

Chapter 1

So You Want to be a Goat Rancher

JJ Jones

Industry Overview

The meat goat industry is an expanding U.S. business. Estimates indicate approximately 50 million pounds of goat meat are consumed each year. Imports from other countries total 23.7 million pounds.

The increasing popularity of goats is due to several factors. The biggest factor is increased demand. A large number of ethnic groups whose members prefer goat meat have settled in the U.S. Outside of the U.S., goat meat is the meat protein highest in demand. Another factor is the attraction of goat production as a sustainable enterprise for producers. Goats can be a profitable enterprise for producers with limited resources, time and capital.

In 2012, USDA estimated there were 2.15 million meat goats in the U.S. Figure 1-1 shows the location and distribution of meat goats in the U.S. Texas has the most meat goats with 820,000 head. Oklahoma ranks third behind Tennessee with 95,000 head.

Although more than 70 percent of the total number of meat goats are raised in the southern

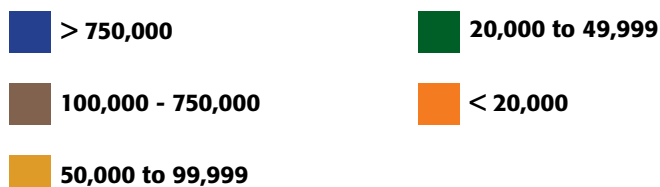


Figure 1-1. Meat goat inventory numbers for 2012.

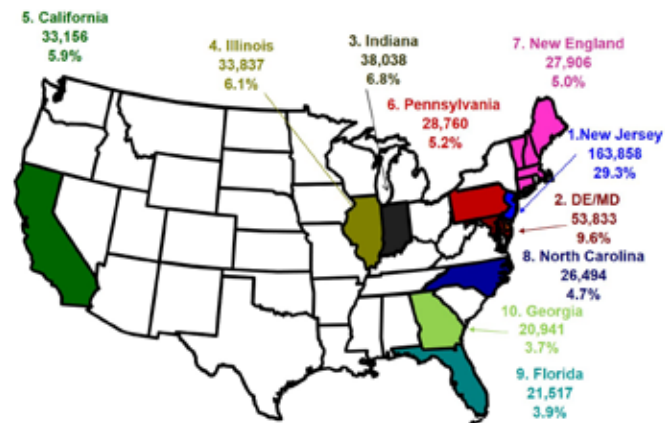


Figure 1-2. U.S. inspected meat goat slaughter numbers for 2012.

part of the U.S., almost 50 percent of the goats commercially slaughtered are done so on the east coast (Figure 1-2).

So You Want to Raise Goats

A producer who wants to start a meat goat enterprise needs to answer a few questions before the first goat is purchased.

The first question a producer needs to answer is why he or she wants to raise meat goats. There are several reasons for raising goats. Each reason has a different set of goals for producers to achieve and different methods of achieving those goals.

Brush Control Operation

One reason to raise goats is for brush control: to clean up woody areas. Producers who use goats for brush control generally are not concerned about overall goat production. They only are interested in the effectiveness of the goats in controlling or removing brushy plant material. Making a profit on the goats is a secondary concern. These producers do not need to buy expensive full-blood does and bucks; they would probably be satisfied with a common crossbred goat. They might even want to consider purchasing weaned wether kids (castrated male goats) instead of breeding stock.

Also, the stocking rate per acre (discussed in Chapter 4) is considerably higher for brush control than for a meat goat enterprise. Therefore, the number of goats required per acre is higher. Another concern for a brush control enterprise is the fencing needed around the brushy area. The type of fencing required to hold a goat is discussed in Chapter 11.

Multi-species Grazing Operation

Another goat enterprise is a multi-species grazing operation. This producer would start a goat operation to compliment other animal enterprises, normally cattle. When goats are grazed simultaneously with cattle, a higher percentage of the pasture production is utilized. Goats typically eat weeds and forbs that cows will not eat, which leaves the grass for the cows. Possible goals for this producer are that both the cattle and goat enterprises would be profitable. Typically, this producer would concentrate on the production side of the meat goat enterprise. Again, this producer would not have to purchase expensive full-blood does, but could start out with a set of commercial crossbred does and a full-blood buck.

Unlike the brush control operation, these producers would face the challenge of where to sell their weaned kids. Determining a market outlet is a critical component of any agricultural enterprise. If no markets exist to sell the product, then production cannot be profitable. Marketing is discussed in greater detail in Chapter 9. Fencing, discussed in Chapter 11, also is very important for a grazing operation.

Pure-bred Meat/Show Goat Operation

A third type of operation is raising purebred meat goats and/or show goats, such as the Boer goat shown in Figure 1-3. Although this type of operation seems to be the most profitable due to the higher prices received for such animals, it is also the type of operation with the highest start-up costs and the highest percentage of failure.

These producers typically are required to purchase higher-priced full-blood does and bucks for this type of operation. This producer also is usually required to join breed associations and maintain registration papers for the goats. The process of marketing these types of goats is more difficult. Producers just starting in the goat business do not typically sell the high-dollar purebred or show goat in their first year or second years. Usually, it takes several years to build up a reputation and a breeding program where quality warrants a high price.



Figure 1-3. Adult Boer goat.

Commercial Meat Goat Operation

The fourth type of enterprise is a commercial meat goat operation. With this type of operation, the goal should be to produce the optimal number of goats to maximize profits. Although this sounds simple, the optimal number of goats will depend on the resources available.

To determine which enterprise is best for an individual producer, the critical factors are the producer's needs, objectives and resources. Once the producer's resources are determined and matched with the production goals, a long-term business plan can be developed.

Business Plan

Determining the type of operation is just the first step of completing a business plan. A business plan is like a road map. Producers start with what they know where they are now, then determine where they want to be in the future. Identifying the best route to get from present to future is one of the main purposes of the business plan. The plan also can help measure the progress between the two points. It lets producers identify their operation's mission, goals, key planning assumptions, operational organization, marketing strategy and financial planning. A business plan helps producers determine if an operation can be feasible.

A business plan consists of a mission statement, goals, key planning assumptions, organizational management and marketing and financial plans.

Mission Statement and Goals

Developing a mission statement and setting goals help identify why the operation exists and expectations. The mission statement should reflect the producer's values and describe what the operation will be and what it will accomplish. By developing

a mission statement, producers have a basis for developing long-term plans and objectives.

Goals can be tangible and intangible, short term or long term and/or monetary and nonmonetary. Goal setting should involve everyone in the operation. It can be used to anticipate problems and plan strategies to overcome them. Goals need to be SMART: specific, measurable, action-oriented, reasonable and established in a time frame.

Key Planning Assumptions

Before getting started on a goat operation, the type, quantity and quality of resources available for that operation must be determined. Resources such as available land, capital, management capabilities, fencing, and marketing channels all need to be evaluated. Once resources are determined, producers can match them up with a production and marketing system and develop a business plan.

Organizational Management

A producer can operate five types of operations:

1. A sole proprietorship
2. A general partnership
3. A Limited Liability Corporation (LLC)
4. A C-Corporation
5. A S-Corporation

The majority of operations will be sole proprietorships or general partnerships. An LLC, C-Corporation and S-Corporation have their own advantages and disadvantages. Producers interested in these type of operations need to consult with a professional tax adviser.

Marketing Plan

A marketing plan is a detailed program to promote and sell a product. Producers must identify the product and determine the best time and place to market that product. Marketing plans are discussed in greater detail in Chapter 11.

Financial Plan

Once the production and marketing systems have been determined, a financial plan can be developed. Producers can develop a financial plan on their own or with the help of programs such as Intensive Financial Management and Planning Support (IFMAPS). IFMAPS helps producers measure resources and develop viable long-range business plans. This service is available through

the Oklahoma Cooperative Extension Service. See Chapter 14, for more information about IFMAPS.

A financial plan helps producers work out a plan on paper and evaluate possible outcomes. If a plan will not work with the available resources on paper, then it will more than likely not work in actual practice. A financial plan also can help identify possible strong and weak points in an operation. A sound financial plan is an important step in developing a profitable goat operation.

A financial plan uses producers' current balance sheets, cash flows and income statements along with enterprise budgets to generate projected balance sheets, cash flows and income statements. A good record-keeping system is needed to generate these financial statements. Record-keeping and financial statements are discussed in Chapter 14.

Budget

As a part of the business plan, producers need to develop an enterprise budget for the operation. Although no two producers will use the same budget, the sample budget (Table 1-1) for a 30-doe herd can be used as the starting point.

The sample budget only takes into account the cash operating costs associated with goat enterprises. The return to land, labor and capital may or may not cover the capital expenses (depreciation, taxes, insurance and land costs) associated with a goat operation. Since each operator has different capital expenses, producers should estimate these expenses.

This sample budget shows a positive return to labor, land and capital of \$953 for a 30-doe herd. Although a positive return of \$31.77 per doe does not seem impressive, it does show that a potential return above operating costs could be made by a meat goat operation. Of course, this budget is just an example. Management practices and cost controlling methods to improve the profit are discussed throughout this manual.

Conclusion

Going into the goat business is not a decision that should be made quickly. Much thought and planning needs to go into the operation before the first goat is purchased, producer must first answer these questions:

- Why raise goats?
- What type of goats to raise?

Table 1-1. Meat goat budget for 30 does, 1 buck, 170 percent kidding and 10 percent death loss.

<i>Income</i>	<i>Description</i>	<i>Total</i>	<i>Per Doe</i>
Market Kids	23 wethers @ 60 lbs @ \$2.00/lbs	2,760.00	92.00
	17 does @ 60 lbs @ \$2.00/lbs	2,040.00	68.00
Cull Does	4 @ 125 lbs @ 0.90/lbs	450.00	15.00
Cull Replacement Does	3 @ 90 lbs @ 1.20/lbs	324.00	10.80
Total Income		\$5,574.00	\$185.80
Operating Expenses			
Pasture	10 acres @ \$15/acre	150.00	5.00
Hay 8.16 tons @ \$70/ton		571.00	19.04
Supplement			
Mature Does	240 lbs./doe @ \$300/ton	1,080.00	36.00
Buck	300 lbs./buck @ \$300/ton	45.00	1.50
Replacement Does	300 lbs./doe @ \$300/ton	270.00	9.00
Salt and Mineral	\$2.14 per head	64.00	2.13
Guard Animals	14.6 bags @ 50 lbs bag/dog/year @ \$14/bag	204.00	6.80
Vet (Health and Deworming)	\$6.75 per head	209.25	6.97
Marketing	\$9.00 per head sold	423.00	14.10
Fuel and Repairs	\$8.17 per breeding doe	245.00	8.17
Annual Operating Capital	\$3,261.25 @ 7%	228.29	7.61
Total Operating Expenses		\$3,489.54	\$116.32
Return to Land, Labor, and Capital		\$2,084.46	\$69.48
Fixed Expenses			
Interest		451.00	15.04
Taxes and Insurance		102.00	3.40
Depreciation		885.71	29.52
Total Fixed Expenses		\$1,438.71	\$47.96
Returns to Labor and Land		\$645.75	\$21.52

- What are the available resources?
- Where are the available markets?

Once these questions have been answered and a successful business plan developed, producers can begin the meat goat operation. This manual will provide the basic information needed to help answer these questions and produce meat goats successfully.

References

OSU Enterprise Budget Software. <http://www.agecon.okstate.edu/budgets/>
 USDA, National Agricultural Statistics Service, Statistical Highlights of U.S. Agriculture: 2005. <http://www.nass.usda.gov>

Chapter 2

Breeds of Meat Goats

JJ Jones and Harold Stephens

Many different breeds of meat goats are available for use in a commercial operation. Choosing which breed to raise depends upon terrain, resources, marketing opportunities and producer preferences. Before choosing a breed or combination of breeds, producers need to evaluate each of these factors.

The following is a description of the breeds of meat goats widely used in the U.S. Some breeds require certain characteristics to be registered with their respective breed associations. These characteristics are listed where relevant. Several other breeds are available throughout the world and even in the U.S., but they have not gained widespread use.

Spanish or Brush Goat

Spanish or brush goats, shown in Figure 2-1, came from Europe during the early exploration and colonization of North America. These goats either escaped from or were released by Coronado, DeSoto and other Spanish Explorers. Therefore, goats have existed in Oklahoma and Texas since the 1540s. Pockets of wild goats descended from these animals and roamed this area for about 400 years until goat production became profitable.

These feral goats became known as Spanish or brush goats. Many people think of this goat breed when discussing a goat enterprise. These goats have

no specific breed ancestry; they have developed through natural selection. The term Spanish also is used to describe any goat of unknown ancestry.

Since this goat breed has been developed from a wild background, its body type may be smaller than other breeds. The dominant trend in the wild was for smaller, more agile goats, and this breed thrives on rough terrain.

Essential for the wild, the does (females) have small udders making it easier for them to forage hilly or rough terrain. Cactus, thorns, rocks and other obstacles would damage large udders. Also because of its wild background, this breed is extremely hardy.

The Spanish goat tolerates extreme heat and cold and favors brush and weeds for forage. Some producers have referred to them as the Brahman cow of the goat world because they make excellent mothers. The does thrive and produce with little management. They may also be some of the most parasite-resistant goats available. Many Texans prefer to use them in a crossbreeding system with the Boer goat.

Body shape, ear shape, horns, hair and color are not consistent. This breed can be red, black, white, or any combination with short or long hair, horns or polled (no horns), or long or short ears. Size varies greatly due to climate, terrain and available breeding stock.

Boer Goat

The Boer goat was developed in South Africa. It is a cross between native African goats and European, Angora and Indian goat breeds. The name is derived from the Dutch word meaning farmer. The first Boer goat registration was started in 1959 in South Africa. The Boer goat was imported in limited numbers into the U.S. during the 1970s, but more heavily beginning in 1993.

The Boer goat is primarily a meat goat. It is a horned breed with lop ears and shows a variety of color patterns although they are generally recognized for their red head and white body, such as



Figure 2-1. Spanish or Brush goat.



Figure 2-2. Boer goat.

the one shown in Figure 2-2. The Boer can be used very effectively in combination with cattle due to its browsing ability and limited impact on the grass. Boers can produce kidding rates of 200 percent with weaning rates of 160 percent. They are low maintenance and have sufficient milk to rear a kid for early maturing. Puberty is reached in about six months for bucks and 10 to 12 months for does. An adult Boer buck weighs between 240 and 300 pounds and an adult doe weighs between 200 and 225 pounds. They are capable of an ADG (average daily gain) of more than 0.44 pound per day, but 0.3 to 0.4 pound per day is more standard. The Boer goat also has an extended breeding season, making it possible to produce three kid crops every two years.

Kiko Goat

Developed by the Goatex Group, LLC in New Zealand, the Kiko goat is shown in Figure 2-3. They were developed from the most substantial and fertile native goats in a breeding program where population dynamics were rigorously applied to produce a goat with enhanced meat production ability with browse conditions. Selected feral does were crossbred with Nubian, Toggenburg and Saanen bucks, with further cross-breeding in the second



Figure 2-3. Kiko goats.

and third generations. The breed was established in 1986. Kiko is the Maori word for flesh or meat. Kiko goats remained in New Zealand until they were imported into the U.S. in the early 1990s.

Kikos are known for their hardiness and ability to achieve substantial weight gains with natural conditions and without supplementary feeding. The Kiko goat is large framed, early maturing and comes in every color. Most North American Kikos are white, since mostly white goats were imported and white is the dominant gene. Many Kikos carry genes for color and colored Kikos can be registered. The hair coats of Kikos will range from slick in summer to flowing hair when in wintry mountain country.

They are not as heavily boned as some breeds but have exceptional conversion rates. Therefore, cutability (ratio of lean meat to fat in the carcass) is expected to be high.

The Kiko is a consummate browser and will range extensively when run in open country. They are not affected by substantial climatic variation and are equally at home in sub-alpine mountain country and arid brush land. The does are ample, feminine and generally have good udder placement and attachment. They are capable of conceiving, carrying, giving birth to and rearing multiple offspring without intervention under less than ideal conditions. The males display substantial characteristic horns.

Kiko kids are born of average size but with considerable vigor, and they are known for their growth rate after birth with little to no input. Growth rate is a defining characteristic of the Kiko goats, which display a rate of growth at least equal to any other meat goat breed.

In New Zealand, the Kiko has been called the go anywhere, eat anything goat because of its ability to thrive under less-than-ideal conditions. Since the

Kiko was developed in New Zealand, which has a temperate climate much like that of the southeastern U.S., this breed is an ideal livestock for the eastern half of the nation.

Myotonic Goat

Myotonic goats, also called Tennessee Fainting goats, Wooden Leg goats or Stiff Leg goats, are one of the few goats indigenous to the U.S. Some Texas ranchers have renamed them Tennessee Meat Goats. This goat has two strains and most of them are found in Tennessee and the eastern U.S.

Myotonic means that when the goats are frightened or excited they lock up and often fall over (faint) and lie very stiff for a few seconds. This description is an over-simplification, but the chemicals, which are rushed to humans' muscles and joints to prepare them for fight or flight are withheld in the Myotonic goat under exciting or frightful circumstances.

No one really knows their origins. One of the possibilities is that a private herd sold to a Tennessee farmer around 1880 was the beginning of the breed. A man named John Tinsley arrived in Marshall County, Tenn., with four goats, a buck and three does, which he had brought from Nova Scotia. When he moved on a year later, he left his goats behind. All the fainting goats in the U.S. can probably trace their origins back to these four.

Myotonic goats that have been selected for meat production are heavily rumped, deep-chested animals. Most are black and white, such as the one shown in Figure 2-4, but multiple colors are not uncommon.



Figure 2-4. Myotonic or Tennessee Fainting goat.

They breed year-round, are easy kidders and have good milk production. Many breeders have noted the breed has the capability to produce two kiddings per year. They are good mothers, and in most cases a bonding pen is not needed. Since they are not good climbers and jumpers, they are somewhat easier to keep than other goats.

The American Livestock Breed Conservancy has placed this breed of goat on their rare list, with an estimated world population of less than 10,000. They have now been discovered as excellent cross-breed stock for the Boer goat. The fainting gene is recessive; therefore, it is usually not expressed in crossbred animals.

Virginia State University has revealed a meat-to-bone ratio of 4:1, which is significantly higher than other breeds. Prairie View A&M showed a 6 percent to 10 percent greater meat yield achieved by using a Myotonic buck on other breed does. Virginia State and Virginia Tech have revealed these durable, self-sufficient pasture animals to be more parasite resistant than other breeds.

Savanna Goat

The Savanna goat was developed in the 1950s from native goats of Southern Africa on the rugged harsh bush country where temperatures and rainfall can vary greatly. This breed was developed to thrive in a minimum-care, Savannah environment. The results are a goat that is fertile, heat- and pest-tolerant and drought resistant with good meat quality. They are year-round breeders. A breed registry was established in 1993.

The goats typically are all white, like the two shown in Figure 2-5, with lop ears similar to a Nubian. They have a thick pliable totally black-pigmented skin and a short smooth coat. They resemble the Boer breed, but are more compact with shorter legs. The does have a good mothering ability and bond well with their young. The Savanna goats are also efficient foragers and survive with minimal input. They adapt to a variety of unpleasant climates like sun, cold and rain. They have a natural resistance against tick-borne diseases such as heartwater and against other external parasites.

Pygmy or Cameroon Dwarf Goat

The Pygmy goat originally was called the Cameroon Dwarf goat. This goat is mostly restrict-



Figure 2-5. Savanna goats.

ed to West Africa. Similar forms of Pygmy goats also occur in northern, southwestern and east Africa. However, what is called the Cameroon Dwarf goat is the one used in the U.S. It is the breed that came from the former French Cameroon area.

The Cameroon Dwarf goat, shown in Figure 2-6, has a full coat of straight, medium-long hair that varies in density with seasons and climates. On females, beards may be non-existent, sparse or trimmed. On adult males, abundant hair growth is desirable; the beard should be full, long and flowing with the copious mane draping cape-like across the shoulders.

All body colors are acceptable. The predominate coloration is a grizzled (agouti) pattern produced by the intermingling of light and dark hairs of any color.

For a Pygmy goat to be registered, the goat must have breed-specific markings. These markings include the muzzle, forehead, eyes and ears being accented in tones lighter than the dark portion of the body in goats of all colors, except goats that are solid black. Front and rear hoofs and cannons are darker than the main body coat, as are the crown, dorsal stripe and martingale; again except in goats that are solid black. On all caramel goats, light vertical stripes on front sides of darker socks are required.

Although not usually considered a meat goat, the Pygmy goat has been used in crossbreeding programs with other meat goat breeds to reduce the carcass size and fat content.



Figure 2-6. Pygmy or Cameroon Dwarf goat.

Nubian Goat

The Anglo-Nubian or Nubian goat, shown in Figure 2-7, is an all-purpose goat, useful for meat, milk and hide production. The Nubian is a relatively large and graceful goat. It was named for Nubia in northeastern Africa. The original goats imported from Africa, Arabia and India were long-legged, hardy goats that had some characteristics desired by goat breeders in England. English breeders crossed these imported bucks with the common short-haired does of England to develop the Nubian goat prior to 1895.

The Nubian breed is regarded as having an aristocratic appearance. The Anglo-Nubian carries a decidedly Roman nose and is always short-haired. The head is the distinctive breed characteristic, with the facial profile between the eyes and the muzzle



Figure 2-7. Nubian goat.

being strongly convex. The ears are long (extending at least 1 inch beyond the muzzle when held flat along the face), wide and pendulous. They lie close to the head at the temple and flare slightly out and well forward at the rounded tip, forming a bell shape. The ears are not thick, and the cartilage is well defined.

The hair is short, fine and glossy. Any color or colors, solid or patterned is acceptable. Black, red or tan are the most common colors, any of which may be carried in combination with white. Usually Anglo-Nubian males have shorter hair, particularly along the back and on the thigh.

Summary

Although these are not all of the meat goat breeds available, these breeds are the most numerous in the U.S. Some groups are trying to develop new cross-breeds of meat goats such as the TexMaster (a cross between Myotonic goats or Tennessee Meat goats and Boer goats), Genemaster (3/8 Kiko x 5/8 Boer), and Sako (a cross between Savanna and Kiko).

There is no such thing as a single best breed to use in meat goat operation, as there is more variation among individuals within a given breed than there is on average between different breeds.

Many more crossbred cattle and swine exist in the U.S. than all of their purebreds combined. Perhaps a useful message can be found in these statistics for goat people.

References

American Boer Goat Association, San Angelo, TX: <http://www.abga.org>.

American Kiko Goat Association, Jasper, GA: <http://www.kikogoats.com>.

Breeds of Livestock, Department of Animal Science, Oklahoma State University. <http://www.ansi.ok-state.edu/breeds>.

Domestic Animal Genetic Resources Information System, International Livestock Research Institute, Addis Ababa, Ethiopia. <http://www.dagris.ilri.cgiar.org>

Chapter 3

Meat Goat Selection

Jack Wallace, David Sparks, DVM and JJ Jones

Selection as a Tool for Profit

The four cornerstones of any successful livestock enterprise include selection and breeding, health and nutrition, management and marketing. This chapter will discuss those factors pertaining to the selection of functional breeding animals that offer the producer the greatest opportunity to manage and market meat goats for profit. Any discussion on the selection of breeding or market animals is based on the ideal or prototypical standard for that species. With that ideal animal in mind, producers can then go out and select bucks and does closely resembling the model they have in mind.

Though different producers in the goat business have different goals based on individual preferences, level of experience, physical and financial resources, existing situations and managerial abilities, the economically important traits are common to all levels of production in the real world of commercial meat goat production. The profit pyramid illustrates the hierarchy of economically important traits in commercial meat goat production (Figure 3-1). Reproductive efficiency is the foundation of profitability and includes such traits as fertility, proficiency, mothering ability, milk production and longevity to name a few. Simply put, having more kids to sell for a given number of does will influ-

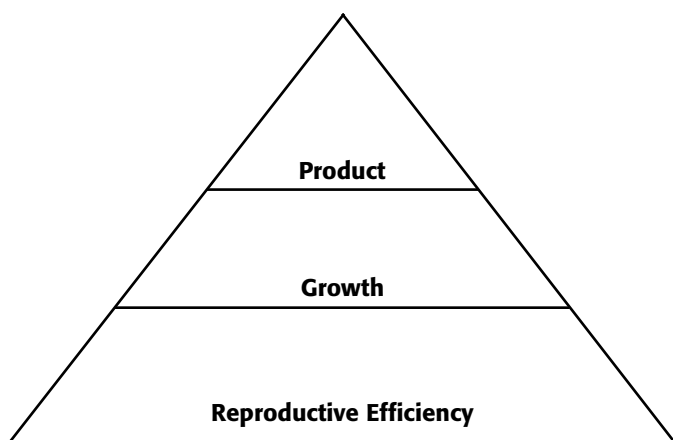


Figure 3-1. The profit pyramid.

ence the bottom line of the operation more than any other factor. Adding value to those traits are the growth traits of the kids such as weaning weight, yearling weight, rate of gain and feed efficiency. At the top of the pyramid are the market-oriented products such as pounds of kid sold, quantity and quality of retail meat (cabrito or chevon), mohair, cashmere, milk, etc.

Selection Criteria

The term selection denotes the act of choosing, and while the act of selection may be somewhat subjective in nature, there are guidelines and resources available to take a lot of the guess work out of the process. Three of the most notable include visual appraisal, pedigree and performance data. There are a variety of opinions as to which may play the most significant role, however the business environment suggests the more objective the decision-making process can be, the greater the profit potential. With that in mind, it becomes obvious that performance data based on the most economically important traits offers the most reliable information to aid in the decision-making process. While we may focus more on the performance side of selection, we also will discuss the contributions of the visual appraisal and pedigree aspects of the selection process.

Performance Information

Selection involves the choosing of the proper bucks and does for the breeding herd. The buck contributes 50 percent of the genes in any one kid and the doe contributes the other 50 percent of the kid's genetic makeup. However, if a buck is kept in the breeding herd for three or more years, and replacement does are selected with his genes for three generations, the buck actually contributes 87.5 percent of the genetic makeup of the herd. This makes selection of the buck the most important choice producers make to influence the productivity of their herd for generations to come. Performance-tested bucks can come from on-farm tests or central

test-station programs. These tests provide common environments for the contemporary test groups and feature growth and carcass (determined by ultrasound exam) trait data. This kind of information offers advantages for both buyers and sellers. Buyers get information on the buck that is useful to compare to other bucks in the test, and gives them an idea of the buck's genetic value to their herd. The advantage to the sellers is that they can use the information as a marketing tool to enhance the value, thus the price received for the buck. Additional information obtained from breeders offering on-farm performance test data include weaning weight, kidding percentage, kid weight weaned per doe, and more. An example of the more common performance-tested selection criteria, the standardized 90-day weaning weight and respective index value, is shown in Table 3-1.

At first appearance doeling 5018 may be the obvious choice of the three based on her actual weaning weight record, however, as the test data is standardized in an effort to level the playing field as far as comparisons go, by adjusting for age of dam, size of litter and 90-day weaning weight, it becomes clear that doeling 5044 with the adjusted 90-day weaning weight of 59 pounds and the weaning weight ratio of 111 is the keeper of the three. Of course, depending on how many replacements producers need, they may very well select doelings 5018 also because her adjusted 90-day weaning weights was respectable, and their weaning weight ratio was above 100 (standard average for the test group).

Realizing that the reproductive rate in the doe herd is the major determinant of income in commercial meat goat operations provides perspective when considering performance data and the financial implications.

The economically important traits not only are the result of individual matings, but also are influenced by the various breeds and lines or families within their respective breeds. In Table 3-2, dam line 2 has been more productive and therefore po-

tentially more profitable than either of the other two dam lines. As producers consider their own situations, resources and abilities, it is important to recognize several of the economically important traits that will respond to selection instead of focusing on only one particular trait to place emphasis on. Table 3-3 summarizes data from studies conducted at Tennessee State University.

To more fully realize the benefits of a deliberate selection program, producers should maintain a good set of records that documents the results of planned matings, breeding season results, kidding season results and weaning performance. Records can be as simple and straightforward as ledger entries or as sophisticated as computerized spreadsheet entries. A simple catch-and-weigh system for getting the birth weight of kids is shown in Figure 3-2 and Figure 3-3 shows a setup to get weaning and doe weights.

Expected Progeny Difference

Beef producers have had a tremendous tool available to assist in their selection processes for the last 20 to 25 years known as expected progeny difference (EPD). This tool, based on performance data collected by producers and sent to their breed

Table 3-2. Estimated gross revenues for three groups of does.

(\$120/cwt for kids, 36 to 50 lbs., Sel. 2, 9/8/06)

Dam line	Per litter weaned		Per doe exposed	
	Weight	Revenue	Weight	Revenue
1	56.6 lbs	\$67.92	40.6 lbs	\$48.72
2	64.8 lbs	\$77.76	56.7 lbs	\$68.04
3	62.0 lbs	\$74.40	53.8 lbs	\$64.56

Table 3-1. Goat Kidding Records.

Tag No. / Kid	Sex (MWF)	Birth Date	Color	Dam	Sire	Weaning Date	Weaning Group	Age of Dam	Rearing Group Born-Raised	Birth Weight	Weaning Weight	90-day Adjusted Weaning Age	90-day WW Index of Weaning Weight	Weaning Group
5018	F	3/2/14	correct	427	251	7/17/14	1	>3	1-1	10	55	107	53	101
5044	F	3/4/14	paint	261	251	6/17/14	1	>3	3-2	6	49	105	52	111
5173	F	3/27/14	black head	411	251	6/17/14	1	>3	2-2	6	33	82	47	88





Figure 3-2. Fish scales and a plastic bucket make an excellent birth weight measuring system.

associations, has provided a high tech means to improve the genetics of the respective breeds, as well as increase the efficiency and profitability of beef production for the commercial cow-calf segment of the beef industry. Some of the meat goat associations have recognized the benefits of this genetic selection tool, and they have begun developing similar efforts to provide EPDs for their producers. For example, the American Boer Goat Association is developing a model similar to that used in the



Figure 3-3. Postal scales mounted between two pieces of plywood make a nice weighing system for weanlings and does.

sheep industry, which allows for multiple births in the calculations. They wrote a grant and received funding for a cooperative effort between their association, Virginia Polytechnic Institute and State University and Texas A&M University to develop a sire evaluation model. They have collected more than 2,000 records during the last two years for The Begin Program, focusing on the economically important traits such as maternal characteristics, reproduction and growth performance. As they gather more information they may offer stay ability of does (in production) at some point in the future. Though much of this information may not be available for three to five years, the plans are to include much of the performance information on the registration certificates in the future.

Table 3-3. Evaluation of three breeds for doe fitness and reproductive traits.

Trait Boer	Breed of Doe			Standard Error
	Kiko	Spanish		
Per doe weaning kids				
Litter size, kids/dam	1.51 ^B	1.69 ^{AB}	1.79 ^A	0.07
Litter weight, lbs	58.30	66.40	61.60	1.20
Litter weight/unit doe weight, %	53.50 ^B	64.30 ^A	66.70 ^A	2.60
Per doe exposed to bucks				
Litter size, kids/dam	1.03 ^B	1.54 ^A	1.54 ^A	0.09
Litter weight, lbs	40.48 ^B	61.82 ^A	53.24 ^A	1.60
Lameness, cases/doe/year	2.02^B	0.58^A	0.79^A	0.16
Internal parasitism, cases/doe/year	0.54^B	0.10^A	0.17^A	0.06
Fecal parasite egg counts, eggs/gram^C	2.79^B	2.60^A	2.45^A	0.06
Annual doe survival rate, %	78.50^B	99.10^A	93.90^A	3.10

^{AB} Means with different letters differ significantly.

^C Log-transformed mean.

Source: TSU 2006, Browning et. al.

Pedigree Information

Pedigree information, simply stated, suggests and/or verifies the parentage or breeding history of an individual for one or more generations in its family lineage. It can be as accurate and entertaining as coffee shop gossip or as authentic as actual documentation of the respective breed registry. Usually, the pedigree information of an individual offers little more than its ancestral origins, but in some cases, depending on the source or purpose of the information provided, it can include additional specific and/or performance information. Figure 3-4 shows a case where limited performance information is provided in addition to the family history of the individuals.

Visual Appraisal

The visual appraisal part of the selection process is an appropriate part of the process because it provides producers an opportunity to evaluate

the overall appearance and condition of the animal. Although this part of the process is the most subjective, there are some guidelines indicating the optimum form and function for the various classes of animals to be selected. First and foremost, only healthy animals free of disease and parasitism should be selected. Buying from a reputable source with health records on the animals will go a long way in preventing purchasing problems. A healthy animal will appear alert and active, move freely without hesitation or restriction of motion. It will have a full, shiny, hair coat free of debris and patchiness. It should not exhibit any labored breathing, sneezing or coughing. Mucous membranes around the eyes and gums should appear a bright pink in color. It should stand with good posture and its head up. A goat is an intelligent animal and should express some interest in what is going on around it. It should be interested in eating and drinking at meal time.

When considering the conformation of a meat goat, the producer needs to think about the ultimate purpose of the animal, as well as the functionality and durability of the breeding stock. When viewed

Lot 99

Doe

3-12-2005

Tennessee State University



TSU 614 FOUNDATION SPANISH

TSU 5083

AAS GOLDMINE IV

JFK JESSIE III

OK047WSU6

BREED: SPANISH x KIKO F1

NOTE: Sire is Willingham 100% Spanish. Dam is 100% NZ Kiko.

Adjusted 90-day weaning weight = 39.9 lbs Weaning weight ration = 95

Lot 100

Doe

3-13-2005

Tennessee State University



SUNNY ACRES SAMARI

TGF UPHONDO P883

ABGA 96207076 TGF

TSU 5115

TSU 418 FOUNDATION PB KIKO

BREED: BOER x KIKO F1

NOTE: Sire is performance tested Marvin Shurley 100% Boer. Dam is purebred Kiko.

Adjusted 90-day weaning weight = 55.5 lbs Weaning weight ration = 132

Figure 3-4. Examples of pedigree information for meat goats.

from the side, the goat should be well proportioned from head to tail. The back should be level from the point of the withers to the tail. It should be deep-bodied as measured from the back to the chest floor. The slope of the shoulder should approximate a 45-degree angle where the neck blends into the body. Following down the leg, through the knee, which should be straight, to the pastern joint above the hoof, it should approximate a 45-degree angle (similar to the shoulder) with the sole of the hoof or ground. The hind legs should be straight such that you could drop a string from the point of the hip to the ground, and it would lie along the backside of the cannon bone of the hind leg from the hock to the ankle. The majority of the length of the animal should occur from the last rib to the point of the hip (pin bone), and not from the last rib to the point of the shoulder.

From the front view, the chest floor should appear wide. The legs should set at the four corners of the body, being straight through the knees down through the hooves, which should point straight forward, not in or out. There should be an adequate spring of ribs, which will provide sufficient space for the rumen and forage capacity for the goat. The shape of the animal, thickness or bulkiness and movement is determined by the muscling of the animal. Muscle tissue is round and bundle-shaped. The more muscular animals will appear thicker, with a more bulging and rounded mass of bundled tissue. Fat is flat, and overly-conditioned animals will appear very blocky, square and slick, with the fat filling in around the muscles to give the animal a boxy look.

Structural correctness or soundness is something producers must be concerned with from the standpoint of utility and durability of the breeding stock through the years. It expresses itself mainly through the skeletal structure and the way the muscle ties in with the bone. If the goat has adequate bone, it will carry itself well, maintain good posture and withstand a lot of wear and tear through the years. Most of the important principles also were covered in the discussion on conformation. However, with respect to does in particular, structural correctness includes consideration of the udder and teat placement.

Udder Structure and Teat Placement

The udder structure is very important to the longevity and productivity of a doe. A doe must

have a sound udder to raise kids until weaning and therefore be profitable.

A doe's udder should have a good form and attachment. The udder should be well rounded and the floor of the udder should not hang below the hocks of the doe (Figures 3-5 and 3-6).

Does should have a minimum of two functional teats (Figure 3-7). Some breed associations will have standards that disapprove of more than two teats, but for commercial meat goat operations more than two teats can be acceptable. This depends upon how the teats are arranged on the udder.

Does with only one teat will not have the ability to raise more than one kid per breeding season. Does with more than two functional teats may have the ability to nurse or raise more than two kids. Does with more than two teats or cluster of teats on either side of the udder could cause production problems in the future.

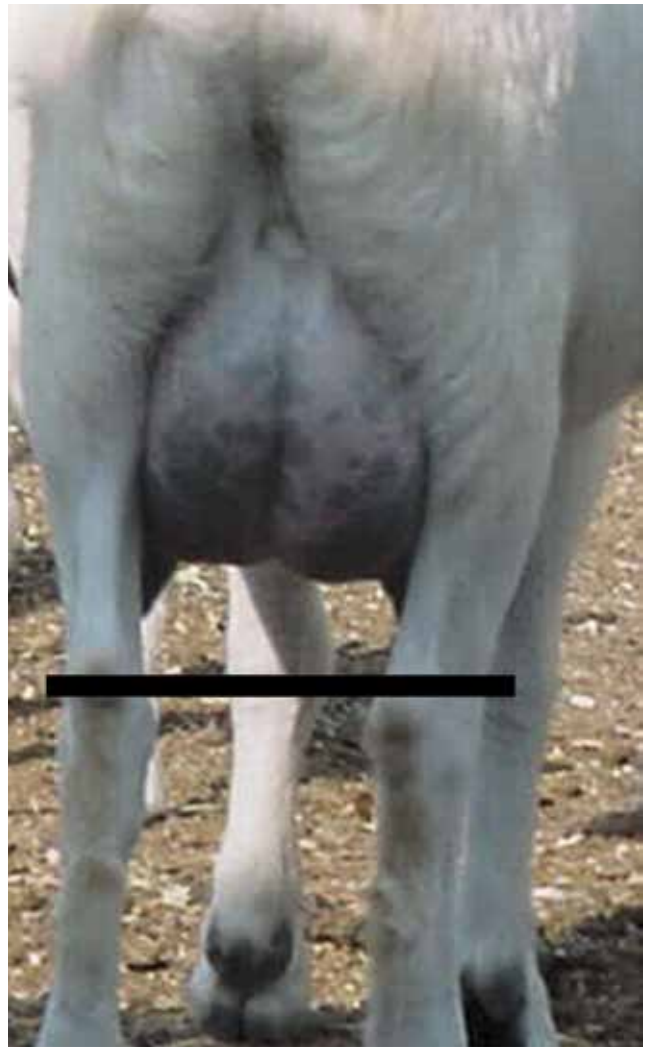


Figure 3-5. Goat doe with good udder structure.

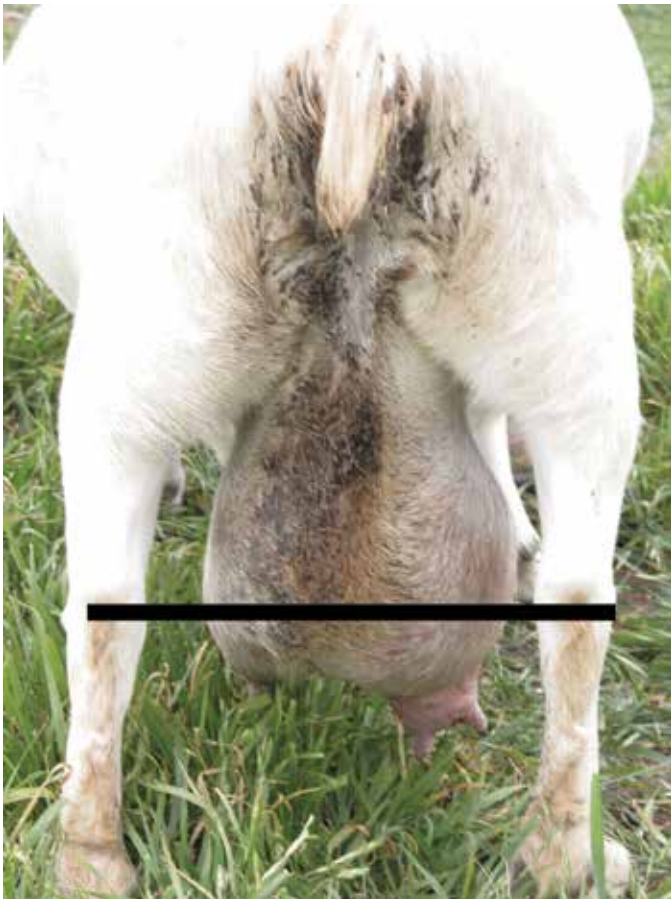


Figure 3-6. Goat doe with bad udder structure.



Figure 3-7. Does udder with two functional teats.



Figure 3-8. Does with fish teats. Left: unacceptable; Right: acceptable.

Does with multiple teats (clusters) on one side or the other of the udder could cause confusion and frustration when a new kid is trying to nurse. These teat arrangements also could cause udder problems such as mastitis during the life of the doe.

Some does will have what is commonly referred to as fish teats (Figure 3-8). These are teats that are fused together. Some breed associations disapprove of fish teats unless they have at least 60 percent separation from the base of the teat. This means that at least 60 percent of the height of the teat is separated from the other teat. At the same time, it is acceptable for there to be two teats present, if one teat is functional and the other teat is a nonfunctional spur (Figure 3-9).



Figure 3-9. Teat with spur.



Figure 3-10. Doe with bottle teats.

As a doe matures, problems with the udder such as bottle teat or mastitis may appear. Mastitis is a bacterial infection of the mammary gland (udder) and will decrease the doe's milking ability. A bottle teat is a teat that appears swollen down to the very end of the teat (Figure 3-10). This teat then is difficult for a small kid to nurse. Once a doe has these problems, they will be problems for the rest of the doe's productive life. A doe that develops these problems should be considered for culling out of the herd.

References

- Browning, R. (2006). Selection of Replacement Does. Oklahoma Meat Goat Conference.
- Machen, R. Udder Conformation. ABGA Judge's Certification.

Chapter 4

Forage, Forbs and Browse

Chris Rice

What Goats Eat

Goats are primarily browsers; they prefer to eat the leaves and buds of tree and shrub species. This, however, is not the entire story because goats will eat grasses, broadleaf herbs, shrub leaves and twig ends of many tree species. Which ones do they prefer? Just like humans who are introduced to a buffet table, goats introduced to a pasture with a variety of forage plants will select the most palatable forage to consume first. This palatability is usually associated with plants grown with the youngest tissue, highest protein and the most readily available plant carbohydrates on highly fertile soils.

As the seasons change, so will the palatability of the forages and the preference of the goat herd for certain forages (Table 4-1). Anything that can be done to provide the goat herd with young nutrient-rich forage will increase the health, productivity and profit potential of the goat herd.

Keeping Young Forage for the Goat Herd

New young plant growth can be provided in two ways.

1. Provide pasture that is manipulated to keep the forage from getting to a mature stage of growth.

Table 4-1. Average seasonal diet comparison of goats.

Season	% Browse	% Grass	% Forbs
Spring	34	49	17
Summer	33	53	14
Fall	53	37	10
Winter	53	42	5

Source: What Range Herbivores Eat and Why TAEX Pub B-6037.

The older the plant tissue becomes, the more lignins the plants lay down in their cell walls. These lignins make it difficult for the animals to digest the nutrients in the plants. Keeping them grazed, hayed or mowed any time the plants begin to mature reduces the forage maturity in the pastures. Keeping those plants in a tender vegetative state can provide plants that are highly selected for nutrient value by the goat herd.

2. Provide young nutritious forage by growing different forage species during different seasons of the year. Most plants are grouped into two categories: warm season and cool season plants. Warm season plants initiate growth in the spring, grow rapidly during May and June, maturing in July, August and September. Cool season plants grow during the fall and spring, and by their nature are generally higher in nutritional value than the warm season species. They also will begin to lose quality in late spring when they begin to mature and set seed heads.

By providing the goat herd with both cool and warm season forage pastures, producers can help provide new green growth for longer periods of the year and have a healthier and more productive goat herd as a result.

Keeping High-Quality Forage for the Goat Herd

Maintaining a high diversity of plant species in a pasture so the animals can select the most palatable plants during their most prominent time of growth is one method of providing high-quality forage. Mixing warm and cool season grasses with compatible legumes and herbs help accomplish this goal. Mixtures of Bermudagrass, annual ryegrass and clovers do well together when managed properly. They all can provide high-quality forage if kept in a tender vegetative state.

Providing the forage plants with the proper soil fertility not only increases the production of the forage in the pasture, but also affects the protein and nutrient content of the forage grown. Without proper nutrition, plants tend to produce less herbage and tend to mature earlier. These two things together reduce both the total forage available to the grazing herd, such as the one shown in Figure 4-1, and the nutritional value of those plants to the individual animal. Often, low fertility will decrease the palatability of forage enough so the animals will refuse to graze those plants.

Soil Fertility in Goat Pastures

Growing forage for any grazing animal, including goats, is dependent on the health of the soil in which the forage is grown.

Soil Testing

Soil testing is an essential element in providing high-quality forage and determining stocking rates based on potential forage production. An old saying warns, “If you don’t know what you have, you’ll never know what you might be able to get.” Growing forage in a pasture without taking a soil test is like driving a car without a gas gauge. Producers have no idea how far they are going to get or how far they could have gone if the tank was filled up.

Soil testing gives an idea of how much of a particular forage can be grown. With this information, producers can set stocking rates in animals per acre without fear of running out of forage too soon. They

also have the ability to determine if adding more nutrients to the soil allows more animals put on a given land area. They can then determine whether or not these extra animals will pay for the additional cost of applying fertilizer. A \$10 soil test will more than pay for itself in increased utilization of the resources producers have or by allowing them to input nutrients to increase stocking rates to proper animal densities.

Taking a soil test is relatively easy to do, but it must be done properly so the information received from the test has value. Soil types and nutrient concentrations can change rapidly across a pasture. To get a soil sample representative of the true nature of the soil and get good test results; several subsamples must be taken from across the pasture. When taking a soil sample, 15 to 20 subsamples are needed from different parts of the pasture.

The goal is to measure the nutrient level in the top 6 inches of the soil, so every subsample should be taken from the soil surface to a depth of 6 inches. The best way to do this is to visit the local county Extension office and borrow a soil probe that is specifically designed for soil sampling. A shovel can also be used to cut a slice 6-inches deep. Put the slice into a bucket.

Walking from one corner of the pasture to the opposite corner and taking a 6-inch sample every 75 to 100 yards works well in getting a good representation of the pastures soils. Once 15 to 20 subsamples have been accumulated in the bucket, they should be thoroughly mixed up. Then about one pint of soil should be placed into a plastic bag and taken to the local county Extension office for analysis. If samples are needed from several pastures, each pasture should be sampled separately to get a good idea of how to manage each pasture.

Primary Soil Nutrients

A healthy soil will have all the plant nutrients needed by the plant to perform its life functions, and that soil will have a pH level that chemically makes those nutrients available for plant uptake. Most of the nutrients needed for plant growth are in high enough abundance so producers do not need to supply them to get adequate forage production. Three nutrients, however, are consumed in large quantities by the plants, and can be at low enough levels in the soil profile to inhibit maximum forage production. These three nutrients are nitrogen (N), phosphorus (P) and potassium (K).



Figure 4-1. A healthy goat herd needs a good forage pasture.

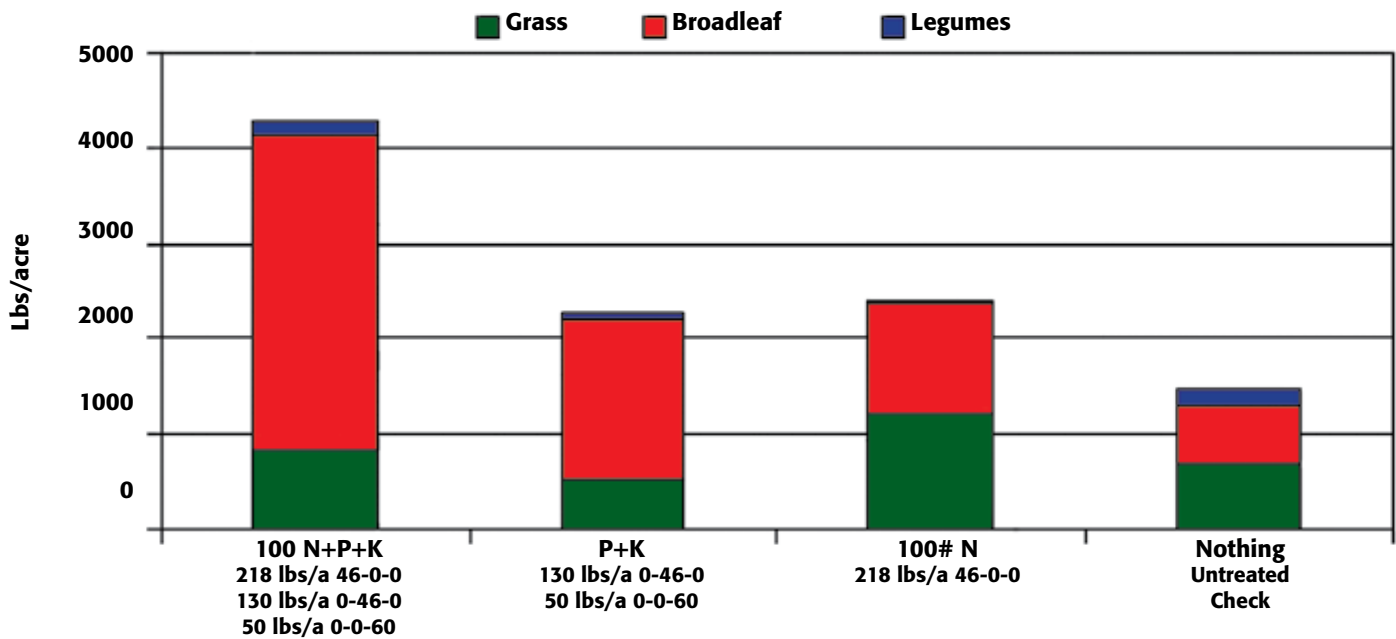


Figure 4-2. Yield data for May and June growth in a 2003 Hartshorne IPM experiment on forage response to selected treatments.

Figure 4-2 shows the results of an experiment on forage responses to selected treatments and the importance of nutrients on plants.

Nitrogen (N)

Nitrogen is the nutrient most needed by a plant. It is also one of the nutrients lost most readily in the environment either through volatilization or leaching. A large build up of nitrogen through time never occurs in soils because through natural processes, nitrogen is being lost through plant uptake, it is moving off into the air through volatilization or down through the soil profile due to its water solubility (leaching).

Phosphorus (P)

Phosphorus (P) is the second most common nutrient deficient in Oklahoma soils. P is not easily lost in the environment; once it is in the soil, it tends to stay. Two things result in low P levels in the soil:

1. The parent material that formed the soil was low in P.
2. Under heavy cropping, the P is removed with the plant material. High production hay meadows where hay is cut and moved to another location can lead to low levels of P. Likewise, old crop production areas converted back to

pasture can have low P levels from long histories of taking crops off these lands. Many Bermudagrass pastures in southern Oklahoma were at one time cotton fields that were cropped intensively without the addition of replacement soil amendments.

Potassium (K)

Potassium (K) is similar to phosphorus because it is not lost to the environment very easily once it is in the soil. Fewer low-K soils than low P soils exist, since most Oklahoma soils originally had large amounts of K. However, K also can be cropped out by high-intensity crop removal. Soils low in K can be found on old crop land and hay meadows.

With P and K levels, once a pasture has sufficient levels to promote proper plant growth, and plant material is not removed from the pasture, the levels of these nutrients will remain sufficient for many years. Although the plants may be removing large quantities of these nutrients, the animals eating these plants do not retain very much of the P and K in their bodies and essentially recycle them to the pasture through their manure.

With nitrogen, although much of the nitrogen in the plants passes through the animal back onto the pasture, a lot of this nitrogen is lost through volatilization and leaching. Therefore, with forage

production systems where high yields are expected, nitrogen will need to be added every year to maintain high forage production levels.

pH

pH measures the relative acidity or alkalinity of the soil. This is important because at low pH, nutrients plants need get chemically tied up in the soil, which makes them unavailable for plant uptake. At the same time, low pH causes molecules such as aluminum and magnesium to be freed from the soil particles. These two molecules can become toxic to the plants, inhibiting growth. For most forage plants, a pH of 5.5 and above is adequate for normal plant growth and enough of the nutrients the plants need to thrive are available in the soil solution for plant uptake.

Legumes such as clovers, alfalfa and lespedeza need pH levels above 6.0 to grow properly. The pH of a soil is easy to manipulate with the addition of agricultural lime. A soil test will determine if lime is needed for the forage species grown and suggest how much lime needs to be applied to correct any problems. The soil test also will tell how much nitrogen, phosphorus and potassium might be needed, based on the forage production levels and the stocking rates desired. The local county Extension educator can help counsel producers on the most appropriate management strategies for their specific operation once the soil test has returned from the lab.

Macronutrients and Micronutrients

Plants need several other nutrients in small quantities to grow. Most soils have high enough nutrients to supply all of the plants' needs. Occasionally, one or more of these nutrients can become deficient and result in reduced plant vigor. Other nutrient problems must be ruled out prior to looking for micronutrient and macronutrient problems, since they are rarely deficient.

If after a pasture has been supplied with the proper levels of N, P and K, and the pH is within the correct levels for adequate plant growth, the producer can then begin looking to other nutrient problems in the forage. If the producer still believes there is a problem with the forage growth after checking standard soil fertility test levels, forage samples can then be taken for macronutrient and micronutrient analysis to the county Extension office. If any of them are in low enough concentrations to inhibit plant growth, the soil can be amended to correct any deficiencies.

Forages

Warm Season Grasses

Bermudagrass

Bermudagrass is a warm season, perennial grass that grows well on most soil types throughout Oklahoma. Goats will actively graze this grass when it is young and palatable. They also will show a marked preference for it, if well fertilized. They will, however, consume other plants. Depending on the time of year, these plants may be higher in protein or contain more sugars and be more palatable. An example of this might be in the spring, in a pasture with low-growing shrubs, greenbrier, weedy forbs and Bermudagrass, the goats may select the brush species and forbs (broadleaf plants sometimes considered weeds) over the Bermudagrass.

As the brush and forbs begin to mature in late summer, the goats may shift their preference to Bermudagrass if it has been fertilized and cut or grazed back by other animals on a regular basis. Bermudagrass that has been allowed to grow and mature past five weeks, however, will be low quality and the goats may ignore it and graze on other, more palatable plants in the pasture.

Native Plant Communities

Native pasture and hay meadows are a complex of grasses and forbs that have evolved to the habitat conditions in Oklahoma through millions of years. Most people, however, think of native grasses in terms of the big four species of grass: big bluestem, little bluestem, Indiangrass and switchgrass. Native grasses encompass much more than these four species. Goats will do well on native grasses due to different species of grasses and forbs growing and maturing at different times of the year. The goats can pick the most palatable plants from a multitude of species. Overgrazing can easily damage native grass complexes and care must be taken to give the plant species in the pasture time to rest and recover between grazing periods. Keeping stocking rates low, using rotational grazing or both can help this recovery.

Old World Bluestem

Old world bluestem is an introduced warm season grass that grows well on upland soils where moisture may be limited. If well fertilized, goats will readily consume it in early spring, or in an early stage of regrowth. It can be very unpalatable to

grazing animals if allowed to become too mature or if fertility levels are low.

Bahia grass

Bahia grass is an introduced, warm season, perennial grass that grows well in southeastern Oklahoma. It has limited cold tolerance and will normally freeze out in the northwest four-fifths of the state. Bahia is a very hardy grass under grazing conditions and is very competitive with other plants for soil nutrients and water. In the early spring, it is a palatable grass to most grazing species but loses palatability and quality quickly in mid-summer. Where it is warm enough for Bahia to survive, it is a good species to grow on low-fertility soils.

Cool Season Grasses

Cool season forages are a great way to reduce purchased feed costs and should be considered anytime pasture resources will allow production and use.

Fescue

Fescue is an introduced cool-season perennial grass. It is both high in protein and digestibility. On varieties infected with endophyte (fungus that lives in the plant), palatability for some grazing animals is low and in some cases may harm the animal. Little scientific evidence exists that endophyte-infected fescue causes harm to meat or dairy goats. More studies need to be conducted to determine the effects. Newer varieties are available that are either fungus free or have a modified fungus in them to make it more palatable and healthier for the grazing animal. Without confirmation that the infected fescue is harmful to goats, the increased cost of establishing these endophyte-free and modified fescues may not be warranted in pastures where only goats will be grazed. They should, however, be considered where other grazing species, such as cattle or horses will be grazed with the goat herd.

Annual Ryegrass

Ryegrass is a cool-season, introduced, annual grass high in quality, protein and palatability. It works well as a single planting or over seeded into a warm season grass in October. It makes little forage during its fall growth period, but early spring production can exceed three tons per acre with the proper soil fertility regime. All grazing animals relish annual ryegrass and will graze it whenever it is available.

Cereal grains

Like ryegrass, the cereal grains (wheat, rye, barley and oats), make excellent cool-season grazing for goats. Wheat and rye, when planted on tilled ground, have the ability to produce a ton of forage in the fall that can be utilized by goats during the winter period. When over-seeded in a warm-season grass sod, it will act more like the annual ryegrass, and most of the forage production will be realized during the spring growing season.

Legumes

Sericea Lespedeza

Sericea lespedeza is a warm-season, perennial legume that grows well on deep soils in Oklahoma. Most ranchers consider it a weed since cattle will not graze it after it is about 6 inches tall in mid-June. Goats have been observed grazing this plant throughout most of the year and are sometimes specifically purchased to help rid ranching operations of this aggressive legume.

Annual Lespedeza

Annual lespedeza is a warm season, annual legume that grows well in most Oklahoma soils. It coexists with warm-season grasses that are not fertilized too heavily, and allow the annual lespedeza space to grow.

Red Clover

Red clover, shown in Figure 4-3, is a cool season, perennial legume that does well in the eastern half of Oklahoma. It is a short-lived perennial with stand life usually lasting from two to three years. Lightly reseeding a pasture with red clover seed every year will usually result in stands that contribute large amounts of forage for several years.

White Clover

White clover is a cool-season, perennial clover that is adapted to heavy grazing conditions because of its low growth habit. It prefers tighter soils with large water-holding capacities and does well when mixed with cool or warm season perennial grasses. White clover is high in protein and is very palatable to most grazing animals. Goats however, have been observed selecting taller forages in grazing systems rather than consuming white clover. White clover actually has been observed increasing as a component of the forage system rather than decreasing when goats graze a pasture.



Figure 4-3. Red clover.

Arrowleaf Clover

Arrowleaf clover is a cool-season, annual clover with high spring production potential. It does well on well-drained upland soils where white and red clover may not grow as well. It must be allowed to occasionally reseed itself, if yearly stands are expected. It is higher in tannin concentrations than red or white clovers, but will be grazed readily by goats.

Alfalfa

Alfalfa is a warm-season, perennial legume that grows well on deep, well-drained, fertile soils. It grows best when grown as a monoculture (by itself), but has been successfully grown when interseeded in warm season grass pastures. Alfalfa is high in protein and extremely palatable to grazing animals but has also been known to cause bloat in large grazing animals.

Miscellaneous Legumes

Many legume plants will grow in Oklahoma pastures depending on the geographic location, rainfall and soil type. Local county Extension educators can provide information on specific legumes adapted to their local areas.

Forbs

Forbs basically are any low-growing broadleaf plant that grows with grass plants. Many people in the cattle industry refer to these plants as weeds.

A weed is a plant that an individual does not want growing in a particular place at a particular time. Goats will readily consume many of the forbs growing in pasture situations during some time period of the year.

Most forbs respond favorably to fertilization, thus increasing their palatability to grazing animals. In goat production situations, using herbicides to control weeds may be detrimental to forage production, since the plants being killed may have been a preferred grazing species for the goat herd. Herbicides should only be used when it has been determined the goat herd will not utilize a particular plant and that plant has started to dominate the pasture.

Brush vines, briars and shrubs

As stated previously, goats are considered primarily browsers: they prefer to eat brush and shrubs, such as the one shown in Figure 4-4. They are opportunist grazers and will choose the most palatable plants available regardless of whether they are grasses, forbs, shrubs or trees. Goat feeding preference will change with the seasons and maturity of the plant species present. A goat is going to selectively feed on what it considers to be the best-tasting plant in the pasture.

Often, goats will select the new leaves of trees and shrubs in the spring instead of forbs and grasses. If they totally strip the trees of leaves, the plants will attempt to sprout new leaves. These new leaves will be attractive to the goats, and they will again feed on them. Through time, the goats will kill the plant by starving it to death by not allowing it to keep leaves long enough to feed itself. If a brush



Figure 4-4. Goat foraging on browse.

plant is tall enough to keep goats from consuming all of its leaves, the tree will survive on those leaves growing beyond the goats' reach. In the winter and early spring, goats will feed on the buds and bark of some trees and shrubs, which is where the plant concentrates a lot of its carbohydrates prior to spring growth. At that time of year, the bark and buds may be the most palatable plant material in the pasture. Any leftover grass may be overly mature, dry and low on protein and carbohydrates. Goats will select the best tasting plant during a particular time of year.

Goats are often purchased for brush control. This task could take a while to accomplish and need a lot of management of the goat herd. A more efficient goal might be to look at a goat herd as a means of making money rather than just for brush control. By intensively managing the herd, producers can realize some return on their investment. Any brush control received as a result is an added bonus.

Bloat

All ruminant animals can be affected by bloat, with cattle being the most susceptible. Goats sometimes have problems with bloat when feeding on wet, nutrient-rich forages. Any time producers introduce goat herds to a green, lush growing legume pasture, they should be sure to have them already full of a dry hay source. They should be watched closely for the first few days they are on the pasture. A commercial bloat prevention block or additive should be considered when putting goats on green lush vegetation.

Balanced Forage Systems

One of a goat producer's goals should be to attempt to get the goat herd to harvest as much of the yearly intake of forage it needs on its own. Animals harvesting their own forage rather than being fed processed feeds will generally cost the producer less, providing a better profit per unit sold. Buying processed grain and hay is expensive when compared to forage grown on the farm and harvested by the animal.

The problem with most grazing systems is they are based on warm-season grass production that only provides high-quality forage for seven months of the year. For the other five months, producers are left to provide for the animals' needs with mature standing dead forage, stored hay or purchased

grain-based feeds. The goal of the producer should be to attempt to spread out the seasonal production of forages grown by utilizing seasonal fertilization strategies and by using forage species that grow during as many months of the year as possible.

Fertilization strategies are as simple as moving fertilizer input dollars to different times of the year. A good example of this is the fertilization of Bermudagrass in late August. This late summer fertilization takes advantage of September rainfall to grow tender, high-quality Bermudagrass during the month of September. This new growth Bermudagrass provides high-quality grazing during October, November and early December.

This growth is sometimes referred to as a standing hay crop. The Bermudagrass needing fertilization should be grazed close during August, so any growth in September is young, high-quality forage. Once the Bermudagrass stops growing in October, this young, high-quality forage will retain most of its quality well into December. The whole area need not be fertilized; just enough acres to carry the herd for two months of grazing. Fertilizing about one-third of an acre for each goat for the two months of grazing would be a close estimate when trying to provide the goat herd with early winter grazing.

Raising annual, cool-season forage such as ryegrass, wheat, rye and barley would be another strategy to reduce the producers' dependence on purchased feeds. By planting and fertilizing one-third of an acre for each goat in the herd, they should be able to reduce the amount of off-farm nutrition sources.

Annual cool-season forages should be planted as early in the fall as possible to take advantage of the moderate temperatures. The earlier the planting, the more forage growth will be achieved before cold temperatures stop the growth of the plants. Wheat, rye and barley should be planted sometime in early September, if large quantities of fall forage are expected. Annual ryegrass seems to establish better if planted the first of October. Not much fall forage production is expected from ryegrass, but when fertilized properly, it will provide the largest amount of spring grazing, compared to the other cool-season annual grasses.

Stocking rates

The stocking rate of any grazing animal should be based on the estimated forage intake of the class of animal being grazing and the production potential of the forage available to that animal. Most of

the literature suggests that for goats, forage intake runs somewhere between 4 to 4.5 percent of body weight of the animal. For a 125-pound doe, such as the one shown in Figure 4-5, this would equate to 5 pounds of forage intake of dry matter per day ($125 \times .04 = 5$ lbs). If a Bermudagrass pasture was fertilized with 50 units of N (108 pounds per acre of urea) and had a projected overall yield of forage at 4,000 pounds per acre, the stocking rate could be determined based on animal intake and available forage production.

One hundred percent utilization of the forage grown in a pasture is never possible because of losses from environmental factors. Fifty percent utilization is a normal amount of forage that will actually occur. Percent utilization factors for grazing goats is not well documented and could vary from 50 to 70 percent, depending on grazing management. Fifty percent utilization is a good estimate of the amount of forage actually consumed by the grazing animal with continuous grazing systems. At 50 percent utilization, a 4,000-pound per acre yield would result in 2,000 pounds per acre actually being eaten by the animal. The other 2,000 pounds would be lost to environmental factors. If a doe needs five pounds of forage per day and she was going to be grazing in this pasture for 200 days, she would need 1,000 pounds of forage, or about one-half acre for 200

days. On 20 acres, 40 does should be able to graze for 200 days.

Stocking rates on brushland are a little more difficult to determine. Measuring the amount of browse per acre can be next to impossible. If brush and shrub control is one of the primary objectives of the producer, then a good rule of thumb on stocking brushland is to start with three to four animals per acre, then to pay close attention to browse lines on the existing vegetation. If the goats are quickly reducing the available browse, stocking rates should be reduced. If no apparent utilization of the existing brush species is observed, the producer may want to increase stocking rates.

When determining stocking rates where cattle and goats are to be grazed on the same pasture, determining stock densities for both species needs to be considered. An 1,100-pound cow consumes about 30 pounds of dry matter per day. If a 125-pound doe consumes 5 pounds of dry matter per day, then six 125-pound does could be substituted for one cow. If 50 cows had previously been run on a pasture during the grazing season, then for every six does desired on that same pasture, the number of cows should be reduced by one. To run 60 does, the number of cows on that pasture would need to be reduced by ten. Therefore, 40 cows and 60 goats would be put on the pasture.

Figuring stocking rates by this method is easy to do, but it may not be the whole story. In pasture land that is a mixture of grass, forbs and brush, the goats may utilize plants the cattle do not eat. When consuming the plants the cattle do not eat, they are not consuming the grass, which would then be available to the cows. Most Texas studies show only a 50 percent overlap in diet preference of cattle and goats, so in a brushy pasture more animals may be possible than is indicated by figuring six goats equals one cow. The smart move would be to stock the pasture based on six goats equaling one cow, then through time, adjust the stocking rates of the cattle and goats to fit the grazing and browsing resource. This method might take a little time and require some observation, but it should result in the most efficient use of the resources.

References

Andrae, John. (2004). *Grazing Impacts on Pasture Composition*. University of Georgia Cooperative Extension Service. Bulletin 1243 Crop and Soil Science Department Cooperative College of Agricultural and Environmental Sciences.



Figure 4-5. An average doe and her kid: 125 pounds of grace and beauty in a good forage pasture.

- Goodwin D.J., J.P. Muir, and R.D. Wittie. (2002). Goat Performance, Forage Selectivity, and Forage Quality Dynamics in Three Cultivated Warm Season Pastures in North-central Texas. *Sheep and Goat, Wool and Mohair* CPR 2002. 90-98. Texas A&M University.
- Hart, S.P. and B. R. Min. (2000). Forage Based Dairy Goat Management. E (Kika) de la Garza Institute for Goat Research. Langston University.
- Hutchens, T. (2003). Kentucky Goat Friendly Pasture Concept. Goat Producers Newsletter. (October-November). University of Kentucky and Kentucky State University.
- Luginbuhl, J-M, J.T. Green, J.P. Mueller, and M.H. Poore. (1996). Meat Goats in Land and Forage Management. Proceedings Southeast Regional Meat Goat Production Symposium, February 1996. Florida A&M University.
- Luginbuhl J-M, M.H. Poore, J.P. Mueller, and Green. Forage Needs and Grazing Management for Meat Goats In The Humid Southeast. Animal Science Facts Publication ANS 00-604MG. North Carolina Cooperative Extension Service.
- Lyons, R.K. and Richard V. Machen, Stocking Rate: The Key Grazing Management Decision. Texas Agricultural Extension Service Publication L-5400, 6-01.
- Muir J.P. (2002). Cultivated Cool Season Pastures for Meat Goats in North-central Texas *Sheep and Goat, Wool and Mohair* CPR 2002. 60-69 TAES, Texas A&M University Experiment Station.
- Pinkerton B. and Frank Pinkerton. Managing Forages for Meat Goats. Meat Goat Production Hand. College of Agriculture, Forestry, and Life Sciences. Clemson University.
- Schoenian, S. (2003). An Introduction to Feeding Small Ruminants. Maryland Cooperative Extension. Maryland Small Ruminant Page. <http://www.sheepandgoat.com/>
- Terrill T.H., W.F. Whitehead, G. Durham, C.S. Hoveland, B.P. Singh, and S. Gelaye. (2004). Preference of grazing goats for cool-season annual clovers. *South African Journal of Animal Science* 2004, 34 (supplement).

Chapter 5

Goat Nutrition

Brian Freking and Justin McDaniel

Nutrition, or feeding, is the single largest cost associated with raising goats, typically accounting for 60 percent or more of total production costs. Nutrition exerts a very large influence on flock reproduction, milk production and kid growth. Late-gestation and lactation are the most critical periods for doe nutrition, with lactation placing the highest nutritional demands on does.

Nutrition levels largely determine growth rates in kids. Kids with higher growth potential have higher nutritional needs, especially protein. Because of their unique physiology, meat goats do not fatten like cattle or sheep, and weight gain rates are often smaller. Nevertheless, many people still believe goats eat and do well on anything from newspapers to tin cans. Attempting to manage and feed goats with such a belief will not lead to successful meat goat production. Animals receiving inadequate diets are more prone to disease and will fail to reach their genetic potential.

Goats require energy, protein, vitamins, minerals, fiber and water. Energy measured in calories usually is the most limiting nutrient, whereas protein is the most expensive. Deficiencies, excesses and imbalances of vitamins and minerals can limit animal performance and lead to various health problems. Fiber is necessary to maintain a healthy rumen environment and prevent digestive upsets. Water is the cheapest feed ingredient, yet often the most neglected.

Many factors affect the nutritional requirements of small ruminants: maintenance, growth, pregnancy, lactation, fiber production, activity and environment. To be fed adequately, animals should be grouped according to their nutritional needs. As a general rule of thumb, goats will consume 2 to 4 percent of their body weight on a dry matter basis in feed. The exact percentage varies according to the size (weight) of the animal, with smaller animals needing a higher intake (percentage-wise) to maintain their weight. Maintenance requirements increase as the animals' activity level increases. For example, a goat traveling a farther distance for feed and water will have a higher maintenance require-

ment than animals in a feedlot. Goats grazing very hilly pastures will have higher nutritional requirements than goats on level pastures of the same quality because they will expend more energy to gather feed on difficult terrain. Environmental conditions also affect maintenance requirements. In cold and severe weather, goats require more feed to maintain body heat. The added stresses of pregnancy, lactation and growth further increase nutrient requirements. Table 5-1 shows some of the factors affecting nutrient requirements.

A goat's nutritional requirements can be met by feeding a variety of feedstuffs. Feed ingredients can substitute for one another as long as the animals' nutritional requirements are being met. Small ruminant feeding programs should take into account animal requirements, feed availability and the costs of nutrients.

Pasture, Forbs and Browse

Pasture, forbs and browse are usually the primary and most economical source of nutrients for goats, and in some cases, pasture is all these small ruminants need to meet their nutritional requirements. Pasture tends to be high in energy and protein when it is in a vegetative (green and growing) state. However, it can have high moisture content, and sometimes it may be difficult for high-produc-

Table 5-1. Approximate nutrient requirements of various classes.

<i>Goats</i>	<i>Crude Protein (%)</i>	<i>TDN (%)</i>
Bucks	8	60
Dry Doe	8	58
Late Gestation	12	66
Lactation avg Milk	9	60
Lactation high Milk	11	65
Weanling	14	70
Yearling	12	65

ing animals to eat enough grass to meet their nutrient requirements.

Grass tetany (lack of magnesium) can occur when goats in early lactation are grazing lush, leafy small grain; annual ryegrass; or grass/legume mix pastures. With those conditions, it is advisable to provide a mineral mix containing 5 to 10 percent magnesium.

As pasture plants mature, palatability and digestibility decline, so it is important to rotate pastures to keep plants in a vegetative state. During the early part of the grazing season, browse (woody plants, vines and brush) and forbs (weeds) tend to be higher in protein and energy than ordinary pasture. In some situations, where brush control in rough areas is the primary purpose of keeping goats, less productive animals can be roughed through and forced to work on brushy areas. If their body condition deteriorates, these animals can then be grazed on better quality pastures. Once a desirable body condition is achieved, the same animals can again be used to control brush. Goats are natural browsers and have the unique ability to select plants when at their most nutritious state. Goats that browse have fewer problems with internal parasites.

Hay

Hay is the primary source of nutrients for goats during the winter or nongrazing season (Figure 5-1). Hay varies tremendously in quality, and the only way to know the nutritional content is to have the hay analyzed by a forage testing laboratory. Samples can be taken to the local county Extension office to be sent for analysis. Typical costs range from 10 to 12 dollars per sample. Hay tends to be a moderate source of protein and energy for goats.



Figure 5-1. Hay can be used as a nutrient supplement during nongrazing seasons.

Legume hays such as alfalfa, clover and lespedeza tend to be higher in protein, vitamins and minerals, especially calcium, than grass hays. The energy, as well as the protein content of hay, depends on the maturity of the forage when harvested. Proper curing and storage also is necessary to maintain nutritional quality of hay.

Concentrates

Feeding concentrates to provide the nutrients that forage alone cannot provide often is necessary, particularly with high-producing animals (Figure 5-2). Times and situations also occur where concentrates are a more economical source of nutrients. Creep feeding and supplemental feeding of kids has been shown to increase growth weight, but should only be done to the extent that it increases profit.

Two types of concentrate feeds can be used:

- energy feeds
- protein feeds

Energy Feeds

Energy feeds typically include cereal grains such as corn, barley, wheat, oats, milo and rye. Processing grains for goats is not necessary unless



Figure 5-2. Concentrates can help supplement forage nutrients.

the animals are less than six weeks old and lack a functioning rumen. One of the problems with feeding a lot of cereal grains is they are high in phosphorus content, but low in calcium. Feeding a diet that is high in phosphorus and low in calcium can cause urinary calculi (kidney stones) in wethers and intact males. Inadequate calcium also can lead to milk fever (hypocalcemia) in pregnant or lactating does.

Protein Feeds

Protein feeds contain high levels of protein (more than 15 percent) and may be of animal or plant origin. Plant proteins include soybean meal and cottonseed meal. Some meat and bone meals are available on the market, but ruminant-derived meat and bone meal cannot (by law) be fed to other ruminants, including goats. Protein quantity is generally more important than protein quality in ruminant livestock, since the microorganisms in the rumen manufacture their own body protein. Livestock do not store excess protein; it is burned as energy or eliminated (as nitrogen) by the kidneys. Since parasites often cause blood loss in goats, higher levels of protein in the diet may enable the animal to mount a greater immune response to parasites.

Byproduct feeds, such as soy hulls, wheat middlings, corn gluten feed or dried distillers grains may contain high levels of various nutrients and can be incorporated into small ruminant diets, if cost effective. Because of their highly variable nutrient content, byproduct feeds should be tested to ensure they do not contain excessive or toxic levels of nutrients.

Many feed companies offer complete goat feeds that are either pelleted or textured and balanced for the needs of the animals in a particular production class. Pelleted rations have an advantage because the animals cannot sort feed ingredients. While complete sheep feeds have been available for many years, it has only been in recent years that meat goat rations have been introduced to the market place. Complete feeds typically come in 50-pound sacks and tend to be much more expensive than homemade concentrate rations. These feeds ensure the feed is balanced correctly.

Vitamins and Minerals

Goats require many minerals. The most important minerals are salt, calcium and phosphorus. The ratio of calcium to phosphorus should be kept

around 2:1 to prevent urinary calculi. Vitamins also are needed in small amounts. Small ruminants require vitamins A, D and E, whereas vitamin K and all the B vitamins are manufactured in the rumen. A free-choice salt block or salt-vitamin-mineral premix should be made available to goats at all times, unless a premix has been incorporated into the grain ration or TMR (total mixed ration). At a minimum, does should be fed free-choice mineral during late gestation and lactation. Either a loose mineral or mineral block may be offered. Force-feeding minerals and vitamins is actually better than offering it free choice, since animals often will not consume minerals according to their needs.

Goats appear to have a much higher tolerance for copper in their diets compared to sheep, but producers are recommended not to use feeds and/or premixes containing copper if the goats are commingled with sheep. Pelleted supplements are available that contain vitamins and minerals, and high levels of protein (34 to 40 percent). These supplements can easily be combined with whole grains or by-product feeds to create a balanced concentrate ration. Coccidiostats can be added to the mineral mix or supplement. Rumensin® (monensin) is FDA-approved for goats. Deccox® also is approved as a coccidiostat for goats.

Water

Goats should have free-choice access to clean, fresh water at all times. A mature animal will consume between three-fourths to one and one-half gallons of water per day. Water requirements and intake increase greatly during late gestation and during lactation. Water requirements increase substantially when environmental temperatures rise above 70 F and decline with very cold environmental temperatures. An animal's nutrient requirements will increase if it has to consume cold water during cold weather. Rain, dew and snowfall may dramatically decrease free choice water intake. Inadequate water intake can cause various health problems. In addition, water and feed intake are positively correlated, meaning that the more feed goats eat, the more water they need. Producers should use common sense when providing water. Because of kids' playful natures and their tendency to climb, they can fall into large troughs. If a large trough is used, large rocks should be placed in it so the kids can climb out should they fall in.

Body Condition

Producers should be concerned with the body condition of their breeding animals. The term body condition refers to the fleshing ability of an animal. Does should not be allowed to become too thin or too fat. Failure in reproduction, low twinning rates and low weaning rates will result if does are too thin. Overly fat does can suffer pregnancy difficulties.

Simply looking at an animal to determine its body condition can be misleading. Rather, animals should be touched and evaluated in a chute. The easiest areas to feel and touch to determine the body condition of an animal are the rib areas on either side of the spine. By running a hand over those areas and pressing down with a few fingers, the producer is able to determine the amount of fat covering the ribs.

Other areas to monitor are the shoulders, the tail head, the pins, the hooks, the edge of the loins and the backbone. Practice makes perfect, so evaluating the animals helps the producer get a feel for it. An easy way to start is to select a few animals that are over-conditioned and some that are thin. This helps identify extreme cases. Then the producer can introduce a small group of animals and compare their condition to the animals having extreme body condition. The producer should develop an eye and a touch for the condition of the animals and strive to maintain a moderate amount of condition on the goats. If the backbone and ribs can easily be seen, the goats are most probably undernourished. When body condition starts to decrease, supplemental feed is usually needed or the animals need to be moved to a higher quality pasture. Waiting until goats become thin to start improving their feeding regime may lead to large production losses.

Producers also should be concerned with the body condition of the breeding bucks. Bucks will have reduced fertility if they are too thin. If bucks are overfed and become too fat, they may have no desire to breed does.

Flushing

Flushing means increasing the level of feed offered to breeding does, mostly energy feeds, starting about one month prior to the introduction of the bucks, to increase body weight, ovulation rate and possible litter size. Increasing the level of energy offered to does should continue throughout the breeding season and for approximately 30 to 40 days after removing the bucks, for adequate implantation of the fetuses in the uterus. Body condition is used to determine whether flushing will benefit breeding does. Does in extremely good body condition tend not to respond to flushing. Does in relatively poor condition because of poor quality summer pastures, high worm loads or late kidding of twins or triplets respond favorably to flushing by improving their body condition.

Flushing can be accomplished by moving breeding does to a lush nutritious pasture three to four weeks prior to the introduction of the bucks. This cost-effective flushing method is underutilized when and where forage is abundant. Another method is feeding one-half pound per day of a high-energy supplement. Corn is the grain of choice for flushing; whole cottonseed is another low-cost, high-energy supplement. The primary goal is to increase condition of thin does, so they should be grouped according to their body condition and fed accordingly to first improve their body condition, then maintain it.

References

Schoenian S. (2003). An Introduction to Feeding Small Ruminants. Maryland Cooperative Extension. Maryland Small Ruminant Page. <http://www.sheepandgoat.com>

Chapter 6

Herd Health

David Sparks, DVM and Barry Whitworth, DVM

Any domestic herd health program, regardless of animal specie, requires a definite level of commitment from the herdsman to develop the necessary knowledge and skills to maintain the health and well being of the animals, in addition to developing a working relationship with their veterinarian. The ability to observe and recognize not only disease symptoms in animals, but also potential disease situations in the herd, along with proper recordkeeping, and management skills will save time, money and effort and improve the opportunities for financial success. A complete herd health program encompasses many aspects of production. However, this chapter will focus more on those factors contributing to infectious diseases, their prevention and/or control measures.

If just beginning your goat enterprise, consider buying all your goats from one well-established herd with good health records. This is important to minimize the chances of buying diseased animals and starting out with health problems. If expanding your already existing herd by purchasing replacement stock, then isolate the new replacements from the existing herd for 30 days in an effort to avoid introducing any disease into the herd. This management practice will prevent the introduction of potentially infectious organisms from the newly purchased animals to your herd through commingling. The immunity level of your herd may be significantly different than that of the other goats, and make them particularly susceptible to any pathogenic organisms the replacements may be harboring in their population.

Generally speaking, goats are fairly healthy animals. However, as with any animal, stress will weaken the immune system's response to exposure to infectious organisms and increase the chances for disease to develop. A good health program emphasizes prevention (proper vaccination), good management (minimizing stress) to keep animals healthy and avoiding exposure to infectious organisms.

Common Diseases and Vaccination Programs

Consult a veterinarian to establish a vaccination regime. Vaccines give the best results when the animals being vaccinated are healthy, and not stressed due to poor nutrition, parasites, weather or previous exposure to the disease organisms. Development of the immune response is somewhat age sensitive, and depending on the circumstances, the relatively older kids seem to respond to certain vaccines better than younger kids. If tetanus is a problem in your herd, then vaccinating early would be recommended. Vaccinate kids either before weaning or after they have recovered from the stress of weaning. Vaccinate in the neck or side of the brisket just under the skin (subcutaneously) by making a tent when you pinch the skin with your thumb and forefinger. Use a one-inch long, 18-gauge needle. An example list of vaccines for Oklahoma might include the following:

As a minimum, use a clostridial vaccine offering protection against *Clostridium perfringens* type C and D as well as tetanus (CDT) and either a Leptosporosis or Vibrio-Lepto (for southeast Oklahoma). Your veterinarian should be consult-



Figure 6-1. Area of the neck that injections should be administered to a goat.

ed for other recommended vaccinations in your area, such as Chlamidia, sore mouth or *Caseous Lymphadenitis*.

A suggested vaccination regime might be:

Vaccinate kids from unvaccinated mothers with CDT at about four weeks, then every four weeks through weaning. Vaccinate kids from vaccinated mothers at eight weeks and again at weaning between 12 and 16 weeks. Adult animals should be vaccinated annually. If does receive their annual booster 30 to 45 days before kidding, their immunity level, and subsequently the immunity level in the colostrum, will be at an optimum level. This results in the greatest possible passive immunity for the kids near kidding time and provides better and longer newborn protection.

Other vaccines are sometimes used, but not labeled for goats and require a veterinarian-client-patient relationship for extra label usage.

Enterotoxemia

Enterotoxemia is commonly called “overeating disease” and is caused by *Clostridium perfringens*. This bacteria is almost always present in the environment and in the ruminant digestive tract. It usually does not cause problems, but with the right conditions in the gut due to sudden changes of feed or by ingestion of large quantities of concentrates, the organisms multiply rapidly and produce a toxin. This toxin causes necrosis of the gut, diarrhea and central nervous system dysfunction. The onset and progression of the disease is very rapid and often not noticed until they are at or near death. There is an antitoxin available but seldom are the affected goats noticed in time for it to be effective. Although nursing kids and mature animals can show the condition, it is most often seen in weanlings and yearlings. Often, the biggest and best kid in the group is the one affected. Prevention relies on a good CDT vaccination program and avoiding sudden changes in feed and feeding high levels of concentrates.

Urinary Calculi

This condition also is called urolithiasis or urinary stones. It is caused by an imbalance of phosphorous and calcium. When the phosphorous level in the diet is too high or the calcium level too low we get the formation of stones. This is most often seen in wethers, is common in bucks, but is almost never



Figure 6-2. CD&T vials.

seen in females. It most often affects weanlings and yearlings. Since grains and protein supplements are typically high in phosphorous, while forages and hays are typically high in calcium, it is usually seen with high concentrate diets. It is seen commonly in young animals that are being pushed for maximum growth and development, such as show prospects. It is important to make sure water is clean and fresh because limited water intake due to dirty water or cold weather can bring on problems. Urinary acidifiers such as ammonium chloride in the diet can help prevent the formation of stones, but this is no substitute for adequate roughage in the diet. Affected animals are in pain, hump up or lie down, cry repeatedly and may dribble urine. Once a blockage has occurred it should be considered an emergency and a local veterinarian called at once.

Caseous Lymphadenitis

Caseous lymphadenitis (CL) is caused by a bacteria invading the lymph nodes of goats and sheep, causing abscesses. These lesions show up as lesions under the skin in various areas of the goat’s body and grow in size until they rupture and spread infection in the herd. Because the organisms can live for some time, this condition is highly contagious. Some goats may only have one lesion then live a normal life, while others have repeat episodes, ultimately involving the internal lymph nodes, causing poor performance and death. Common treatment involves opening the lesion and flushing with iodine to kill the organisms. This should be done away from areas that the goats can access. Abscess from other causes are common in goats and it is important to remember that not all lumps are caused by CL. A conditionally licensed CL vaccine is available from Texas Vet Lab. It is commonly used in herds with endemic and severe problems or show

goats, but should only be used under the advice of a veterinarian. The best way to prevent this problem is to purchase breeding stock from reputable breeders and to avoid sale barn bargains.

Contagious Ecthema

Contagious ecthema, commonly called sore-mouth, is caused by a virus and affects predominantly younger animals. In kids, scabby lesions develop on the lips, gums and sometimes on the eyelids and ears. The lesions clear up with time and leave no permanent damage. Economic loss, and in severe cases death, is due to the kid's inability to nurse effectively. If the mother has not had the disease earlier in life to give her immunity, she is likely to develop lesions on the udder and not allow kids to nurse due to the pain. Common disinfectants can help shorten the duration of the disease. Any kind of soothing salve helps lessen the discomfort and makes nursing easier. There is a vaccine labeled for sheep, but not labeled for goats, therefore may only be used on the advice of a veterinarian. This is a disease with public health significance. People can get lesions on their hands and arms from exposure to the affected animals or to the vaccine. When the scabs fall off, they contain the active virus and remain infective for long periods of time. It is very common on any farm where sheep or goats have been raised.

Contagious Foot Rot

Contagious foot rot, also known as virulent foot rot or malignant foot rot is a specific, lingering or reappearing, tissue-destroying disease affecting the outer skin between the toes and hoof matrix (Figure 6-3). As it destroys the tissue, it causes the hoof to detach at the skin-horn junction. As its name implies, it is contagious and with ideal conditions can infect up to 100 percent of the herd. The disease is caused by the combination of two bacterial organisms working together. The spread of the disease from one animal to another requires warm, moist environmental conditions. Injuries to the feet of goats will enhance the spread of the disease. However, soil temperatures below 40 F will impede the spread of the disease. Affected animals will lose body condition, develop lameness and be seen laying down for a good part of the day. The dying tissue has a characteristic unpleasant odor. Recovery from foot rot occurs, but the affected animal does

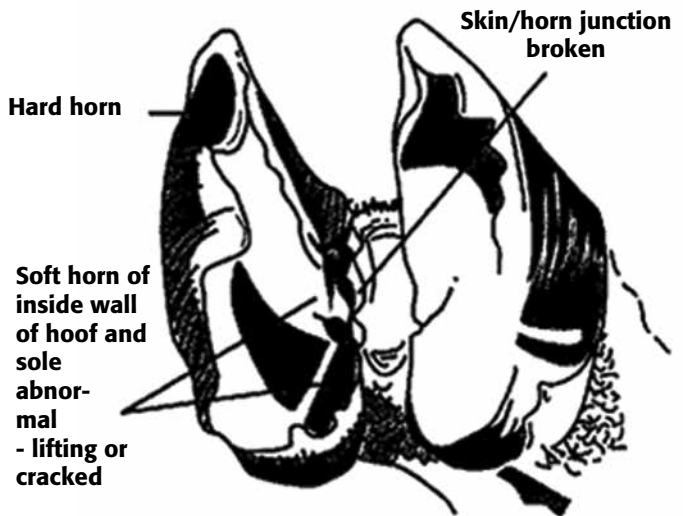


Figure 6-3. Contagious foot rot.

not have a permanent immunity from it, and can become re-infected when conditions are suitable. Preventing the disease begins with proper sanitation throughout the operation, isolating and examining introduced stock for up to 30 days before turning them in with the herd. Treatment includes trimming hooves of affected animals, use of bactericidal solutions in topical sprays and footbaths and antibiotic injections. Although these methods can be effective in reducing the impact and incidence of the disease, constant vigilance and time are required to identify the subclinical or relapsing cases.

White Muscle Disease

White muscle disease in kids, though not common in Oklahoma, does occur in areas where does have been subjected to selenium-deficient and/or vitamin E-deficient diets during or prior to gestation. Forages grown on selenium-deficient soils account for most of the recorded cases of this disease. However, in some cases, various metals (silver, copper, cobalt, cadmium, mercury and tin) present in the soil and/or diet have antagonistic effects on selenium uptake and/or utilization. Acute symptoms of the disease may manifest as sudden death within 2 to 3 days after birth, usually with involvement of the heart muscle, or a general weakness of skeletal muscles preventing the act of nursing, resulting in starvation. In less severe cases, the only observed symptoms may be poor posture, general unthriftiness and diarrhea. Affected kids often are unable to rise due to lack of muscle control, but remain alert and will nurse

if held in position. Prevention of the disease would include an awareness of soil fertility and proper maintenance and proper mineral and/or vitamin supplementation of the herd when necessary. A local veterinarian should be consulted for treatment options if a problem with the disease has occurred.

Floppy Kid Syndrome

Floppy kid syndrome is more appropriately called acidosis of newborns. Unlike white muscle disease, which affects kids from birth, with this syndrome, the kids are normal and active after birth and for the first 3 to 5 days. Newborn kids eat only very small amounts, but eat often. Their mothers may look like they would have a lot of milk, but are actually producing small amounts at a given time due to swelling and edema. As the kids get to be a few days old their appetite and stomach capacity increases just as the doe “comes to her milk.” This can result in an overeating condition, which causes acidosis. The kids who were healthy and active progressively become weak and recumbent. They show no interest in their surroundings, no desire to eat and are flaccid or “floppy.” Respiration is very fast as their system strives to correct the acidosis. If found soon enough, the condition can be corrected by giving baking soda dissolved in water via stomach tube every two hours. The incidence of this condition is increased by feeding does high levels of concentrates prior to and soon after kidding and by confining does and their kids. It is seldom seen in kids born in a pasture and allowed to spend their first few days there.

Common Internal Parasites and Deworming Programs

Of all the predators (coyotes, dogs, cougars, etc.) internal parasites (including coccidia) will kill more goats than all of the others combined. This is primarily due to the barber-pole worm (*Haemonchus contortus*). Common roundworms of cattle feed on mucous and protein in the digestive tract causing unthriftiness, while the barber-pole worm feeds on whole blood, causing death due to anemia. Complicating the control of parasites is that each region of the country will have different parasite problems, requiring different preventive/treatment programs. This is just another example of why it is important to involve a local veterinarian in a para-

site control program for the herd. While the use of dewormers is a necessary tool in an internal parasite control program, it shouldn't be seen as the only tool. Proper nutrition and sanitation is of extreme importance in the control of the effects of parasitism. Goats in good condition and receiving adequate feed often are able to establish a degree of resistance to parasitism, while nutritionally-stressed goats are unable to cope with parasitism, and high death losses can occur. Parasites are opportunists, and therefore parasitic disease problems increase with intensification of production practices and lack of attention to strict sanitation.

A basic understanding of the worm life cycle will help in designing an appropriate parasite control program. The adult female worms lay eggs in fecal matter that passes through goats and is deposited on the pasture. Warm and moist conditions on the ground cause the eggs to hatch within four to 80 days. Upon hatching, the tiny larvae crawl up the blades of grass or weed stems and are eaten along with the plant material as the goat grazes. In extremely hot and dry, or freezing cold weather the eggs will either not hatch or will die. This is why goats in south Texas, New Mexico, Wyoming, and Montana have very few (if any) worm problems. The number of goats, stocking density, forage species, etc. have an impact on the number of worms. The more goats – the more worm eggs! There also will be some goats in the herd that always tend to be more “wormy” than their herd mates. In fact, research indicates 20 percent of the animals produce 80 percent of the worm eggs on pasture. Culling the chronically infested animals will reduce the number of worm eggs available to hatch. Since goats share worms with sheep, but very few with cattle or horses, co-species grazing is a reasonable management tool to reduce the number of worm eggs on pasture. Any goat parasite larva ingested by the cattle or horses will not develop into adults, but be digested. This serves to reduce the number of infected larva and make the pastures safer for goats. Also, rotational grazing programs will help eliminate the number of viable larvae to infect goats as long as the goats do not return to highly infested pastures (sufficient time between grazing infested pastures, or grazing behind other species such as cattle or horses). Other management considerations may include baling extra forage production in certain infested pastures, or plowing under temporary winter or summer annual pastures where appropriate to decrease the number of worm eggs.

There are four classes of internal parasites: (1) roundworms, (2) tapeworms, (3) flukes and (4) protozoa. Of the four types, roundworms are the most economically important. Flukes are economically important in some areas, while adult tapeworms are of minor importance. Coccidiosis is an opportunistic infestation, chiefly caused by stress. It most often occurs around weaning time. It can be prevented by feeding goats medicated feed (containing Deccox®) for two weeks prior to weaning. Proper sanitation in keeping surroundings clean and dry can reduce the spread of the disease. Signs of parasitism are most common in young, very old or diseased and/or stressed animals. Different parasites cause different disease symptoms. In general, most infestations cause weight loss, unthriftiness and poor weight gains. Some parasites can cause diarrhea, decreased appetite, poor conception rates and fluid retention (bottle jaw). In addition to these symptoms, as the goat begins to lose blood from the feeding activity of the worms, pale mucous membranes caused by anemia can be seen around the eye or inside the mouth on the gums. Official diagnosis of worm infestations in goats can be made by gathering fecal samples and taking them to a local veterinarian for a fecal flotation assay, or in some instances when a goat dies, a determination can be made with a necropsy.

In Oklahoma, goat producers must remember that given the right conditions, worms can be present in the pasture to potentially infest goats any time of the year. The following suggestions are made to minimize the occurrence of experiencing a serious internal parasite infestation.

- To stop intestinal worms from accumulating, do not use the same pastures for kidding every year.
- Rotate pastures used for grazing every three to six months.
- If possible, all animals that are de-wormed should be held in a dry lot for at least 24 hours. This is because most de-wormers do not kill the parasite eggs, just the adult worms. Waiting 24 hours will help the animal eliminate most of the parasite eggs in the dry lot and not on pastures, where other animals may ingest the eggs.
- Prevent the post-kidding rise in parasite egg production because goats are very susceptible to worms while lactating.

- Have a veterinarian perform a fecal egg count to check the effectiveness of any de-worming or parasite control programs. This should be done before and 10 to 14 days after de-worming. The amount of fecal egg reduction will show if that dewormer is effective on the farm.
- Select animals that are parasite-resistant. These are goats that have a natural resistance to internal parasites. These animals are often identified through the use of fecal egg counts and Faffa Malan Chart (FAMACHA) eye scores.

Dewormer resistance is a big problem facing goat producers in Oklahoma. Management to slow the development of this problem on the farm can be utilized by:

- Never deworm all of the animals, then move to clean pasture. This ensures that the only worms available to parent the next generation will be resistant ones.
- Do not rotate dewormers as this builds resistance to several dewormers simultaneously. Find a drug that is effective and stay with it as long as it works.
- Use FAMACHA eye scores to determine which goats need deworming and only treat those goats.
- Use management techniques to minimize the need for drug usage as much as possible. The more parasite population on the farm exposed to the drug, the faster they will develop resistance.
- Cull any animals that repeatedly need deworming. By eliminating them, the contamination burden on the other goats is reduced.
- Remember, if deworming more than twice per year, resistant parasites are common.

Most of the products used in other ruminants are not labeled for use in goats and their use would be considered “extra label.” By law, producers must use them as advised by a veterinarian with a veterinarian-client-patient relationship when using them. Drugs are labeled for use in goats are Safeguard® and Rumatel®. Often, goats require doses 1.5 times higher than the typical sheep dose for many of the internal parasite products. Most small ruminant veterinarians recommend giving only oral internal parasite products to goats, as some studies have in-

icated that pour-on products are not very effective in goats.

Common External Parasites and Control Program

Goats are susceptible to many of the same ectoparasites as other livestock species, such as flies, lice and ticks. Many of the ectoparasites are spread by direct contact, or having infested animals in close association with other animals. Some of the symptoms of affected animals would include weight loss, unthriftiness, hair loss, severe scratching, skin lesions, poor appetite and nervousness. Fly control is more a matter of sanitation and chemical use. Keeping barns and pens cleaned will help keep fly numbers down considerably. In addition, premise sprays can be used to assist in fly control. Insecticide dispensers that can be placed in barns, sheds and other structures occupied by goats can be purchased that will emit small doses of insecticide automatically on an intermittent schedule to control flies. Most of the premise sprays labeled for other livestock will work for goats too, however, this is an opportunity to remind producers that many of the insecticides recommended for other livestock do not carry a recommendation on their label for goats, and that this “extra label” usage by the producer should be accompanied with a veterinarian-client-patient relationship. The insecticides listed in Table 6-1 have been found to be effective in controlling many of the goat external parasites mentioned.

Conclusion

From this discussion on goat herd health, it should be apparent to the producer that raising or producing goats is like any other livestock enterprise. To be successful and profitable in a meat goat operation the producer must manage his or her resources, and produce to optimize the net return to the investment in land, labor, capital, management and time. Critical to the success of a goat operation is the attention and effort provided to the proper care and maintenance of a whole herd health program which begins with establishing goals and objectives for the operation, developing a relationship with a local veterinarian who can help in outlining the health management protocols for the different production phases of the operation, following proper sanitation procedures throughout the operation, developing sufficient herd immunity through appropriate vaccination procedures, assuring adequate nutrition and providing for effective parasite prevention and control.

References

- Faerber, Cody W., (2004) *Small Ruminant Manual, Third Edition*. Animal Health Publications.
- Ferrell, Mark (2005) “Goat Medications Table.” Proceedings: S.E. District OSU Extension Agricultural Educators Training Conference, McAlester, OK.
- Hart, Steve (2005) “Goats ‘n More Goats.” Proceedings: S.E. District OSU Extension Agricultural Educators Training Conference, McAlester, OK.
- Parker, DVM Gene (2006) “An interview with an OSU Extension Area Food Animal and Quality Assurance Specialist,” Oklahoma Cooperative Extension Service.

Table 6-1. Insecticides for external parasite control.

<i>Active Ingredient</i>	<i>Effective Against</i>	<i>Treatments</i>
Malathion	Mites, lice	0.5% spray, 4% dust
Lime-sulfur	Mites, lice	2-5% dip
Coumaphos	Mites, lice	0.05 – 0.3% spray or dip; 0.5 – 1% dust
Phosmet	Mites, lice	0.15 – 0.25% dip
Methoxychlor	Mites, lice, ticks	0.5% spray or dip; 5% dust
Atroban 11% EC (Spray)	Lice, ticks	Follow label directions
Atroban 42.5% EC (Spray)	Lice ticks	Follow label directions
GardStar 40% EC (Spray)	Lice ticks	Follow label directions
Python dust (0.075% z-cypermethrin)	Lice, ticks	Follow label directions

Table 6-2. Medications used in goats.

ANTIBIOTICS	<i>Brand Name</i>	<i>Approval</i>	<i>Dosage</i>	<i>Route</i>	<i>Frequency</i>	<i>Withdrawal Interval (Meat)</i>	<i>Withdrawal Interval (Milk)</i>
Procain Pen G	Crysticillin®	extra label	10,000-20,000 IU/lb	SQ	QD	16-21 days	120 hours
Benzathine Pen G	Pen BP-48®	extra label	20,000 IU/lb	SQ	q 48 hours	30 days	NA
Amoxicillin	Amoxi®-inject	extra label	5 mg/lb	SQ	QD	25 days	120 hours
Ampicillin	Polyflex®	extra label	5 mg/lb	SQ	QD	10 days	72 hours
Oxytetracycline	LA-200®	extra label	9 mg/lb	SQ	q 48 hours	50 days	144 hours
Sulfadimethoxine	Albon®	extra label	25 mg/lb	PO	QD	7 days	?
Ceftiofur	Naxcel®	approved	0.5-1 mg/lb	IM	QD	0 days	0 hours
Erythromycin	Erythro-200®	extra label	1 mg/lb	SQ	QD	5 days	96 hours
Tylosin	Tylan-200®	extra label	10 mg/lb	IM	QD	30 days	96 hours
Neomycin	Biosol®	approved	5 mg/lb	PO	BID	3 days	NA
Florfenicol	Nuflor®	extra label	9 mg/lb	IM	q 48 hours	28 days	120 hours
Gentamicin	Gentocin®	do not use					
Tilmicosin	Micotil®	do not use	toxic to goats				
ANTI-INFLAMITORY DRUGS							
Flunixin meglumine	Banamine®	extra label	1.1-2.2 mg/kg	IV / IM	QD	10 days	72 hours
Phenylbutazone	Bute®	extra label	10-20 mg/kg	PO	QD	45 days	120 hours
Aspirin	Aspirin	extra label	100 mg/kg	PO	QD	1 day	24 hours
ANESTHETICS & TRANQUILIZERS							
Xylazine	Rompun®	extra label	0.05-0.1 mg/kg	IM/IV		5 days	72 hours
Ketamin	Ketaset®	extra label	5-10 mg/kg	IM/IV		3 days	48 hours
Thiamylal Na	Biotal®	extra label	10-20 mg/kg	IV	1 day	24 hours	
Yohimbine	Yobin®	extra label	0.25 mg/kg	IV	7 days	72 hours	
Lidocaine	Lidocaine®	extra label	variable for local	anesthesia use 1%			
ANTHELMINTICS							
1. Avermectins							
Ivermectin	Ivomec®						
	Drench	extra label	0.3 mg/kg	PO	14 days	9 days	
Ivermectin	Ivomec® 1%	extra label	0.3 mg/kg	SQ	56 days	40 days	
Doramectin	Dectomax®	extra label	0.3 mg/kg	SQ	56 days	40 days	
Eprinomectin	Eprinex®	extra label	0.5 mg/kg	PO	NA	NA	
Moxidectin	Quest®						
	Cydectin	extra label	0.5 mg/kg	PO	23 days	56 days	
2. Benzimidazoles							
Albendazole	Valbazen®	extra label	10 mg/kg	PO	7 days	120 hours	
Fendendazole	Panacur®/Safeguard®	approved	10 mg/kg	PO	14 days	96 hours	
Oxfendazole	Synanthic®	extra label	10 mg/kg	PO	14 days	120 hours	
3. Cholinergic Agonists							
Levamisole	Levasole®	extra label	8 mg/kg	PO	10 days	4 days	
Morantel Tartrate	Rumatel®	approved	10 mg/kg	PO	30 days	0 days	
COCCIDIOSIS PREVENTION							
Monensin	Rumensin®	approved	15-20 gms/ton feed		0	96 hours	
Decoquinatate	Deccox®	approved	13-91 gms/ton feed		0	24 hours	
			feed or water				

Route Abbreviations: PO = Oral Administration
IV = In The Vein

SQ = Subcutaneous Administration
IM = Intramuscular Administration

Withdrawal Interval – Milk: NA = Insufficient Kinetic Data Available to make a WDI Estimation

Frequency Abbreviations: QD = once a day
BID = twice a day
q 48 hours = every other day

To calculate dose from mg/kg:
Dose in cc = pounds body weight divided by 2.2, times dose in mg/kg, divided by mg/cc in drug
For example: a 100 lb goat getting Fenbendazole at 10 mg/kg and Fendendazole has 100 mg/cc
Dose = 100 divided by 2.2, times 10, divided by 100 mg/cc = 4.5 cc dose for a 100-lb goat

Chapter 7

Bucks and Breeding

Brian Freking and Aubie Keese

Producers should strive for the highest reproductive efficiency to accomplish at least these three primary purposes:

- perpetuation of the species
- maximum food output
- genetic improvement

The objective of this chapter is to provide the basic information to help producers improve reproductive efficiency in their operations. One way to do this is to have healthy pregnant does, such as the one shown in Figure 7-1.

Female Goats (Does)

Female goats (does) reach puberty at seven to 10 months of age, depending on their breed and nutrition. Does should be at 60 to 75 percent of their adult weight at breeding to prevent difficulty in kidding. Does will have higher lifetime production and be more profitable if they are bred to kid as yearlings. Does should kid every year thereafter until at least the age of seven or eight, if they remain healthy.

Most goats are seasonal breeders, reacting to shorter days as a cue for breeding. Breeding season may be manipulated through the use of lights and hormone therapy. The presence of a buck (uncastrated male goat) stimulates the reproductive cycle

(estrus) and the behaviors of the does indicate they are in the fertile part of their cycle (in heat). The doe's estrous cycle normally occurs from August or September until January, with October to December being the peak time for breeding. The estrous cycle is normally 18 to 22 days long.

Does in estrus are at the proper stage for breeding; at this time, they will be receptive to the buck. Estrus lasts for 12 to 36 hours. Signs of heat include tail wagging, swollen vulva, mounting behavior, decrease in milk yield if lactating and a general increase in activity and bleating.

Kids are born about 150 days after breeding. Plan breeding so kids are born during the height of forage production in the spring, making efficient use of the pasture. Keeping accurate breeding records allows producers to know when kids are due and help them prepare for their arrival. Another decision to consider in a breeding season is to match the breeding season to a potential market outcome to take advantage of higher market prices or traditional cycles.

Male Goats (Bucks)

The most important animal in the herd is the buck, shown in Figure 7-2. He provides half of the genetics of the herd, and using a sound, high-quality buck can make significant improvements to the herd.



Figure 7-1. Pregnant doe.



Figure 7-2. Male goat (buck).

Bucks reach puberty earlier than females and must either be separated from them by the age of four months or be castrated to prevent unwanted breeding. Buck kids can be used as herd sires at eight to 10 months, but should not be used as heavily as mature bucks. A veterinarian should conduct a breeding soundness exam to test bucks for fertility and soundness before the breeding season.

Also when selecting a buck, a veterinarian should perform a breeding soundness exam. A general physical exam can check the buck for structural soundness and abnormalities in the sex glands and organs. The scrotal circumference (at the widest point) should be measured, since this correlates with fertility and semen production. As a general rule, dairy bucks should measure 25 to 28 centimeters at 100 pounds, meat bucks should measure 26 to 29 centimeters at 100 pounds, and larger bucks should measure at least 34 to 36 centimeters (Mobini, 2003).

A semen sample should be taken and evaluated. A normal concentration is two billion sperm per cubic centimeter of semen, which 70 percent should be motile. The sperms' morphology should be evaluated to determine whether they are mature and if there are abnormalities. At least 80 percent of the sperm should be normal (Mobini, 2003).

Finally, the buck's libido should be monitored. A sound buck is of no use if he will not service does. A full-grown, healthy buck should easily service up to 50 does. As a rule, bucks should not be bred to their daughters; inbreeding tends to expose genetic problems and lead to weaker stock.

When bringing a new buck into the herd, producers should spend time and effort to locate a superior buck, one that has the traits the producer has identified as being important. A good buck is well worth the investment. A buck that has production records (has been on test or has relatives that have been on a production test) is the surest bet. At the very least, producers should observe both the herd and the parents of the buck.

In any mating system, certain production practices help with record-keeping to maintain selection decisions. One such practice is using visual markers to identify bred does. Animals can be fitted with a harness containing a crayon that will mark the females in heat when mounted. This procedure helps identify efficient females in the herd.

Some goat producers use artificial insemination (AI) for breeding. This requires excellent heat

detection skills and is more labor-intensive than natural service, but AI allows the economical use of outstanding sires. The American Dairy Goat Association (ADGA) offers a booklet about AI. AI classes are offered by Langston University in Langston, OK., and sometimes by goat associations. AI technicians may be available in some areas of the country. For more information, contact the local county Extension educator.

Breeding goats can involve different strategies. Each of these strategies will have different consequences for the herd, and wise producers will pick a strategy that fits their own philosophies and goals. No single strategy fits all situations, but each strategy is a wise choice for certain goals and production systems.

Pregnancy Diagnosis

While not of immediate concern in extensive goat operations that utilize extended natural mating, the early determination of pregnancy can be a useful management tool with more intensive production conditions or when AI and embryo transfer are employed. Pregnancy diagnosis will identify the females that require repeat breeding or insemination and/or will allow the separation of pregnant and open females for different management. When fetal numbers can be determined as part of the pregnancy diagnosis, different feeding regimes can be applied to single and multiple litter-bearing females.

To be most useful to the producer, pregnant animals need to be identified as early as possible in gestation and provide an estimate of fetal numbers. Techniques have either focused on the detection of physical changes resulting from pregnancy (fluid accumulation and presence of a detectable fetus) through palpation and ultrasound. Techniques also have been concerned with identifying maternal and fetal physiological signals (progesterone or uterine proteins) associated with pregnancy.

The most promising technique currently available for pregnancy diagnosis is the use of real-time ultrasound scanning. Real-time ultrasound through the skin allows reliable pregnancy diagnosis as early as 35 days into gestation.

Techniques using pregnancy-specific protein B, is now available for use in small ruminants. Does can be tested for pregnancy at 30 days or later using a simple blood test.

Breeding Systems

One concept, regardless of breeding strategy, is selection. Selection simply means using some goats for reproduction and some for food. Selection ensures more desirable goats produce more offspring than the less desirable goats. Other concepts include these breeding strategies: inbreeding, line breeding, line crossing and crossbreeding. These strategies have slightly different definitions, but the important thing is the pairing of animals for reproduction can have varying outcomes, depending on the relationship of the animals mated.

Table 7-1 shows the comparisons of inbreeding/line breeding and crossbreeding traits and potential consequences.

Line breeding/inbreeding

One breeding strategy is line breeding, which is different from inbreeding just in degree. Both of these strategies involve mating related animals. Inbreeding can be arbitrarily set as the mating of first-degree relatives (offspring and parents, or siblings), although this is only one possible definition among many. Line breeding can then be considered as the mating of related animals, but of close relationship less than first degree.

Line breeding (or inbreeding) results in uniformity of offspring, especially if adopted as a long-term strategy with appropriate selection. Since parents are related, line bred animals increases genetic, appearance and performance uniformity. A very important historic note is that line breeding and inbreeding are the usual strategies for the establishment of breeds. Predictability is the major attribute of breeds that breeders find useful. The predictability and consistency of any breed is why most breeders choose it; they want a specific type of goat producing a specific product.

Potential problems of line breeding (and these are more common with inbreeding) include loss of general vigor and especially loss of reproductive performance. Obviously, selection can help offset these. As a result, many line bred and inbred resources are indeed productive, vigorous and reproductively sound.

Line crossing

Line crossing is the crossing of different lines within a breed, and while it has some of the same consequences as crossbreeding, it does contain this within a single breed. As a result, the variability is not as great as a cross between breeds, so the boost from hybrid vigor is not as great. With line crossing, the benefits of crossbreeding can be achieved without loss of breed character and type. Consistency of production is still diminished, and each individual situation will indicate whether this is a good tradeoff or not.

The phenomena associated with crossbreeding and line crossing is going to have differing consequences for different breeders, largely due to differences in the breeders' philosophies. That is, what do they want and how do they want to get there? These questions are essential for all goat breeders, but are not frequently asked. In the absence of a guiding philosophy and set of goals, breeding programs fail to make the progress possible with such guidance.

Line crossing takes time and commitment, while crossbreeding can be a quick fix and is a tempting strategy for a variety of reasons. One outcome of crossbreeding is initial phenomenal results, especially if the parents are intelligently selected.

Crossbreeding

Crossbreeding is a philosophic and biological opposite to line breeding and involves the mating of animals of two different breeds. Crossbreeding is a fascinating phenomenon, partly because different

Table 7-1. Comparisons of inbreeding/line breeding and crossbreeding.

<i>Trait</i>	<i>Inbreeding/line breeding</i>	<i>Crossbreeding</i>
Uniformity	Good	Poor
Fertility	Poor (to good with selection)	Good
Growth	Poor (to good with selection)	Good
Predictability	Good	Poor
Overall vigor	Poor (to good with selection)	Good
Longevity	Moderate	Good

things happen depending on which stage of crossbreeding is considered.

The first stage is the initial cross. A useful example comes from cattle. When Angus and Hereford cattle are crossed, the initial result is a very uniform crop of black baldy calves, which have benefited from the specific combination of the genetic array of the parental breeds. Each calf gets half from each breed. Since each parental breed is uniform, and each calf gets half from each breed, every calf is pretty much like the next. This first calf crop is reaping the benefits of homogeneous parental breeds.

If these calves are in turn used for reproduction, variability then increases since these calves are half one thing, half another. Using only color as the marker, these calves (when interbred) would produce black, black baldy, red and Hereford pattern calves. The initial consistency is gone, and the result is a variable group of calves.

Variability is not all bad, and if combined with selection, the excellent goats can be skimmed off the herd and used for advantages in shows and other situations. They may indeed have excellent type and performance. What they lack, though, is the ability to consistently pass along this excellence to the next generation.

Many of the advantages of crossbreeding, such as increased vigor and reproductive efficiency, are somewhat the disadvantages of line breeding. Conversely, the disadvantages of crossbreeding, such as lack of consistency and predictability, are the advantages of line breeding.

Summary

The result of this discussion is that crossbreeding does not make sense if the goal is consistent production generation to generation. Crossbreeding does make sense in many circumstances, one of which is the production of show animals. While

something of an extreme, a potential cross of a terminal sire (meat goat breed or meat goat producing system) would be mated with some sort of small, fertile, line-bred maternal female. All of the kids should be reasonably uniform, making an appealing lot for sale. While they may not in their own turn produce uniform offspring, they themselves are uniform and the clever breeder can take advantage of that fact.

Every breed can benefit from several breeders using slightly different strategies, philosophies and methods. It is healthy for a breed to have some breeder's line breeding and others line crossing. This strategy allows for successful combinations to be developed in a variety of locations and conditions, and all of this is good for goat breeds and goat breeders. A single program and philosophy will not fit all situations, and breeders need to encourage some diversity of approaches and techniques.

Table 7-2 gives a summary of the breeding strategy choices for different producer's goals.

Resources

American Dairy Goat Association
209 West Main Street
P.O. Box 865
Spindale, NC 28160
828-286-3801
<http://www.adga.org>

Langston University Agricultural
Research and Extension
P.O. Box 730
Langston, OK 73050
405-466-3836
<http://www.luresext.edu/goats/index.htm>

References

Mobini, Seyedmehdi. 2003. Georgia Small Ruminant Research and Extension Center, Fort Valley State University. Proceedings from an unpublished presentation at the American Dairy Goat Association National Convention, October 2003.

Table 7-2. Summary of some choices of breeding strategy for different producer goals.

<i>Goal</i>	<i>Inbreeding/line breeding</i>	<i>Crossbreeding</i>
Uniform kid crop	Good choice with selection	Good in first cross, then poor
Supreme show goats	Poor in most cases	Good if nonuniform goats
Rapid growth meat kids	Moderate at best	Good to excellent

Chapter 8

Kidding

Marty Montague

Kidding, the act of the birthing process in goats, shown in Figures 8-1, 8-2 and 8-3, is the culmination of the breeding process in goats. Goat kids are the primary source of income in commercial goat breeding herds. They represent the cash crop of the goat enterprise. Kidding represents the finale of the approximately 150-day gestation period in the breeding doe. Likewise, it adds another level of management to the goat herd.

This chapter contains a discussion of a number of factors that should be considered or addressed prior to kidding to reduce the amount of stress on the goat herd and management.

Deworming

Animals with a rough hair coat and general appearance that stay thin and do not gain weight may have a high internal parasite or worm load. Such animals will not breed well. Therefore, it is a good practice to deworm the breeding flock (does and bucks) prior to the introduction of the bucks to the does. Does should not be dewormed during the first 20 to 60 days of pregnancy, because the stress associated with handling and deworming may cause the animal to abort. In addition, some dewormers may induce abortion. Does also should not be dewormed two to three weeks prior to kidding, or at kidding because the doe hormonal changes will induce gastrointestinal parasites to produce a lot of eggs. These eggs will be excreted in the feces and contaminate pastures and the animals' other surroundings.

Kidding

Close to the end of the gestation period, grazing the pregnant does nearby helps producers easily check on them. Any supplement of concentrate or hay should be fed to the does at night. Late feeding can delay birthing to the early morning hours in the majority of animals. Have some kidding pens ready for weak kids or reluctant mothers. Prekidding



Figure 8-1. The water bag appears.



Figure 8-2. The kid comes through the birth canal.



Figure 8-3. The birth process is complete.

signs in goats are not always easy to detect; however, mucous discharge is a sure sign that kidding is close.

Kidding Process

There are three stages of the kidding process. Stage one is the preparatory stage. During this stage, the kid should rotate into the upright position and the cervix will start to dilate. The doe will become restless as her uterus starts to contract. This stage can last between four to eight hours with mature does and six to 12 hours with doe kids (first time mothers).

Stage two is the delivery stage. The water sac will appear first as the kid enters the birth canal. The water sac will then rupture and the front feet and head should appear. Then the kid is delivered. This stage should take less than one hour for mature does, but can take up to four hours for doe kids.

Stage three is the cleaning stage. The doe's straining decreases as the attachment between the uterus and placenta relaxes and separates. The placenta then is expelled from the doe. The placenta is commonly referred to as the afterbirth. This stage can last from one to eight hours.

All three stages should take place with little to no assistance from the producer, although sometimes it is necessary to lend assistance. Generally this assistance will be during stage two of the kidding process. Determination of when assistance is needed is sometimes difficult and usually requires close observation.

Normal Births

In goats, the kids can be delivered in two normal presentations. Figure 8-4 shows the anterior presentation. The kid's head is first with the front legs extended out of the birth canal. A majority of births occur this way. Unless the kid is too big for the birth canal, no assistance should be needed. Figure 8-5 shows the posterior presentation with the hind legs extended through the birth canal and the back end coming first. This is normal and a doe should be able to have the kid with no assistance. It is when the presentation is not normal that assistance may be needed.

Abnormal Presentations

If a doe begins stage two of the kidding process and the kid or kids are not positioned in a normal

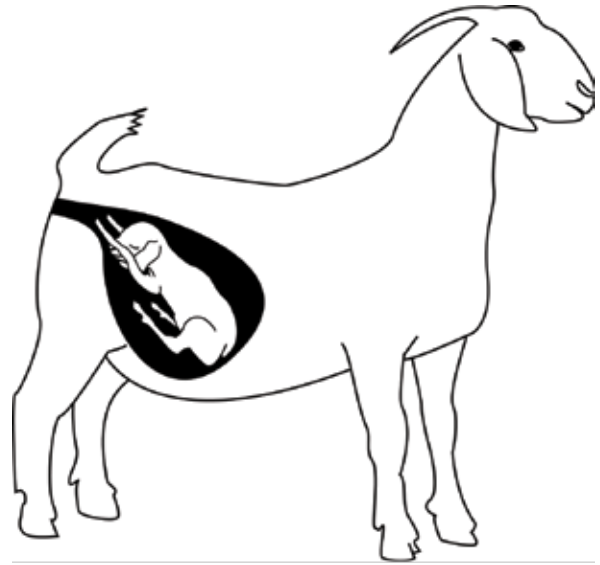


Figure 8-4. Anterior presentation with front legs stretched through the birth canal.

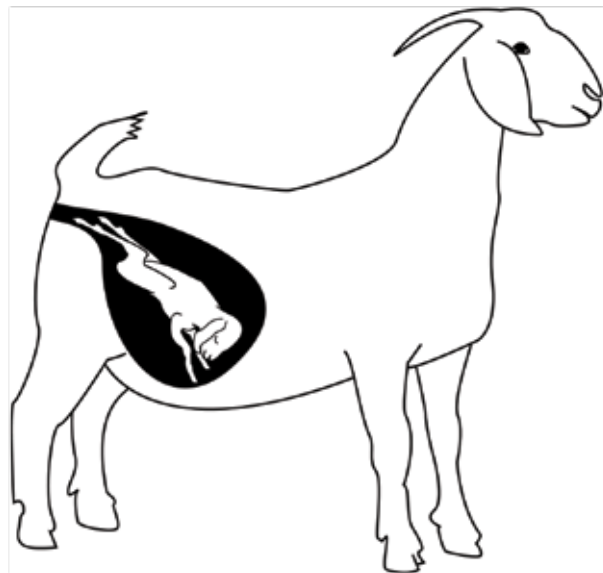


Figure 8-5. Posterior presentation with back legs stretched through the birth canal.

presentation the doe could have difficulty giving birth. Figure 8-6 shows some of the abnormal ways a kid can be positioned. If a kid is positioned abnormally, it must be repositioned to a normal presentation before it can be delivered. This requires assistance from the producer or a veterinarian.

When To Lend Assistance

Once the doe enters stage two, a producer should watch her very closely. Some does can deliver their kids quickly and some may take up to 2 hours. Unless a producer is closely observing the doe, it may be difficult to determine how long she

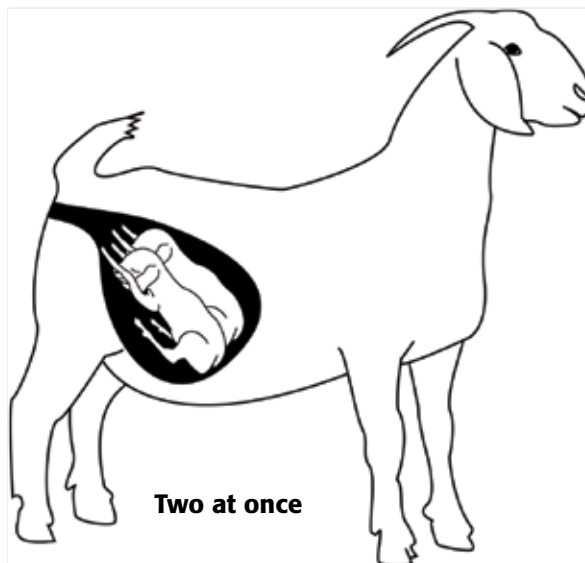
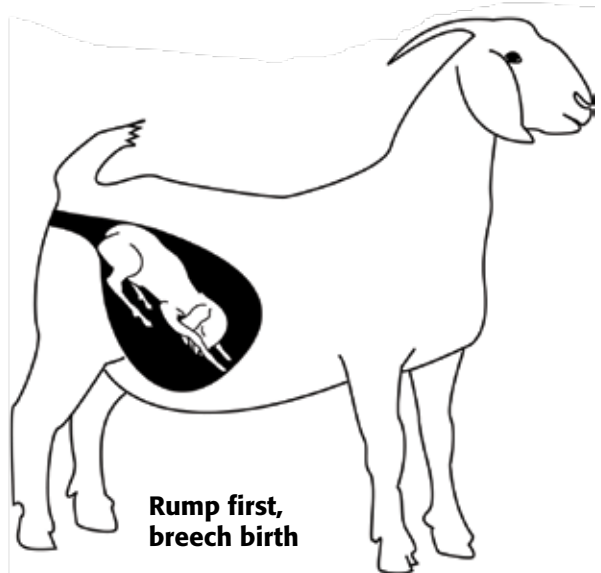
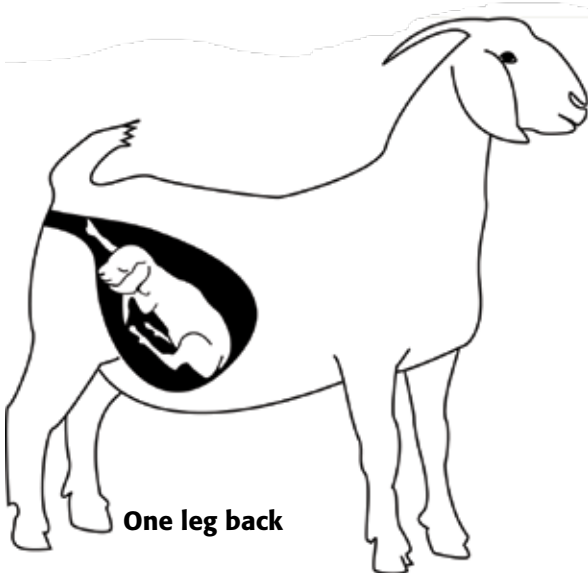
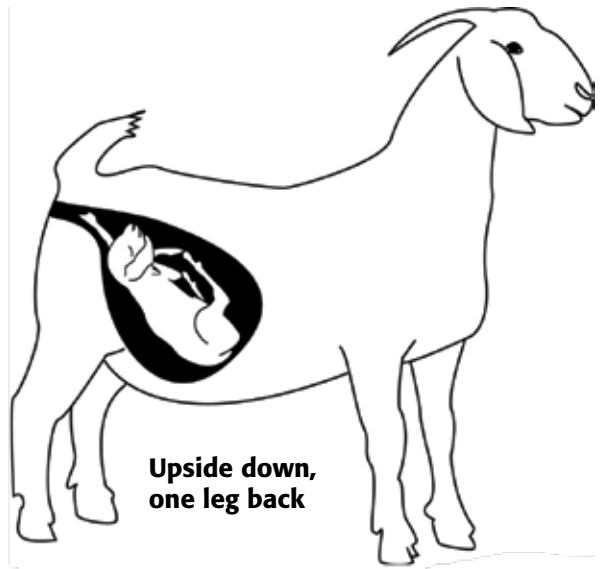
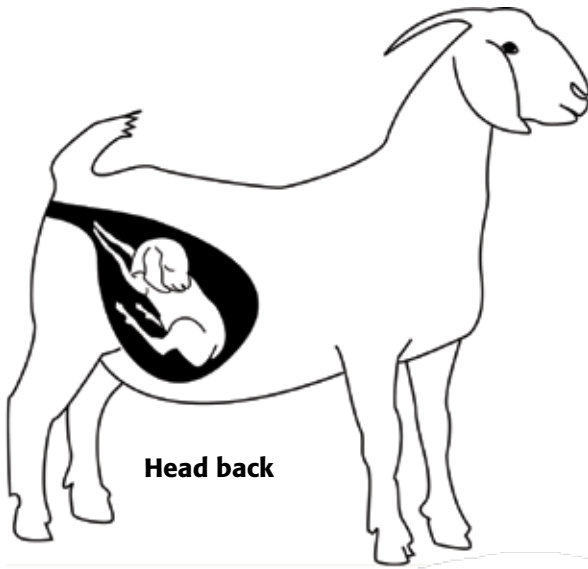


Figure 8-6. Abnormal presentations.

has been straining. It is recommended not to allow a doe to strain hard for more than 30 minutes. Many times the doe will stop straining and the uterus may contract around the kid.

How To Assist

Once it is determined that a doe needs assistance, the producer must choose to do it themselves or have it done by a veterinarian. As mentioned before, if the kid is abnormally positioned that position must be corrected. This requires inserting the producer's hand into the birth canal and uterus to reposition the kid. Now the birth canal of a goat is relatively small when compared to the average hand of producers. This size difference could cause another source of frustration because if a producer is unable to get their hand into the birth canal, they will not be able to reposition the kid.

In some cases, it may be that the kid is just too large for the canal for easy passage. In this case, all the assistance that is needed is pulling of the kid through the canal. Producers must be careful and not pull too hard or try and force a kid through the canal. This may cause damage to the doe.

When To Stop

After attempting to reposition or pull the goat through the birth canal for 30 minutes and a producer has not been successful, it is time to get professional help. Although commercial goats may not be valuable enough to justify a large veterinary bill, producers should consider the potential value of future breeding when making this decision.

Nutrition of Newborn Kids

Colostrum is the first milk produced after parturition (the actual birthing process). Colostrum contains a high content of immunoglobulins (antibodies), vitamin A, minerals, fat and other sources of energy. Antibodies are proteins that help the goat kid fight off diseases.

The ability of kids to resist disease is greatly affected by the timing of colostrum intake and the quantity and quality of the colostrum ingested. Reports from cattle indicate that if left alone, 25 percent of the young do not nurse within eight hours and 10 to 25 percent do not get sufficient amounts of colostrum. Colostrum should be ingested or bottle-fed (in case of weak kids) as soon as kids have a suckling reflex. In cases of extremely weak kids, they should be tube-fed.

The producer must be certain all newborn kids get colostrum soon after birth (within the first hour after birth and certainly within the first six hours) because the percentage of antibodies found in colostrum decreases rapidly after parturition.

The antibodies in colostrum need to be consumed before the kids suck on dirty, pathogen-loaded parts of its mother or stall. In addition, the ability of the newborn kid to absorb antibodies also decreases rapidly 24 hours after birth. Newborn kids should ingest 10 percent of their body weight in colostrum during the first 24 hours of life for optimum immunity.

The extra colostrum produced by high-lactating does during the first 24 hours following kidding can be frozen for later use when needed. Only first milking from healthy animals should be frozen for later feeding, and the colostrum from older animals that have been on the premises for several years is typically higher in antibody content against endemic pathogens than is colostrum from first fresheners.

Ice cube trays are ideal containers: once frozen, cubed colostrum can be stored in larger containers and the trays used for another batch. Ice cubes are the perfect size for newborn kids, thus thawed colostrum is always fresh, and waste reduced to a minimum. Thawing colostrum either at room temperature or at a fairly low temperature is recommended. Colostrum should never be overcooked during the thawing process.

Revaccination against tetanus and enterotoxemia (over-eating disease) two to four weeks before the kidding date is commonly used to improve the protective value of the colostrum against these conditions.

When to Kid and When to Wean

Kidding season and weaning age depend on several management and marketing factors. However, kids born in very late winter and early spring, when grazed with their mothers on lush, high-quality small grains or cool-season forages, will grow faster and will be healthier than kids born during the heat of late spring and early summer, when forages mature and worm burdens increase. Letting the kids nurse and graze with their mothers for as long as the doe stays in good enough body condition so as not to impair the success of its next breeding season is a sound management practice that will ensure rapid growth of the goat kids.

Weaning is a very stressful period for kids and coccidia infestations generally show up at weaning. Frequent observation of weaned kids is very important. Kids showing signs of coccidia infestation should be treated immediately; otherwise they will dehydrate and die. Coccidia can damage the lining of the intestines, and if not treated properly, surviving kids may not grow to reach their normal size and production potential.

Body Condition Scoring (BCS)

As the breeding season approaches, producers should be concerned with the body condition of their breeding does. Goats should not be allowed to become too thin or too fat. Failure in reproduction, low twinning rates and low weaning rates can result if does are too thin. Overly fat does can suffer pregnancy toxemia, but fat does are rarely a problem. The BCS chart is located in Chapter 10.

Flushing, or increasing the level of feed offered to breeding does, can be accomplished by moving breeding does to a lush nutritious pasture three to four weeks prior to the introduction of the bucks. This cost-effective flushing method is underutilized in the southeast where forage is abundant. Another method is feeding one-half pound per day of a high-energy supplement. Corn is the grain of choice for flushing; whole cottonseed is another low cost, high energy supplement. The goal of supplements is to increase the intake and body weight. Breeding does should be grouped according to their BCS and be fed accordingly, first to improve their body condition, then to maintain it.

Summary

Table 8-1 contains a summary of the reproductive characteristics of goats.

Table 8-1. Summary of reproductive characteristics in goats.

FEMALE	
Age of puberty	7 to 10 months
Breeding weight	60 to 75% of adult weight
Estrous cycle	
Length	18 to 22 days
Duration	12 to 36 hours
Signs	Tail wagging, mounting, bleating
Ovulation	12 to 36 hours from onset of standing heat
Gestation length	146 to 155 days
Breeding season	August to January
Seasonal anestrus	February to July
Buck effect on estrus	Positive
MALE	
Age of puberty	4 to 8 months
Breeding age	8 to 10 months
Breeding season	All year
Breeding ratio	1 buck: 20 to 30 does

References

- Alabama Meat Goat and Sheep Producers Small Ruminant Pocket Guide. (2006). Alabama Cooperative Extension Service.
- Damerow, G. (1993). *Your Goats, A Kid's Guide to Raising and Showing*. Storey Books.
- Meat Goat Production and Marketing Handbook. Clemson University. http://Boergoatshome.com/kidding_photos.php
- Luginbuhl, J-M, M.H. Poore, J.P. Mueller, and J.T. Green. (1998). Breeding and Kidding Management in the Goat Herd. http://www.cals.ncsu.edu/an_sci/extension/animal/meatgoat/MGBrdKidd.htm
- Thedford, T.R. Delivery Problems in Sheep and Goats and Methods of Correction. 1984 International Stockmens School Sheep and Goats Handbook, Volume 4.

Chapter 9

Goat Marketing

JJ Jones

Producing a goat kid is only the first step in a meat goat operation. The next step is to market or sell the kid. Goat production is not an industry where an operation is started and buyers come to it. Goat production is like most other agricultural enterprises because producers must be able to find and/or develop their own marketing channels. Goat kids can be sold in several different ways. Producers must determine which method is best for their operation and develop a plan for that marketing channel. This is the marketing plan discussed as a part of the business plan in Chapter 1.

Marketing Plan

As mentioned in Chapter 1, a marketing plan is a detailed program to promote and sell a product, in this case goats. To develop a marketing plan, producers must answer three questions:

1. What to sell?
2. Where to sell?
3. When to sell?

Once these questions are answered, producers can develop a marketing plan.

What to Sell?

At first, this seems to be a simple question. Most goat producers are going to sell goats, but what type, size and sex of goat will they sell? Are producers going to sell their does and bucks as market animals? Are they going to sell their does as replacement does? What weight will the kids be at selling time? Do the producers want to try and sell show goats? Are the goats to be sold as registered full blood or percentage goats? Is the producer going to sell wethers or bucks?

Producers also need to consider the type of goat wanted in their area or by the local market. Sometimes local demand for certain types of goats could make selling the wrong type of goats difficult and unprofitable. Producers need to do research when determining what product is wanted in their area.

By determining the type of goat a producer wants to sell, it will help determine that producer's marketing plan. It is permissible to market a combination of different types of goats, but each type of goat to be produced needs its own marketing plan.

Where To Sell?

The answer to this question will depend on the type of goat being sold. If producers plan to sell weaned kids for market animals, then a weaned kid market location needs to be found. Some weekly livestock auction barns sell goats during the regular weekly auction and some have special weekly or bi-monthly auctions for goats (Figure 9-1).

Locations of local auction barns that sell market goats need to be determined before any goats are ready to sell. If the local auction barn does not have a regular goat sale, where is the closest auction barn that does? If the local auction barn has a goat sale, is it a good sale? What type of goats does that auction typically sell? What is the price range and average price for goats going through the auction? What are the costs for selling at that sale (ie., commission, in-



Figure 9-1. Goats at an auction.

insurance and yardage). How does it compare to other nearby sales? Does the producer have the type of goats that normally sell at that site?

Answering these questions will require visiting the local sale barns and questioning other goat producers. Producers need to visit with the sale barn owner/operator to see what types of goats are typically sold in their sales. They should count the number of buyers at the sale and watch what each one is typically buying. Usually buyers will stick to one or two types of goats. The more successful sales will have several buyers and large numbers of goats available to sell. Beginning producers also may want to visit with other local goat producers. They should ask them what type of goats they sell and where they sell them. Each producer may have a different opinion about where to sell and why. Listening to these varying opinions may help a new producer to decide where to sell.

After visiting the sale barn and taking note of the types of goats sold and the prices received, producers can compare those prices to other sale barns in the area or state. They should visit other sale barns or look for the state's official United States Department of Agriculture (USDA) reported prices. These reported prices can be located at www.ams.usda.gov. Once on the Website, follow these instructions:

1. Locate the Goat tab at the top of the page.
2. Move the mouse over the tab and a drop down menu will appear.
3. Click on auctions on the drop-down menu.
4. The next screen will display a map with the states reporting goat prices. Click on the state of interest.

If more than one auction is reported, the producer must choose the auction of interest. Click on the sale location. It should then display the most current market report for that auction. Producers can then use the market report listed and compare the prices with those they received at their local auction.

When determining where to sell goats, producers must consider other factors besides price:

- distance to the auction
- regularity of the auction
- commission charged by the sale barn
- consistency of the auction

Producers sometimes can afford to take a lower price at one auction if the travel distance to another



Figure 9-2. A truck full of goats heading to an auction.

sale is too far or the other auction barn commissions are higher.

Selling at the local auction has its advantages and disadvantages. One advantage is the ease of process. Generally, all producers have to do is get their product to the barn by sale day. If the auction has multiple sale dates and the first one is inconvenient, then the next one will come up soon. Also, producers do not have to be concerned about payment for their product.

A disadvantage may be the recognition of a superior product. Most sale barns do not single out producers who do a better than average job. These animals, although deserving of a higher price, may not receive it. Also, producers are at the mercy of the market conditions for that day. If, for some reason the market is off that day, producers may be forced to take the price offered or buy the animals back and pay commission.

Another option for marketing goats is a production sale. A production sale is usually a sale operated by a formal group such as a county association, a group of producers or an individual breeder. Typically these types of sales are for registered breeding animals or commercial breed stock such as does and bucks or show animals. Some sales allow grade (non-registered) breeding animals. These sales generally have a higher selling cost than normal auctions. Before choosing this option, producers should carefully examine the type of goats being sold and determine the possible net price they may receive.

Typically, the best place to sell goats is directly off of the farm. This method eliminates the stress and cost of hauling goats to market and the cost of commissions. Producers wanting to sell goats directly

off of the farm will need to know the approximate weight and value of the goats before selling them.

One advantage to selling off of the farm is being able to promote the final product. Producers can attempt to ensure the buyer knows the type of product, which allows the producer to receive the price they feel they deserve.

A disadvantage to selling off of the farm is the possibility of not receiving funds. Producers must take the risk of receiving fraudulent checks for their product. Producers also must do some form of advertising to inform prospective buyers about the types of available animals.

When To Sell?

The best time to sell goats depends on the type of goat being sold and to whom the goat is being sold. As with other livestock enterprises, goat prices typically are seasonal. Kids, replacement does and bucks are in higher demand at certain times of the year. For example, two to three weeks before a holiday, when goat meat is typically served, goat kids for slaughter have a higher demand. This higher demand typically causes prices for the preferred size of goat to increase.

Figure 9-3 shows the seasonal price index for three different weight groups of kids at the Perkins Livestock Auction in Perkins, Okla. A sea-

sonal price index can show when prices are typically the highest and lowest during throughout the year. Take into account that goat prices have only been recorded since around 2004. Therefore, the amount of price information is not as abundant as other livestock enterprises, but this information shows the highs and lows of the markets.

For the Perkins market, the high prices for the 20 to 40 pounds kids occur in March, but for the heavier 40 to 60 pounds and the 60 to 80 pounds kids the peak prices occur in April. After this time period prices decline into the summer time until they reach their low point in August and September.

A number of factors could change these seasonal patterns, but generally these are beyond a producer's control. Producers need to have some flexibility in their marketing plans to be able to react to sudden price changes.

Like other livestock enterprises, goat meat demand is greater than normal at certain times of the year. Generally these times are associated with certain holidays where goat meat is preferred. Table 9-1 shows the list of holidays, affiliated ethnic or religious groups, dates and types of goats desired.

Some of the holiday's dates are based on the lunar calendar and therefore change from year to year. This change can be as much as three weeks in either direction. If part of the producers' marketing plan is to meet the demands of certain holidays, they must stay informed of the specific dates each year.

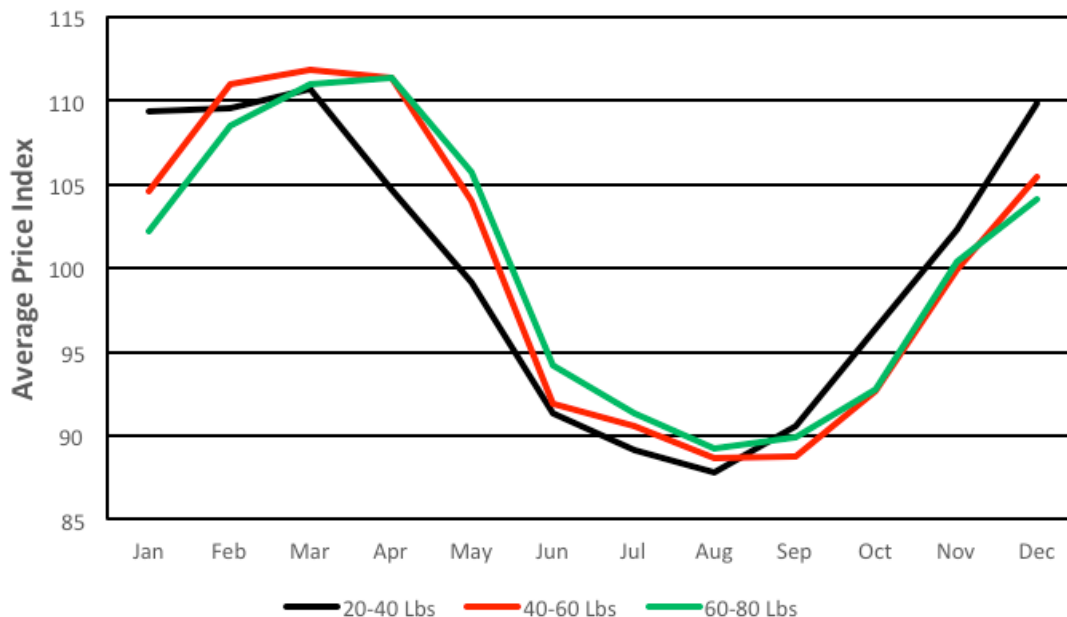


Figure 9-3. Season price pattern for three different weight groups of kids at the Perkins Livestock Auction in Perkins, Okla.

Table 9-1. Future dates of holidays where goat is typically served.

<i>Holiday</i>	<i>Date</i>	<i>Size of Kid</i>
Chinese New Year	January - February	60 to 80 pounds
Easter (Western)	Late March - April	20 to 50 pounds
Easter (Eastern and Greek)	April to Early May	20 to 50 pounds
Independence Day	July 4	20 to 35 pounds (older kids accepted)
Caribbean holidays	August	60 pound bucks
Start of Ramadan (Muslim)	Lunar Calendar	45 to 120 pounds
Eid al Fitr (Muslim)	Moves Every Year Lunar Calendar	less than 12 months 45 to 120 pounds
Eid al Adha (Muslim)	Moves Every Year Lunar Calendar	60 pounds optimum Yearlings, blemish free
Dassai (Hindu)	October	Male goats only, size depends upon number being fed
Cinco de Mayo (Mexican)	May 5	20 to 35 pound kids

For more information about exact holiday dates visit <http://www.sheepandgoat.com/articles/ethniccalendar.html>

Once the three questions of what, where and when are answered, producers can develop a marketing plan.

Conclusion

Production of goat kids is just one part of a goat enterprise. Marketing the end product is just as important as the production. Producers should develop a marketing plan for their goat enterprise. The marketing plan should take into effect the producer's planned production schedule along with the season-

al pattern of goat prices. The producers also should allow some flexibility in the marketing plan to take advantage of sudden unforeseen changes in prices.

References

- Coffey, Linda. (2002). Sustainable Goat Production: Meat Goats Livestock Production Guide. <http://attra.ncat.org>
- Sheep and Goat Marketing Information. Ethnic Holiday Calendar. <http://sheepgoatmarketing.info>
- USDA. National Agricultural Statistics Service, Oklahoma Market Report LS-550. http://www.ams.usda.gov/mnreports/ko_ls550.txt

Chapter 10

General Herd Management

Justin McDaniel, Marty Montague and JJ Jones

This chapter includes a discussion of the following general management practices of a meat goat operation.

- animal identification
- breeding seasons
- castration
- disbudding
- hoof trimming
- herd management calendar
- body condition score

Some of these practices are mentioned in other chapters, but this chapter will present them in greater detail.

Animal Identification

Each goat in an operation should have some method of being identified. Animal identification allows a producer to keep and maintain production records such as kidding percentages, weaning percentages, health schedules and problems and management practices. Several identification systems are available. The system used depends on the size of the herd, environmental conditions, and the primary purpose for identifying the individual animals.

Ear Tags

The most common method to identify an animal is to use an ear tag. Ear tags come in a multitude of colors, shapes and sizes. Ear tags can come either pre-numbered or blank. The type of ear tag used depends on the individual producer's preference and the primary reason for using the ear tag.

The ear tag comes in two parts (Figure 10-1):

- A flat part (where the number goes) with a female end.
- A round button part with a steel sharpened shank.

This shank is used to pierce the ear and then lock into the female portion of the flat part of the



Figure 10-1. Ear tags and tagging pliers.

tag. These tags are semi-permanent. They are meant to stay in until the producer wishes to cut them out. Sometimes these tags will get accidentally ripped or cut out. Some producers use two ear tags for this reason. For a demonstration of how to place an ear tag into the ear of the animal visit OSU's Meat Goat YouTube Channel (youtube.com/user/OSUMeatGoat) for an instructional video.

Scrapie Tagging

The USDA Scrapies program was developed to help eradicate scrapies from U.S. sheep and goat herds. Scrapie is a degenerative and eventually fatal disease that affects the central nervous systems of sheep and goats. Because of this program, goat producers must identify their goats with a scrapie ear tag to sell their goats (Figure 10-2). These tags also can be used for a producer's animal identification program.

Who may identify sheep and goats?

- producers



Figure 10-2. Official Oklahoma Scrapie ear tag.

- licensed livestock dealers
- approved livestock markets

What animals must be identified?

All sexually intact sheep and goats of any age being moved for any of the following reasons:

- sale
- exhibitions
- slaughter
- change of ownership

Unidentified animals arriving at livestock auctions and special sales must be identified before the animal can sell. Typically, a livestock auction will place a scrapie tag in the goat's ear and charge the producer for the service.

Each of the following items qualifies as official scrapie identification:

An Official USDA Tag

- How are official USDA ear tags obtained?
- Tag request forms can be obtained from the Oklahoma Department of Agriculture, Food, and Forestry (ODAFF) at 405-522-6131.
- The tag request form must be completed and signed. Incomplete forms will not be processed.
- The form is returned to ODAFF, Animal Industry Services. The address is on the form.
- Tagging pliers are provided with the first order; any additional pliers can be purchased from ODAFF.
- Producers also can order scrapie tags from ear tag manufacturers such as Premier and AllFlex. This would allow producers to use only one tag for both identification and scrapie.



Figure 10-3. Tattooing pliers and ink.

Legible Official Dairy Goat Registry Tattoo

- Tattooing is another method of individually identifying animals. Tattooing involves using a set of tattooing pliers and ink, shown in Figure 10-3, to permanently place an alphanumeric number in the goat's ear. The tattoo ink is forced into ear by the sharp needle-like pens of the tattoo pliers. If done correctly, this process is permanent, but the goat must be caught for the number to be seen. Some breed associations require tattooing as part of the registration process (only if the animal is accompanied by a registration certificate).

Legible Flank or Tail-web Tattoo

- For animals not suitable for ear tagging, a legible flank or tail-web tattoo containing the premise ID and the individual animal number. **NOTE:** Illegible tattoos are considered the same as no identification.

Scrapie Flock Certification Program Tag

- The Scrapie Flock Certification Program is a voluntary five-year certification program for those producers who want to certify their flocks/herds are free of scrapie. The owner pays for the tags used for this program. They

may request a scrapie tag on the tag request form or call the Oklahoma USDA office 405-427-9413 for information about this program.

- Do animals have to be tested for scrapie? No official live animal test for scrapie exists at this time. Many owners have blood samples collected for genetic testing in their sheep to help them with selective breeding for resistance against scrapie. This genetic testing is paid for by the owner and is highly recommended for breeding flocks.

Breeding Seasons

A breeding season is the time of the year that the male goat (buck) is placed with the female goats (does) to impregnate them. The time of year selected for breeding depends on when the producers want to sell their goats. For example, if producers want to sell goats for the Easter market, they must breed their does to have kids in November. The gestation period of a goat is 150 days, or five months. For November kids, the does must be bred in June. Therefore, the buck needs to be placed with the does around June 1.

The length of the breeding season also depends on the producers' production goals. By having pre-defined breeding seasons, producers can target marketing opportunities, select nutrition programs that fit the plane of nutrition needed, and make it easier to maintain routine management practices. Some producers allow the buck to run with the does year round. This type of breeding season limits producers' marketing and planning options because the kids are being born yearround. Also, a 12-month breeding season makes it more difficult to determine kidding percentages and other vital performance records. By using a limited breeding season, producers can plan kidding, weaning and marketing times, plus easily identify problem production animals not breeding on a regular basis.

Table 10-1 is a gestation table that has the corresponding dates between the date bred and the expected kidding date.

Weaning

Weaning is the act of removing the kids from the does. Most kids are weaned at 60 to 90 days of age. In some cases, the doe will wean her kid(s) be-

fore this time if she is under unusual stress. Before weaning though, producers need to prepare the does for slowing down their milk production:

- Several days before weaning, stop grain feeding the does.
- Beginning on the day the kids are weaned, withhold water from the does for 24 hours to help stop milk production
- Watch the does carefully for several days for signs of redness on their udders or for does obviously suffering pain from full udders. In some cases, the pressure on the udder can be relieved by milking out a small amount of milk. However, the doe should not be milked dry, since that will cause her to continue producing milk.
- Feed does a low-quality, dry hay until they have completely dried off.

Kids may continue to eat from a creep feeder for a few days after weaning. After that point, they can be hand fed twice a day. Kids should receive a high-quality hay to go with their grain.

Shortly after weaning, producers may want to sort buck kids from doe kids and feed them accordingly. This procedure will prevent any early maturing doe kids from getting bred and help prevent smaller does from being pushed away from the feeder by larger bucks.

Castration

The decision to castrate, which is the removal of a male goat's (buck) testicles, depends on the producer's operation and marketing opportunities. Only top-quality bucks should be kept for breeding purposes. If a producer is not keeping a buck for reproduction purposes, the decision to keep the buck kids intact should be based on the producer's available markets. In some markets, buck kids are preferred over castrated males (wether kids), but in general, wethers are preferred.

Advantages

The advantage of castrating buck kids is that goats can reach sexual maturity at three months of age. By castrating, the producer eliminates the possibility of unwanted pregnancies. Also, wether goats are easier to handle. Young bucks can be very troublesome and difficult to handle.

Table 10-1. Gestation table.

Breeding Date	Due Date	Breeding Date	Due Date	Breeding Date	Due Date	Breeding Date	Due Date	Breeding Date	Due Date	Breeding Date	Due Date
Jan 1	May 31	Mar 3	Jul 31	May 3	Sep 30	Jul 3	Nov 30	Sep 2	Jan 30	Nov 2	Apr 1
Jan 2	Jun 1	Mar 4	Aug 1	May 4	Oct 1	Jul 4	Dec 1	Sep 3	Jan 31	Nov 3	Apr 2
Jan 3	Jun 2	Mar 5	Aug 2	May 5	Oct 2	Jul 5	Dec 2	Sep 4	Feb 1	Nov 4	Apr 3
Jan 4	Jun 3	Mar 6	Aug 3	May 6	Oct 3	Jul 6	Dec 3	Sep 5	Feb 2	Nov 5	Apr 4
Jan 5	Jun 4	Mar 7	Aug 4	May 7	Oct 4	Jul 7	Dec 4	Sep 6	Feb 3	Nov 6	Apr 5
Jan 6	Jun 5	Mar 8	Aug 5	May 8	Oct 5	Jul 8	Dec 5	Sep 7	Feb 4	Nov 7	Apr 6
Jan 7	Jun 6	Mar 9	Aug 6	May 9	Oct 6	Jul 9	Dec 6	Sep 8	Feb 5	Nov 8	Apr 7
Jan 8	Jun 7	Mar 10	Aug 7	May 10	Oct 7	Jul 10	Dec 7	Sep 9	Feb 6	Nov 9	Apr 8
Jan 9	Jun 8	Mar 11	Aug 8	May 11	Oct 8	Jul 11	Dec 8	Sep 10	Feb 7	Nov 10	Apr 9
Jan 10	Jun 9	Mar 12	Aug 9	May 12	Oct 9	Jul 12	Dec 9	Sep 11	Feb 8	Nov 11	Apr 10
Jan 11	Jun 10	Mar 13	Aug 10	May 13	Oct 10	Jul 13	Dec 10	Sep 12	Feb 9	Nov 12	Apr 11
Jan 12	Jun 11	Mar 14	Aug 11	May 14	Oct 11	Jul 14	Dec 11	Sep 13	Feb 10	Nov 13	Apr 12
Jan 13	Jun 12	Mar 15	Aug 12	May 15	Oct 12	Jul 15	Dec 12	Sep 14	Feb 11	Nov 14	Apr 13
Jan 14	Jun 13	Mar 16	Aug 13	May 16	Oct 13	Jul 16	Dec 13	Sep 15	Feb 12	Nov 15	Apr 14
Jan 15	Jun 14	Mar 17	Aug 14	May 17	Oct 14	Jul 17	Dec 14	Sep 16	Feb 13	Nov 16	Apr 15
Jan 16	Jun 15	Mar 18	Aug 15	May 18	Oct 15	Jul 18	Dec 15	Sep 17	Feb 14	Nov 17	Apr 16
Jan 17	Jun 16	Mar 19	Aug 16	May 19	Oct 16	Jul 19	Dec 16	Sep 18	Feb 15	Nov 18	Apr 17
Jan 18	Jun 17	Mar 20	Aug 17	May 20	Oct 17	Jul 20	Dec 17	Sep 19	Feb 16	Nov 19	Apr 18
Jan 19	Jun 18	Mar 21	Aug 18	May 21	Oct 18	Jul 21	Dec 18	Sep 20	Feb 17	Nov 20	Apr 19
Jan 20	Jun 19	Mar 22	Aug 19	May 22	Oct 19	Jul 22	Dec 19	Sep 21	Feb 18	Nov 21	Apr 20
Jan 21	Jun 20	Mar 23	Aug 20	May 23	Oct 20	Jul 23	Dec 20	Sep 22	Feb 19	Nov 22	Apr 21
Jan 22	Jun 21	Mar 24	Aug 21	May 24	Oct 21	Jul 24	Dec 21	Sep 23	Feb 20	Nov 23	Apr 22
Jan 23	Jun 22	Mar 25	Aug 22	May 25	Oct 22	Jul 25	Dec 22	Sep 24	Feb 21	Nov 24	Apr 23
Jan 24	Jun 23	Mar 26	Aug 23	May 26	Oct 23	Jul 26	Dec 23	Sep 25	Feb 22	Nov 25	Apr 24
Jan 25	Jun 24	Mar 27	Aug 24	May 27	Oct 24	Jul 27	Dec 24	Sep 26	Feb 23	Nov 26	Apr 25
Jan 26	Jun 25	Mar 28	Aug 25	May 28	Oct 25	Jul 28	Dec 25	Sep 27	Feb 24	Nov 27	Apr 26
Jan 27	Jun 26	Mar 29	Aug 26	May 29	Oct 26	Jul 29	Dec 26	Sep 28	Feb 25	Nov 28	Apr 27
Jan 28	Jun 27	Mar 30	Aug 27	May 30	Oct 27	Jul 30	Dec 27	Sep 29	Feb 26	Nov 29	Apr 28
Jan 29	Jun 28	Mar 31	Aug 28	May 31	Oct 28	Jul 31	Dec 28	Sep 30	Feb 27	Nov 30	Apr 29
Jan 30	Jun 29	Apr 1	Aug 29	Jun 1	Oct 29	Aug 1	Dec 29	Oct 1	Feb 28	Dec 1	Apr 30
Jan 31	Jun 30	Apr 2	Aug 30	Jun 2	Oct 30	Aug 2	Dec 30	Oct 2	Mar 1	Dec 2	May 1
Feb 1	Jul 1	Apr 3	Aug 31	Jun 3	Oct 31	Aug 3	Dec 31	Oct 3	Mar 2	Dec 3	May 2
Feb 2	Jul 2	Apr 4	Sep 1	Jun 4	Nov 1	Aug 4	Jan 1	Oct 4	Mar 3	Dec 4	May 3
Feb 3	Jul 3	Apr 5	Sep 2	Jun 5	Nov 2	Aug 5	Jan 2	Oct 5	Mar 4	Dec 5	May 4
Feb 4	Jul 4	Apr 6	Sep 3	Jun 6	Nov 3	Aug 6	Jan 3	Oct 6	Mar 5	Dec 6	May 5
Feb 5	Jul 5	Apr 7	Sep 4	Jun 7	Nov 4	Aug 7	Jan 4	Oct 7	Mar 6	Dec 7	May 6
Feb 6	Jul 6	Apr 8	Sep 5	Jun 8	Nov 5	Aug 8	Jan 5	Oct 8	Mar 7	Dec 8	May 7
Feb 7	Jul 7	Apr 9	Sep 6	Jun 9	Nov 6	Aug 9	Jan 6	Oct 9	Mar 8	Dec 9	May 8
Feb 8	Jul 8	Apr 10	Sep 7	Jun 10	Nov 7	Aug 10	Jan 7	Oct 10	Mar 9	Dec 10	May 9
Feb 9	Jul 9	Apr 11	Sep 8	Jun 11	Nov 8	Aug 11	Jan 8	Oct 11	Mar 10	Dec 11	May 10
Feb 10	Jul 10	Apr 12	Sep 9	Jun 12	Nov 9	Aug 12	Jan 9	Oct 12	Mar 11	Dec 12	May 11
Feb 11	Jul 11	Apr 13	Sep 10	Jun 13	Nov 10	Aug 13	Jan 10	Oct 13	Mar 12	Dec 13	May 12
Feb 12	Jul 12	Apr 14	Sep 11	Jun 14	Nov 11	Aug 14	Jan 11	Oct 14	Mar 13	Dec 14	May 13
Feb 13	Jul 13	Apr 15	Sep 12	Jun 15	Nov 12	Aug 15	Jan 12	Oct 15	Mar 14	Dec 15	May 14
Feb 14	Jul 14	Apr 16	Sep 13	Jun 16	Nov 13	Aug 16	Jan 13	Oct 16	Mar 15	Dec 16	May 15
Feb 15	Jul 15	Apr 17	Sep 14	Jun 17	Nov 14	Aug 17	Jan 14	Oct 17	Mar 16	Dec 17	May 16
Feb 16	Jul 16	Apr 18	Sep 15	Jun 18	Nov 15	Aug 18	Jan 15	Oct 18	Mar 17	Dec 18	May 17
Feb 17	Jul 17	Apr 19	Sep 16	Jun 19	Nov 16	Aug 19	Jan 16	Oct 19	Mar 18	Dec 19	May 18
Feb 18	Jul 18	Apr 20	Sep 17	Jun 20	Nov 17	Aug 20	Jan 17	Oct 20	Mar 19	Dec 20	May 19
Feb 19	Jul 19	Apr 21	Sep 18	Jun 21	Nov 18	Aug 21	Jan 18	Oct 21	Mar 20	Dec 21	May 20
Feb 20	Jul 20	Apr 22	Sep 19	Jun 22	Nov 19	Aug 22	Jan 19	Oct 22	Mar 21	Dec 22	May 21
Feb 21	Jul 21	Apr 23	Sep 20	Jun 23	Nov 20	Aug 23	Jan 20	Oct 23	Mar 22	Dec 23	May 22
Feb 22	Jul 22	Apr 24	Sep 21	Jun 24	Nov 21	Aug 24	Jan 21	Oct 24	Mar 23	Dec 24	May 23
Feb 23	Jul 23	Apr 25	Sep 22	Jun 25	Nov 22	Aug 25	Jan 22	Oct 25	Mar 24	Dec 25	May 24
Feb 24	Jul 24	Apr 26	Sep 23	Jun 26	Nov 23	Aug 26	Jan 23	Oct 26	Mar 25	Dec 26	May 25
Feb 25	Jul 25	Apr 27	Sep 24	Jun 27	Nov 24	Aug 27	Jan 24	Oct 27	Mar 26	Dec 27	May 26
Feb 26	Jul 26	Apr 28	Sep 25	Jun 28	Nov 25	Aug 28	Jan 25	Oct 28	Mar 27	Dec 28	May 27
Feb 27	Jul 27	Apr 29	Sep 26	Jun 29	Nov 26	Aug 29	Jan 26	Oct 29	Mar 28	Dec 29	May 28
Feb 28	Jul 28	Apr 30	Sep 27	Jun 30	Nov 27	Aug 30	Jan 27	Oct 30	Mar 29	Dec 30	May 29
Mar 1	Jul 29	May 1	Sep 28	Jul 1	Nov 28	Aug 31	Jan 28	Oct 31	Mar 30	Dec 31	May 30
Mar 2	Jul 30	May 2	Sep 29	Jul 2	Nov 29	Sep 1	Jan 29	Nov 1	Mar 31		

Disadvantages

The disadvantage to castrating is that buck kids will grow faster than wether kids. Also, once the buck is castrated, the process can not be reversed.

Timing and Methods

Castration should take place at the youngest age possible, since the stress of castration can adversely affect growth in older animals and the chances of complications increase. Buck kids can be castrated as soon as the testicles descend into the scrotum (Figure 10-4). Three methods of castrating bucks are available: knife castration, the elastrator method (banding) or the emasculatome method.

Knife Method

The knife method is the surest method of castration. Items needed for knife castration include: a sharp knife or scalpel, soap and water, disinfectant, antiseptic and tetanus antitoxin.

The knife method involves the following steps:

1. Have an assistant hold the kid, roll it over onto its back and hold the back legs.
2. Make sure the scalpel or knife is clean by washing it in soap and water and then disinfectant.
3. Wash the scrotum with soapy water and disinfectant.
4. Push the testes up into the scrotum and cut the bottom one-third of the scrotum off. The testes should now fall below the bottom of the scrotum.
5. Grab one of the testes and pull downward. The testes will be slick and somewhat difficult to

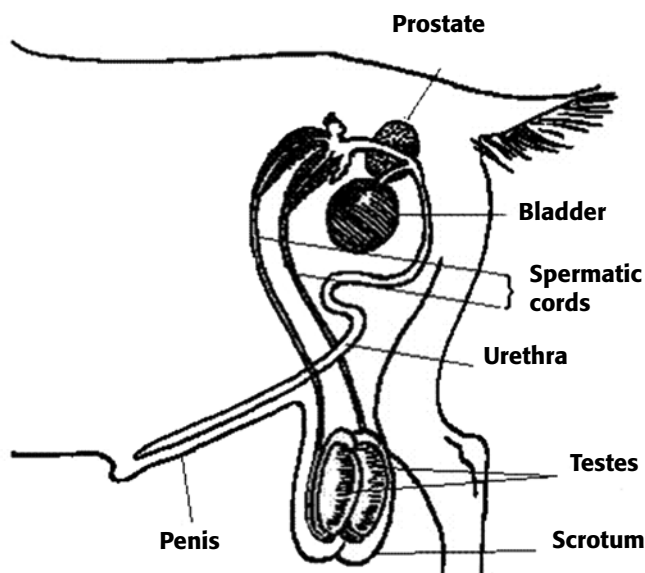


Figure 10-4. Goat buck reproductive organs.

hold onto, so grab firmly. Pull downward until the spermatic cord breaks. If the kid is older than 6 weeks, this cord may have to be cut.

6. If any of the spermatic cord is hanging below the scrotum, it must be removed. This could be a source of infection if left alone.
7. Apply the antiseptic to the scrotum.
8. Administer the tetanus antitoxin.

Elastrator Method (Banding)

Another method of castrating buck kids is the elastrator method or banding. This involves putting a special rubber band around the base of the scrotum. This band will cut off the blood supply to the scrotum and testes causing them to slough off in 10 to 14 days. This method is more effective and less stressful to younger kids whose scrotal tissue is not well developed. The equipment needed is an elastrator (instrument used to apply the bands) and castrating bands. **NOTE:** Do not use household rubber bands.

The elastrator method involves these steps:

1. Have the assistant put the buck kid's head between their legs and then bend over and grab the back legs and lift up. This puts the testicles of the goat at a reasonable height and allows the goat to be restrained fairly easily.
2. Place the castrating band onto the prongs of the elastrator, shown in Figure 10-5. Turn the elastrator so that the prongs face the body of the goat. Squeeze the handle of the elastrator, expanding the castrating band, and place the band over the scrotum. The band will need to be placed at the base of the scrotum. Make sure the rudimentary teats are not caught in the band.
3. Work the scrotum so that both testes are below the castrating band. Do not place the band around only one testicle. The other testicle will remain in the body and the buck kid will be able to impregnate does. Once both testes are below the band, release the handle of the elastrator



Figure 10-5. Elastrator.

causing the band to constrict. Then pull the elastrator away from the goat. The band should stay in place. **IMPORTANT:** Make sure that both testes are below the band. If they are not, cut the band off and try again.

4. Administer the tetanus antitoxin.

For a video demonstration of how to castrate a buck kid using an elastrator (banding method), visit OSU's Meat Goat YouTube channel.

Emasculatome Method

The emasculatome method involves using a Burdizzo instrument to crush the spermatic cord and cut off the blood supply to the testes. This procedure causes the testes to atrophy (die), but the scrotum remains intact. The emasculatome method is known as the bloodless method since no cutting is required, and when done properly, the skin is not even broken. However, care must be taken to be sure that both cords are properly crushed.

The emasculatome method involves the following steps:

1. Have the assistant roll the buck kid onto its back and hold the back legs.
2. Wash the upper portion of the scrotum and disinfect it.
3. Grab the scrotum and work the testes down into the scrotum and the spermatic cord between your fingers. Place the jaws of the burdizzo on the upper scrotum, just below where it attaches to the body. Position the jaws so about two-thirds of the scrotum is crushed. Leave the burdizzo closed for 15 to 20 seconds. Open the jaws and move the burdizzo 1/2-inch lower and crush the other side of the scrotum. **IMPORTANT:** Make sure that the spermatic cords are between the jaws of the Burdizzo both before and after the jaws are closed.

Disbudding

Disbudding is the practice of removing the goat's horns. By removing the horns, the goats are less likely to get their heads caught in fences. It also makes it safer for children and older producers to work around the goats. If the goat kids are going to be show animals, some shows require the horns on wether goats be removed.

Disadvantages

The disadvantages to removing the horns is now the goats have no handles to grab when trying to catch them and some purebred associations require horns be left intact. By removing the horns, a producer is removing the goats' defense against predators. To disbud or not is a decision the producer will have to make.

The equipment needed to disbud a goat includes the following items:

- A disbudding box (shown in Figure 10-6).
- A disbudding iron.
- Leather gloves.
- Some type of metal accessory holder to hold the disbudding iron when not working on a goat is recommended. A holder helps conserve heat and reduces the risk of burning someone, other items being used or the dehorning iron's cord.

Disbudding Box

A disbudding box can be made or purchased. The diagram in Figure 10-6 shows the dimensions of the box. The box should be made from 3/8-inch plywood and the lid from a 1 by 8 inch board. The headpiece can be purchased at a local farm sup-

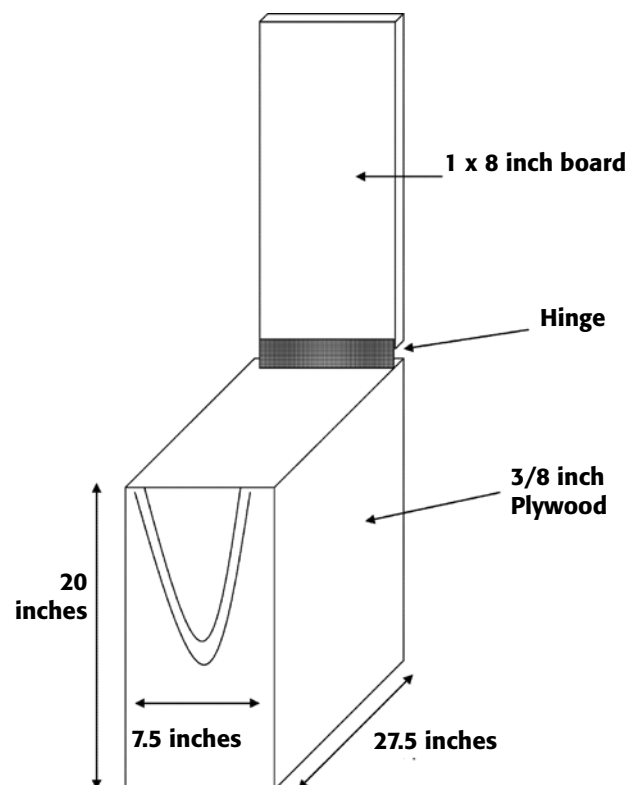


Figure 10-6. Disbudding box.

ply store or on the Internet. Not shown is the belly block that is inside the box. The belly block should be located 9 inches from the front of the box and 9 inches from the top of the box. This block keeps the goat kid from lying down in the box.

Disbudding Irons

A number of disbudding irons are available, and producers should always read the instructions. Some irons take longer to heat up and do not retain their heat as well as others. These irons work fine as long as the operator is patient.

Timing and Procedure

The best time to disbud goats is between two to four weeks of age or just as the horn is breaking through the skin. Once the horn becomes much bigger, it is more difficult to remove.

Disbudding includes the following steps:

1. Place the kid into the disbudding box.
2. Hold the goat's head across the rigid part of the nose.
3. Apply hot iron with medium pressure until a ring the color of copper encircles the horn – usually not more than 15 seconds. A risk of causing brain damage exists if the iron is left on the horn bud too long.
4. Repeat step 3 on the other horn.
5. Use the disbudding iron to remove the horns. Usually a scraping motion is most effective. If the horns are burned appropriately, the buds can be removed with very little effort.
6. Reapply the hot iron until the exposed bone is slightly yellow in color. Typically, four to six seconds is sufficient
7. Use the edge of the iron to cauterize any small bleeders.
8. Repeat steps 5 through 7 on the other horn bud.
9. Optional: Apply a topical antibiotic spray such as Furox®, Scarlet Oil®, or AluShield®, which will help repel flies and prevent infection.

For an instructional video demonstrating how to disbud a goat visit OSU's Meat Goat YouTube channel.

Hoof Trimming

Hoof trimming can be an important management task when raising goats. This task is often overlooked or not done in a consistent manner. Goats that do not have their hooves trimmed in a

timely manner can experience a myriad of foot and leg problems. Goats that cannot walk cannot forage for food.

The amount of time between trimmings depends on many factors such as type of terrain, the goat's age, level of activity, nutritional level, and breed. Goats raised in confinement situations and fed relatively high amounts of concentrates require more frequent trimmings. Goats raised in hilly, rocky terrain and large acreages require less trimmings. Therefore, a goat's hoof should be trimmed on an as-needed basis.

After becoming familiar with how a hoof is supposed to look, producers will know when a goat's hooves need to be trimmed (Figure 10-7). Some producers time the hoof trimming with other activities such as vaccinations, deworming or kidding.

The easiest time to trim a hoof is after a rain or heavy dew. The hoof wall is much softer, therefore easier to cut. The idea behind trimming hooves is to correct the overgrown hoof and allow the goat to walk without any discomfort. A goat hoof wall should be parallel with the coronary band (Figure 10-8).

Hoof Shears

A set of sharp hoof shears (Figure 10-9) is needed for hoof trimming. These shears can be purchased at most farm supply stores or catalogs. Several types of shears are available, but the shears must be made specifically for hoof trimming. Any



Figure 10-7. Overgrown hooves.

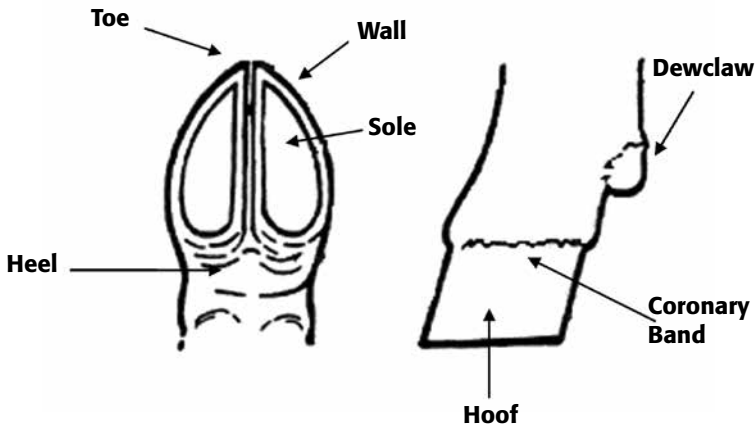


Figure 10-8. Parts of a goat hoof.



Figure 10-9. Hoof trimming shears.

other type of shears will not work. The best set is one that can be re-sharpened.

Optional equipment can include a rasp and hoof knife. Producers also may want to have some iodine, copper sulfate or turpentine available in case of hoof injury.

Procedure

1. Immobilize the goat.
 - Immobilization can be done in several different ways. One way is to have a goat squeeze chute. These chutes catch the goat's head and squeeze the goat so it cannot move easily. Most of these chutes also rotate, which allows the producer to have the goat hooves at a level that does not require bending. Having a squeeze chute allows the trimming to be performed by one person.
 - If a squeeze chute is not available, a milking or blocking stand can be used. Using a stand requires lifting the goat onto the stand.

- Another method is to tie the goat's head to a fence or panel and the producer can squeeze the goat between themselves and the fence or panel. The producer can then bend over and grab the foot for trimming.
2. After immobilizing the goat, the hooves need to have all of the dirt cleaned from the sole and between the toes. This makes it easier to see what needs to be trimmed and the shears will not be dulled as badly while trimming.
 3. Trim the hoof wall (Figure 10-10). The hoof wall may be folded over the sole of the hoof. Carefully pry it away from the sole and cut it off. Do not get in a hurry. By taking it slow and easy the producer runs less risk of cutting too deep and causing the hoof to bleed. Next, trim between the hooves where the heels meet. The heels are softer than the hoof walls. If some time has elapsed since the last trimming, the toes may need to be trimmed back. If producers have a question of how the hooves should look, they should compare the clipped hooves to those of a very young kid.

If the hoof is terribly overgrown, one trimming may not correct it. The hoof should be trimmed until the sole turns pink. Then, the producer should come back to that animal in one or two weeks and continue to trim in stages until a proper hoof shape can be obtained (Figure 10-11).

By keeping the goat's hooves properly trimmed, producers are able to minimize feet and leg problems and keep their goats looking and feeling healthier.

For an instructional video demonstrating how to trim hooves visit OSU's Meat Goat YouTube channel.

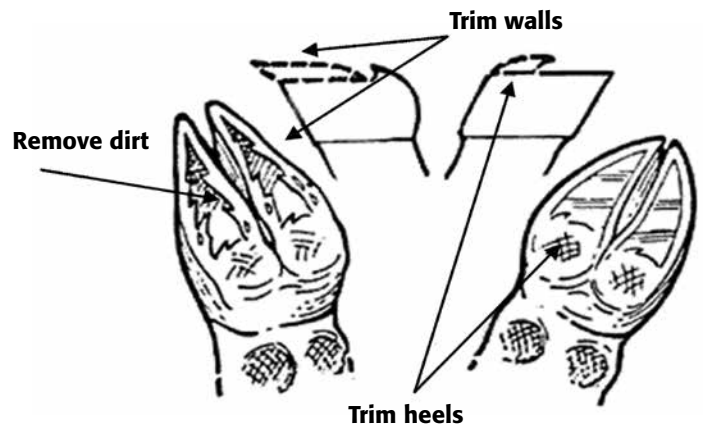


Figure 10-10. Remove all dirt from the sole and between the toes before trimming.

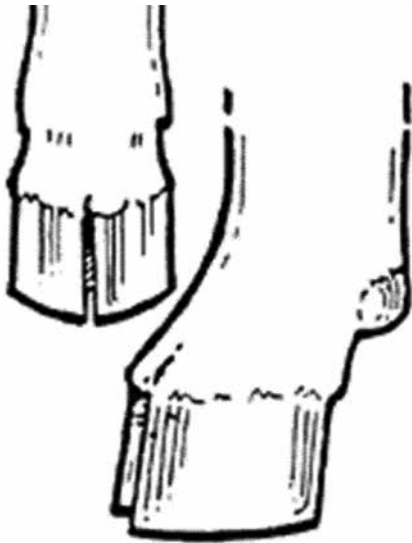


Figure 10-10. A Properly trimmed hoof.

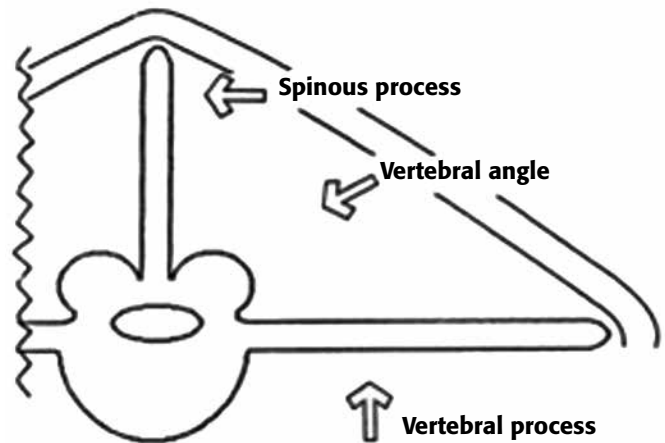


Figure 10-12. Parts of the loin. Spinous processes are the bones felt on top of the back. Vertebral processes are the long bones horizontal to the spinous process. The vertebral angle is the triangle between the top of the spinous process, the edge of the vertebral process, and the skin. The muscle inside this angle is the longissimus or eye muscle, a roast, or part of a T-bone steak.

Body Condition Scoring

As the breeding season approaches, producers should be concerned with the body condition of their breeding does. Goats should not be allowed to become too thin or too fat. Failure in reproduction, low twinning rates, and low weaning rates will result if does are too thin. Overly fat does can suffer pregnancy toxemia.

Body Condition Scoring System

Figure 10-12 shows the loin structure of a goat, which is the region of the back between the ribs and hips. The descriptions tell what is felt on the loin with firm fingertip pressure. Also discussed are bones, or *tuber ischii*, the part of the pelvis located at either side of the vulva in does and the same location in bucks. Other versions of condition scoring describe fat padding on the chest floor and how it correlates with features included in this system.

Table 10-2 shows condition scores for the loin area with descriptions of the features, causes, problems, and solutions. Each of the five categories in

Table 10-3 has a descriptive title and a score number. Padding over the ribs is never used to accurately judge body condition.

For an instructional video showing how to use the body condition scoring system visit OSU's Meat Goat YouTube channel.

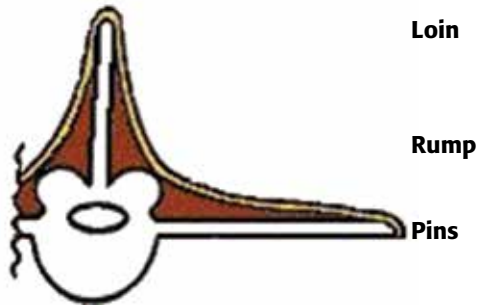
References

- Body Condition Scoring of Goats. Langston University. <http://www2.luresext.edu/goats/research/bc-showto.html>
- Machen, R. Disbudding Kid Goats. PowerPoint presentation from Texas Cooperative Extension Service.
- Machen, R. Hoof Trimming 101. PowerPoint presentation from Texas Cooperative Extension Service.
- McKinney, T. Castrating Buck Kids. Langston University. <http://www2.luresext.edu/goats/library/factsheets/go4.htm>
- Stanton, T. All About Castrating and Urinary Calculi. 1999. Cornell University. <http://www.ansci.cornell.edu/4H/meatgoats/meatgoatfs10.htm>
- USDA Scrapie Program. National Center for Animal Health Programs. <http://www.aphis.usda.gov/vs/naphis/scrapie>

Table 10-2. Body condition scores for the loin area.

**Scores 1 through 3 represent muscle growth/expansion.
Muscle does not grow after score 3
Scores 4 and 5 represent fat accumulation.**

1 POOR



- No muscle on edges of transverse process, bones very sharp, thin skin.
- The vertebral angle has little muscle and is very concave.
- Spinous processes are very prominent with no muscle in between.
- Sharp outline visible; no muscle between skin and bones.
- Very sharp. No padding.

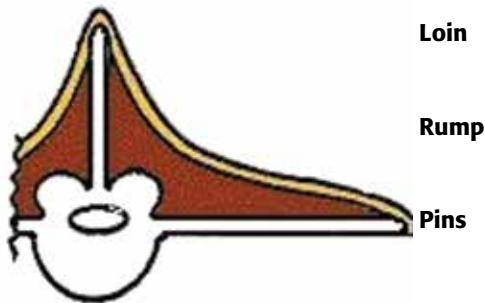
Features: The skeleton has little or no muscle. The hollows in the flanks below the loin are very concave.

Causes: Poor diet, disease, parasitism, lactation or any combination of these.

Problems: Slow growth rate in kids, stunting in growing animals, conception failure, weak or dead newborns, metabolic disease during pregnancy, very susceptible to disease.

Solutions: Better nutrition, management and herd health program; evaluate disease status.

2 THIN



- Muscle extends to the edges of transverse process; spacing can be felt between the vertebral processes, thin skin.
- Outline slightly contoured; light padding but bones still somewhat prominent and very easy to feel.
- Sharp, little padding.

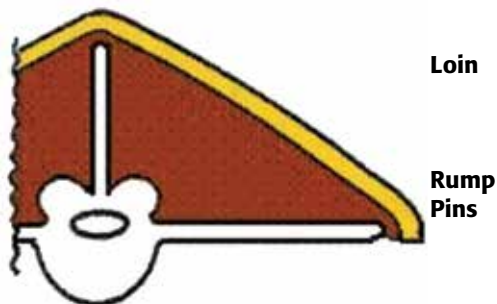
Features: The skeleton has some muscle. The hollows in the flanks below the loin are somewhat concave.

Causes: Poor diet, disease, parasitism, lactation or any combination of these.

Problems: Slow growth rate in kids and growing animals, metabolic disease, weak or dead newborns, susceptible to disease.

Solutions: Better nutrition, management and herd health program; evaluate disease status.

3 GOOD

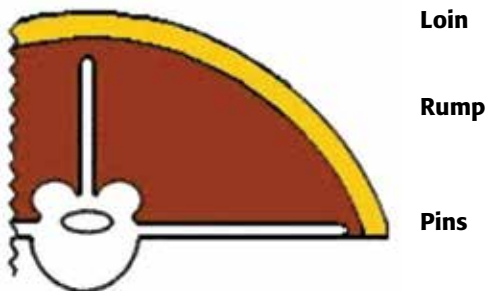


- Muscle and subcutaneous fat covers edges of vertebral processes; individual bones are somewhat distinct.
- Smooth, without signs of fat; pelvic bones and spine are distinct.
- Slight pressure needed to feel the pin bones.

Features: Muscle over skeleton felt with gentle pressure. Firm pressure is not needed to feel bones. The hollows in the flanks are barely concave or are level with the surrounding area of the sides.

Problems: None. Maintain condition at 3 or slightly higher, depending on age and production status.

4 FAT



- Vertebral processes are indistinct and firm pressure is needed to feel them.
- The vertebral angle is rounded but not yet bulging over the spinous process.
- Spinous process spacing is difficult to detect; the spine is felt as a hard line.
- Heavily padded with fat; bones can only be felt with firm pressure.

Features: Very firm pressure needed to feel all bony structures.

Causes: Feeding in excess. Limited exercise.

Problems: Inhibited locomotion, easily tired, orthopedic abnormalities, dystocia and metabolic disease.

Solutions: Reduce plane of nutrition. Provide exercise.

5 OBESE



- Edge of the vertebral process and the spacing between is too fat to feel bones.
- The vertebral angle bulges over the level of the spinous process.
- The spine lies in the center of a groove of fat.
- Buried in fat the bones are very indistinct and hard to locate.

Features: The bones are covered with a thick layer of fat over the muscle and are very hard to feel.

Causes: Feeding in excess. Limited exercise.

Problems: Inhibited locomotion, easily tired, orthopedic abnormalities, dystocia and metabolic disease.

Solutions: Reduce plane of nutrition. Provide exercise.

Chapter 11

Fencing

Brian Freking

Producers have numerous fencing options for the confinement and protection of livestock. Many traditional materials such as barbed and woven wire fences are suitable for fencing. However, newer materials including high-tensile wire also should be considered prior to selecting a fencing type. The fencing type should be selected for maximum effectiveness of individual fencing needs. Fencing materials should provide the longest life and lowest maintenance to optimize livestock confinement and protection. Routine inspection and maintenance is helpful in giving long and trouble-free service.

Fencing Considerations

Horned Goats

Special consideration must be given to fencing for horned goats. Fencing should prevent horned goats from placing their heads on the other side of the fence or should have openings large enough to let animals slide their head through the fence and back. Permanent electric fences also make good fences for horned goats.

Predator Control

Predator control is another important consideration for goat fencing. Five-strand high tensile electric fence is particularly useful for discouraging predators such as dogs and coyotes. However, fences must be kept free of vegetation to maintain electric current on the fence.

Coyotes can pass through openings as small as 4 ½ inches. Some manufacturers produce fencing with bottom openings of 6 by 3 inches for predator control and 3 by 3 inches for predator proofing.

Goat Fencing

Several options currently are available for goat operations that include barbed wire, cable, woven wire, net wire and electric fencing.

Factors for selecting a fencing type include affordability, maintenance, durability and effectiveness of containing livestock. Fencing types vary from physical barriers such as woven wire and

board fences to psychological barriers such as electrified poly wire or tape. High-tensile electric fences are a combination of both barrier types.

Barbed Wire

Barbed wire is the most common fence material, which can be made goat proof. Most barbed wire fences in Oklahoma are four or five strands and are very good at holding cattle, but very poor for holding goats. Barbed wire fences do not effectively confine goats, if higher grazing pressures are applied to the fenced-in area. Goat-proof barbed wire fences require at least five to six wires with the spacing on the bottom starting at 3 inches and increasing to 5 inches at the top.

Standard barbed wire fencing usually has three to five strands stretched between posts. The typical fence height is either 51 or 54 inches. Spacing between wires depends on the number of line wires and the fence height as shown in Figure 11-1. Line posts usually are spaced 12 to 20 feet apart.

Suspension barbed wire fencing consist of four to six strands of 12 ½-gauge barbed wire stretched tight, so no more than 3 inches of sag exists between posts. The wire strands are held apart by twisted wire stays, plastic battens or droppers spaced 16-feet apart. Line posts usually are spaced 80 to 120 feet apart. An important aspect of this fencing is that H-braces or corner posts must be very stable and must resist up-heaving and kick out.

NOTE: Never electrify barbed wire.

Woven Wire

Heavy or extra heavyweight woven wire fencing, shown in Figure 11-2, are excellent for goats. Fence height should be at least 39 inches high to prevent animals from climbing over the fence. However, fence height depends on the breed to be confined.

Woven wire fencing consists of smooth horizontal (line) wires held apart by vertical (stay) wires. Spacing between line wires may vary from 1 ½ inches at the bottom for small animals to 9 inches at the top for large animals. Wire spacing generally increases with fence height.

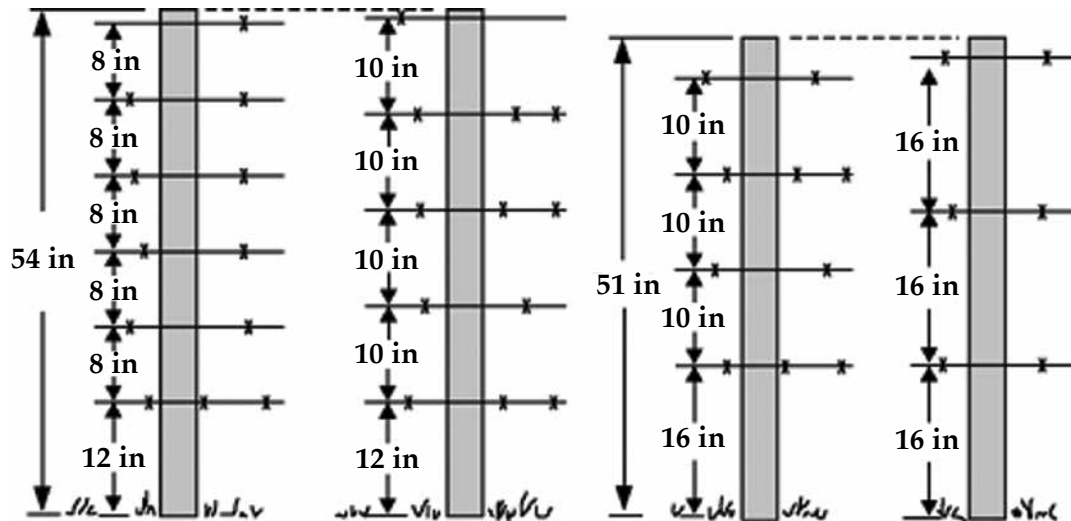


Figure 11-1. Barbed wire fencing.

Woven wire fences are available in numerous combinations of wire sizes and spacing, number of line wires and heights. Most fences range in height from 26 to 48 inches. Stay wires should be spaced 6 inches apart for small animals and 12 inches apart for large animals.

The standard design numbers listed on the manufacturer's tag (attached to fence rolls) describe the fence, illustrated in Figure 11-2. For example, a design number of 1047-12-11 indicates that the fence has 10 line wires and is 47 inches high, has 12 inches of spacing between stay wires, and has 11-gauge filler wires (wires between the top and bottom line wires).

Woven wire fencing is excellent for predator control. One strand of high tensile electric wire can be used at the bottom of a woven wire fence. If electric wire is not used, the fence bottom should be placed on the ground to allow for the use of snares where predators dig under the fence. At least one manufacturer makes woven wire fencing with stay wires attached to line wires with a fixed knot. This prevents predators from sliding apart the stay wires and entering the confined area.

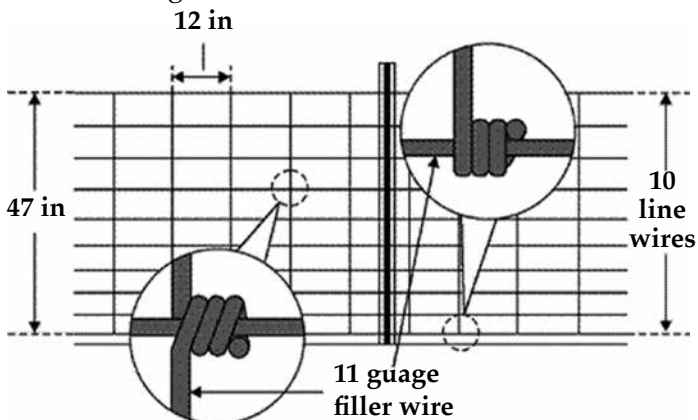


Figure 11-2. Woven wire fencing.

Cable Wire Fencing

Cable wire fencing is expensive and generally is used for confinement areas. This fencing consists of 3/8-inch steel wire cables stretched between anchor posts. Fence height varies from 60 inches for a four-cable fence to 72 inches for a six-cable fence.

A heavy-duty spring is fixed to one end of each cable and attached to an anchor post to absorb the shock on the wires caused by animal contact. The fence may consist of as many cables as desired, although a six-cable fence is recommended for large animals. This fence has become less popular in recent years; the 10-strand high-tensile electric fence has taken its place.

Mesh Wire Fencing

Mesh wire fencing is made in 11, 12 1/2, 14 and 16 gauges, and fences are available in diamond-mesh and square knot designs. Fence height generally varies from 50 to 72 inches. The square knot wire design is formed from single line wires spaced 4 inches apart and stay wires spaced 2 inches apart (Figure 11-3). The joints are held by a piece of short wire formed into a knot.

The diamond-mesh wire design uses two smooth wires spaced 4 inches apart, which are twisted together for all line wires, shown in Figure 11-4. Stay wires consist of single smooth wires the same size as the line wires. These stay wires are wrapped around adjacent line wires to form a triangle with a 2-inch base. The diamond shape is formed when two of these triangle bases are fitted together.

Both mesh fence designs are strong and highly safe for animals. However, these fences are expensive and used primarily for confinement areas or small acreages. Mesh wire fence is priced similarly to woven wire fence on a per-roll basis, although

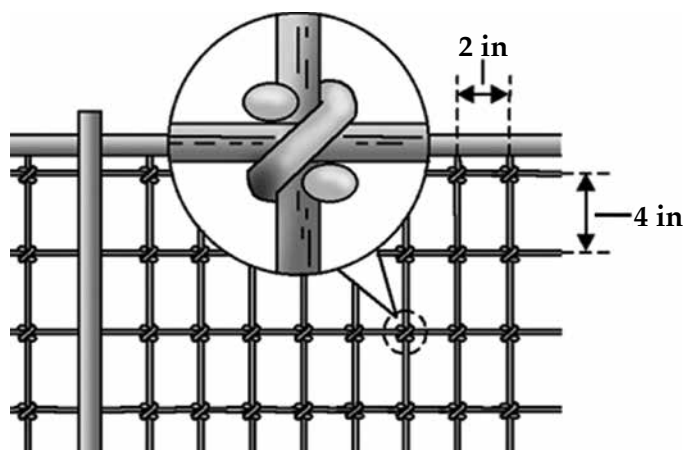


Figure 11-3 Mesh wire fencing.

mesh wire rolls typically contain one-third of the fence length found in woven wire rolls.

Board Fencing

Board fencing is made from 1- to 2-inch thick by 4- to 6-inch wide boards nailed to flat-sided wooden posts. Board fences can be built to any height, although 4 ½- and 5-foot heights are most common.

Posts typically are spaced every 8 feet. However, board length should always be checked before deciding on spacing. For example, if 16-foot boards are purchased, the posts can not be driven straight enough to attach the boards every 8 feet and post spacing must be decreased.

Board fences are strong, attractive and safe for animals. However, these fences are often built incorrectly by placing the boards on the wrong side of the post to maintain aesthetics. The boards should always be attached to the side of the post facing the livestock. Otherwise, animals tend to push boards off the post when they lean or push against the fence.

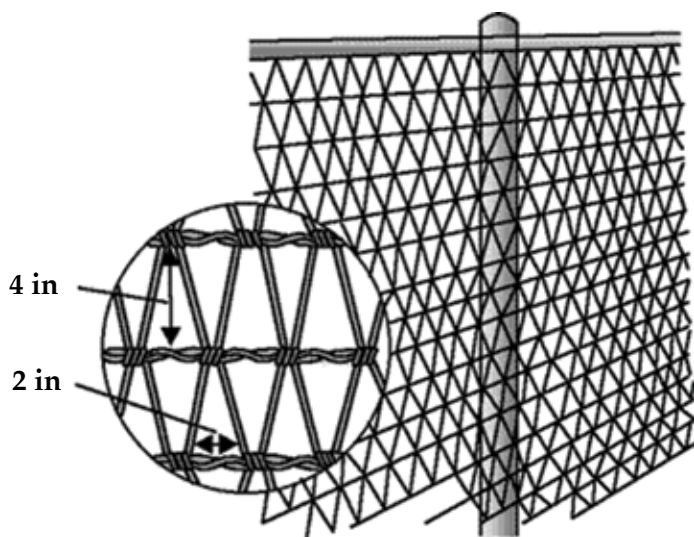


Figure 11-4. Diamond wire fencing.

Board fences are expensive to build and maintain. Furthermore, the addition of one or more boards significantly increases the amount of materials needed or the labor required to build and maintain the fence. Labor is considerably higher for board fences than for most wire fences. Other disadvantages include the boards splintering, breaking and rotting.

High-Tensile Fencing

High-tensile fencing is easy to handle, requires little maintenance, and can be relatively low-cost. This type of fencing can withstand livestock contact and low temperature contraction without losing its elasticity. With time, high-tensile wire has less stretch or sag, which is commonly associated with conventional fence wire. This type of fencing is not recommended for horses unless electrified versions are used, and the owner is willing to accept some risk of injury.

High-tensile fencing is constructed with 11- to 14-gauge wire with a tensile strength of 170,000 to 200,000 pounds per square inch (psi) and breaking strengths of approximately 1,800 pounds. Wires are held in tension along posts spaced 16 to 90 feet apart. At installation, each wire is tightened with a permanent in-line strainer (Figure 11-5), and is set at 200 to 250 pounds of tension. In-line strainers should be placed near the middle of the fence line to provide the same tension in both directions.

Tension indicator springs, shown in Figure 11-6, are used to set and maintain the correct wire tension. One tension spring should be used on one wire per fence and set to the proper tension. The other wires can be tightened to the same tension by feel or sound (similar to tuning a guitar). The tension spring generally is set on the second wire. However, placing the tension spring on the top wire provides some additional give to minimize damage caused by falling tree limbs.

Electric Fencing

Electric fencing (Figure 11-6) is a safe and effective means of providing permanent and temporary fencing for most livestock. Their purpose is to supply sufficient electrical shock to any animal, whether livestock or predator, coming in contact with the wire, deterring them from continuing. Livestock unfamiliar with electric fences must be trained to respect and stay away from the electric wire.

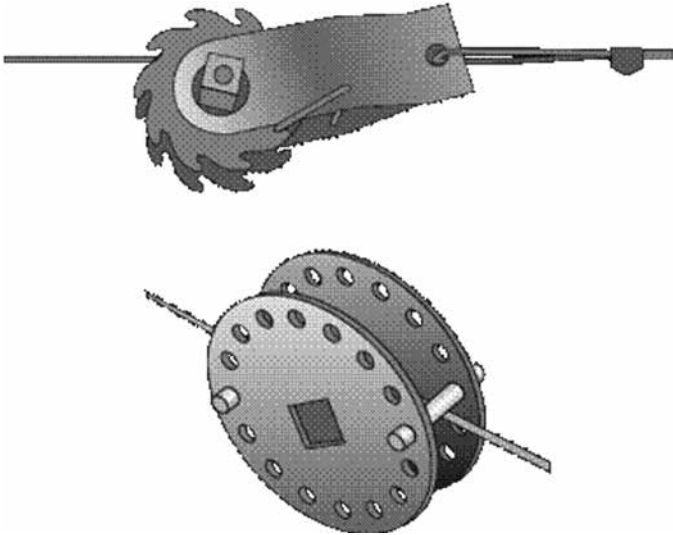


Figure 11-5. Tension in-line strainers.

Temporary Electric Fencing

Temporary electric fencing can be constructed from numerous materials. One of the more popular products consists of fine aluminum or stainless steel wires woven together with polyethylene fibers to form what is known as poly tape. This product comes in various colors with black being the most difficult for animals and humans to see. Brighter colors such as white or orange are much easier to notice and are recommended where visibility is especially important. Poly tape also is available in various wire densities. The maximum length for poly tape with a low wire density is about 1,200 feet. Poly tape with a high wire density can be used for longer runs.

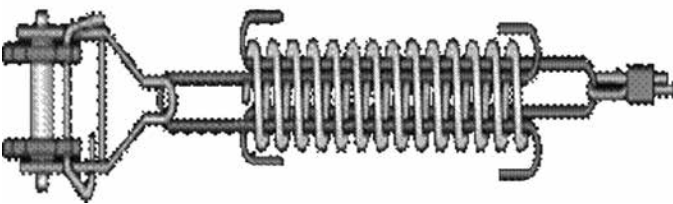


Figure 11-6. Tension indicator spring.

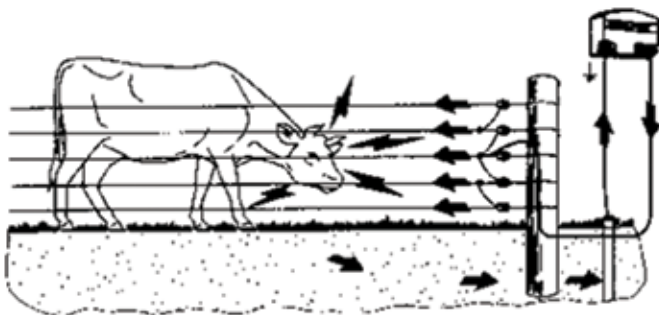


Figure 11-7. Electric fencing.

Permanent Electric Fencing

Permanent electric fencing generally consists of two or more strands of smooth wire. However, fences designed for small predator control may have as many as 10 or 12 strands. Alternate wires are hot. Other wires serve as grounded returns to the controller. The ground wire return design is recommended where the soil may be dry at times.

Permanent electric fences can be built from aluminum, stainless steel and high tensile wire. These types of wire conduct electrical charges for longer distances than poly tape. However, they are more difficult for animals to see. Animals will not be effectively trained to avoid electric wire unless they can see the wire when they feel the shock. Attaching strips of brightly colored cloth or plastic to the wire creates contrast and movement for easier visibility.

Electric Fence Equipment

Controllers

A controller, also called a charger or energizer, regulates the flow of energy in the fence wire by supplying pulses of high voltage electricity in short duration. An animal that comes in contact with an energized fence wire completes the circuit from the fence wire through its body, and then through the ground to the ground rod. The discomfort of the shock discourages the animal from further contact with the fence.

In most states, it is unlawful for any electric fence to be energized unless a controlling device regulates the charge on the fence wire. The controller must meet the safety standards of either the Underwriter's Laboratories, Inc. (UL) or the International Commission for Conformity Certification of Electrical Equipment (ICCC). Homemade or inexpensive, high impedance controllers should not be used. They may cause serious injury or death to both humans and livestock. Furthermore, the use of poorly designed controllers may result in grass fires around the fence.

Energizers

Joules and How Energizers are Rated

Joules are a measurement of energy. One joule is one watt for one second. A watt is volts multiplied by amps. A joule is the measure of kick of a pulse. However, each manufacturer measures and deter-

mines their own joule rating and many different factors are involved such as the following examples:

1. Was the rating determined at the energizer or on the fence line?
2. At what load was the measurement taken: 100 ohms; 500 ohms; 1,000 ohms; or even 50,000 ohms of resistance? (50,000 ohms means no fence connected to energizer.)
3. Was the test made at the end of a fence line, and if so, how long and of what size or gauge was the wire?

Until an independent testing agency does exactly the same test on all energizers, domestic or imported, the rating of fence energizer performance is nothing more than a general comparison.

Most energizers are rated with a minimum and a maximum joule rating for each model. The energizer will perform in this range, depending on the many different conditions that occur on each farm or ranch as outlined in the explanation above.

Livestock control using electric fencing depends on the following factors:

1. soil fertility and soil moisture
2. length of fence wire and size (gauge)
3. vegetative growth on fence line (such as weeds and grass)

NOTE: Use a fence energizer good enough to overcome any or all of the above factors.

Another misconception about performance of electric fences is how many miles of fence can be electrified. Many manufacturers advertise that their energizer will power 25 or even 50 miles of fence. The question should be not how much fence will it power, but if it will control animals under this condition. If performance in miles is a concern, a good rule of thumb is to multiply the joule rating by six. This calculation should give the approximate miles of fence for which the unit is designed.

Electric Fence Posts

Various kinds of posts are available for electric fences including wood, fiber glass, plastic, steel, or low-conductivity composites. Wood and steel posts require insulators to prevent short-circuiting of the fence through the posts. Plastic step-in posts work well for temporary fencing, but should be treated with ultraviolet inhibitors (UV treatment) to minimize deterioration in sunlight.

Wire

Steel wire longevity depends on the type and thickness of protective coating around the wire. Zinc is commonly used to cover (galvanize) steel wire to protect it from rusting. Zinc can be applied to steel wire in several ways and some are claimed to be superior to others. However, results of the American Society of Testing and Materials (ASTM) show no practical difference among galvanization methods.

Zinc coatings are measured in ounces of zinc per square foot of wire surface. The more zinc per square foot, the more years of wire use before rusting starts. The ASTM has established classes of zinc coatings for steel wire based on the number of years that galvanizing delays wire rusting under different climatic conditions. Class 1 has the lightest zinc coating, and Class 3 has the heaviest. Machinery, livestock and fire may damage the zinc coating, which results in wire that rusts sooner than undamaged wire. Steel wire may have less than a Class 1 coating, which is often referred to as regular galvanizing. Many local dealers stock steel wire with either regular or Class 1 coatings. Wire with a Class 3 coating may have to be specially ordered from the manufacturer.

Tying Off Corners

When tying off the wire at the strainer post, making a good strong self-locking knot is important, as shown in Figure 11-8.

Tying Off End Strain Insulators

A good strong knot also must be made when tying off end strain insulators. Using a simple twist

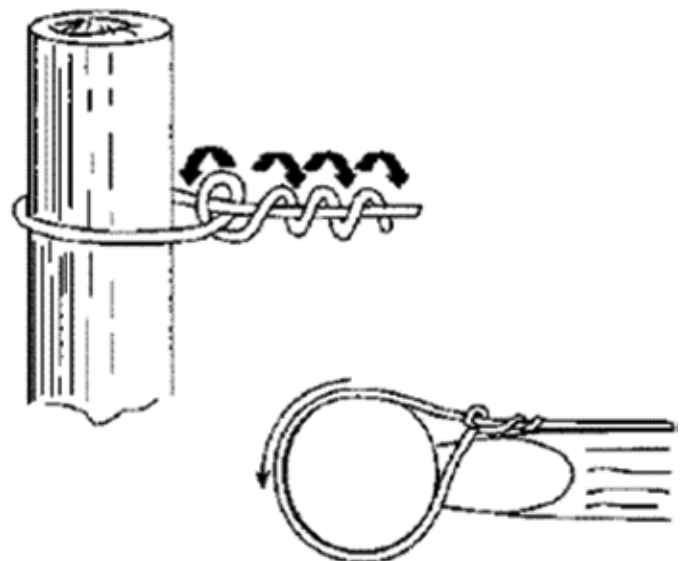


Figure 11-8. Tying off corners.

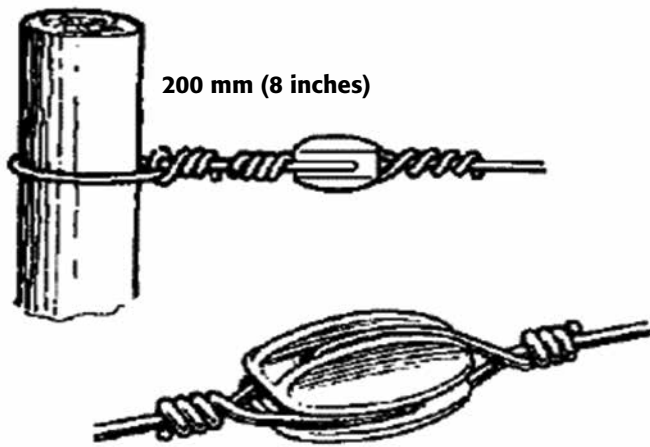


Figure 11-9. Tying off end strain insulators.

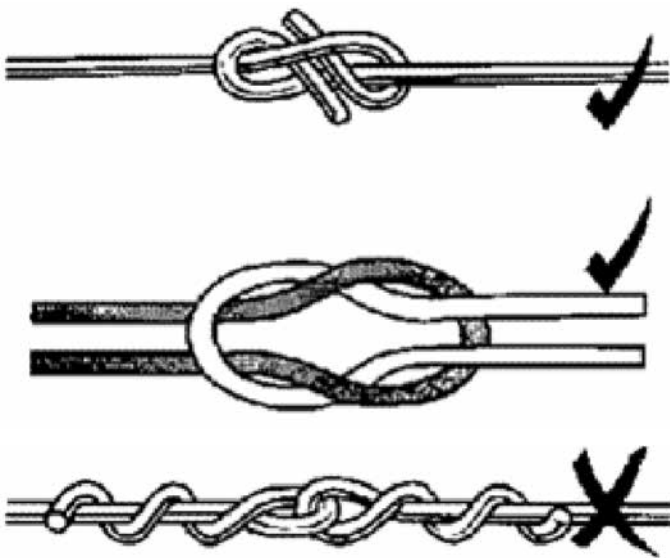


Figure 11-10. Wire splicing.

knot, wrapping the wire around itself at least four times and keeping the insulator within 8 inches of the strainer post (Figure 11-9), will prevent animals from pushing between the insulator and strainer post.

When tying off end strain insulators, the wires always should be tied so that they strain from the center of the insulator.

For most fences, 12 ½-gauge high-tensile wire is recommended for use. For long lead-out wires or corrosion problems (from salt spray and other elements), a heavier gauge wire such as 10-gauge or 8-gauge should be used.

Wire Splicing

Incorrectly joined wires can be a major cause of power leakage. When joining wires together in the middle of a fence line, use either a figure eight knot or a reef knot (Figure 11-10).

Lead Outs

At least one 12 ½-gauge double-insulated cable should be used as the lead out. Two or more joined in parallel are better, because this configuration lowers the resistance of the wire. Table 11-1 shows wire resistance for certain wire diameters. The resistance numbers show the ohms resistance of galvanized steel fence over one mile. The lower the ohms, the lower the resistance. Different metal types have varying resistances. For example, one mile of 11-gauge aluminum wire has only 18 ohms resistance. Aluminum wire makes an excellent lead out through very long distances, but it is at least double the price of conventional steel wires.

Lead outs can be run either overhead or underground. Underground is preferred because of less chance that high vehicles will interfere with the lead out. Where lead outs are being run underground in high traffic areas, the lead out cable or cables should be run through irrigation tubing as an extra safeguard against damage. Using insulated cable as a lead out has several advantages:

- No chance of shorting out on sheds or the ground.
- Totally waterproof, easily installed, and long lasting.

The longer a lead out wire is the greater its resistance. Resistance of the wire is one of the biggest problems to overcome. Larger diameter wires create less resistance and; therefore, have a better current flow.

Practical Suggestions for Long Lead Outs

- Use bigger diameter wires. For example, use 10-or 8-gauge wires instead of a 12 ½-gauge.
- Run wires in parallel. Run two or more wires along the fence line side by side, and connect these wires together at each strainer post. (See the diagram in Figure 11-11.) Two wires together will half the resistance and three will reduce it to only one-third.

Table 11-1. Wire Resistance.

Wire Diameter (Gauge)	Resistance (Ohms per mile)
8	22.5
10	35
12 ½	56
14	87
16	145

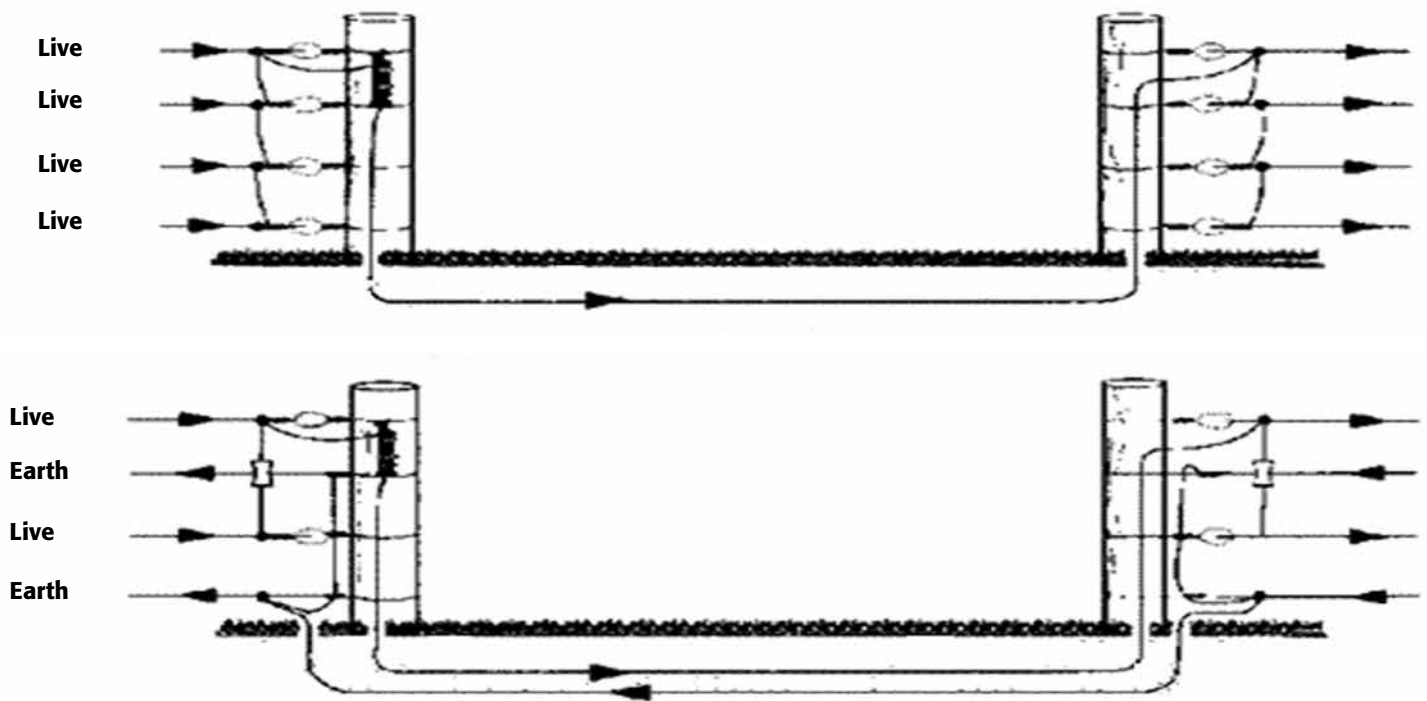
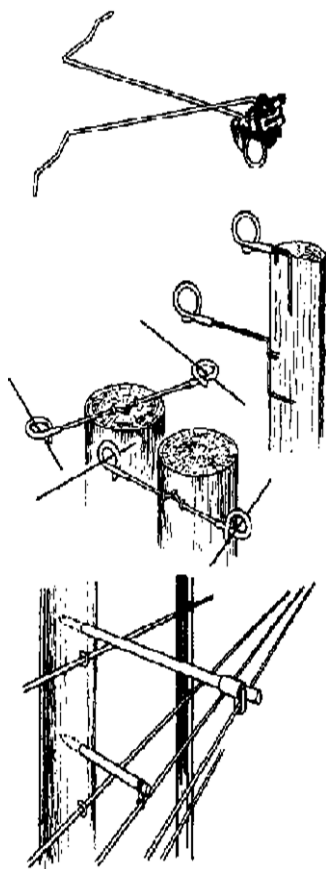


Figure 11-11. Practical suggestions for long lead outs.



Wire Offsets

These offsets are attached by twisting them around fence wires. They come with either porcelain or pinlock insulators.

Steel Offsets

These offsets are used for driving into timber posts. They can be affixed to the top or the side of the post and driven directly into the posts.

Fiberglass Offsets

These offsets can be driven into timber posts (drill pilot holes first) and can also be used for most concrete posts. They are available in 12 inch lengths and come with either a fixed nylon clip or a moveable steel clip.

Figure 11-12. Offsets for electrifying conventional fences.

- Use aluminum wire for lead outs. Aluminum wire has only one-sixth the resistance of steel wire. It does not have the same tensile strength, however, so a minimum diameter of 11-gauge is recommended.

Electrifying Conventional Fences

Using offsets (also known as standoffs or outriggers), such as those shown in Figure 11-12, to run electrified wires has the following benefits:

- Stock pressure on existing conventional fences is reduced, which will extend the life of old fences and add years to new ones.
- Old conventional fences can be rejuvenated by running an electrified wire on both sides. The wire can be run either on the top of the posts to stop animals from leaning over the fence, or an offset can be attached to the fence at about two thirds of the height of the animal being controlled. An offset in this position will stop animals from rubbing against the fence.
- When attaching offsets to an existing fence, checking that all wires are in good condition is important. Broken wires can come in contact with the electrified wires and cause shorts. Outriggers should be placed no more than 16 to 22 yards apart. The offsets should be placed as close to the line posts as possible for rigidity.

Gateways

When crossing gateways, insulated 12 ½-gauge cable buried at least 12 inches underground is recommended. In heavy traffic areas, the insulated cable should be run through irrigation tubing for extra protection before it is buried. The ends of the tubing should be turned down to prevent water from entering.

Overhead crossings are not recommended because they are susceptible to damage.

When installing an electric fence, the following points should be considered:

- Attach each end of the insulated cable to the fence line with joint clamps.
- If the fence system is a fence ground return system, run a ground cable plus the live cable under the gateway.
- Always use 12 ½-gauge cable, as it is more conductive than 16-gauge cable.
- Never use household electrical cable under gateways.
- Never use spring gates or tape gates instead of insulated cable to carry the current across the gateway.
- Where there is a ground cable and a live cable crossing a gateway, mark the cables to prevent cross-connection.
- Always allow extra cable, to avoid joins.

Flood Gates

Flood gates, shown in Figure 11-13, are ideal for use in creeks, river beds and other areas prone to flooding.

To install a flood gate, follow these steps:

1. Strain a wire between two posts (one on either side of the creek).
2. Clamp on lengths of galvanized chain hung at intervals of 6 inches. For large animals, this can be increased to 12 inches. The length of the chain is kept to 12 inches above the lowest average water level.
3. Connect the flood gate controller (energy limiter) between the fence and the flood gate, which limits the amount of power on the flood gate during a flood so the remainder of the fence continues to have a high voltage.

Where a likelihood exists of water levels remaining high for extended periods of time, placing a cutout switch is recommended.

Lightning Protection

Both the input (120 volt source) and the output (fence) side of the charger need to be protected from lightning. The following two options would protect the input side.

1. Use a power surge protector (MPS). Some studies have shown that the majority of damage is caused by surges from the utility side. The power surge protector is the easier of the two to install. This simple device plugs into the grounded receptacle with the charger cord connected to it.
2. Since some chargers do not have external access to the fuses, the second option to consider is to replace the original plug with a fused plug (MFP). This fused plug has two internal fuses that can be easily replaced if a problem should occur.

A lightning diverter and choke coil (MWLA) for the output side is shown in Figure 11-14. The output side usually takes the blunt force of a lightning strike to the fence line. Most chargers have some type of lightning surge protection built into their circuitry. However, if a lightning strike gets past this protection, repairs or replacement can be costly. Since lightning naturally seeks the ground by the path of least resistance, this discussion centers on giving it an easier route than through the charger.

Multiple hot wire jumpers should be made on the fence at a location where any lightning surge energy has to pass through the diverter and choke before reaching the charger. Proper installation of

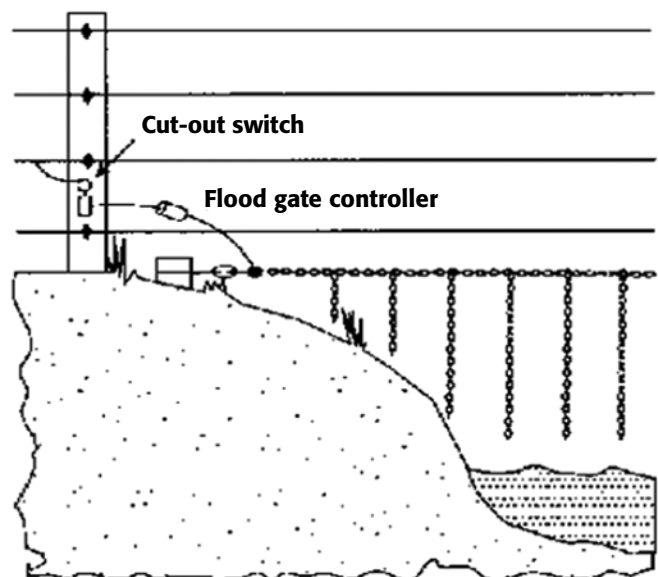


Figure 11-13. Flood gates.

the lightning diverter is essential to its operation in the event of a lightning strike on the fence line.

For best results, perform the following actions:

1. Install the diverter close to the charger (minimum of 50 foot between beds).
2. Use a choke coil in very close proximity to the diverter; the closer the better.
3. If installing the fence leaves enough of a leg of wire after crimping around the end or corner post, pass the wire through the diverter and connect it to the choke coil. Otherwise, use a split bolt line tap to connect to the main fence line.
4. Mount the lightning diverter and choke coil to the post as shown in Figure 11-14. Unscrew the top nut on the diverter and lay the wire from the fence line in the top slot and connect it to the choke coil. Tighten both connections.
5. Attach the wire from the charger to the other end of the choke coil.
6. Install the ground bed. Run the wire from the bottom of the diverter to the ground bed and insulate it where it crosses the wires.

Fencing Examples

Permanent-offset

Figure 11-15 shows a possible permanent offset setup that utilizes both woven wire and high tensile offset wire, which would make an excellent sheep and goat fence.

The following items are advantages of permanent offset fencing:

- Smaller energizers can be used that are less costly and safer. High joule output units are normally used to overcome voltage drops due



Figure 11-14. MWLA lightning protection.

to vegetative contact. This system can eliminate or reduce that need.

- Cuts down on maintenance and voltage checks.
- Improves predator and guard animal control.
- Decreases incidence of heads being caught in woven wire.
- Reduces the possible liability risk of public access since contact with a hot wire on the inside of a boundary fence means that the public must be trespassing.

One disadvantage of permanent offset fencing is that the cost of the material is more expensive if starting from scratch.

Permanent High Tensile Smooth Wire

The least costly permanent fence per year of useful life utilizes only high-tensile (HT) smooth wire. Wire can be secured to wood posts or T-posts and energizing the wire can be all hot or alternate variations of hot and ground, shown in Figure 11-16.

The following items are some of the advantages of permanent high-tensile smooth wire fences:

- Low-cost boundary fence
- Easiest permanent fence to install
- Economical for straight and level fences
- Good for subdividing pastures or paddocks

The following items are some of the disadvantages of permanent high-tensile smooth wire fences:

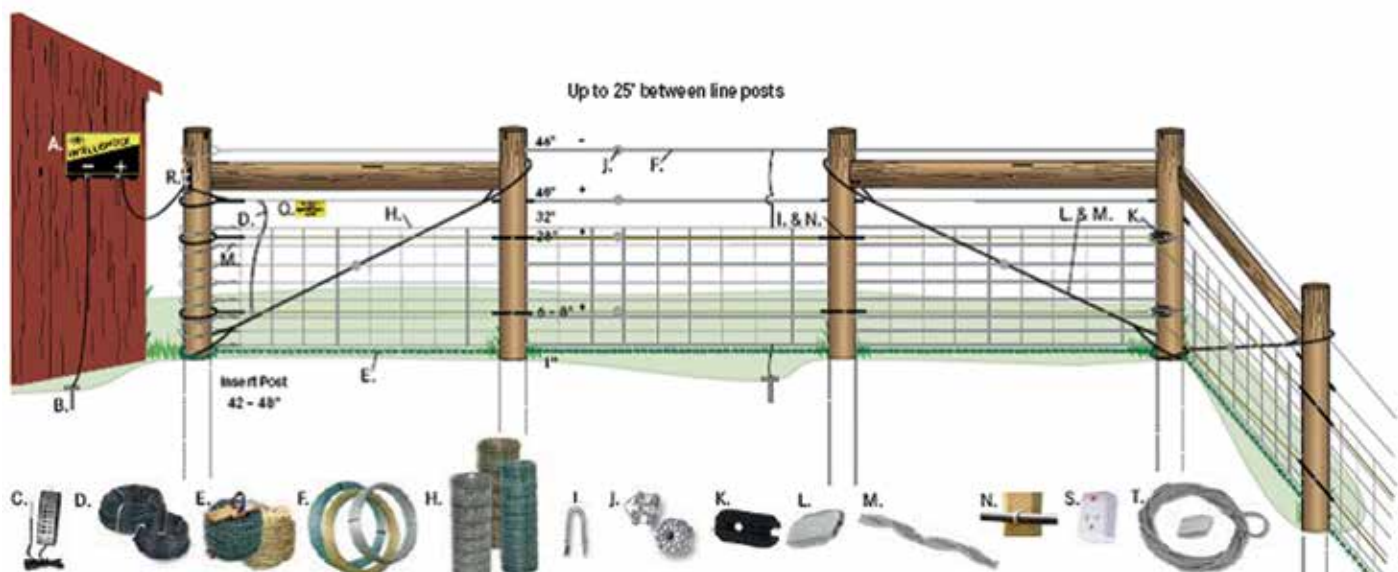
- Less reliable for predator and livestock control
- Higher drain on energizers from vegetation
- Increased maintenance cost and management time.

Temporary Electric Fencing

Electric net or hot tape, rope, twine or fine wire can be used for very effective short-term boundary control. Portable fences provide flexibility in pasture management and are ideal for short-term animal control or rotational grazing. Easily transported, constructed and maintained, portable fences are an effective temporary fencing solution for a range of animals and situations. Figure 11-17 shows the different post options available.

Strip Grazing

Temporary fencing gives the versatility to strip graze; make temporary paddocks or pens; and pro-



Typical parts involved:

- | | | | | |
|---------------------------|--------------------------------|------------------------|-----------------------------------|------------------------------|
| A. Energizer | B. Ground rod (6' 5/8") | C. Fence tester | D. Insulated cable | E. Barb wire |
| F. HT smooth wire | H. HT woven | I. Staples | J. Daisy or Hayes strainer | K. Terminal insulator |
| L. Gripple lock | M. Twist lock | N. Supatube | Q. Warning sign | R. Cut-out switch |
| S. Surge protector | T. Speed brace | | | |

Figure 11-15. Diagram showing a possible permanent offset setup that utilizes both woven wire and high-tensile offset wire.

protect trees, gardens or other areas from unwanted damage caused by wildlife and other animals.

The suggested equipment and strip grazing method are illustrated in Figure 11-18 and 11-19.

Intensive grazing has a number of advantages:

- Ensures maximum use of available pasture, particularly in times of feed shortage.
- Provides enhanced pasture growth and more controlled, even grazing.
- Allows areas not normally fenced, such as cropping paddocks or road frontages, to be quickly and easily fenced and grazed.
- Provides improved financial returns from increased production.
- Intensive grazing is ideally suited to cattle and sheep, but also can be used for other animals such as horses, goats and deer. Cattle can be grazed using a single wire. If goats and cattle are being grazed together, then two wires may be required.

Intensive grazing also has disadvantages:

- Less reliable for predator and livestock control
- Higher drain on energizers from vegetation
- Increased maintenance cost and management time

Planning

Constructing a high quality fence is important to ensure less problems in the future.

Electric fences do not need to be constructed to the same strength as conventional fences because they provide a psychological barrier rather than a physical one. They should still, however, be soundly constructed to withstand the rigors of use.

The overall layout of the electric fencing system deserves careful planning to ensure receiving the best possible advantages from it. The time spent in planning helps find and repair any faults or shorts quickly and assists with stock management.

Figure 11-20 gives an example of a basic plan of an ideal fence set on a flat, rectangular farm.

Consideration of the same principles should also be applied on hill country or less favorably shaped farms.

To make a basic plan, place a sheet of clear plastic over an aerial photograph of the property and draw in the old and planned fence lines. This activity helps to pinpoint things producers needed to know before starting, such as the following items:

- The overall length of the proposed new electric fencing and existing fencing to be electrified.
- The position of laneways and gateways.
- The location and length of supply lines from the energizer to the electric fence.
- The placement of cutout switches.
- Whether mains, battery or solar powered energizers will be needed.

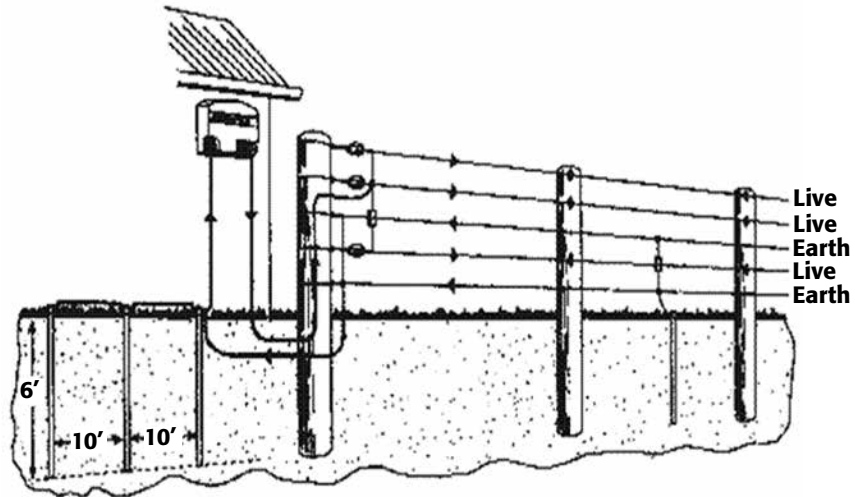
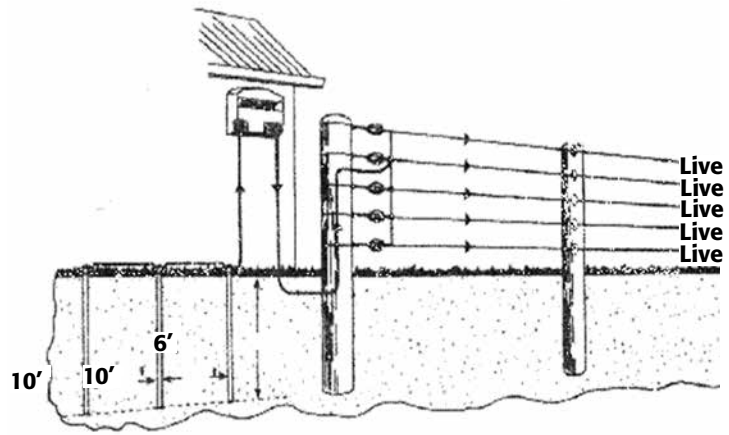
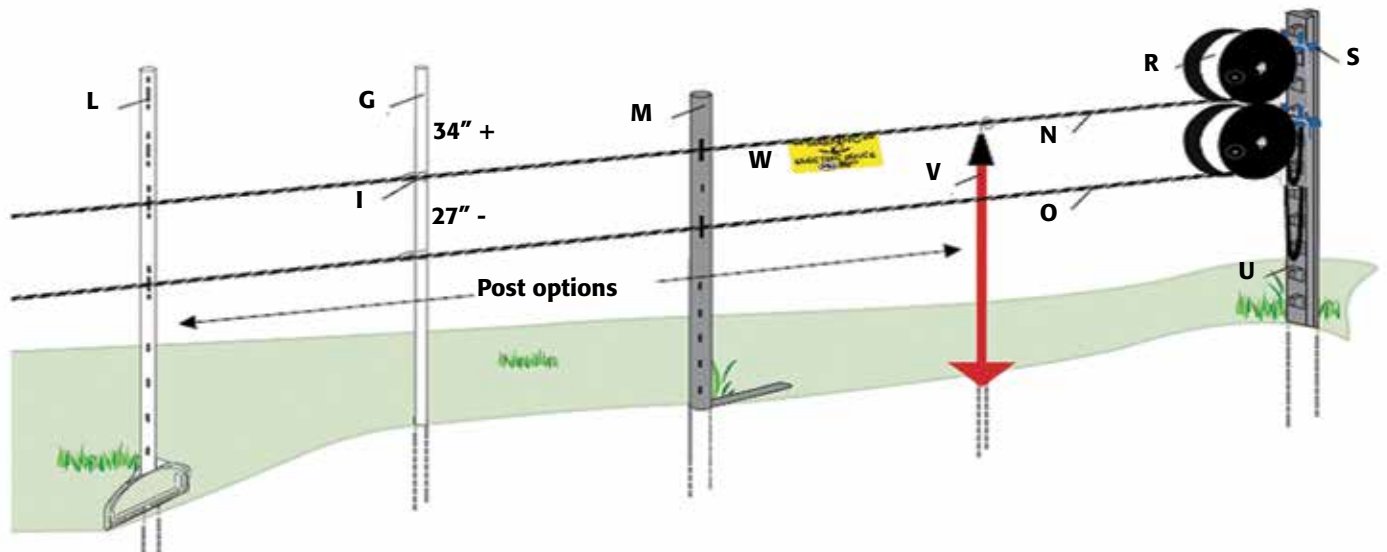


Figure 11-16. Live-live versus live-earth.



G. Fiberglass post
O. Plastic tape
W. Warning sign

I. Metal clips
R. Reel

L. Tread in post
S. T-post bracket

M. Insultimbers
U. T-post

N. Plastic rope, twine
V. Pigtail tread in post

Figure 11-17. Post options for electric fencing.

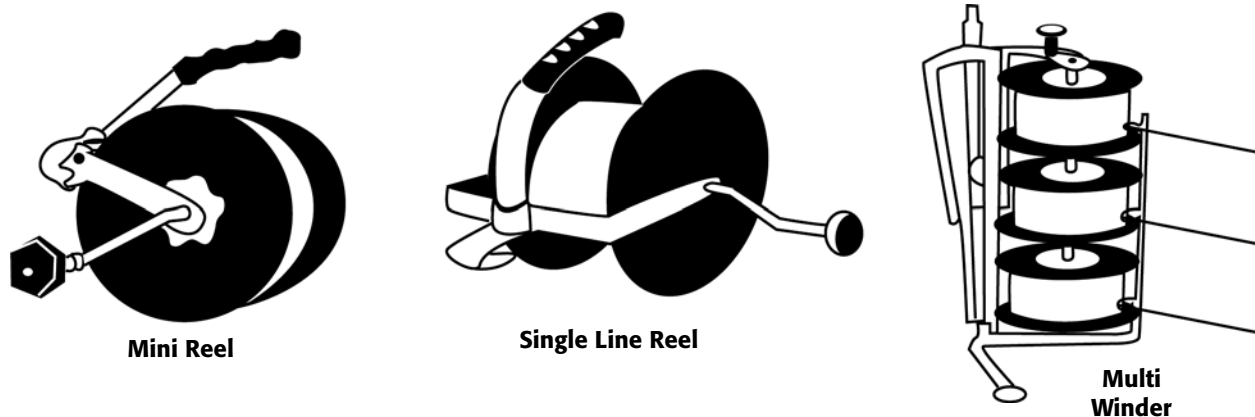


Figure 11-18. Strip grazing equipment.

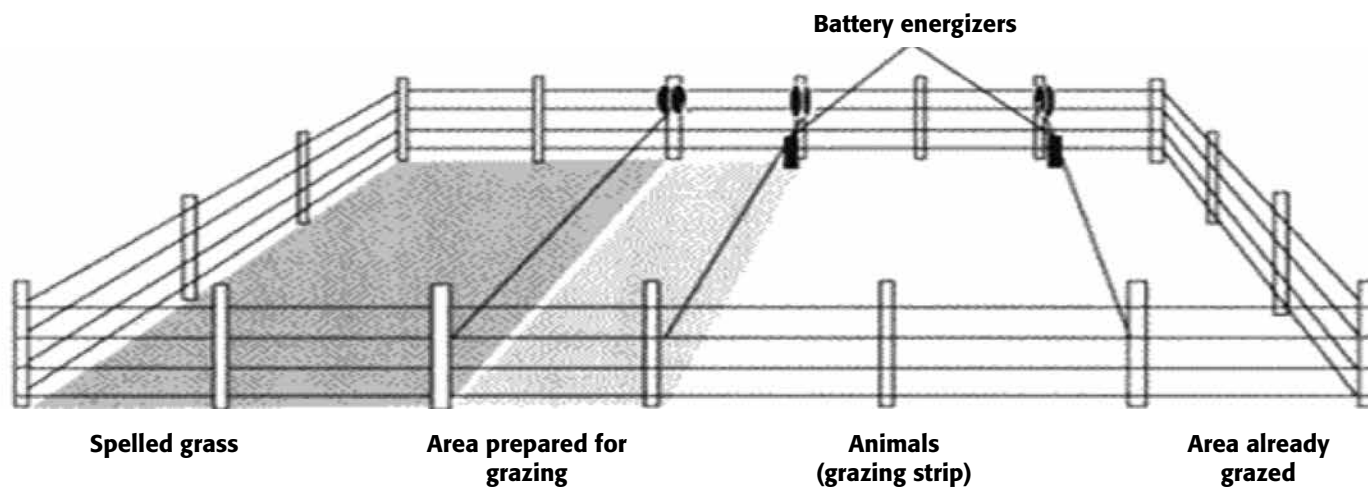


Figure 11-19. Suggested strip grazing method using electric fencing.

- What size energizer, or in some cases, the number of energizers required.
- The location of the energizer.
- The location of the ground.
- The direction the current flows. Knowing this direction will help with maintenance and fault finding.

Fencing Costs

Tables 11-2 and 11-3 show comparisons of various fencing costs for both perimeter fencing and interior fencing.

Paddock Size and Shape

Whenever possible, paddocks should be made square. This configuration allows better pasture management with more even grazing. Long, narrow paddocks create more walking and footpaths, while the backs of the paddocks are often undergrazed.

Where possible, a laneway down the center or side of the subdivision should be incorporated. This will assist with stock movement and access.

The size of the paddocks is not as vitally important as the number of paddocks. Obviously, both are relative to the size of the farm and the number and types of animals stocked. The number of paddocks is important so it allows for intensive grazing, locking up of hay and silage and the flexibility of longer rotations during times of feed shortage.

Subdivision of hilly terrain deserves careful planning. Wherever possible, fence lines should follow the contour of the land so sunny slopes, shady slopes and flat land are all kept separate. This configuration allows for better pasture management, especially in areas prone to erosion.

Strip grazing also can be incorporated to gain even better pasture management. See the diagram in Figure 11-19.

Suggested Intensive Grazing Method

For intensive grazing, the fence generally is moved daily, and the distance it is moved is based

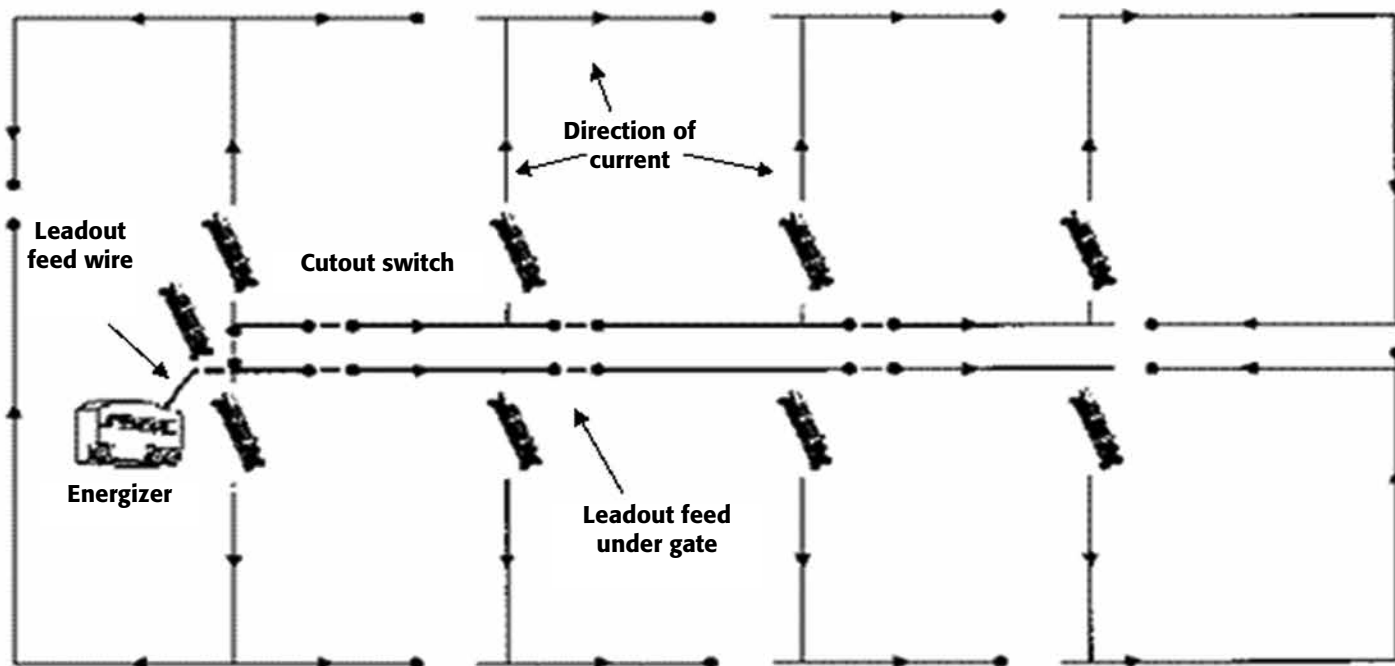


Figure 11-20. Basic layout plan for an electric fencing system.

upon the number of animals being grazed and the quality and quantity of available pasture.

A back fence also should be erected to stop animals from returning to the areas already grazed, thus allowing a quicker recovery of the pasture.

Goats can be grazed in the same manner as cattle, but may require three wires instead of a single wire. Alternatively, portable netting also may be used.

For any other animals being grazed, wires can be set up depending on the heights of the animals.

Polytape, maxi-shock, polywire and/or polyrope are ideally suited for temporary fencing since they are extremely flexible and light, yet very strong and easily rewound onto fence reels.

References

Estimated Cost For Livestock Fencing. (1999). Iowa State University Cooperative Extension Service.
 Fencing Materials for Livestock Systems. (2003) Virginia Tech Cooperative Extension Service. Pub No. 442-131, Revised.
 Managed Grazing Systems and Fencing for Distribution of Beef Manure. Publication EQ379. <http://muextension.missouri.edu/explore/envqual/eq0379.htm>
 Planning Fencing Systems for Intensive Grazing Management. University of Kentucky: ID-74. <http://www.ca.uky.edu/agc/pubs/id/id74/id74.htm>
 Rotational Grazing. Publication ID-143. <http://www.ca.uky.edu/agc/pubs/id/id143/id143.htm>
 University of Maryland. <http://sheepandgoat.com/fencing.html>

Additional Company Resources

Gallagher
 130 West 23rd Avenue
 North Kansas City, MO 64116
<http://www.gallagherusa.com/pf.manual.aspx>

Kencove Fence Supplies
 344 Kendall Road
 Blairsville, PA 15717
<http://www.kencove.com/Premier1>
 2031 300th Street
 Washington, IA 52353
<http://www.premier1supplies.com>

Southwest Power Equipment
 26321 Hwy 281 North
 San Antonio, TX 78260
<http://www.swpowerfence.com>

Tru-Test
 328 Grant Road
 Mineral Wells, TX 76067
<http://www.speedrite.com/>

Power Flex Fence
<http://www.powerflexfence.com>

Pasture Management Systems, Inc
<http://www.pasturemgmt.com>

Twin Mountain Fence
<http://www.twinmountainfence.com>

Table 11-2. Perimeter fencing costs on an 80 acre farm (Perimeter = 7,467 ft).

<i>Item</i>	<i>Woven Wire</i>	<i>Barbed Wire 6 strand</i>	<i>High Tensile (nonelectric) 8 strand</i>	<i>High Tensil (electric) 5 strand</i>
Estimated useful life (yr.)	20	20	25	25
Initial cost	\$7,070	\$7,696	\$4,946	\$4,285
Average annual maintenance (% of initial cost)	8%	8%	5%	5%
Depreciation	63	68	35	30
Interest on investment	124	129	100	94
Maintenance	100	109	44	38
Total cost per year*	287	306	179	162
Total cost per foot/year	0.22	0.23	0.14	0.12

* Annual average ownership cost by fence type (based on a 1,320 foot fence).

Table 11-3. Interior fencing costs using electric polywire fence.

<i>Item</i>	<i>Amount Needed</i>	<i>Cost Per Unit</i>	<i>Total Cost</i>
Wood posts (4 inch diameter)	2	\$9.50	\$19.00
Composite post (1 1/8 x 54 inch)	33	\$4.00	\$132.00
HT wire 12.5 ga	2 x 1,320 ft.	\$0.024	\$63.36
Energizer (priced over 4 yrs)	1/4	\$500.00	\$125.00
Cut-out switch	1	\$9.50	\$9.50
Grounding/Lightning rod	4	\$10.25	\$41.00
Labor estimate	2 hrs	\$15.00	\$30.00
Total*			\$420.00
Total per foot			\$0.32

*Based on a 1,320-foot fence.

Chapter 12

Housing and Corrals

Tom Smith

Introduction to Goat Housing

While goats are very adaptable and were originally wild animals, they have become domesticated by man and have been introduced to weather conditions and factors different than where the species developed. Goats require protection from three stress factors: rain, wind and cold. An animal stressed by any of these conditions can swiftly become seriously ill. Therefore, whether raising goats for brush control, meat production, dairy purposes or show animals, shelter is necessary. This chapter will discuss various options for housing.

Open Housing

When building a new structure for housing goats, the least expensive option and easiest to build would be what is commonly referred to as a three-sided shed. This type of building should have the open side facing away from prevailing winter winds. The open side may even be enclosed except for door openings if desired. Examples of open housing options are shown in Figures 12-1 and 12-2.

The roof should be sloped to drain runoff to the rear of the structure, and should be situated where drainage is not a problem. Such sheds designed spe-



Figure 12-1. Open housing example.



Figure 12-2. Open housing shed with corrals.

cifically for goats commonly measure 5 to 6 feet tall at the front, with the rear measuring 3 to 4 feet tall. This low height will help hold the body heat lower down to the ground at the goat's level. Length and depth of the structure can vary, depending on the number of animals it is designed to shelter. Mature goats in open housing systems will need 10 to 15 square feet of bedding space per animal.

While the floor is often only the natural soil, three to four inches of wheat straw or poor-quality hay can be added for bedding. Some sources recommend allowing a manure pack to accumulate in the winter, providing a heat source as the lower layers decompose.

Such structures frequently are built of treated wood posts, lumber and corrugated sheet iron, although welded pipe frames, heavy sheet metal, plywood or almost any other material can be utilized. Remember that untreated wood will decay through time, and goats will gnaw at certain types of wood, slowly destroying the structure. Painting will preserve lumber and plywood, but some paints contain chemicals which are harmful to goats.

Confinement Housing

If intending to completely enclose your goats, other factors must be considered. As the complexity increases, so will the maintenance and building expenses. Construction materials may vary, rang-



Figure 12-3. Confinement housing example.

ing from using or modifying an existing structure, as seen in Figure 12-3 or building a simple barn to an elaborate facility. Floors may be of dirt, wood or concrete. Regardless of the type of construction or the materials involved, there are several necessities that must be included in the structure.

Windows or artificial lighting must be provided. Most sources recommend 1 to 2 square feet of window space per animal to prevent health problems.

A healthy goat needs fresh air, but a draft can create respiratory problems. Ventilation fans should be designed to circulate air from the floor in the winter and from the ceiling in the summer. They also should be capable of moving 150 to 200 cubic feet of air per minute in the summer and 20 cubic feet per minute in the winter.

The structure should provide each animal with sufficient space. In complete confinement, a mature goat needs 20 square feet of floor space. An additional 25 square feet of space should be available in a separate exercise yard. Be sure to allow for the space taken up by feed and water troughs.

Additional heating normally is not required if dry bedding is available and there are no drafts. Dirt floors need 3 to 4 inches of wheat straw, poor quality hay or a similar material. Concrete floors should contain 5 to 6 inches of bedding. Drainage of urine and removal of manure must also be provided on concrete floors.

Insulation can be added to prevent warm air inside the barn from condensing on cold walls. Such condensation can increase frequency of colds and other respiratory problems. If insulation is used, it is important to remember to cover it with plywood or a similar product to prevent consumption by the goats.

Kidding Pens

Many goat producers prefer to have their does give birth in kidding pens, both for protection from

predators and to provide easier monitoring for kidding problems. This also allows for monitoring the post-natal health of does and newborn kids. Pens may be easily constructed in either open or confinement housing, from a wide variety of materials.

Kidding pens are available from several sources in the form of pipe and wire panels, which may be joined together. They may also be made from cutting wire panels to the desired dimensions, built of lumber, chain link or any other material commonly used for goat corrals. Panels may be joined together by wire, hog rings or, if frequently taken apart and moved, duct tape (which is much the same color as wire panels and may be cut with a knife for removal). Examples of kidding pens are shown in Figures 12-4 and 12-5.

Heavily pregnant does are usually less likely to attempt to jump or climb out of pens, but do not rely on this when considering dimensions. Kidding pens should be a minimum of 48 inches high. Pre-manufactured panels are available which, vary from 5 feet to as much as 10 feet long. Kidding pens should be a minimum of 5 feet long and 5 feet wide or 6 feet long and 4 feet wide. Does with single births may be kept for a short time in the smaller pens, but those with multiple kids should be placed in pens up to as much as 40 or 50 square feet. Bedding of hay, straw or wood shavings is recommended.

On dirt floors, permanent or semi-permanent pens may be added at any time by inserting wood posts or steel T-posts. T-posts have the advantage of being removed with a tractor front-end loader or 3-point lift or use of an automotive jack.

Ideally, in barns with concrete floors, location and size of kidding pens should be considered prior



Figure 12-4. Kidding pen.



Figure 12-5. Kidding pens inside confinement housing.

to construction. If this is not an option, pens may be added by securing one or more sides to the wood or metal supports for the barn (posts, studs, pipe, etc.).

Alternatives

Goats do not require fancy facilities. Other materials and products have been used for housing. Old chicken houses, hog barns, concrete blocks, calf hutches (often seen at dairies) and even railroad boxcars and enclosed semi-trailers (with the undercarriage removed) have been used in designing housing for goats. As long as the shelter provides protection from wind, rain and cold, your goats will probably not get restless (Figure 12-6).

Goat Corrals

In addition to shelter, a goat operation must have facilities for goats to be confined, whether for processing for sale or veterinary care, exercise for show animals, weaning or other management reasons. This will require construction (or adaptation if using existing pens designed for other species) of pens capable of containing goats (Figure 12-7).

Goats have been called the “Houdini” of the animal kingdom. It has been said, if daylight or smoke will pass through a fence, a goat can escape from it. While these are exaggerations, a germ of truth remains: Goats are extremely intelligent and will, on occasion, manage to escape from what appears to be a goat-proof barrier. Regardless of the construction, problems will inevitably arise, but following the “5 P Law” (Prior Planning Prevents Poor Performance)



Figure 12-6. Alternative housing example.

can minimize the stress and inconvenience of wandering goats.

If planning to build completely new facilities, site selection is important. Goat pens should be located on a well-drained location to prevent pooling of rainfall and unsanitary conditions. Wet goats, as discussed elsewhere, are susceptible to a multitude of disease organisms, and confining goats where a mixture of rain and manure has accumulated is a sure recipe for sickness.

Once the problem of location has been resolved, the goat rancher must determine the size and shape of corral needed. Most sources recommend a minimum of 25 square feet of floor or ground space per animal. The shape of the pen should also be considered. If the confinement is to be used for exercise of one or two show animals or meat goats, a long, narrow run may be preferred, due to the fact that an animal will get more exercise in this design than in a square pen with the same area in square feet. If a larger number of animals will be confined, more conventional shapes will be adequate. A word of caution is appropriate here, however. Goats, like all herd animals, will frequently “pile up” in corners,



Figure 12-7. Confinement areas should match the needs of the herd.

which can cause injury to animals and put pressure on fences. For this reason, square corners should be rounded as much as possible by angling the fence line or placing stock panels across existing corners, improving the likelihood that animal movement will continue to flow around the perimeter of the enclosure.

Livestock producers of all species have learned a few rules regarding construction of pens or corrals:

- Purchase quality materials. No fence is any stronger than the weakest link.
- Perform routine maintenance. Swinging gates will sag, net wire and chain-link fence will stretch with repeated pressure, welds will break and lumber will decay.
- Posts should be located outside the pens. While positioning the posts on the inside will make your corrals look more attractive to your neighbors, any pressure from within can push out nails, fence staples or wire clips and disconnect the building materials from the posts, allowing animals to escape.
- Never build to equal the minimum strength, height or size you think you need. Frightened goats, wild animals and even acts of nature can test the construction of the best fence. And even though many sources state that a fence 48 inches high is adequate to contain a goat, there have been countless examples of individual animals which could jump or climb over a 4-foot-tall fence. Also, by building larger facilities than may be needed at the present time, sufficient room is available to comfortably contain more animals if (and when) the herd size increases.
- Take into consideration the type of animal(s) to be confined. Mature bucks, horned animals, and small kids each have different construction requirements.
- Include smaller pens, a loading chute and an alleyway or other area to sort animals for veterinary care, weaning, transportation or other purposes.

Materials

The next factor to consider is the type of material from which to build the pens. There are more types of fencing available than there are breeds of goats. This text will discuss the most common types of fencing used for constructing goat corrals.

Welded wire panels (cattle or hog panels)

Usually sold in 16-foot lengths, these are available in various heights up to 60 inches, although taller ones are available. Depending on the diameter of the wire, dimensions of the panel, and the size of the openings, prices currently range from approximately \$17.95 for the light-weight 50-inch by 16-foot cattle panel to as much as \$226 per panel for one with 2-inch by 2-inch spacing and measuring 8 feet by 12 feet (2014 data, price quotes FOB J&I Manufacturing, Madill, OK).

Advantages: Wire panels can be cut to any desired dimension with bolt cutters or a hack saw. They can be assembled quickly and can be attached to wood posts with fence staples, welded or otherwise attached to pipe posts and horizontal rails, or even clipped onto steel t-posts. For producers who already have corrals for cattle, wire panels are easily added with a minimum of effort to make these facilities appropriate to contain goats. If an existing barbed-wire or net-wire fence already is on site, they may be quickly connected using brass hog rings. This connection will need to be checked on a regular basis, as the rings tend to spread apart when stressed.

They are strong and, being galvanized, resist rust unless placed in contact with the soil. Wire panels are available that are suitable for all types of goats, from small kids to mature bucks.

Disadvantages: If the wrong type of panel is used, goats can occasionally get their heads caught, even if horns have been removed. Small kids may put their heads through panels with openings as small as 4-inch by 4-inch spacing. If animals can get their necks over the top, through time, the top may become bowed down (Figure 12-8) enough for goats to escape. Wire panels do not conform well to irregular terrain, so site selection is important when using them. In addition, goats frequently place their front feet on fence rails, feed troughs, stumps, or other items. Due to this habit, the welds on wire panels may, over a period of time, become broken. This can eventually result in an enlarged opening in which goats may become entrapped or even escape. Also, unless sufficient posts are used, extremely pushy goats such as mature bucks may bend the panels or even cause a section of the fence to lean and eventually collapse. This is most commonly observed in conjunction with steel t-posts in deep, coarse sandy soils. Finally, the ends of the wires protrude slightly and may have sharp corners, which can cause injury to animals and especially the installer.



Figure 12-8. Leaning on a fence can eventually cause it to bow down.

Chain Link Fence

Chain link fence, shown in Figure 12-9 is readily available at most hardware or home-improvement stores and can be found in various heights and lengths. Prices for 50-foot lengths vary from \$57 for 48-inch 11 ½-gauge to \$189.04 for 60-inch 9-gauge (Lowe's, 2014). Posts, top rails, gates and concrete add to this cost.

Advantages: Chain link has an attractive appearance and also helps prevent access by predators. It is strong and, being galvanized, rust is not a factor. It is suitable for all ages, sexes and breeds.

Disadvantages: Chain link fence is heavy and may be difficult to install. Due to the relatively small diameter of posts for chain link fence, cement is recommended, especially for corners, braces and gate posts, to prevent the fence from leaning. Horned goats occasionally become entangled. Some animals may try to climb chain link. Repeated



Figure 12-9. Chain link fencing.

climbing or rubbing may cause the fence to stretch and bow. Also, many goats have learned to push against the bottom of traditional gates, forcing their way through to escape, while others have discovered how to raise the latch. An extra bottom latch and locks of some form on both latches are highly recommended.

Wood Fence

Materials for wood fences can be obtained from many sources. Lumberyards and home-improvement centers carry both treated and un-treated lumber, plywood and posts. Sawmills may provide "rough-cut" hardwood lumber in various dimensions at reasonable prices. Economy-minded producers may even wish to cut posts and poles from their own property.

Advantages: A wood fence can be built with only post-hole diggers, hammer, nails and a saw. No special tools are needed. It can be built to the contour of the terrain. Depending on the desires of the owner, it can be either painted or rustic in appearance. Plywood, commonly available in 4-foot by 8-foot sheets and varying thicknesses, creates a barrier that goats cannot see through, squeeze between or get a foot hold to rear up on, and cannot get a head or leg caught in. Addition of a strand of 4-point barbed wire or electric fence at the bottom can prevent predators from digging under this barrier. Boards also can be spaced in such a manner as to provide secure containment of goats, while denying access to predators.

Disadvantages: Untreated or unpainted lumber decays with time and exposure to the elements. Commercially-treated posts and lumber are available, but many preservatives contain arsenicals or other chemicals, which are toxic if consumed by animals. Paints may also contain toxins. The adhesive which binds the layers of plywood will rapidly deteriorate from rainfall, if not protected by paint or other sealant. Also, goats often will nibble on many varieties of wood, eventually consuming the fence and allowing for escape.

Net Wire or Field Fence

Field fence as shown in Figure 12-10 is purchased on rolls, usually measuring 330 feet. Like wire panels, field fence is available in many heights and with numerous options regarding the size of openings. Currently, a roll of 39-inch sheep and goat fence (the least expensive option) costs \$109.17 (J&I Mfg., 2014). Although a confinement pen construct-



Figure 12-10. Net wire or field fencing.

ed solely of this material would not be tall enough to prevent some animals from escape. Woven horse mesh with 2-inch by 4-inch spacing can be found in 100-foot and 200-foot rolls and ranging from 48 to 72 inches tall. V-mesh also is available in 165-foot rolls and with a choice of 50-inch or 58-inch heights.

Advantages: When properly installed, field fence adapts to the contour of the terrain. Properly selected varieties help deny access to predators and prevent exit by goats. It is available at most farm centers, building material suppliers and home-improvement stores. Galvanized fencing resists rust. It can be used with pipe or wood corners and brace posts can be either wood posts or steel t-posts. Field fence can be utilized in combination with electric fence or barbed wire to resolve special problems such as confining mature bucks in isolation. It can also be added to an existing barbed wire fence simply by stretching it tightly from the corners or stretch posts, attaching to the posts with clips, wire or staples and securing to the barbed wire with hog rings.

Disadvantages: As with wire panels and chain-link fencing, goats can get their heads and/or horns caught in field fence, especially if no attention is paid to the dimensions of the openings in the mesh. Special efforts must be made to adapt field fence to irregular terrains. Due to weight and awkward dimensions, it requires two people (or great innovation) to build field fence.

Barbed wire

Barbed wire is readily available from almost any farm center, building supply or hardware store. Like other materials, it is galvanized and resistant

to rust. It comes in 440-yard rolls, in either 2-or 4-point varieties. It is available in diameters of 12 ½ gauge, 13 ½-gauge and gaucho (small diameter which should not be overtightened).

Advantages: Availability and ease of construction are the primary reasons for use. With correct spacing of wires, a predator-resistant barrier can be built. It can be attached to almost any type of post. It readily conforms to almost any terrain. Existing barbed-wire fences can be adapted for goats by using small-diameter “stays” of wood, metal, plastic or other materials placed closely together and attached to the barbed wire with wire, fence staples, or other methods to prevent goats from escaping.

Disadvantages: Barbed wire has sharply-pointed barbs at regular intervals along the full length of each strand in a fence. While these discourage goats and other livestock from attempting to escape or push against the fence, the barbs can cause severe injury to both animals and people, especially during construction. Attaching either twisted wire or wood stays to prevent escape by goats is hard work and time-consuming.

Electric fence

Electric fencing has been used successfully for holding animals of almost all species. It can be either temporary or permanent, and may be constructed with high-tensile wire, light electric-fence wire, wide, flat poly tape, or twisted plastic rope/wire combination. (Figure 12-11)

Depending upon the location and the needs or desires of the rancher, chargers are available, which are powered by batteries, solar energy or by plugging into an electrical outlet. Some sources recommend chargers that will supply 4,500 volts of electrical current for goat fences (the same sources suggest 2,500 volts for cattle fence). A properly-operating ground connection and good insulators are vital to success with electric fence.

Advantages: Electrical fence is easily installed. It does not require tremendous tension because the animals do not push against a properly-operating electric fence. Predators develop a great respect for an electric fence. Insulators are available for wood posts, steel t-posts, or almost any other type of support for the wires. In addition, posts can be purchased that are of non-conductive materials. Electrified wires can be placed below and between existing strands of barbed wire, or placed a few inches inside other materials to prevent climbing or pushing.

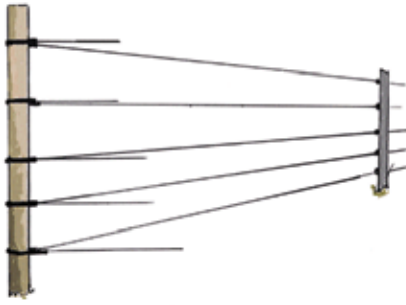


Figure 12-11. Electric fence.

Disadvantages: Electric fence can be disabled by contact with weeds, fallen limbs, lightning or other interference, and goats will quickly discover the lack of current and escape. Drought can disable all but the deepest of ground contacts. Deer or other wild animals may occasionally come into contact with electric fence. Their panicked reaction can tear

down even the sturdiest fence. On occasion, the owner or members of the family may accidentally contact the electric fence. While not fatal, this can disrupt the harmony associated with farm life.

Other options

Other methods and materials for containing goats are available. This chapter has only attempted to describe the most common alternatives. Goat ranchers have successfully used the choices described, or combinations of these options, successfully for generations. Failure to include a type of goat corral in this manual is not intended to imply that it is inadequate or defective. Materials and designs for goat pens should only be limited by imagination and budget. Proper research and planning are the keys to successfully containing the goats.

Chapter 13

Predator Control

Brian Pugh

In Oklahoma, goat producers are blessed with climatic conditions conducive to viable goat production. However, they also are burdened with the eastward expansion of predator populations that constantly are increasing. Predator control within a goat herd is probably one of the single most important factors in maintaining profitable returns from a goat operation. In 2004, U.S. losses of goats and kids to predators totaled more than 155,000 head at a value of \$18.3 million. Figure 13-1 shows the percentage of sheep and goats lost to various predators in the U.S. during 2005. Comparing these figures to a death loss of 260,200 head with a value of \$33.3 million for all other causes (respiratory, viral diseases, weather, age, theft and other causes), shows what a heavy toll predators can take on a goat operation (United States Department of Agriculture, 2005).

What are predators? Many animals qualify as predators with respect to a goat herd. However, coyotes, feral or pet dogs and to a lesser extent bobcats top the list in goat depredation studies (Figure 13-2). Occasionally, foxes, eagles, mountain lions and bears also can cause losses of goats and kids. The day may come where goat losses to these latter species may become more frequent in the forested areas of Oklahoma.

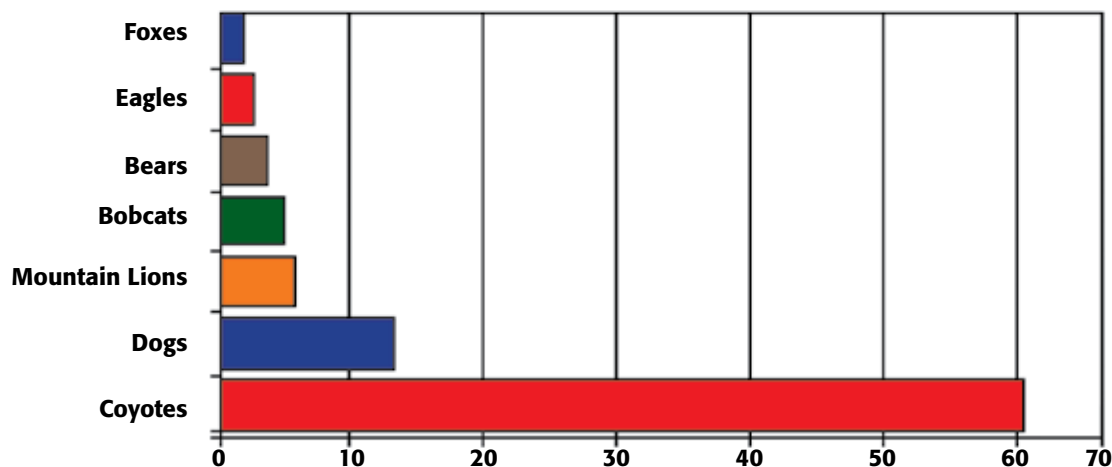


Figure 13-1. The percentage loss of sheep and goats by predator species across the U.S. (USDA, 2005). Note: Data was not available for goat losses only.

Figure 13-2 shows the percentage loss of sheep and goats by predator species in Oklahoma in 2005 compared with other causes of death. As expected, coyotes are Oklahoma's top predator. It is also apparent from the graph that Oklahoma has a larger problem with goat predation due to dogs than the U.S. as a whole (27 versus 12 percent). This could be contributed to a higher human population density, therefore, dog density when compared to other goat-producing areas in the U.S.

So how do producers deal with predators? Most responses focus on a lethal method of control. Most producers often overlook the easiest and sometimes most efficient methods of minimizing predation, which are management practices keeping the predators away from the prey.

Integrated Predator Management

Most producers are familiar with the concept of IPM (Integrated Pest Management). However, producers should consider the concept of Integrated Predator Management (IPM) for their goat herds. IPM is just that, an integrated approach strategy for reducing and controlling predation within the goat

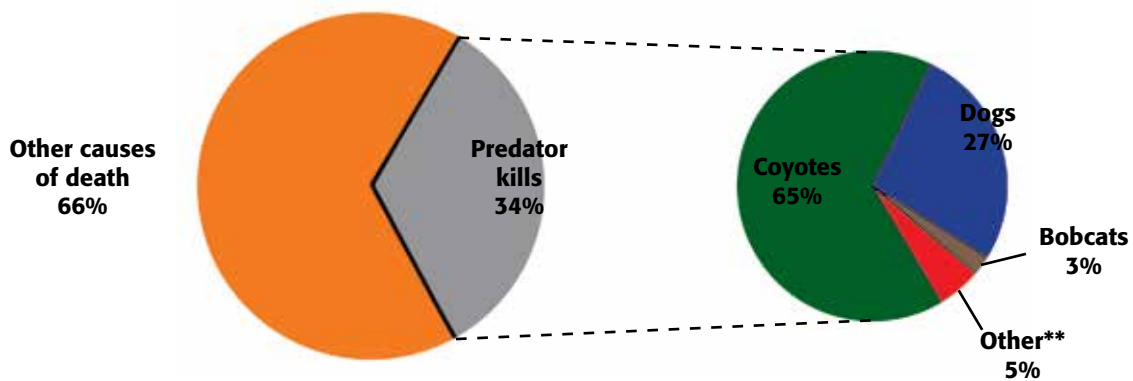


Figure 13-2. The percentage loss of sheep and goats by predator species in Oklahoma (USDA, 2005). Note: Data was not available for goat losses only. ** Other refers to losses from foxes, vultures, eagles, and other small predators.

herd. Many methods are available for predator control, ranging from a very passive control effort to lethal control practices. Each producer has a choice of method to employ. However, no one method of control will completely reduce depredation of the goat herd. Therefore, a number of these methods should be used together to address the prevention and control of predation events.

From an economical standpoint, producers need to prevent predatory losses, rather than control the problem once it has occurred. The method of only greasing the squeaky wheel is the wrong approach for predator control. With predators, the wheel should be constantly serviced to prevent the dreaded failure. Once any predator has killed, that predator will return again to claim another meal. Preventing that first meal is where this chapter will focus its attention.

Basics of Integrated Predator Management

The following methods are examples of nonlethal predator management:

- physical separation (fencing, night penning and sheds)
- cultural practices (herding, carrion disposal, herd checks, culling and habitat management)
- predator deterrent (fright tactics and guard dogs)

Lethal control predator management would include:

- predator thinning by trapping
- hunting
- using toxicants

Nonlethal Methods of Predator Control (Passive Control)

Nonlethal predator control is the most widely used and trusted method for reducing goat losses. These methods are usually viewed by the public as management practices imposed by the producer and not predator control in the traditional sense. These passive techniques work well because the emphasis is on keeping the goats in a safe, healthy environment before problems arise. Once again, an ounce of prevention is worth a pound of cure.

These methods do not directly address eliminating predators from the area, but dealing with isolating the goat herd from predators. Passive methods used for predator control include: fencing, kidding sheds, day herding, night penning, fright tactics, carrion removal, culling weak animals, frequent herd checks and habitat management. Another popular method used widely across the U.S. is the presence of a guardian animal such as a dog, llama or donkey.

Fencing

A well-constructed fence of woven or high-tensile electric wire can sometimes repel the majority of predators. Coyotes prefer crawling under fences, and they are inclined to dig under an impassible woven-wire fence. An apron fence prevents digging, but is costly. Apron fences should be buried perpendicular to the existing fence and be approximately 2 feet wide. If cost prohibits using an apron fence on a large scale, it is a great option for corrals.

Electric fencing also is a highly feasible option for most goat operations. To adequately deter coyotes and dogs, a 5- to 6-foot fence with top wires no more than 8 inches apart and four bottom strands with a 4-inch spacing should be installed. This con-

figuration will practically eliminate predators from crossing onto the property. An additional electric wire can be added 8 to 10 inches out from the bottom of an existing electric or net wire fence, spaced 6 to 8 inches off the ground to discourage digging or crawling under the fence. Fencing options are discussed in greater detail in Chapter 11.

Kidding Sheds

Kidding sheds are a simple, but effective method of removing goats and their kids from high-risk predation areas. Kidding sheds are structures for use during the kidding season, and they provide not only relief from inclement weather, but also reduce predation. The sheds are usually located in highly visible areas, close to a barn or house. These sheds do not necessarily deter predators from entering, but they do remove doe goats from secluded areas of the pasture during kidding. Kidding sheds are discussed in more detail in Chapter 12.

Day Herding

Day herding is another technique used to reduce predation on the goat herd. There are two forms of day herding, herding by the producer (common in other regions of the world) and herding by a guardian animal. This is a very labor-intensive process if left up to the producer, which requires close supervision of the herd during daylight hours. With many U.S. producers holding down another job during the day, day herding may best be accomplished by a trained guardian animal. This method seems to be the most widely used form of day herding in the U.S., and it can drastically reduce predation during daylight hours. Trained guard dogs will be discussed starting later in this chapter.

However, even with constant supervision during daylight hours, a goat herd is likely to receive the most pressure from predators at night. This minimizes some of the effectiveness of day herding without the use of a full-time guardian animal.

Night Penning

An effective method in both research studies and on goat operations is night penning. As previously stated, predators are most active during dawn, dusk and nighttime. By removing the goat herd from distant and secluded areas (brushy areas) during these times, the contact between the predator and prey can be effectively limited.

The pen must be constructed of impassible wire that neither the goat nor the predator can breach (see

Chapter 11). The pens usually are constructed close to the barn or the producer's house for convenience and safety. Again, this method requires intensive labor inputs, but the rewards justify the additional work. The goats must be gathered in the evenings and driven into the pen. In the morning, they can be let out into the pasture on their own accord. This method can be extremely effective with the help of a guard animal, who will learn the penning routine along with the goats and can be the sole protector during daylight hours. Obviously, the size of the herd, grazing distance from the pen, and a producer's penning facilities will dictate whether this is a viable method of protection.

Fright Tactics

Fright tactics also have been tested and used for quite some time. According to some research, fright tactics are only marginally effective for predators. The tactics that work well do not work for very long. Predators are predators for a reason; they learn through experience what is a meal, an enemy or a dangerous situation. What might frighten them for the first few days becomes second nature after a few weeks, and they go back to their predatory ways.

Some tactics have included loud bursts of sound, moving and flapping objects, perimeter lights with motion sensors and even scarecrows. Some research shows that for noise-making devices to be effective, they must be discharged within close proximity of the predator's ear (within 1 to 2 feet). This is very difficult to accomplish, and eventually the predator becomes conditioned to the sound stimulus and learns that it is no real danger.

Other research studies have indicated (Linhart et al., 1984) that timed devices, set to activate at predetermined time intervals were less effective because the predators habituated themselves to the stimuli. A tested device that was triggered every eight minutes during darkness was effective for 91 nights before coyotes returned to predation, indicating that using animal-activated devices (not timed), and devices with varying sounds and movement can delay or even eliminate predator habituation.

However, other studies have shown a very significant decrease in depredation with the use of two frightening devices (Vercauteren et al., 2003): an acoustic device and an acoustic scarecrow device with a strobe light, that when triggered by motion sensors, initiates a moving scarecrow. The study was conducted on 4,500 ewes. After 288,000 sheep/nights (number of sheep times the number

of nights) 240 sheep were killed in the unprotected herds, while no sheep were killed with the use of either device after 12,685 sheep/nights.

Objects that move and flap with the wind or are motorized can have some positive results. However, repetition once again shows the predator these objects are not harmful. On the other hand, one of the main attractants of bobcats is something that flaps and moves with the wind, much like a ball of string or a feather floating on the air is to a house cat. Therefore, producers must use their own judgment when it comes to moving objects. Attracting a highly efficient goat killer onto the property is not desirable.

Some producers hang dead coyotes on their fences in an effort to deter other predators from returning. However, producers must be conscience of how the nonagricultural public sometimes perceives this as blatantly showing disregard for wildlife. No available research shows a reduction in predation when using the dead animal method, although it is often repeated by some producers.

Removing Carrion

Any carcasses, afterbirth and other materials should be disposed of properly and in a timely manner. Predators have excellent noses and once a carcass has ripened a few days, they can smell it from a great distance (Figure 13-3). By disposing of these carcasses by burial, incineration or composting, producers can reduce the odors that attract predators onto the property. Similarly, carcass dumps are excellent places for predators to get a taste of what is on the farm. As soon as does kid, any remaining afterbirth should be transported away from the farm or buried in a location predators are not likely to find it. The goal is for all nearby predators to never acquire a taste for goat meat.

Culling Weak Animals

Weak animals are probably one of the greatest attractions for predators besides carrion. A weak goat in the herd is attractive for every passing predator. Because the animals are weak, it becomes a part of natural selection that only the strong survive. Predators are constantly on the lookout for the easiest meal possible, and will notice these weak members of the herd. These goats should also be culled to increase the herd performance level. A weak or chronically sick goat requires more care and supervision; therefore, increasing costs and labor. Producers need to maintain a healthy, strong herd to reduce its attractiveness to predators.



Figure 13-3. Carrion should be disposed of as soon after detection as possible.

Frequent Herd Checks

Another vital management tool producers can implement to reduce depredation of the goat herd is simply to conduct frequent herd checks. No other management tool can replace actually viewing the animals on at least a daily basis. By observing the herd on a regular schedule, producers can start to recognize problems before they start. If a predator kills two goats a day, producers should realize this the next day and try to remedy the situation as soon as possible. For every day the problem is left unresolved, more goats could be lost. For livestock of any kind, herd observation is crucial to the efficiency and production of the herd.

Habitat Management

Controlling the growth of habitat surrounding the operation and at least around the barns and pens should be of utmost importance. Coyotes rely on ambush tactics to catch and kill larger prey. Brushy areas are excellent habitat for coyotes because it offers them everything they need. They have shelter from weather, other food sources and a means to more easily stalk and ambush goats.

Brush piles and briar thickets also are not a good idea around a goat operation. Rabbits tend to prefer these areas and can reproduce at an alarming rate. Rabbits are a preferred food source for almost every predator, and they are attractive enough to cause predators to linger in the area.

Using goats for habitat management presents a dilemma: how to use goats to control brushy habitat growth that predators love and not lose any goats to the predators. Whether using goats for weed or brush control or just grazing the goats in wooded areas, producers should keep in mind that goats are very vulnerable to predators during these grazing

forays. If possible, the goat's movements should be restricted to only those areas being cleaned, which allows the goats to flash graze the habitat in a short amount of time. The longer they are in this dense habitat, the greater chance a predation event might occur. When the habitat is thick and impenetrable, intensively graze these areas to thin them as quickly as possible, use a guard animal and remove the goats during the night.

Guardian Animals

When choosing a guardian animal for the herd, the options vary widely. Guardian animals are not considered a necessity for a goat herd, although they can be of benefit. Every situation is different for each operation. Guardian animals drastically reduce predation in most research studies. However, some producers have had little or no luck with guardian animals and have had problems such as guard dogs killing goats or never staying with the herd.

For some producers who have implemented many of the passive methods described in this chapter, a guardian animal could be an unnecessary expense. Again, each producer must honestly assess the individual situation and determine what combination of methods will work best for them. However, a well-trained guard dog or other guardian animal kept in a goat herd that is accessible to predators will decrease predation events.

Guard Dogs

The most common guardian animal is the dog. Various breeds of guard dogs are available, yet they all have similar features in common. They should be loyal to their owner, attentive to the herd and fearless when faced by a predator. Some say that a guard dog instinctively protects goats, others say training them is a must. It actually takes some of both. Most breeders agree that by familiarizing the pup with the producer and breaking them to lead and tie, problems are avoided down the road. Most of what a dog uses to deter predators is instinctual, but a dog's friendliness to the goats and the producer hinges on early training.

By breaking dogs to lead and tie, goat herds can more easily be relocated along with their protectors. It is also a necessity if cable snares are used for coyote control. A dog caught in a snare will associate this with being tied, and generally lay down until help arrives. A dog's training should be productive

and short. Too much time spent with the pup will build the bond between the producer and the dog, not the desired interaction between the goats and the dog. At a young age, pups should be introduced to the herd, as shown in Figure 13-4, with human supervision at the beginning. If all signs are positive, the dog can be left in a corral with the goats to continue the bonding process.

Although guard dog options are varied, the cheapest pups in the local newspaper are usually not the best option. Most experts agree that contacting a reputable breeder, with known bloodlines, to find dogs compassionate to goats and have the guarding instinct well-bred into their bloodline is a better choice.

Another option is to buy proven adult dogs such as those shown in Figure 13-2, which typically costs more money, but they can be trusted with the herd and used to train future pups. Most proven adult dogs cost from \$300 to \$500. However, being assured the goat herd is safe from predators and the dog itself is repayment enough.

Unfortunately, the investment does not only consist of the purchase price. Most breeds of guard dogs are of large stature and require an equal proportion of dog food. An adult dog can require about \$150 to \$250 of annual maintenance costs (such as feed and health care), which can make one of these dogs a sizeable investment.

This investment probably cannot be recovered with a small herd (10 to 15 head), because of the possibility that very little predation would occur on a per head basis. However, if you depreciate the dogs purchase price over five years and add annual maintenance costs (\$100 + \$200), it takes just \$300 worth of goats each year to pay for one dog. At 2007 prices of roughly \$1.00 per pound for a 70-pound kid, a competent guard dog need only save four kids to pay for itself (assuming the high range of



Figure 13-4. A puppy should be introduced to the goat herd while still young.



Figure 13-5. Proven adult dogs can usually be trusted with the goat herd.

dog maintenance costs.) Understandably, most experts agree that trying to reduce the yearly maintenance costs is not wise. Hungry guard dogs are more likely to roam away from the herd in search of food, and in some cases malnourished dogs have turned on the goats themselves.

Different breeds are available for guarding a goat herd, yet no available research shows a propensity for one breed over another. However, some of the following breeds are more people friendly than others, and in populated areas, this should be taken into account. In essence, the choice comes down to personal preference and availability of a breed/breeder in the area.

Great Pyrenees

The Great Pyrenees, shown in Figure 13-6, is one of the most popular guard breeds in the U.S. Originally from France, they are a good natured, trainable dog, mildly athletic and attentive to the herd. Problems with hip dysplasia have been evident in the past, more so in this breed than others, which could be due to their popularity and the higher numbers of dogs in the U.S. Great Pyrenees are large white dogs that stand 25 to 32 inches at the shoulder. Their mature weight is from 85 to 140 pounds.

Anatolian Shepherd

Originally from Turkey, Anatolians, shown in Figure 13-7, have immense speed and agility and are fierce in battle. They are trainable and kind to the herd, but can be stubborn. These brown colored dogs stand 27 to 30 inches at the shoulder and weigh from 80 to 150 pounds, appropriate to size and structure. They are very muscular, athletic-looking dogs, with heavier weights evident in the males.



Figure 13-6. Great Pyrenees.



Figure 13-7. Anatolian Shepherd.

Akbash

Originally from Turkey, the Akbash, which means white head, is shown in Figure 13-8. These dogs are calm natured and attentive to the herd. They carry a keen protective instinct for not only the herd, but also property (territory). Adult dogs stand 27 to 31 inches at the shoulder, weighing from 75 to 130 pounds, with males being the heaviest.

Maremma

Another popular guard dog breed, the Maremma (Figure 13-9), is originally from Italy. They are intelligent thinkers, courageous and pos-



Figure 13-8. Akbash.



Figure 13-10. Komondor.



Figure 13-9. Maremma.

sess a strong distrust of strangers. They have been used successfully for protecting herds and families. However, this tendency against unknown humans should be considered for safety reasons. They are athletic, very active and in constant need of a job to keep them busy. Maremmas are white, mature at a height of 24 to 28 inches at the shoulder and a weigh of 65 to 100 pounds. Maremmas are one of the smaller-sized breeds of guardians, and therefore might be useful for smaller operations not wanting the maintenance costs of the largest breeds.

Komondor

Originally from Hungary, Komondors, shown in Figure 13-10, are the picture seen in many people's minds upon hearing the words sheep dog.

Long chord-like hair covering the body characterizes this breed. They have been used successfully to fend off coyotes and bobcats in the western U.S. Komondors are hardy in foul weather, big statured and muscular, although they are not as heavy as they appear. Mature shoulder heights are 27 to 31 inches, with a mature weight of 80 to 100 pounds. Consideration should also be given to the use of this breed in a warm climate, as its hair would likely increase heat stress in these dogs. (Breed information from the Purdue University website, 2006).

Guard Dog Choice

These dogs are not the only breeds available to be used as guard dogs; but these are some of the more popular breeds in the U.S. For further information on different breeds of guard dogs contact the local Extension educator. Breed choices are strictly up to the producer, and recommendations cannot be made as to what breed is the best for any given situation. A study in Colorado showed no difference in success rates for preventing predation between the breeds mentioned above. The study also showed no difference in protection abilities between males, females or neutered males. However, their research did indicate that neutered males were less likely to wander away from the herd than intact males.

Llamas and Donkeys

Llamas, shown in Figure 13-11, and donkeys are another option for use as guardian animals. Some producers have used them successfully to reduce



Figure 13-11. A llama with a goat herd.

predation. The following characteristics are some of the benefits of using these species:

- They are less likely to be affected by traps and snares.
- They are less likely to injure or kill goats in the herd (reported by some producers).
- They eat the same forage available to the goats, thereby reducing labor and costs (any forage consumed by these species is actually a hidden inputs cost).

However, these two species have not shown the same level of protection as the dog in research studies.

Llamas and donkeys do have some drawbacks:

- They will not stand their ground against mountain lions or bears.
- They must be carefully introduced to the herd in the beginning.
- Both llamas and donkeys must be gelded (castrated) to be effective.
- One donkey per pasture/herd is all that is recommended. Any more than one, and the donkeys will bond with each other and ignore the herd.

Again, many options are available for guardian animals that must be assessed by the individual producer. Goat producers who have had a good guardian llama or donkey say they will never own anything but that species. Others have had nothing but headaches from these two species. Producers must use their own judgment and make a selection that will meet their management goals.

Multiple Methods Most Effective

So which one of these methods is the right one for a goat operation? The deciding factor is how

intensive is the producer willing to make the management inputs. In reality, using as many of these methods as possible will increase the success of controlling predator losses. The sum of combined methods offers greater protection than the value of each individual method. For example, a well constructed fence, a guard dog, night penning, culling all weak animals and frequent herd checks will result in less predation than if only one method from this list is removed.

Lethal Methods of Predator Control (Active Control)

When passive efforts have been exhausted and goat predation is still occurring, increasing predator control efforts and stepping up to an active control method may become necessary. As the name implies, active control methods usually result in the reduction of predator numbers within close proximity of the goat operation.

However, producers unsure about lethal control practices should not be concerned with totally eradicating the predator, especially the coyote (Figure 13-12). Despite extensive harvest of predators such as coyotes, they continue to increase their populations yearly at an alarming rate. The same adaptation that allows them to live in suburbs, wilderness areas, deserts, and extremely cold regions also allows them to be adept goat killers that are quick to realize human patterns and avoid danger. This self-preservation instinct also is what makes an educated goat killer a very big problem for producers



Figure 13-12. A coyote.

and drastically reduces the methods available for successful control.

First, producers must develop a control plan. They should remember that a coyote is a territorial animal, which means that every individual coyote establishes a home range or territory in which it hunts for food, mates and dens. It must determine its own social rank in the pecking order of other surrounding coyotes. Therefore, every coyote home range is a sign of rank, or status, within a family pack. When one animal dies or is driven away, another animal will claim this territory, either an animal from the family unit, or perhaps a new transient coyote. This is where the problems with eliminating all coyotes on sight begin.

Many research studies have shown that by eliminating local coyotes which no propensity to prey on livestock, the door is being opened for other potential goat killers to take up residence. Therefore, producers must first assess if they are truly surrounded by goat killers. If not, it may be in the best interest of the herd to reevaluate a few of the passive techniques and improve the perimeter barriers.

If producers are interested in active control, it should be because they do have a predation problem already occurring. If this is the case, it might surprise some producers that the bulk of goat kills can be blamed on one or two animals. A 14-year study conducted by UC Berkeley and USDA indicated two very important points to remember when approaching active control methods. The most intriguing find was that sheep losses due to predators were not correlated with predator removal numbers. This result means that by harvesting more predators, producers will not necessarily see a reduction in predation.

However, they also found the dominant alpha coyote was responsible for 89 percent of the 74 dead lambs during a two-year portion of the study. The subordinate betas were responsible for no lamb kills. This indicates that by targeting the alpha leader producers can drastically reduce goat depredation. Regrettably, alpha coyotes are the most difficult to capture because of their survival habits.

Cable Restraints

The use of cable restraints and foothold traps are both excepted methods for capturing wary predators. Cable restraints (also known as snares) are a very effective tool for coyote control because of their ease of use, light weight, the travel patterns

of coyote and the willingness of a coyote to enter a restraint. The 3/32-inch aircraft cable is the accepted size for use on coyote restraints; 5/64-inch and even 1/16-inch cables can be used for bobcats and fox. Cable restraints are useful for bobcats if used correctly. However, cats tend to shy away from snares unless the set is perfect.

Crawl-unders are locations where predators have excavated the soil from beneath the fence creating a crossing. These crawl-unders are an ideal position to hang a restraint, as the coyote is habituated to the crossing location as well as the sight of cable or wire at the set (Figure 13-13). Restraints set in these locations should be supported from the fence, have a 7- to 10-inch loop diameter, and must be 2 inches off the ground. When crawling under a fence, a coyote scoots its front feet on the ground to ease its shoulders under the fence. A restraint loop touching the ground will invariably be tripped and become ineffective.

If the producer wants to capture an animal alive (in case it is a neighbors' pet or guard dog), it is important to stake the end of the restraint away from the fence and nearby brush to prevent entanglement. Some caught coyotes have been known to attempt jumping the fence, and will hang themselves if allowed enough slack. The preferred way to prevent the animal from expiring is to install a snarelock. This device prevents the snare from closing far enough to cause asphyxiation of the restrained animal. Other useful set locations are on a coyote trail leading to carcass disposal locations, near stream crossings and in trails in tall grass.

NOTE: Check local game laws before setting any trap or cable restraint in trails or near exposed bait or carcasses. For more information on setting cable restraints for predators, check with the local

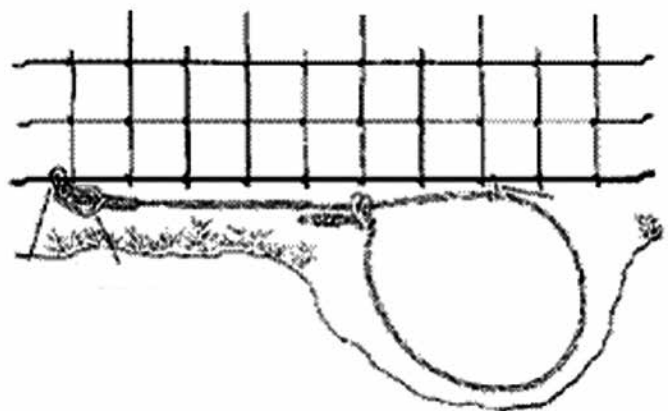


Figure 13-13. A crawl-under cable restraint.

county Extension educator for books and articles published by research universities.

Trapping

Steel Foot-Hold Traps

Steel foot-hold traps have come a long way in the past few decades, and the public's perception of broken legged animals chewing their foot off could not be further from the truth. Traps are modified with wide jaws to increase surface area and reduce pinpoint pressure and skin abrasion. In-line springs are installed to reduce the force of a predator's movements and eliminate shoulder injury to the animal. Most animals are caught across the pad of their foot, never up on the leg, and very little damage is done.

These trap modifications are in an effort to release all nontarget animals, and in fact incidental catches of guard dogs or pets can be released with little injury. After one capture of a guard dog, it becomes aware of what the traps are and avoids them in the future. However, coyotes can learn the same response from a sprung trap and repeatedly dig up set after set, so caution must be used to catch the predator the first time around.

Live Traps or Cages

Unfortunately, coyotes are almost impossible to trap in live traps or cages. It is against their nature to enter a tightly confined area. However, bobcats can be captured very successfully in just these situations. Some wildlife agencies offer services to producers who need problem predators removed. The local game warden also may be able to introduce producers to a local private trapper who can help with the predator problem. A valid point to remember is that a trap in an inexperienced person's hands can alert local predators to the control efforts. The professionals then have much more difficulty completing the job efficiently once called to the scene.

Denning

Denning is a method of coyote control used throughout the spring when females have their pups in dens. The den is located through observation of the adult female, and the pups are removed from the area. Usually, the female also will leave the area. This method is useful for reducing the number of coyotes in the area. However, it does require a rather large investment of time to find the denning sites of numerous coyotes.

Predator Calling (hunting)

Another method of predator removal is using wildlife callers to effectively hunt these predators (Figure 13-14). Coyotes, bobcats and foxes are lured within gun range by the sound of a dying rabbit (or in some cases, a bawling kid goat for the predators that know what this sound is). A competent hunter in coyote country can be very effective in removing some of the bolder coyotes looking for a meal. As long as hunters understand where they can and cannot hunt and shoot and knows the rules, they should follow on any property, a beneficial partnership can develop for little or no money to the goat producer with very good results.

M-44 (Sodium Cyanide) and Livestock Protection Collars (LPC)

Toxicants, such as M-44 (sodium cyanide) and livestock protection collars (LPC), are illegal to use in Oklahoma and some other states for all parties except wildlife control agencies. The main concern with the use of laced bait and gas discharge toxicants by anyone untrained in their use is the indis-



Figure 13-14. A producer holds a bobcat that was threatening his herd.

criminate death of any animal that comes into contact with these devices. Therefore, if all other methods of control fail and this is the next logical step, please contact the nearest wildlife control agency or Oklahoma chief game warden. The local county Extension educator will also be happy to assist producers in making the initial contact.

Summary

As more and more goats make their way onto Oklahoma farms and ranches, the need for effective predator control increases. Coyote and bobcat populations are on a steady rise, and the occurrence of mountain lion and black bear sightings in southern Oklahoma has increased drastically in the past 10 years. Goat producers will face a predator problem at some point in time.

Again, the key to reducing goat predation to acceptable levels begins with the idea of IPM (Integrated Predator Management.) Producers must realize that any one method will not eliminate predation of their goat herds. A combination of passive methods and active control, when necessary, can result in greatly reduced pressure on the goat herds, without trying to eradicate the predator. Regardless of the producers' decisions, they also must remember that even predators serve a function in the grand

scheme of things, and they can be very beneficial for keeping vermin numbers in check. Ideally, the producer should be responsible for controlling the goat herd population, not the local predators.

References

- Andelt, W.F. (1995). Livestock guard dogs, llamas, and donkeys. Colorado State University Cooperative Extension. (23 October, 2006). <http://goatconnection.com/articles/>
- Linhart, S.B., Sterner, R.T., and Theade, J.W. (1984). Efficacy of light and sound stimuli for reducing coyote predation upon pastured sheep. *Protection Ecology* 6: 75-84.
- Littlefield, R.R. (1995). Predator control with guard dogs. University of Wisconsin-Madison. Chippewa County Extension Service.
- Lorenz, J.R., Coppinger, L. (1996). Raising and training a livestock-guarding dog. Oregon State University Cooperative Extension. EC 1238, Extension publication.
- Purdue University. (2005). Using guard dogs as predator control. (23 October, 2006). <http://ag.ansc.purdue.edu/sheep/>
- Vercauteren, K.C., Lavelle, M.J., and Moyles, S. (2003). Coyote-activated frightening devices for reducing sheep predation on open range. 10th Wildlife Damage Management Conference Proceedings.
- United States Department of Agriculture. (2005). Sheep and goats predator loss. National Agricultural Statistics Service (NASS), Washington D.C. (5 January, 2006). <http://usda.mannlib.cornell.edu/>

Chapter 14

Record-keeping

JJ Jones

Record-keeping is a very important part of any agricultural enterprise. By keeping both production and financial records, producers are better able to manage their operations. Without records, a producer will have a harder time determining progress made towards the operations' goals and objectives. This chapter discusses the methods of keeping records and what types of records should be maintained.

Record-keeping Methods

Two basic methods of keeping records are available to producers. These methods are hand-written (Figure 14-1) and computerized record-keeping programs. Each method has its advantages and disadvantages. Individual producers must determine which method fits their situation and resources. But neither system works if there is no consistency or regularity in how the records are maintained.

Hand-written Record-keeping

Hand-written record-keeping can be the simplest method. For hand-written record-keeping systems, producers can use a published workbook such as the E-908 Oklahoma Farm and Ranch Account Book or a simple ledger book. Either method requires pe-

riodic entry and summation. The major problem with a hand-written record-keeping system is that producers must manually summarize the records, which could lead to math mistakes or omissions.

Computerized Record-keeping

Computerized record-keeping systems are the more costly of the two systems. To use a computerized record-keeping system, a producer must own a computer and also purchase the necessary computer software programs. Producers must find a record-keeping software system that fits their needs and abilities. Both production and financial record systems are needed, but typically few computer programs do both. Because of this, producers may desire to use two different computer programs or a combination of computerized and hand written records.

If a producer is comfortable using spreadsheet programs, they could develop record-keeping programs using spreadsheet software such as Excel. By developing their own program, a producer can tailor the spreadsheet to meet their expectations and needs.

OSU had developed a spreadsheet package that will help producers maintain certain production records. To download this record keeping software visit the OSU Meat Goat website at www.meatgoat.okstate.edu.

Production Record-keeping Systems

Production record-keeping systems are limited in the number available, and many of the programs available are configured for pure-bred breeders (Figure 14-2). Although these programs can be used for commercial operations, the cost and the limited information gained from these programs may be prohibitive.

Financial Record-keeping Systems

Financial record-keeping systems are more readily available than production record-keeping systems because the financial records maintained for a meat goat operation are similar to other types of agricultural operations. Choosing a financial re-

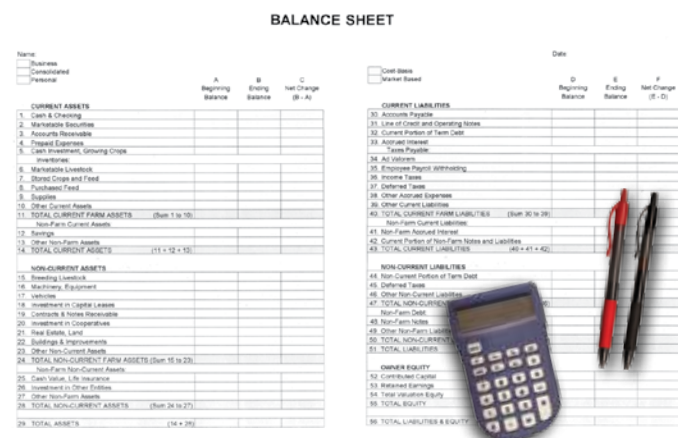


Figure 14-1. Hand-written record-keeping is one of two record-keeping methods available to producers.



Figure 14-2. Proper record-keeping allows producers to keep an accurate inventory of their herds.

cord-keeping system usually is done by personal preference. Several are available that produce similar reports and summary information. When choosing a program, producers should pick one they are comfortable using. Producers may want to check into what programs have workshops available to demonstrate how to use the program for agriculture. One such workshop is the Quicken for Farmers Workshop offered by the Oklahoma Cooperative Extension Service.

Quicken is a financial record-keeping system readily available at any office supply store and is typically priced less than \$60. Quicken's interface is similar to a checkbook register and relatively simple to use. Quicken allows producers to categorize and group transactions for easy reporting. Quicken also allows producers to assign tax categories to transactions, which allows a producer to print tax schedules if necessary. Quicken can be as detailed or generic as a producer wants it to be. Quicken is not a true double-entry accounting software package. Producers needing this should investigate using QuickBooks.

Production Records and Measures

To keep good production records, each goat will need to be individually identified. Once all of the animals are identified, producers can keep track of births, matings, health programs and problems and removal from the herd (Figure 14-2). Animal identifications also help producers match up offspring

with parents. All of these factors help producers make culling decisions in the future. For more information about animal identification, please refer to General Herd Management (Chapter 10).

Meat goat production measures are difficult to define, since no standard performance measures have been established. However, a few production measures do exist that can help measure the efficiency of the operation

Pregnancy Percentage

Pregnancy percentage is an indicator of breeding performance of the herd. Low pregnancy percentages can be an indicator of reproductive or health problems or poor nutrition.

Determining pregnancy percentage requires the use of a veterinarian or special pregnancy-detecting tools such as pregnancy blood testing. Being able to detect if a doe is pregnant means producers can make the decision to cull or rebreed that animal at an earlier time period than waiting until after the kidding season is through.

$$\text{Pregnancy \%} = \frac{\text{Number of exposed does diagnosed pregnant}}{\text{Number of does exposed}} \times 100$$

Kidding Percentage

Kidding percentage is a good indicator of breeding performance. Since goats have the ability to have multiple offspring, the kidding percentage can be greater than 100 percent. Most goat operations will need to maintain a kidding percentage of greater than 160 percent to remain profitable.

Kidding percentage is one of the more economic production factors. This number indicates the number of kids being produced, which is the product to be sold. The higher the percentage number, the more goat kids a producer has to offer at market.

$$\text{Kidding \%} = \frac{\text{Number of kids born (dead or alive)}}{\text{Number of does exposed}} \times 100$$

Kid Death Loss Percentage

Kid death loss percentage can be an indicator of problems with the herd's health program, the kidding environment, nutrition and the breeding program.

The kid death loss percentage number needs to

be as small as possible (less than 10 percent) to assure a profitable operation. A high kid death loss percentage reduces the number of marketable kids.

$$\text{Kid death loss \%} = \frac{\text{Number of kids that died (born dead or died after birth)}}{\text{Number of does exposed}} \times 100$$

Weaning Weight and 90-Day Adjusted Weaning Weight

Weaning weights are a measure of production for each female goat. Typically this is what producers are striving to recover as income from pounds of product. Recording weaning weights of the kids gives a measure of performance of their herd and recognizes individuals within the herd as either top or poor performance animals.

The 90-day adjusted weaning weight is a measure allowing producers to adjust the weaning weights of the kids produced based on certain production factors. Those factors include the number kids born and raised that were born to the dam. The age of dam is also an adjustment factor as well as the sex of the kids when weaned. These adjustments allow for each kid to be compared on an equal basis. The adjustment factors are listed in Table 14-1.

Contemporary Groups

A contemporary group is a set of meat goat kids born and raised together under uniform conditions. Performance testing for genetic evaluation requires

Table 14-1. Goat 90 Day Weaning Weight Adjustment Factors.

<i>Effect</i>	<i>Group</i>	<i>Adjustment Value</i>
Litter Size born – raised	1-1	1.00
	1-2	1.14
	2-1	1.04
	2-2	1.18
	3-1	1.08
	3-2	1.23
	≥3-≥3	1.27
Age of Dam (years)	1	1.10
	2	1.09
	3+	1.00
Sex of Kid (weaned)	Buck	1.00
	Doe	1.11
	Wether	1.08

Source: <http://sheepandgoat.com> - David R Notter, PHD, Virginia Tech

factors like age, nutrition and location to be equal for all kids. Kids in a contemporary group are born within a 60-day period and managed together from birth to weaning. Dams also should be managed similarly to weaning.

Data from kids born outside the 60-day window or managed differently (e.g. show circuit, bottle babies, kept in separate pastures) are excluded from the group. Contemporary groups for kids weaned at three months old are planned 8 to 10 months earlier at the start of breeding. Breeding seasons no longer than 6 to 7 weeks ensure kids will be within the 60-day age range at weaning.

Because ages vary in a contemporary group of kids at weaning, weight comparisons can be biased. A 79-day-old kid cannot be expected to weigh as much as 112-day-old kid. Therefore, weaning weights are converted to a standard 90-day age basis. Two equations are used to generate 90-day weights.

First calculate average daily gain (ADG):

$$\text{ADG} = (\text{Weaning weight} - \text{birth weight}) / \text{weaning age}$$

Once average daily gain is determined, the second equation gives the 90-day weight:

$$\text{90-Day Weight} = (\text{ADG} \times 90) + \text{birth weight} \times \text{litter adjustment} \times \text{age adjustment} \times \text{sex adjustment}$$

When birth weight is not available, ADG cannot be determined. In the absence of birth weight records, the previous equations can be replaced with the following equation based on weight per day of age:

$$\text{90-Day Weight} = (\text{Weaning weight} / \text{weaning age}) \times 90$$

Adjustments are made to 90-day weights because litter size and age of dam can affect weaning weight. On average, weaning weights decrease as litter size increases and young does wean lighter kids than mature does. Multiply 90-day weights by the appropriate correction values (Table 14-1) to get adjusted 90-day weights.

Bucks and/or wethers are typically heavier than doe kids, but sex of kid adjustments are not necessary if comparisons are made within single sex contemporary groups. Buck kids are compared

only to other buck kids and doe kids compared to other doe kids, etc.

Comparisons of the dam’s production would however need these adjustment factors calculated to ensure a fair evaluation of performance between dams within a contemporary group. Table 14-2 shows example records for five does.

An additional step is generating weaning weight ratios. Within each sex group, individual kid weights are compared to the group average to produce ratios for relative evaluations. Ratios show the deviations of kid weaning weights from the contemporary group average. A ratio is calculated with the following equation:

$$\text{Weaning Weight Ratio} = (90\text{-day kid weight} / 90\text{ day herd weight average}) \times 100$$

A ratio of 100 is equal to the group average. A kid with a weight of ratio of 122 is 22 percent heavier than the group average. Conversely, a kid with a ratio of 91 is 9 percent lighter than the group average.

Financial Records

Maintaining an accurate set of financial records is important for two reasons. The first reason is tax preparation. Operating a meat goat enterprise

allows a producer to file an IRS Schedule F, Profit and Loss from Farming Form, as long as that enterprise is operated with the purpose of making a profit. The second reason is to measure the overall financial performance of an operation. The same set of records can be used to do both taxes and measure financial performance.

The types of financial records producers need to maintain can be broken down into four different groups: income, expenses, assets and liabilities.

Income

Income records are simply the amount of money received from the sale of any product or any services performed. When a producer sells a group of kids, the money received is considered income. Also, any money received from government agricultural programs is considered income. Money received from the sale of a capital asset such as a tractor or purchased breeding stock is discussed in the Assets section.

Expenses

The amount of money spent on items needed for the operation of the goat enterprise is expenses. Careful records of expenses need to be kept. Expenses include, but are not limited to, money spent on feed, fertilizer, seed, repairs, supplies,

Table 14-2 Example Records.

Performance Information	Dam ID 30A	ID 201Z	ID 201Z	203A	202
Dam Age	2	3	3	1	3+?
Kid ID	50C	5C	6C	7C	51C
Born - Raise	1-1	2-2	2-2	1-1	2-1
Birth Weight	8	7	5	6	8
Sex	Buck	Doe	Doe	Doe	Wether
Age at Weaning	91	85	85	90	89
Weaning Weight (ww)	60	55	52	45	58
90 D Adj ww	65	76	72	55	66
Ratio	97	114	108	83	99

90 Day Adjusted Weaning Weight Calculations

$$\frac{\text{Kid 50C}}{60-8/91*90+8*(1.00*1.09*1.00)} = 64.7$$

$$\frac{\text{Kid 5C}}{55-7/85*90+7*(1.18*1.00*1.11)} = 75.7$$

$$\frac{\text{Kid 6C}}{52-5/85*90+5*(1.18*1.00*1.11)} = 71.7$$

veterinarian expenses, taxes and interest. Money spent on capital purchases for items with a useful life greater than one year are not considered ordinary expenses, but rather, they are capital expenses. Capital expenses are amortized and depreciated over the life of that capital asset, as discussed in the Assets section. Examples of capital expenses would be breeding animals, tractor, fencing and feeders.

Assets

Assets include everything owned that has value, which includes but is not limited to, land, buildings, purchased and raised breeding animals, tractors, trucks, trailers, equipment, purchased and raised feed and money in checking, savings and investment accounts. The information needed to be maintained includes asset description, age, and value (cost and market). The asset list is used to build balance sheets, determine depreciation schedules, and evaluate the overall net worth of the operation. Extension Fact Sheets AGEC-971, Schedule of Assets, and AGEC-752, Developing a Balance Sheet, discuss in greater detail how assets are used for financial management of the operation.

Liabilities

Liabilities include everything that is owed, which includes, but not limited to, notes payable to banks, equipment dealers, car dealers and individuals. Plus money that is owed to agribusinesses and credit card companies. Information needed to be maintained includes principal balance, interest rate, payments (monthly or annual), and the length of a loan. Liabilities are used to develop balance sheets, determine interest costs and determine solvency of the operation. Extension Fact Sheet AGEC-972, Liabilities Schedule, discusses in greater detail how liabilities are used.

Financial Statements

Once a record-keeping system has been established, producers can then develop their financial statements. These financial statements are the balance sheet, cash flow statement and income statement.

Balance Sheet

A balance sheet is a summary of assets and liabilities of the operation. The balance sheet is one of the most frequently used financial statements for measuring a business' financial position. When

applying for a loan, the first thing the lender will request a balance sheet be provided. An operation's net worth is determined by using a balance sheet. The net worth of the operation is the total dollar amount of assets minus the total dollar amount of liabilities. Extension Fact Sheet AGEC-752 discusses how to create and maintain a balance sheet.

Cash Flow

A cash flow statement measures the cash flow in and out of an operation. Cash flow statements can be done on an annual or monthly basis. Projected cash flows can be done for multiple years in the future. Cash flow statements reveal seasonal patterns of cash surplus and deficits and may suggest when cash is available for debt repayment. Extension Fact Sheet AGEC-751 discusses how to create a cash flow statement.

Income Statement

An income statement combines information from the balance sheet and cash flow statement. An income statement records the revenue and expenses from an operation. It can measure an operation's profitability. Extension Fact Sheet AGEC-753 discusses the methods of creating an income statement.

Once a set of financial statements have been created, calculation of financial ratios can be done to evaluate an operation's financial situation. Analysis of the financial statements and ratios reveal strengths and weaknesses of the operation. Extension Fact Sheet AGEC-237, Farm and Ranch Stress Test, discusses measuring a farm's financial stress level.

IFMAPS

Oklahoma farmers and ranchers can use the IFMAPS program to receive confidential farm business planning. IFMAPS' plans include budgets, cash flow statements, balance sheets, income statements, debt worksheets and financial measures. IFMAPS



support staff can help farm and ranch families identify and evaluate options to improve their financial situations. They also help the producer interpret the financial statements and ratios calculated. For information about the IFMAPS program, please contact the local county Extension educator or the IFMAPS center at 1-800-522-3755.

Conclusion

Both production and financial record-keeping systems are essential tools for any business. The records can be kept in a ledger or on a computer, as long as they are maintained on a regular basis. These records can help producers make production and financial decisions that could benefit the operation.

References

- Doye, D. (2004). Developing a Cash Flow Plan. OSU Extension Fact Sheet AGEC-751. Cooperative Extension Service. Oklahoma State University. <http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1782/AGEC-751web.pdf>
- Doye, D. (2004). Farm and Ranch Stress Test. OSU Extension Fact Sheet AGEC-237. Cooperative Extension Service. Oklahoma State University. <http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1821/AGEC-237web-color.pdf>
- Doye, D. and H. Haefner. (2004). Liability Schedule. OSU Extension Fact Sheet AGEC-792. Cooperative Extension Service. Oklahoma State University. <http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1710/AGEC-792web.pdf>
- Doye, D. and H. Haefner. (2004). Schedule of Assets. OSU Extension Fact Sheet AGEC-791. Cooperative Extension Service. Oklahoma State University. <http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1779/AGEC-791web.pdf>
- Doye, D. and L. Shipman. (2002). Financial Recordkeeping for Farmers and Ranchers. OSU Extension Fact Sheet AGEC-302. Cooperative Extension Service. Oklahoma State University. <http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-2483/AGEC-302web.pdf>
- Internal Revenue Service, Farmer's Tax Guide, IRS Publication 225
- Love, R., H. Haefner, and D. Doye. (2004). Developing a Balance Sheet. OSU Extension Fact Sheet AGEC-752. Cooperative Extension Service. Oklahoma State University. <http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1805/AGEC-752web.pdf>
- Shipman, L. and D. Doye. (2004). Developing an Income Statement. OSU Extension Fact Sheet AGEC-753. Cooperative Extension Service. Oklahoma State University. <http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1789/AGEC-753web.pdf>

Chapter 15

Livestock Mortality Management

Josh Payne

Introduction

Livestock mortality is an issue faced by every livestock farming operation. Proper management of on-farm animal mortalities is vital for proper nutrient management and controlling disease. Improper disposal of dead animal carcasses, such as abandonment, may cause odor nuisance and the resulting leachate (carcass fluids) can negatively impact surface water and groundwater quality. If the animal died of an infectious disease, pathogenic bacteria and viruses may be present within the carcass. These pathogens can be spread by insects, rodents, predators and subsurface or aboveground water movement, as well as through direct contact with other livestock or poultry, leading to increased disease transmission risks. For these reasons, best management practices should be followed when reacting to animal mortalities. Furthermore, most states, including Oklahoma, have regulations requiring proper disposal of livestock and poultry mortalities making unacceptable practices such as abandonment illegal.

Common Livestock Mortality Disposal Methods

Burial

Perhaps the most common method of disposal is burial. When proper guidelines are followed, burial can be a safe option. However, poor site selection, such as sandy soils or areas with high water tables, may pose a threat to groundwater contamination. Studies have shown zones of nitrogen accumulation years following burial of livestock in pits. Furthermore, burial does not recycle nutrients for forage growth as carcasses are buried too deep for nutrient uptake by most plants. Oklahoma burial guidelines include construction of a pit at least 300 feet away from waterways and at least 1 foot above any floodplain level (Figure 15-1). Carcasses should be covered with at least 2.5 feet of topsoil af-

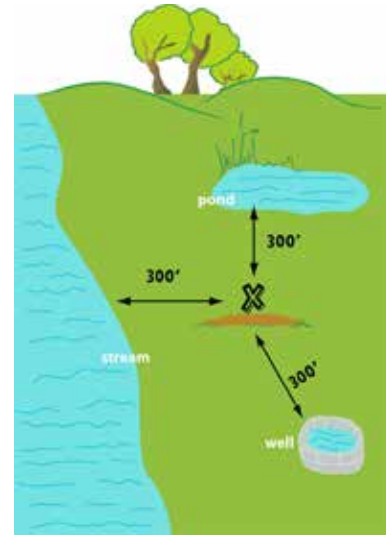


Figure 15-1. Site selection for burial.

ter placement in the pit. For more detailed information on carcass burial, refer to Oklahoma Statutes Title 21 Sections 1222 and 1223.

Landfills

Disposing of carcasses at a licensed landfill that accepts animal mortalities is another form of burial. Landfills may require notification before delivery and/or documentation from a licensed veterinarian stating the cause of death. Landfill tipping fees should be assessed and may range from \$20 to \$40 per ton. Other considerations are transportation costs and breaches of biosecurity by moving carcasses off-farm. As with burial, nutrients from the carcass are not recycled and increasing landfill volume is not a sustainable practice. For a list of Oklahoma landfills accepting dead animals, visit poultrywaste.okstate.edu

Incineration

Incineration is a safe and effective means of carcass disposal, especially from the standpoint of biosecurity. The carcass is completely consumed by fire and heat within a self-contained incinerator. This process destroys pathogens by achieving high

temperatures. Any remaining ash can be mixed with manure and land-applied following a nutrient management plan. Incineration is mainly designed for smaller carcasses and fuel costs should be considered. An air quality permit may be required. Due to odor and emission concerns, open air incineration is not allowed in Oklahoma unless the animal died of an infectious or contagious disease. It is often difficult to build an open fire hot enough to fully consume the carcass. Open air incineration should only be conducted during certain emergency disease management situations with regulatory permission.

Rendering

Rendering is a heat-driven process that cooks the product between 240 F and 290 F, while killing pathogens and converting the carcass into a value-added product such as an animal feedstuff. These feedstuffs, such as meat and bone meal, are generally used as pet food ingredients. Fat is another byproduct used to produce rubber, soap or biodiesel. Although rendering is a very effective method, currently, there are limited rendering services available. The transportation expense of collecting small volumes creates a financial obstacle for most rendering companies. Furthermore, federal regulations require that the brain and spinal cord be removed from cattle 30 months of age and older prior to rendering. This practice was implemented to further strengthen existing safeguards against bovine spongiform encephalopathy (BSE) disease transmission risks, but it has also increased processing costs for rendering plants. Some rendering facilities will still collect routine livestock mortalities, while some require the producer to transport carcasses to the plant. Fees may be associated with this service. Rendering can be a viable option, if locally available. Biosecurity and disease transmission risks should be considered when allowing vehicles on the farm and when transporting carcasses off-farm. Visit poultrywaste.okstate.edu for a current list of available rendering services.

Composting

Composting dead animal mortalities is an inexpensive, biosecure and environmentally sound approach to addressing the issue of carcass disposal. By definition, composting is a controlled biological decomposition process that converts organic matter into a stable, humus-like product. The carcass (nitrogen source) is buried in a bulking agent (carbon source), such as wood shavings, allowing for the

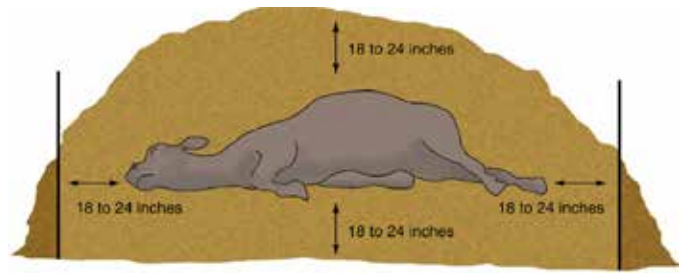


Figure 15-2. Livestock mortality compost pile.

proper carbon to nitrogen ratio (C:N) required by microorganisms to successfully decompose the carcass while absorbing excess moisture and filtering odor (Figure 15-2). The high temperatures (130 F to 150 F) achieved through proper composting will destroy most pathogens. Microorganisms will degrade the carcass leaving only a few small bone fragments, which are brittle and break easily. This valuable byproduct can then be land-applied as a fertilizer source, adding nutrients and organic matter to the soil, or recycled for new compost piles. Proper management is key for composting to be effective. As with burial, site selection is important. The site should be located in an area that does not pose a risk to surface or groundwater contamination.

Steps to Composting Livestock Mortalities

- Construct a barrier with livestock panels
- Prepare a carbon pad at least 18 inches deep
- Place animal in center, ensuring large carcasses are at least 18 inches from the pad edge and small carcasses are at least 12 inches from the pad
- Lance rumen to deflate gas buildup
- Add water until carbon source is damp but not wet
- Cover carcass with at least 18 inches of carbon material

Catastrophic losses are best composted in windrows of bulking agent due to the increased quantity of carcasses. Height, width and length of these windrows are dependent on the size and amount of carcasses to be composted. For both routine and catastrophic composting, piles must be appropriately managed to achieve proper decomposition and prevent scavenger invasion. Emergency management plans should be in place for catastrophic losses. With large numbers of mortality, more than one option may be necessary. For more information on livestock mortality composting, refer to Extension Fact Sheet, BAE-1749 On-Farm Mortality Composting of Livestock Carcasses.



Figure 15-3. Livestock mortality compost pile with barrier.



Figure 15-4. Brittle bone and humus-like material remains of a 700-lb stocker calf following 150 days of composting.

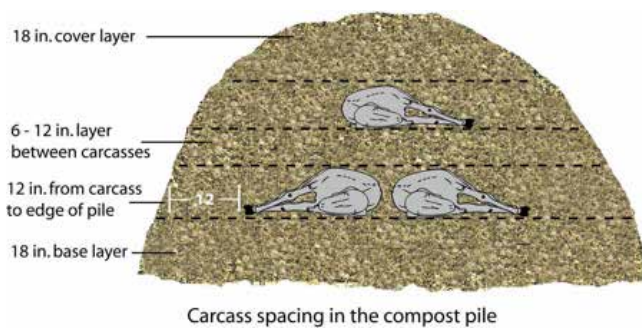


Figure 15-5. Carcass spacing for small stock. Illustration courtesy of Langston University.

Conclusion

Proper livestock mortality disposal is essential to the sustainability and environmental stewardship of farming operations. In addition, state laws regulate disposal methods. These methods should

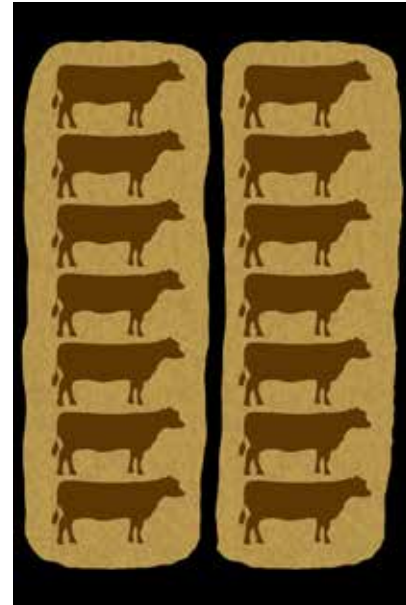


Figure 15-6. Windrow composting for multiple mortalities.

adequately dispose of animal carcasses without negatively affecting the environment, while remaining economical to the producer. Incineration, rendering and composting are common methods preferred for carcass disposal. Each method recycles nutrients, producing a usable byproduct. Local availability and cost may limit both incineration and rendering. When properly managed, composting livestock mortalities is a safe, effective option for most producers to consider.

References

- Merkel, R. and T. Gipson, 2010. Goat mortality composting. American Institute for Goat Research.
- Langston University. Available at: http://www2.luresext.edu/goats/extension/AIGR_ExtBull_Mort_Compost.pdf
- Payne, J. and B. Pugh, 2010. On-farm mortality composting of livestock carcasses. Oklahoma Cooperative Extension Fact Sheet. BAE-1749. Stillwater, OK. Available at: <http://www.poultrywaste.okstate.edu/files/BAE1749%20On-Farm%20Mortality.pdf>
- Payne, J., 2009. Proper disposal of routine and catastrophic livestock and poultry mortality. Oklahoma Cooperative Extension Fact Sheet BAE-1748. Stillwater, OK. Available at: <http://www.poultrywaste.okstate.edu/files/BAE1748%20Proper%20Carcass%20Disposal.pdf>

