your goat herd. Basic herd health practices with special focuses on parasite and hoof health. There will also be information related to marketing, forage selection and management, and nutritional management for your goats.

The first step in any livestock operation is to set goals. Goals are always specific to the enterprise and must be set at the start to provide direction to the rest of the planning process. Determining what type of producer you wish to be will help you set these goals. There are different types of producers that fit different needs in the industry and each has its own specific set of economic and production challenges.

To determine what type of producer you wish to be, we must first make the distinction between hobby and agriculture producers. Hobby producers are those people who wish to have some animals but never expect or require them to generate income to cover their costs. These people raise the animals simply because they like to raise them. They may sell or consume some of them on occasion but they are not expected to cover their cost of production. This type of producer is not always high cost, but they will generally spend what it takes regardless of the potential return.

Agriculture producers are those people that raise animals to generate income for their farm and family. These animals are expected to produce and generate more income than their cost. They are expected to be profitable at some point. There are both large and small scale agriculture producers. These producers are willing to spend on their animals but base their spending on expected returns. This publication is designed with the agriculture producer in mind.

Types of Producers

Within agriculture producers, there are three basic types of producers: elite seed stock, multiplier seed stock, and commercial. Each segment has a different market target and some producers fall under more than one category. If we picture the industry similar to a pyramid we can better understand the importance and role of each segment.

Commercial producers are the base of the pyramid and make up the largest number of producers in the industry. Without this strong foundation, the others would not be able to survive. The primary market for these producers is the commercial meat market. These producers sell the largest number of animals and make their profit through strategic spending and keeping cost as low as possible while maintaining or improving productivity. All producers will sell some animals through the meat markets; however, the commercial producer sees this as their major source of income.

The multiplier seed stock producers are the middle of the pyramid and provide breeding stock to the commercial producers. There are fewer of them than the commercial producers because there is less need for their product. Multiplier seed stock producers are responsible for producing most of the breeding stock used in the industry. These producers are often purebred breeders and in many cases have enterprises that are similar to the commercial producers but generally have higher inputs than commercial producers, but sell higher value breeding animals to offset these higher inputs. They may also generate some crossbred breeding stock for specific markets.
The elite producers are the top of the pyramid and have the least numbers. They are the producers that generate the breeding animals used by other elite and multiplier producers. Elite seed stock producers are those producers that generate the high end breeding animals. These are the ones that are winning most of the shows and have bucks in the AI catalogs. These are the producers that spend larger, but expect and generally receive bigger returns. These are in generally the high stakes gamblers of the industry. They are the producers that generate the genetics that we will use within a breed in the future.

Setting Goals

All producers need to set some goals for their farm. Both long and short term goals are important for your success. It is also important that you write down these goals and refer to them at least yearly. The goals for the farm need to be specific but attainable and realistic. Your goals should also be performance based and move your herd in a profitable direction. Economic and business goals should be included and fit in with production goals.

When setting goals, it is important to know where your herd is in relation to performance and economics. Once you determine this, it is easy to set goals that move you in a positive direction and help to increase profitability and productivity. Having a goal of becoming the best, most profitable goat producer in Kentucky is very admirable, but how would you determine when this was achieved? How do you measure it against all other producers? Goals need to be specific to your farm and measurable on your farm.

Short term goals should help move your operation toward your long term goals. An example of a short term goal may be to decrease the number of single births by 50% in two years. The corresponding long term goal may be having a 200% kid crop weaned in 10 years. One of the major purposes of short term goals is to address the different components needed to reach the long term goal. This helps you focus on the details without losing the bigger picture and allows for success to build as you progress.

The importance of writing the goals down is to help you focus and make a commitment to achieve the goals. This is critical to keep from “chasing fads” in the industry. Referring to these goals at least annually helps you make better decisions related to your animals. This is critical to moving you forward because you begin to evaluate decisions on genetics, health, and nutrition relative to your goals. Will adding this new buck help you achieve a goal? What supplement should we use and when to increase reproduction? Many other questions become framed by your goals.

Finally it is important not to set too many goals at one time. All producers have a goal of being sustainable in their production. I recommend that producers start by asking the question where do we want to be in 10 years? Then ask where do we need to be in 5 years to achieve that? These are your two primary long term goals. Now set shorter term goals (max of 2 years) to help you achieve the 5 and 10 year goals. Write them all down as part of a business plan and stick to them.

Animal Genetics and Selection of Breeding Stock

Animal genetics are the foundation of improved production. Producers need to have an understanding of several basic genetic principles including heritability, heterosis, breed differences, dominant and recessive traits, and genetic resistance to disease. With this knowledge producers are able to increase their production efficiency and improve productivity of their herd without increasing cost of production. Table 1 lists basic definitions of terms important in animal genetics and selection. Having a better understanding of these terms will help you improve your herd through selection and management of genetics.
It is also important for producers to understand that the only way to improve performance is to select animals based on performance. For many years random mating has been practiced with the predictable result of a wide variation in performance and quality of goats being produced. The only way to produce uniform animals of a specific quality is through genetic selection based on performance records. One of the first steps is the selection of breeds to meet the needs of your goat operation.

**Breeds and Types of Goats**

Goat breeds are generally divided into three primary types: dairy, meat and fiber goats. There are also...
some breeds that are considered dual purpose, generally being utilized for milk and meat production. It is important to remember the purpose of the breed when considering buying goats. Crosses between breeds and different classifications can produce desirable individuals but there can also be drawbacks to these crosses.

Common meat goat breeds are the Boer, Kiko, Savanna and Spanish. Crosses between these breeds have resulted in very good performance and hardy kids with a desire to survive. Most breeders are utilizing Boer genetics to increase muscle in their goats. Commercial producers will need to consider crossbreeding to take advantage of survival traits and improve productivity of their does. It is recommended that producers cross meat breeds primarily for meat production. Table 2 lists several breeds, their breed type, and important traits to consider with that breed.

Table 2. Common breeds of Goats.

<table>
<thead>
<tr>
<th>Breed</th>
<th>Type</th>
<th>Traits of Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpine</td>
<td>Dairy</td>
<td>High milk production</td>
</tr>
<tr>
<td>Angora</td>
<td>Fiber</td>
<td>Mohair yield, light muscled, must be sheared</td>
</tr>
<tr>
<td>Boer</td>
<td>Meat</td>
<td>High growth rate, muscling, lower health traits.</td>
</tr>
<tr>
<td>Cashmere</td>
<td>Fiber</td>
<td>Fiber production</td>
</tr>
<tr>
<td>Kiko</td>
<td>Meat</td>
<td>Hardy, low input, large framed</td>
</tr>
<tr>
<td>LaMancha</td>
<td>Dairy</td>
<td>High milk production, very small ears</td>
</tr>
<tr>
<td>Myotonic (Fainting goats)</td>
<td>Meat</td>
<td>Smaller framed, very heavy muscled, hardy goats</td>
</tr>
<tr>
<td>Nubian</td>
<td>Dual – Dairy/meat</td>
<td>Good milk, large framed, more meat than most dairy breeds</td>
</tr>
<tr>
<td>Pygmy</td>
<td>Meat/pet</td>
<td>Small framed, slow growth rate, heavy muscled, currently not desirable in most markets</td>
</tr>
<tr>
<td>Saanen</td>
<td>Dairy</td>
<td>Good milkers and hardy, moderate framed</td>
</tr>
<tr>
<td>Savanna</td>
<td>Meat</td>
<td>Growth and survival, little research at this time</td>
</tr>
<tr>
<td>Spanish</td>
<td>Meat</td>
<td>High survivability, moderate frame, good mothers</td>
</tr>
</tbody>
</table>

There are literally hundreds of other breeds of goats out there, but these are the most common. When determining which breed or breeds to use, producers need to consider markets and availability of a breed. Most meat goat producers are using Boer or Boer crosses in their herds. Because of this if you wish to sell breeding animals Boer is popular, but there are a larger number on the market. Other breeds, such as the Kiko and Spanish are also popular but more difficult to locate. However, regardless of numbers, quality breeding stock is critical to everyone's success.

Crossbreeding has been studied in cattle and sheep for years and has proven to be a valuable tool for commercial producers. Research with goats is starting to show the value of controlled crossbreeding programs. A crossbreeding plan allows for the combining of desirable traits from multiple breeds to produce a higher value offspring. An example would be using Kiko does with Boer bucks to get the survival traits of the Kiko and the muscling and growth of the Boer in the offspring. Another example would be the use of a Nubian X Spanish cross does in a commercial herd to get higher milk production and survivable in the does then crossing them with a Myotonic buck to get better muscling in the offspring.

Crossbreeding programs can improve growth traits but their greatest strength is in the increase in...
survival, reproduction, and mothering. Crossbred does simply make better mothers than purebred does, and crossbred offspring seem to survive better than purebred kids. The greatest amount of heterosis is found when you cross animals of unrelated breeds. However this tends to create a problem of finding quality replacement crossbred females. Producers need to utilize crossbreeding systems to maintain a high level of heterosis while producing quality replacement females. The most common system is a two breed rotational system because it is the simplest to follow.

A two breed rotational system requires two breeding pastures and two bucks of different breeds (breeds A and B). The system takes does sired by breed A and breeds them to bucks of breed B and does sired by breed B are bred to bucks of breed A. Replacement does are kept from each sire breed to maintain the herd size.

Another popular crossbreeding system is a terminal system. This is where the producer has a herd of crossbred or purebred does and uses a buck of a different breed to produce kids that will all be marketed through the commercial meat market. Crossbred females are often used because of maternal heterosis found in these females. The problem with this system is how to produce replacement females.

Some multiplier producers specialize in production of first cross (F1) does that are marketed to commercial producers as replacement females. This is another way to maintain a crossbred female while using a terminal cross. Other producers use a combination of a rotational and terminal system. There are other breeding systems that can be utilized and modified to fit different needs.

Regardless of the breeding program it is critical for all producers to keep good records. These records will allow you to evaluate and select the best animals to move your herd toward your goals. Records are the only way to determine which animals are meeting and exceeding your performance goals. It is also the best way to measure your progress.

Record Keeping

Record keeping can be as simple or complex as you wish. The key is to get a system that you can use and use the records you keep. It is important in record keeping to keep things as simple as possible but to gather as much information at the same time. Most producers are keeping some economic records for tax reasons. Those records need to be incorporated into budgets, and production records also need to be maintained.

Basic production records will include animal inventory, animal identification, growth information, reproduction information, and marketing information. Performance records include most of these and are essential for selection of higher producing animals. A good set of performance records will start with an inventory of all breeding animals on the farm.

The animal inventory will include individual animal identification, including official Scrapie tags and farm tag identification (ID). These records should also include information on the age, or date of birth, for all breeding animals on the farm. This will allow you to better understand the age distribution of your herd.

The next set of records needed is kidding data. This includes individual kid ID, dam ID, sire ID, type of birth, birth date, and birth weight. You can add other information to help you specifically but these are the basic ones. The next step is to take weaning data for each kid weaned. This will be added to the kidding data and must include weaning date and weight as well as rearing type. Make a special note for any kid fostered or raised on a bottle.

With this information you will be able to calculate kidding rate, weaning rate, and adjusted weaning weights. This information will help you evaluate which does and bucks are doing the best job for your farm and which should be culled. It will also allow you to select replacement does that are from multiple births and had the best growth performance. By doing this you can increase your kidding rate, and hopefully weaning rate, while improving growth rate and mothering ability in your herd.
Other records you should keep are related to animal health and death losses. You need to keep a health or treatment record on each animal on your farm. This will allow you to select animals that have fewer health problems for replacements and cull breeding stock that are constantly needing deworming or foot treatments. This will improve the health and productivity of your whole herd.

Records on death losses need to include date of loss and information on the cause of death. This will assist you in identifying problem times of the year and diseases or other issues that need to be addressed. By doing this you will be able to focus your management and treatments to better fit your situation. This will allow you to increase survival and ultimately improve production and profitability. The same information should be kept on culled animals.

### Animal Health

To be successful it is critical that you maintain a healthy herd. To do this you need good genetics and nutrition for your animals. However the best genetics and nutrition are useless without a good herd health plan.

A health plan includes a sound biosecurity plan, vaccination program, parasite control program, foot care program, and treatment program. You should develop a relationship with a veterinarian or other qualified expert in your area and work with this person to insure an animal health plan for your goats. With goats a relationship with a veterinarian is critical because most medications are not labeled for use in goats and you need a prescription to legally use them. Only your veterinarian can give you a prescription to use a product in a way other than what is on the label.

It is also important to know what a normal healthy goat should look like. This includes normal vital signs of a goat listed in Table 3. You should also observe your animals and learn their normal behaviors. A healthy goat will look vigorous and stand correctly. It will be attentive and it’s hair coat will be smooth. A goat in good health will also have alert, “shiny” eyes. Goats are social animals and tend to stay with a group. Animals that do not wish to stand, separate themselves from the herd, or look depressed are generally in poor health. These may be the first and only signs a goat gives you of an illness. So it is very important to be observant and examine any animal that does not behave as normal.

<table>
<thead>
<tr>
<th>Data</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>101.5 F</td>
<td>104.0F</td>
</tr>
<tr>
<td>Heart Rate</td>
<td>70/min</td>
<td>80/min</td>
</tr>
<tr>
<td>Respiration Rate</td>
<td>12/min</td>
<td>15/min (resting)</td>
</tr>
<tr>
<td>Age at Puberty</td>
<td>7 months</td>
<td>10 months</td>
</tr>
<tr>
<td>Length of estrous cycle</td>
<td>18 days</td>
<td>22 days</td>
</tr>
<tr>
<td>Gestation length</td>
<td>146 days</td>
<td>155 days</td>
</tr>
</tbody>
</table>

### Biosecurity Plan

Biosecurity is the reduction of risk of exposure or spread of diseases on your farm. This includes disease, parasites, and poisons. Basic biosecurity plans are used to help reduce exposure risk and spread of different diseases and parasite problems between and within farms and should be in place before you purchase your first animal.

The place to start is with the construction of a quarantine (isolation) facility. This is a location where animals can be held separate from the rest of your herd. The quarantined animals should have no direct contact and should not share a common food or water source with other animals on the farm. This should also be an area that is easy to clean and sanitize. This area can be used for housing of sick
animals as well. This facility will be used for all newly purchased and returning animals (from shows or exhibits) before they are added to the production herd.

Upon arrival, all new animals should be placed in the quarantine facility and treated for parasites and foot problems. The goats should have their hooves trimmed and go through a foot bath (10% zinc sulfate solution is recommended, copper sulfate also works) allowing a 3 to 5 min soak. They should be treated for parasites with a product from all three classes of dewormers as well as treated for lice. After 10 days, a fecal sample should be run to determine if any parasite eggs are present and the animal should be treated again if necessary. This will reduce the risk of adding resistant parasites to your farm and reduce foot problems later. The quarantine facility should have a rock or concrete floor and the animals should not have any access to grazing during this time.

During this time, it is also a good idea to vaccinate new animals to be sure their protection is up to date before they are placed in your herd. Check the animals for other disease or problems during the quarantine period, including Caseous lymphadenitis (CL), sore mouth (orf), foot rot, lice, etc.

Animals that go to livestock shows or exhibits should also be placed in the quarantine facility when they return. During this stay, observe these animals and watch for signs of illness. This will help you prevent the introduction of new diseases to your herd. All animals should be placed under quarantine for a minimum of 14 days upon return to the farm. New arrivals should be kept separate for 14 to 30 days.

Vaccinations for Goats

It is critical that you work with your veterinarian or other qualified expert to make a health plan for your herd. A good health plan will be based on specific diseases in your area and what you plan to do with your herd (i.e. show stock, sell breeding stock out of state, meat production). A good health plan centers around a solid vaccination program that protects your animals from the most common diseases. There are two basic reasons we vaccinate our animals: 1) to prevent disease and 2) if an animal is exposed or contracts the disease, previous vaccinations help reduce the recovery period.

There are four basic vaccinations many goat producers are using today. These are *clostridium perfringens* type C and D, tetanus, sore mouth (orf), and CL. All producers need to vaccinate for *clostridium* and tetanus. This is generally done with a single product.

*Clostridium perfringins* is more commonly known as “overeating” disease and you should vaccinate for types C and D. The product used is commonly referred to as CD & T vaccination.

Depending on your past experience and if you are planning to show animals you may want to vaccinate for orf, also known as sore mouth or more properly as contagious ecthyma. There is a commercial vaccine available for this condition in sheep and this product is very often used by goat producers. This is a live vaccine so use care when handling to reduce personal exposure (use gloves when handling).

Caseous lymphadenitis (CL), also known as cheesy gland or abscess disease, is caused by a bacterial infection that causes an abscess generally in the neck or jaw area of the goat but can be located in other areas. This disease is a very important one and needs to be treated and prevented more aggressively by many producers. Vaccines are available for this condition in sheep and there are some being produced specifically for goats. These vaccines are very hard on the animals because they cause a mild infection in the animals and should not be given to pregnant females within two months of kidding.

Both CL and orf can be spread to humans. Because of this, it is critical that you treat infected animals with care. It is important to wear gloves when handling animals with these diseases and work to prevent them when ever possible. People with show animals need to know that you will not be allowed to enter a show with active cases of either on your animals.

Parasite Control in Goats

Internal parasites are the number one problem with goats causing the greatest amount of death and
economic losses for the industry. Unfortunately there are not many products proven to be effective for parasite control labeled for use in goats. However, most products can be used with the advice of a veterinarian.

The predominant parasite problem is *Haemonchus contortus* also known as the barber pole worm. This parasite is a blood sucking worm that creates anemia in the animal and reduces the animal’s resistance to other infections and parasites. It is also very good at surviving and is becoming resistant to many dewormers.

To control parasites you should have a parasite management plan in place that you have discussed with your veterinarian. It is recommended not to treat all animals at the same time because about 20% of the goats carry about 80% of the parasites, often referred to as the 80:20 rule. Selective treatment helps control parasites in those animals that need it while reducing the rate of resistance buildup to the product you are using.

To selectively treat, it is recommended that you become trained and utilize the FAMACHA© system. This system evaluates the level of anemia in your animals and only recommends treatment for animals that are becoming clinically anemic. Animals that are judged to be anemic need to be treated with an effective dewormer.

Along with the selective treatment, there are times of the year when all animals need to be treated for parasites. This is primarily around kidding. All does should be dewormed at kidding. There is research that shows an increase in parasite eggs associated with kidding. Treatment of animals about 1 month (when you give the CDT booster) before kidding will help reduce parasite load and this jump in egg production. However, animals on pasture will pick up more parasites so treatment of all does at kidding, as part of processing kids and mothers is an alternative to before kidding.

Other parasites of concern include coccidia and lice. Coccidia are protozoa found in all goats. They become a problem in animals that are stressed and are more of a problem in younger animals. The normal method for control is to include an coccidiostat in your feed or to treat the water at weaning or other strategic times during the year.

Lice are typically a problem in the winter when animals tend to stay grouped closer together and utilize shelter more often. Treatment is generally through a pour-on de-lice product available through your veterinary or farm supply source. If goats are not listed on the label you need to consult your veterinarian before using them.

Remember that with any medicine or chemical of any type, you need to always read and follow label directions. If the product is not labeled for use in goats you can only use it under the supervision of your veterinarian. Be sure to follow all disposal regulations and protect products from other animals and people. Follow all meat and milk withdraw times before marketing animals, selling, or consuming any milk from treated animals.

**Nutrition for Your Goats**

Nutrition plays a critical role in production and health of your animals. Proper nutrition allows your animals to express their genetic potential. Different nutrients, especially minerals, are critical for fighting diseases in the body. This makes nutrition one of the most important parts of any livestock production operation.

Because goats are ruminant animals, they have the ability and need to consume forages as a major part of their diets. Their digestive system is specifically designed to utilize high fiber diets and has the ability to convert what would otherwise be unusable food items into high quality protein. Goats however are somewhat unique among farm ruminants in that they
prefer browsing over grazing. This, along with other unique digestive system attributes, allows them to thrive in areas where other farm animals would not, but it does not mean they have lower nutritional requirements.

Goats actually have somewhat higher nutritional requirements than cattle due to a shorter digestive tract and higher metabolism. However, due to their unique mouth parts they are able to collect the highest quality parts of browse and forbs where cattle can not be as selective. Because of this, cattle and goats generally do not compete for the same forage species in a pasture. They also have different grazing preferences than sheep, again reducing competition when grazing the same land.

Producers need to become familiar with the basic nutritional requirements of goats at different stages of production and sizes of animals. This will improve your ability to meet the animals’ needs and reduce problems related to nutrition. The basic nutrients for all animals are protein, energy, minerals, vitamins, and water. Most vitamins are provided by the bacteria in the ruminant, however vitamin A may be deficient in animals on stored forages and vitamin D may be deficient on animals not exposed to the sun for long periods of time.

**Protein and Energy Requirements for Goats**

The major nutritional requirements of animals are protein and energy. These are the ones that producers need to use when balancing a diet. The requirements will vary depending on age, stage of production, and weather. Most diets are based on animals in dry weather with minimum wind for animals in their temperature “comfort zone”. This zone can change as the animal transitions between winter and summer hair coats but is generally between 40 - 85 degrees F.

Protein is the building block for all body functions. It is the nutritional component that provides amino acids which are used in the construction of muscle, bone, tendons, and all enzymes in the body. Because of this, it is critical that the animal receives enough protein to maintain all body functions. Protein is generally expressed as crude protein in the diet and is stated as a percent of the total diet. However the animal has a requirement in pounds of protein per day so it is critical that the animal consumes enough of the diet to meet this need.

Energy is the power source for the animals and supplied in the form of carbohydrates (found mostly in forages) or starches (found mostly in grain) depending on the source. In the rumen of the goat there are bacteria that break down these large structures to produce energy. However, there are different types of bacteria that break down each type. Because of this it is important to change diets slowly to allow the microbes time to adjust to the new diet. Energy powers all body systems and excess is stored in the body as fat. Animals will increase fat reserves during good times and utilize them during times of poor diet. However, this process is wasteful and can cause problems. It is best to maintain your animals in good condition with a moderate amount of fat for emergencies but not enough to cause problems with reproduction.

Protein levels are printed on all feed tags, however energy is not listed. The most common indicator on a nutritional analysis for energy is total digestible nutrients or TDN. It is becoming more common today to see energy expressed as net energy for gain (NEg) or maintenance (NEm). This is a more useful term as it relates to energy requirements; however we still see both listed on nutrient requirement tables.

The best source for producers to find out about the requirements of their animals and balancing rations is to visit the Langston University web page and use their nutrient calculator. Their web page is http://www.luresext.edu/goats/research/nutritionmodule1.htm. This calculator will allow you to determine the nutritional requirement for your animals and work to balance a ration to fit your specific needs based on the forages and feeds you have available. Table 4 lists some basic nutrient requirements for a Boer cross doe at different stages of production.

**Mineral Requirements for Goats**

Mineral are important to keep a goat healthy. Many minerals are critical to fighting disease including
parasitism and foot scald. The most important thing to remember when considering mineral supplementation is that goats have a higher copper requirement than sheep. Because of this, you should not use a “sheep and goat” mineral for goats. Goats usually prefer loose minerals. When supplementing minerals be aware of antagonisms in mineral nutrition. Most of these are related to sulfur and iron oxide which reduce the ability to absorb important minerals such as Se and Cu. Other antagonisms occur and can reduce the effectiveness of your supplementation program. Your local extension office should be able to provide you with information on specific problems in your area.

Utilize a good quality trace mineralized salt to meet your goat’s mineral needs. You should not feed both a complete feed with minerals added and free choice minerals at the same time. This wastes money and can potentially put your animals in danger for toxicity. Most common feeds do not contain a complete mineral package, so read the feed label.

Most minerals are divided into two categories, macro and micro minerals, depending on the amount required by the animal. The major macro minerals are calcium, phosphorus, sodium, sulfur, and magnesium. The major micro minerals are copper, zinc, iron, iodine, manganese, and selenium. The Table 5 list minerals requirements for goats evaluated and determined for Kentucky by Dr. John Johns and Mr. Terry Hutchens.

There are many good quality minerals on the market for goats and these are the best choices for your animals. It is critical that you learn to read the label on your feed and minerals to know what is in the

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>&lt;95d pregnant</th>
<th>&gt;95d Pregnant</th>
<th>14d in lactation</th>
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</thead>
<tbody>
<tr>
<td>TDN (lbs)</td>
<td>1.47</td>
<td>1.62</td>
<td>3.32</td>
</tr>
<tr>
<td>CP (lbs)</td>
<td>0.16</td>
<td>0.22</td>
<td>0.58</td>
</tr>
<tr>
<td>Dry Matter (DM) (lbs)</td>
<td>2.26</td>
<td>2.36</td>
<td>4.51</td>
</tr>
<tr>
<td>Calcium (CA) (g)</td>
<td>3.26</td>
<td>5.26</td>
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</tr>
<tr>
<td>Phosphorus (P) (g)</td>
<td>2.28</td>
<td>3.68</td>
<td>5.84</td>
</tr>
</tbody>
</table>

Table 4. Nutritional Requirements for a 100 pound Boer Cross Doe.
products. Some feeds and minerals can contain medications to help control coccidia and diseases while others don’t. There are also a large amount of variation in ingredients and chemical analysis between different minerals. We also know that goats receive part of their daily requirements from the forage and feed they receive, reducing the amount of some minerals they need. If you are not sure about what minerals your goats need, contact your county extension office and they should be able to help you find a good quality mix for your area.

**Importance of Forage in the Diet**

Goats are ruminant animals and this means that they are very good at digesting forages. They have a fairly high fiber requirement in their diets. In most situations forage is more economical to feed your goats than grains or other purchased feeds. However the forage must meet the animals’ nutritional requirements to be of use.

Goats will graze different forages at different times of the year and prefer different types of forage than other grazing animals. They tend to be able to select a fairly high quality diet if it is available. However, they will learn to consume grain and prefer it over forage if offered. Because of this, many first time producers make the mistake of thinking their animals must have grain because they “complain” if they don’t get it.

In fact, with good quality grazing or stored forages, goats need very little grain supplementation to meet their nutritional needs. The key is to know the quality of the forage you have available. The best way to learn about forage quality is to have a forage quality test done on your stored forages and even some of your pastures if necessary.

In general, green growing grass or browse will provide the goat with enough nutrition to perform through most of the production cycle. However, stage of maturity and moisture content affect forage quality greatly. That is why producers need to strive to keep the grass growing and green through out the grazing season. Don’t let the goats over graze or under graze an area. If the forage gets too tall, cut it for hay to feed later before it goes to seed. If the forage is growing slow, move the goats to new pasture ahead of scheduled rotations and feed hay if necessary.

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Late Gestation</th>
<th>Pasture, Grazing Doe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium (Ca) min %</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>Calcium (Ca) Max %</td>
<td>20</td>
<td>17</td>
</tr>
<tr>
<td>Phosphorus (P) %</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Salt, min %</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Salt, max %</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Magnesium %</td>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>Zinc, ppm</td>
<td>2700</td>
<td>1350</td>
</tr>
<tr>
<td>Manganese, ppm</td>
<td>2500</td>
<td>1250</td>
</tr>
<tr>
<td>Copper, min ppm</td>
<td>1400</td>
<td>750</td>
</tr>
<tr>
<td>Copper, max ppm</td>
<td>1600</td>
<td>850</td>
</tr>
<tr>
<td>Iodine, ppm</td>
<td>140</td>
<td>70</td>
</tr>
<tr>
<td>Selenium, ppm</td>
<td>50</td>
<td>25</td>
</tr>
<tr>
<td>Vitamin A, IU/lb</td>
<td>300,000</td>
<td>150,000</td>
</tr>
<tr>
<td>Vitamin E, IU/lb</td>
<td>300</td>
<td>150</td>
</tr>
</tbody>
</table>
You should also have a forage quality test done on all stored forages you plan to feed to your goats. There are several labs available to do these tests for you. It is critical that a good random sample is collected of your forage for the test and that each “lot” of forage is tested. A “lot” is all the forage taken from one field at one cutting. Over the years labs have proven that forage quality can vary greatly between fields and cuttings within a year as well as between years. This makes it important to test each year.

The test results can then be used to help you balance your feeding program and insure that your animals are fed properly.

**Basic Ration Balancing**

Balancing a ration is the process of insuring that the feeding program meets the needs of your animals. This also helps you know if you need to supplement and what areas need to be supplemented. To be successful in balancing a ration you will need to know the nutritional value of your forages and supplement source. You will also need to know the nutritional requirement of your animal which depend on the age, weight, and stage of production of your animals. Many of the basic values are available from forage analysis, animal nutrition books and extension publications.

Many producers have had problems with animals because they failed to have a forage analysis conducted before starting a winter feeding program. There are many publications available on how to take a forage sample and many labs that will conduct the analysis for you. In Kentucky, the simplest way to have your forage analyzed is to contact the Kentucky Department of Agriculture’s Forage Testing Program at 800-248-4628. They will arrange to take the sample and conduct the analysis for you for a minimal cost.

After getting your forage tested, you will need to look up the nutritional requirements of for your animal in a publication or at the Langston University Nutritional calculator web page located at: http://www.luresext.edu/goats/research/nutritionmodule1.htm. This page will allow you to determine the nutritional requirements of your animal and then balance a ration using the forage and supplements you have available.

Using a nutritional calculator is the simplest method of balancing a ration for your animal. However, if you do not have access to the internet or need to make some quick adjustments there are other methods. First, your goats will consume between 2 and 3 % of their body weight in dry matter each day depending on availability and digestibility. For most mature goats, this equals about 3 to 4 pounds of hay each day. Use your forage analysis to determine if your goats will meet their needs when consuming this amount each day. For example if your forage analysis indicated 11% CP and your goats will consume 3 pounds DM (4 lb as fed and 75% DM hay) then we calculate the amount of CP consumed is 11% X 3 = 0.33 lb CP/day in the diet. If your goat has a CP requirement below 0.33 lbs/day then hay alone can meet that need. You will need to do the same for the energy as well.

If your forage cannot meet your animal’s nutritional needs, then you need to supplement the forage. To quickly balance a ration you need to know how much you will be deficient in the specific nutrient and then calculate how much of your chosen supplement will be needed to meet that deficiency. Then reduce the amount of forage consumed by that amount and see if you still meet all the animal’s needs.

Economics will play a large role in how much you supplement. However, you must provide adequate nutrition for your animals if you expect them to grow and reproduce for you. By balancing the ration and only supplementing when necessary you will be able to reduce your feed cost and maintain productivity of your animals.

It is critical that you always have available a good quality trace mineral mix for your animals. Be sure not to double up on minerals by having a complete mineral mix added to your feed. It is acceptable to have some minerals in both, but minerals such as copper should only be added to one source.

**Predators and Predator Control**

All livestock producers are concerned about predators and controlling losses due to them. This is especially true with small ruminant producers. Due to the size of your animal it becomes easy for predators, including domestic dogs, to attack our herds and flocks.
Predation may occur from several sources including coyotes, foxes, domestic dogs, and birds of prey. The control of predators often requires a combination of methods, i.e., a guardian animal and a good fence. There are also times of the year when predators are more of a concern. For example, mature does do not generally have a problem with foxes or birds of prey, however during kidding season these predators may take kids.

Dogs are the most common guardian animal; however donkeys and llamas are also used. The choice of guard animal is a personal preference. Many producers have had good success with all types. The key is to get a well trained guard animal and not make a pet out of it. Training of the guard animal is critical to its success in protecting your herd. There are several good publications on training guard dogs and some are listed in the resource section of this publication.

A variety of dog breeds can work for predator control. The Great Pyrenees is the most widely used, but the Komondor, Akbash, Anatolian Shepherd, and Maremma are also used as guardian dogs. It is important to remember that guardian dogs are not “stock” or herding dogs. Herding breeds have a desire to herd animals, they can become aggressive with your animals and may even kill goats if left alone with them. Guardian dogs act largely independent of man, doing what instinct and conditioning tell them to do.

New concerns with guardian dogs tend to center around feed bans and feed additives. Some feed additives and ingredients are not approved, and are potentially dangerous for dogs, but are common in goat feeds. Cotton seed products are one issue with dogs as are ionophores, both can be contained in goat feeds. In small quantities they generally will not harm the dogs. Ruminant derived protein is prohibited from all ruminant feeds by federal law. Producers need to either create a dog feeding area or purchase dog feeds without ruminant protein, to prevent the goats from consuming the dog food spilled or not consumed by the dog.

Female donkeys are often used as guard animals. Intact male donkeys do not make suitable guardians because they can become aggressive with does and bucks during breeding season. A good guard donkey will chase and trample a predator; they will bed down with the goats and sound a fearsome alarm at any strange noise or smell. When compared to dogs, a smaller percentage of donkeys make excellent guard animals, but owners who have a good one swear by them; those who don’t, swear at them. An obvious advantage is the fact that the donkey eats what the goat eats, no special feeding is required. However, ionophores are not labeled for equines and may be toxic to them, so be sure to check the feed and mineral tag for problems.

Llamas are becoming more popular as guard animals. However, research on their effectiveness is limited. Intact males do not make good guard animals because they may become protective of does during the breeding season and they may become very aggressive with people. Work at the University of Wyoming with llamas as guardian animals in sheep indicates that their effectiveness comes from their curious and fearless nature, complimented by their size. Sheep that attach themselves to the llama are seldom bothered; those who wander may not receive protection. In almost no cases have they recorded confrontational activity by the llamas. Llamas also have an advantage of consuming forage with goats and those that are good are very good but the bad ones can be very dangerous to both livestock and people. There is also concerns that llamas have similar parasite problems as goats and are very susceptible to meningeal worms.

Other animals are also used by some people as guard or protectors of small ruminants. These may include horses, mules, ponies, and cattle. The success of these as guard animals vary with the individual animal and how well they bond to the animals being protected. Just as with donkies, horses, ponies, and mules will attack a predator to defend their offspring or other herd mates. If they accept the goats or sheep as their offspring or herd mates, they will be protected. Cattle are another issue and most will not attack a predator but will run it out of a pasture if they feel threatened or have young. Unfortunately they don’t always protect the area as dogs will and you may lose goats if they do not stay in close with the cattle.
When selecting a guard animal, talk to the person you are purchasing it from and learn about its parents and how they have performed as guard animals. Ask about how the animal was raised and with what type of animals it has been exposed. Remember that young animals are often not always reliable because they want to “play” at times like all kids. It is important to keep a close watch on new guarding animals to make sure they bond with your goats and do not decide to “play” rough with them.

Finally you may never see your guard animal defend our herd or even find evidence that it has happened. However, if you know that there are predators in your area and you are not losing animals to them, something is working. You also must be aware that many guard animals can become aggressive toward people, especially strangers, so be sure to warn visitors and post signs to protect your self. Also, check with your local and state regulations related to domestic dogs and wildlife damage control.

Additional Resources for Goat Producers

National eXtension goat community of practice. http://extension.org/goat

MEAT GOAT HOME STUDY COURSE. http://bedford.extension.psu.edu/agriculture/goat/Goat%20Lessons.htm

WEB-BASED TRAINING AND CERTIFICATION PROGRAM FOR MEAT GOAT PRODUCTION. Langston University. http://www2.luresext.edu/goats/training/qa.html

