

This lesson deals with sheep production as an enterprise by first evaluating its advantages and disadvantages, then identifying enterprise types and their locations, outlining primary wholesale cuts of meat and by-products derived from sheep production. Finally, this lesson considers some of the changes that have taken place in the industry.

Advantages and Disadvantages of Sheep Production

In every enterprise, there are advantages and disadvantages to producing a product. There are always problems to solve and new techniques to try.

Advantages

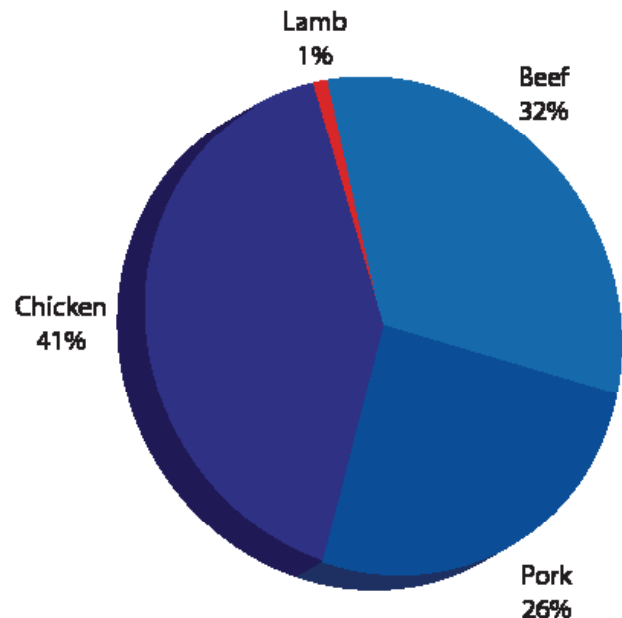
Sheep production offers many advantages. Sheep eat a variety of forages including weeds and brush. This is very beneficial to a producer because sheep do not require high-quality forages. Sheep are also helpful in eating grain that is lost in the field at harvest. Another advantage to sheep production is that the animals are very versatile and can graze in various environments such as rugged mountain areas and on land where crops cannot be produced. Wool breeds can also withstand the colder regions of the country. Sheep can be profitable for a producer because they frequently have multiple births, can be raised on a limited number of acres, and require a low initial investment. They also yield many by-products that consumers use daily. Finally, a major advantage to producing sheep is the final product: meat. Lamb is considered more digestible than other red meat. Because it does not marbled, lamb does not contain cholesterol. Lamb provides protein and is high in B vitamins, niacin, zinc, and iron.

Disadvantages

As with the production of any product, there are always disadvantages. One of the main drawbacks is that Americans do not consume very much lamb. Consumers are not willing to pay high prices for certain cuts of lamb, although less expensive cuts of lamb meat are available. The public's meat preferences are heavily drawn to beef and chicken, as illustrated in Figure 1.1. Another adverse

factor is that the meat processing and marketing structure fluctuates. This means that a sheep producer's enterprise may be profitable for one year but not the next, depending on how many sheep are marketed at a given time relative to consumer demand.

Figure 1.1 - U.S. Meat Consumption



Producers have also been affected by low wool prices. Currently, there is not a high demand for wool clothing on the market. An additional problem is that sheep are easy prey for predators because they are unable to defend themselves. Sheep are also very susceptible to diseases, injury, and various external and internal parasites. Many of the parasites are deadly to sheep and can cost the producer a lot of money. Because sheep are fragile animals, producers must carefully manage them to prevent injuries.

Another disadvantage to sheep production is that labor costs for managing sheep are high and much of the work involved with sheep production is seasonal, such as at shearing and breeding times.

Sheep Production

Enterprise Types and Their Locations

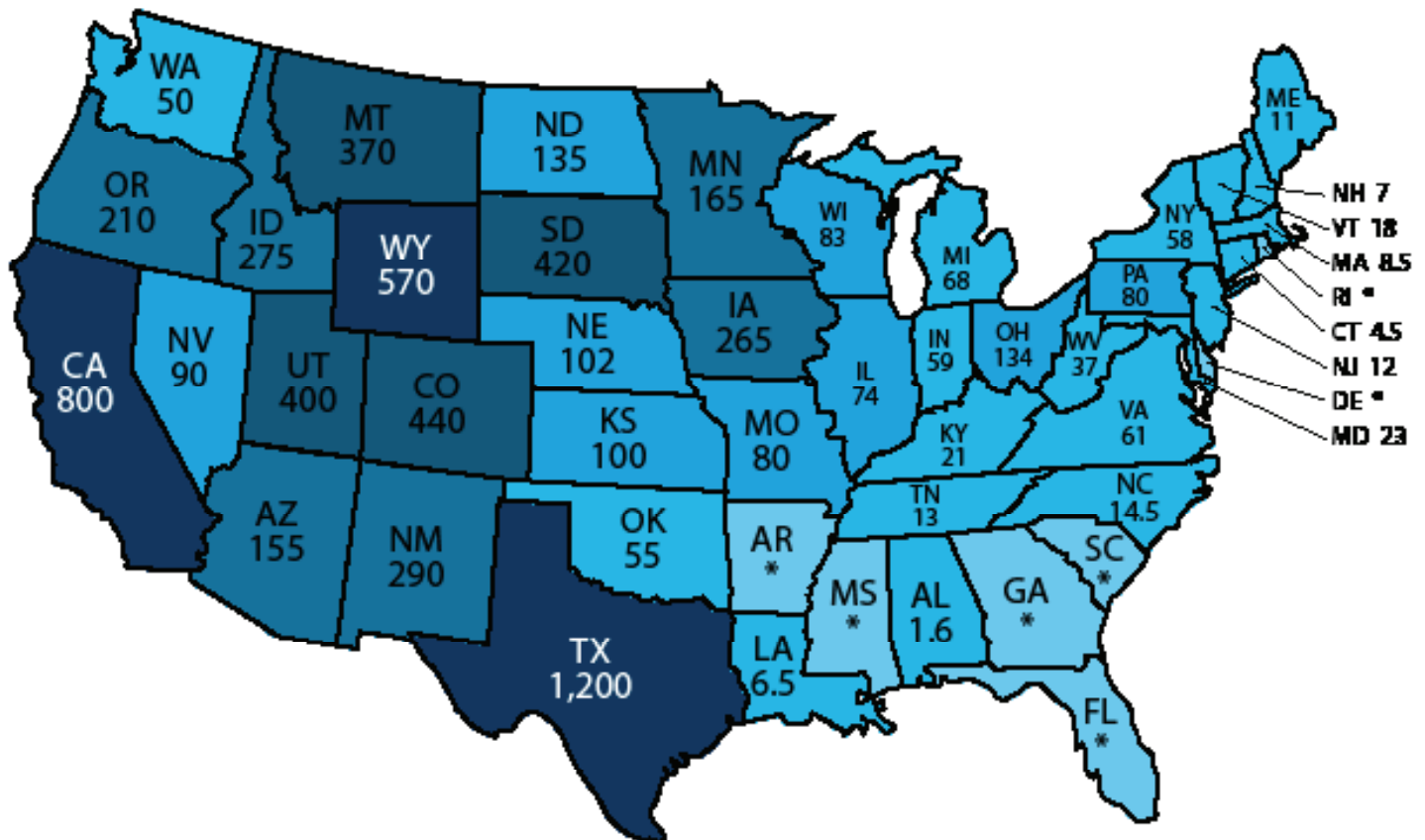
Every state in the nation has at least a few sheep producers. Figure 1.2 illustrates where producers are distributed throughout the country and shows how many sheep are produced in each state. The numbers on the map are in thousands. Not pictured on the map, Alaska has a total of 1,600 sheep. The states displaying a star (*) produce a combined total of 50,000 sheep. Hawaii, also not pictured on the map, contributes to the combined total of 50,000 sheep. The three states that produce the most sheep are Texas, California, and Wyoming.

There are many different enterprise types around the country. With the changing industry, sheep producers have to determine which type(s) will work best for them and be the most profitable. Producers display certain sheep that are well suited for exhibition. See Showing Sheep in the appendix.

Purebred

Purebred operations produce superior genetic traits using stud rams and ewes. These operations produce rams that are sold to producers who want to introduce certain genetic traits into their breeding operations. Purebred operations also sell replacement ewes to producers who are just entering the business or to established producers who want to replace the older ewes in their operations. This type of enterprise must focus on providing good breeding stock to sell to producers. Some examples of genetic traits a purebred operation might specialize in are those that improve carcass qualities and increase growth rate. Some purebred sheep animals are exhibited in shows at local, county, state, and national levels. Purebred operations are located throughout the United States, although most are in the East.

Figure 1.2 - U.S. Sheep Production



Farm Flock

Another type of enterprise is the farm flock operation. This is the most common type of enterprise and can range anywhere from 10 sheep to several hundred. Sheep farm flock operations are often part of a diverse farming operation where crops and other animals are also raised. Farm flocks tend to be a secondary enterprise for producers, so numbers are kept to a minimum. The sheep are raised in a feed lot and/or grazed in pastures. The sheep are raised for meat production and wool, even though wool is declining in value. Farm flock animals are not usually exhibited at fairs.

Some producers have sheep on the farm to use acres of land that cannot be tilled. The sheep clean up the weeds and brush and do not require a full-time shepherd. The majority of farm flocks are located in the central, eastern, and southern United States. Half of the flocks are located in the Corn Belt region, which is the central section of the country.

Range

Range producers have large flocks of about 1,000 or more sheep that graze on hundreds to thousands of acres of inexpensive land. The amount of land they graze on depends on the quality of the forages. One shepherd can usually handle 1,000 to 1,500 sheep. Range lambs are smaller than purebred or farm flock animals and are raised for meat production. Range producers choose this method of sheep production due to the lack of quality grazing land available in the area. The majority of range operations exist in the western states.

Club Lambs

Club lambs (also called market lamb) are raised for carcass quality and overall eye appeal. Generally, these sheep are crossbred and have short life spans because they are raised for meat production. The size of the sheep differs, depending on the genetic traits of the animal. Families often show stock as 4-H and FFA projects or exhibit the sheep at fairs on the local, county, state, regional, and national levels. Incentives for exhibiting club lambs include prize money, recognition, and the opportunity to partici-

pate in a recreational family-oriented activity. Some club lambs are raised as hobby sheep to produce meat and wool. Club lambs are raised all over the United States but predominantly in grain-producing areas in the Midwest.

Primary Products and By-products of Sheep Production

The sheep industry is small but it adds diverse products and by-products to the market. In addition to being processed as meat, sheep also produce by-products that are often used in common items such as chewing gum and deodorant.

Sheep production yields primary wholesale cuts of meat: leg, loin, rib, shoulder, and breast/foreshank. Leg and the loin are the most expensive cuts. Lamb is a young, tender meat, low in fat, and with a light flavor. Prices vary according to the cut. Refer to Cooking Lamb in the appendix for a variety of cooking tips and recipes.

By-products of sheep production are derived from three sources: (1) hide and wool; (2) fats and fatty acids; and (3) bones, horns, and hooves. Table 1.1 illustrates sample by-products from these sources.

Changes in the Sheep Industry

The sheep industry is always changing and as a result has become very diverse. Sheep are not just raised for meat and wool. They provide various products that contribute to the economy. However, even though sheep are useful to consumers, the total number of sheep is decreasing.

In 1942, there were 56 million sheep in the United States. In 2000, there were only 7.2 million sheep nationwide. These numbers are declining in many areas due to the public's lack of interest in sheep and the time and money that are needed to produce them. Large operations are replacing the small farms, a trend that has led to the production of more profitable livestock such as cattle or swine. These livestock animals tend to have less deadly health hazards and are not subject to stress as much as sheep are. Predators do not threaten

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Table 1.1 - Sheep By-products

| Hide and Wool | Fats and Fatty Acids | Bones, Horns, and Hooves |
|-----------------|----------------------|--------------------------|
| Shoe linings | Chewing gum | Gelatin desserts |
| Slippers | Medicines | Toothbrushes |
| Leather gloves | Dish soap | Photographic film |
| Book bindings | Candles | Shampoo and conditioner |
| Carpet | Shaving cream | Plywood and paneling |
| Blankets | Antifreeze | Bone china |
| Lanolin | Crayons | Wallpaper |
| Insulation | Dog food | Marshmallows |
| Tennis balls | Explosives | Piano keys |
| Clothing | Tires | Bandage strips |
| Fleece products | | |

cattle and swine as much as sheep, so producers do not lose as many animals as a sheep producer might. It is also becoming increasingly difficult to find seasonal laborers to help with sheep production. The result of these changes is that today most producers have small flocks of 50 or fewer sheep.

The cost of lamb meat grew steadily over a 40-year period. In 1961 lamb was 15¢ per pound. As of April 2001, the average price of a retail cut of lamb in Missouri ranged from \$2.00 per pound for ground meat (burger) to \$8.00 per pound for lamb chops and loin. This is partially due to increased production cost of raising sheep. The number of lambs produced is decreasing, which means the supply available to meet demand is decreased. Prices are therefore increased. Prices also fluctuate throughout the year, depending on the season. From February to June, the price of lamb tends to be higher than normal due to the demand for the meat during the Easter season.

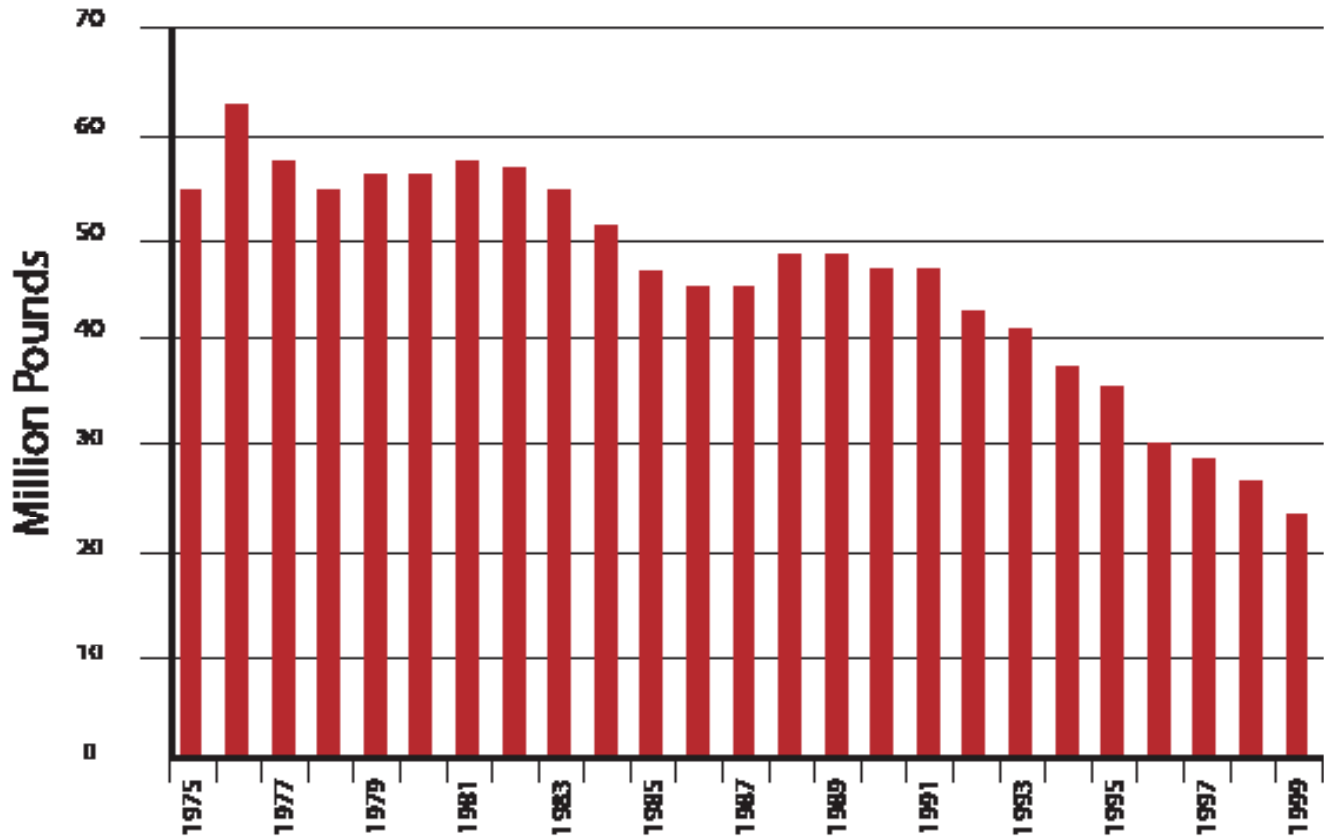
Just as the cost of meat has affected the sheep production industry significantly, other factors have influenced it as well. Wool prices are unstable. In 1978 the price of shorn wool was 75¢ a pound and then rose to \$1.38 per pound in 1988. But in 1998, prices plummeted to 60¢ per pound. The production of lamb wool per pound from 1975 to 1999 also fell, as illustrated in Figure 1.3.

Consumers' preferences are changing. They want more nylon, Dacron, and other synthetic fibers that are easy to care for. This has hurt the wool market for producers. At times it may cost the producer of a small flock more to shear the sheep than the wool is worth.

Summary

Like any enterprise, sheep production has its advantages and disadvantages. Whereas sheep are highly adaptable to various environments and provide a healthful source of red meat, consumers do not eat much lamb and the demand for wool has dropped. Yet producers throughout the United States are raising sheep that differ in size and purpose. Lamb provides five primary wholesale cuts of meat, and many by-products are derived from the hide and wool; fats and fatty acids; and bones, horns, and hooves. However, during the last 60 years, the number of sheep produced has declined due to decreased consumer demand. Despite these changes in sheep production, the sheep industry is still intact.

Figure 1.3 - U.S. Wool Production from 1975 to 1999



Credits:

Acker, Duane, and Merle Cunningham. *Animal Science and Industry*. 5th ed. Upper Saddle River: Prentice Hall, 1998.

Barrick, R. Kirby, and Hobart L. Harmon. *Animal Production and Management*. New York: McGraw-Hill Book Company, 1988.

"Fast Facts About Sheep Production in America." American Sheep Industry Association, Inc. <<http://www.sheepusa.org/news/ffpdf/ffshepprod.html>> (10/11/00).

Gillespie, James R. *Animal Science*. Albany: Delmar Publishers, 1997.

Herren, Ray V., and Roy L. Donahue. *The Agriculture Dictionary*. Albany: Delmar Publishers, Inc. 1991.

"Per Capita Consumption of Meat." <<http://www.ers.usda.gov/publications/sb965/>> (3/6/01).

"Sheep and the Environment." American Sheep Industry Association, Inc. <<http://www.sheepusa.org/environment/products.html>> (10/11/00).

"Shorn Wool Prices." <<http://usda2.mannlib.cornell.edu/data-sets/crops/89004/table34.wk1>> (3/6/01).

Smith, Barbara, Mark Aseltine, and Gerald Kennedy. *Beginning Shepherd's Manual*. 2nd ed. Ames: Iowa State University Press, 1997.

Taylor, Robert E., and Thomas G. Field. *Scientific Farm Animal Production: An Introduction to Animal Science*. 6th ed. Upper Saddle River: Prentice Hall, 1998.

"U.S. Wool Production." <<http://www.sheepusa.org/marketplace/woolgraphs/woolproduction.html>> (3/6/01).

This lesson addresses the selection process when managing a sheep operation. Within Missouri and throughout the Midwest, producers can choose many different breeds of sheep. Each breed possesses unique qualities that may benefit the operation. In addition to being familiar with the various breeds, producers must know how to select individual animals that possess desirable traits. This lesson also identifies the parts of a sheep and defines other terms important to the sheep-selection process.

Major Breeds in Missouri and the Midwest

More than 30 breeds of sheep are raised in the United States. The breeds discussed in this lesson are those that are most commonly raised in Missouri and the Midwest, according to the American Sheep Producers Council. Sheep are divided into three basic classes based on their commercial use: ewe (maternal) breeds, ram breeds, and dual-purpose breeds. See Showing Sheep in the appendix for information on exhibiting market and breeding sheep.

Ewe (Maternal) Breeds

Both ewes and rams can be classified as a ewe breed. The classification “ewe breed” refers only to the characteristics that both the ewes and rams have in common.

Replacement ewes (one of the breeds listed in Table 2.1 or a cross of the breeds) have characteristics related to maternal abilities. Ewe breeds are generally white faced; have strong traits in mothering, multiple births, longevity, and milking abilities; and can adapt to certain environmental conditions. They are also known for their large body size and wool production. Refer to Table 2.1 for the characteristics of some ewe breeds.

Table 2.1 - Ewe (Maternal) Breeds

| Breed | Characteristics |
|----------------|---|
| Corriedale | <ul style="list-style-type: none"> • Polled • White face, ears, and legs • Acceptable carcass qualities |
| Delaine-Merino | <ul style="list-style-type: none"> • Rams horned, ewe polled • Fine white wool • Do well on poor grazing ground |
| Finnsheep | <ul style="list-style-type: none"> • Small frame • White ears, nose, face, and legs • Medium to coarse fleece • High lambing rates |
| Rambouillet | <ul style="list-style-type: none"> • Large, blocky frame • Ewes polled, rams both horned and polled • White, fine wool • Very hardy |
| Targhee | <ul style="list-style-type: none"> • Large, blocky frame • Polled • White face with no wool • Long reproductive life |
| Columbia | <ul style="list-style-type: none"> • Large, blocky frame • White face, ears, and legs • No wool on face • Long legs |

Ram Breeds

The second class of sheep is the ram breed. These animals are strong, muscular, and have good carcass quality. They also have good growth rates. Ram breeds make efficient use of feed and can be marketed at a younger age.

Ram breeds are also known for sexual aggressiveness and fertility, which are qualities that enable the producer to breed and crossbreed them readily. Refer to Table 2.2 for characteristics of some major ram breeds.

Sheep Production

Table 2.2 - Ram Breeds

| Breed | Characteristics |
|-----------|---|
| Cheviot | <ul style="list-style-type: none">• Small, blocky frame• Polled• White face, black nostrils, white legs |
| Hampshire | <ul style="list-style-type: none">• Large, blocky frame• Polled• Black face, ears, nose, and legs• Medium to fine wool• Ewes – good milkers |
| Oxford | <ul style="list-style-type: none">• Very large, blocky frame• Polled• Gray to brown face, ears, and legs |
| Suffolk | <ul style="list-style-type: none">• Large, blocky, and muscular frame• Polled• Black face, ears, and legs• No wool on legs and head• Rapid growth• Desirable, muscular carcasses |

Dual-purpose Breeds

Dual-purpose breeds are raised to improve wool and meat qualities in production. E. H. Mattingly developed the Montadale breed in St. Louis, Missouri, in 1933. Mattingly started with a Columbia ram and purebred Cheviot ewes. He spent several years selectively breeding the offspring to obtain what has become one of the most popular dual-purpose breeds known for its high-quality carcass and wool. See Table 2.3 for information on dual-purpose breeds.

Table 2.3 - Dual-purpose Breeds

| Breed | Characteristics |
|-----------|---|
| Dorset | <ul style="list-style-type: none">• Blocky frame• Medium sized• Can be polled or horned• White ears, nose, face, and legs• Medium to coarse fleece• Muscular carcasses |
| Montadale | <ul style="list-style-type: none">• Blocky frame• Polled• White face, ears, and legs• No wool on legs or face |

There are also other breeds such as hair breeds and milk breeds.

Factors in Selecting a Breed

When a producer selects a sheep breed, he/she has to consider many variables to ensure that the production goals are met. The following factors help determine which breed the producer will choose to raise.

The type of enterprise a producer chooses is not only important to a successful operation, but it also determines which breed is the best one to select. To determine the most suitable enterprise, the producer must consider the region of the country he/she lives in and available resources such as forages, land, finances, time, and labor and management requirements. This information guides the producer in selecting the appropriate breed for those conditions.

Another important factor a producer should consider is the adaptability of the breed. Researching how well different breeds can adapt to the environment and knowing their flocking instincts provide valuable information to a producer that will affect the success of the operation.

Other critical components are the availability of food and fiber resources and marketing opportunities. The pro-

Selection of Sheep

ducer should ensure that a market is nearby that sells sheep and that a demand exists for the breed he/she intends to raise. The producer must also be able to identify the availability of breeding stock in the area and conclude if the local breeding stock exhibits preferred traits. If the desired traits are not available nearby, then production costs will rise due to added travel expenses.

Factors in Selecting a Sheep

Producers must consider many factors when selecting an individual sheep and should know what they are purchasing before making a decision. Several selection factors can help determine if a producer will make or lose money in the operation. Five of the most common factors are soundness, production records, conformation, health, and economic traits.

When selecting a sheep, a producer should examine the animal for soundness. A sound animal is free of blemishes, has no defects, and has good feet and legs.

The producer should ask to see the production records of the animal. Those records should contain information on heredity, nutrition, fertility, age at puberty, any birthing difficulties of the ewe, and any diseases or parasites the animal has had. This information can be very useful in determining the animal's reproductive characteristics and general health.

Conformation is another important consideration when selecting sheep. Conformation deals with height, length, and depth of the body. Good conformation features include a straight top line; good-sized, strong, straight legs so the sheep can carry itself properly; good length of body; and in ewes, a wide rump with a 15° angle from hips to pins to promote easier lambing.

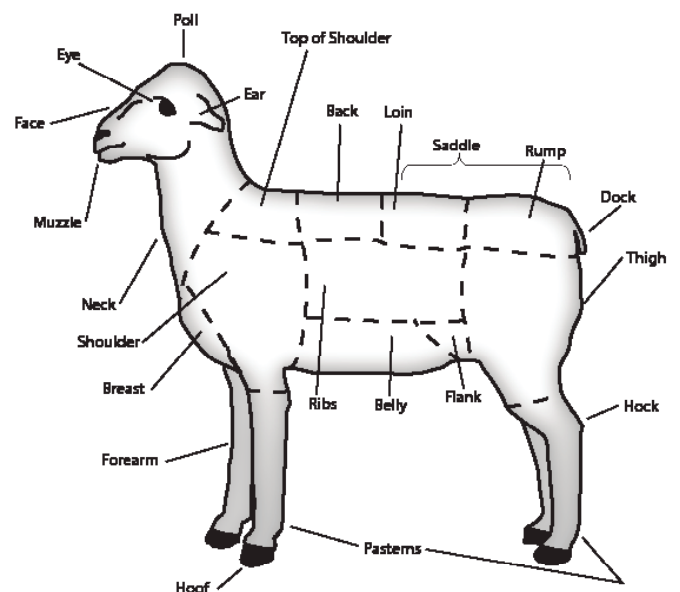
When selecting sheep the producer should be aware of the animal's health. The producer should learn characteristics of common diseases before purchasing sheep to distinguish between a healthy and sick animal. The producer should also ask for health records that are signed by a veterinarian. Another way to avoid buying sick sheep is to buy an animal that comes from a well-known and respected breeder. Even if the animal is purchased in this manner, the producer should still obtain its health records.

A final consideration in selecting sheep is to determine the economic traits each animal offers the producer's operation. This term refers to the amount of feed required for the sheep to gain weight. Because the rate of gain varies with each breed, the time it takes to market the animal also varies. This affects when the producer may realize a profit on his or her investment.

Parts of a Sheep

It is important for sheep producers to know the different parts of the animal so they can communicate with veterinarians, consumers, and other producers more effectively. Producers should be able to identify the parts of a sheep as illustrated in Figure 2.1.

Figure 2.1 - Parts of a Sheep



Terms Associated with Sheep and Sheep Production

Producers must understand common terms associated with sheep and sheep production. Knowing correct terminology enables them to communicate effectively with a veterinarian about what is wrong with their sheep and about the affected area of the body. Many terms are associated with sheep and sheep production; this lesson identifies only some of them in Table 2.4. Refer to the Glossary for additional sheep terms.

Sheep Production

Summary

When selecting sheep, the producer should know what breeds are available and what traits the different breeds exhibit. It is also important to be able to distinguish between a healthy and an unhealthy sheep by examining the animal's soundness, production records, and conformation. This knowledge, combined with an understanding of the terms associated with sheep production, is an invaluable tool for the producer with plans to establish or expand his or her flock.

Table 2.4 - Common Sheep Terms

| | |
|---------------------------|---|
| Banding | (1) This is a method of castration in which a tight rubber band is placed around the scrotum. This process cuts off circulation to the testicles and destroys them. (2) This is a method of docking in which a tight rubber band is placed around the tail, which cuts off circulation and destroys the tail. |
| Creep feeding | A penned-in feeding system for young lambs that has an opening that prohibits mature sheep from entering; the feeder contains special feed for the young lambs while they are nursing |
| Dock | (Noun) the stub end on a sheep's or lamb's tail; (verb) to cut short the tail of a lamb for sanitary reasons |
| Dry lot management | A bare, fenced-in area used as a place to feed and fatten lambs |
| Ewe | A female sheep of any age |
| Lamb | The offspring (of either sex) of a sheep; meat that is less than 1 year old |
| Mutton | The meat of a grown sheep that is more than 2 years old |
| Ram | A male sheep that has not been castrated and is used for breeding purposes |
| Wether | A castrated male sheep |

Credits:

Acker, Duane and Merle Cunningham. *Animal Science and Industry*. 5th ed. Upper Saddle River: Prentice Hall, 1998.

Barrick, R. Kirby and Hobart L. Harmon. *Animal Production and Management*. New York: McGraw-Hill Book Company, 1988.

“Breeds of Livestock.” Oklahoma State University. <<http://www.ansi.okstate.edu/breeds/SHEEP/MONTADAL/>> (1/9/01).

Gillespie, James R. *Animal Science*. Albany: Delmar Publishers, 1997.

Ricketts, G. E., R. D. Scoggins, and D. L. Thomas. *Recommendations for a Sheep Management Program*. University of Illinois at Urbana-Champaign. North Central Regional Extension Publication 240.

Scott, George E. *The Sheepman's Production Handbook*. Denver: Abegg Printing. 1982.

Smith, Barbara, Mark Aseltine, and Gerald Kennedy. *Beginning Shepherd's Manual*. 2nd ed. Ames: Iowa State University Press, 1997.

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Management Practices for Sheep

This lesson addresses basic management practices in sheep production: maintaining adequate facilities, land, and equipment; monitoring sheep for physical signs of health problems; preventing and controlling diseases and parasites; minimizing loss from predators; and considering proper nutrition for the sheep.

Facilities, Land, and Equipment Needed in Sheep Production

For effective sheep production, producers need proper facilities, a sufficient amount of land, and the appropriate equipment for handling and producing sheep.

Facilities

Sheep need an adequate form of shelter, and lambs, in particular, need to be protected. This could be a barn, machine shed, unused hog buildings, or any other suitable building on the land that could house sheep. The building should be kept dry, free from drafts, and have good ventilation so that moisture does not build up and cause health hazards. Electricity and water should be installed in the shelter to help the producer. A corral helps the producer maneuver the sheep with ease.

Land

The amount of land needed depends on the type of enterprise. For example, a farm flock can be raised on a few acres of land whereas range sheep usually graze on hundreds of acres. If sheep are in a confined area only, they need 16 to 20 square feet of space per animal. If kept in an open-front building, sheep require 10 to 12 square feet of space in the building plus 25 to 40 square feet of outdoor lot space per animal.

Equipment/Supplies

The type of equipment/supplies that a producer requires may vary, depending on the operation. Some operations require watch animals, such as sheepdogs, llamas, and donkeys to protect the flock. They are very important to have because they deter predators and help the producer

maneuver, or work, the animals. Some producers may be able to borrow equipment. The following are typical items needed in sheep production. To maintain the flock's general health, the producer should have docking and castrating equipment, hoof trimmers, and shearing and deworming equipment. To give the animals medication, the producer also needs drenching equipment for administering oral liquid medication, a balling gun for oral delivery of pills, and injection equipment for vaccines and medicines.

Tattooing, ear notching, and ear tagging equipment are needed to properly identify the animals. The producer should also have a record book to document everything that happens in the operation. These records usually include births, miscarriages, diseases, and medications, among other details.

Throughout the sheep's development, the producer keeps track of how much the animal weighs, so therefore weight scales are desirable. Weight is a good indicator of the animal's general health and its suitability for going to market. Knowing how much the animal weighs is useful when taking sheep to market, shearing, or medicating a sick animal. Sufficient feeders, watering facilities, panels, and corrals are needed as well.

Physical Signs That Sheep Have Health Problems

A good producer should always monitor the flock for signs of health problems. Once sheep become ill, it is hard for them to fully recover. By noticing physical signs early, a producer can save the sheep and save money for the operation.

One key sign that an animal has health problems is isolation from the flock. Some other signs to look for are pale eyelids (which may indicate parasites or anemia), poor growth, a large amount of weight loss, potbellies, and swelling under the jaw known as bottle jaw (also called poverty jaw). A significant decrease in milk production may be a sign that a ewe is sick. A producer may also notice sheep with a loss in appetite or diarrhea.

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Management Practices Used to Prevent and Control Diseases

The best way to control diseases is to prevent them from happening. A producer should be able to identify common diseases to ensure that the entire flock receives proper care. Five common diseases that sheep can develop are pneumonia, foot rot, enterotoxemia, tetanus, and mastitis in ewes. Each disease has different causes, symptoms, and treatments.

Description of Common Sheep Diseases

Of the five common diseases mentioned above, pneumonia and foot rot are highly contagious. The symptoms of pneumonia are high temperature, depression, runny nose, and loss of appetite. Preventive measures include ventilating the animal's shelter. As mentioned earlier, good ventilation prevents the unhealthy accumulation of moisture. Bedding must be dry and clean, and the sheep should not be overcrowded. Treatment with antibiotics is also effective.

A sign of foot rot is lameness, inability to breed, lengthy time to reach market weight, and red swelling between the toes. To prevent this disease, the producer should trim the sheep's hooves regularly and remove the animal from wet pastures. Antibiotics are used for treatment.

Enterotoxemia is an overeating disease with high death rates. The sheep overeats and then a poisonous bacterium begins to grow rapidly in the animal's gastrointestinal tract. Symptoms are convulsions or nervousness and diarrhea. Unfortunately, there is no cost-effective treatment once the animal has the disease. However, the producer can prevent enterotoxemia by regularly vaccinating the sheep, slowly introducing the animal to grain, and controlling grazing.

Symptoms of tetanus, also known as lockjaw, are localized stiffness in the neck and jaw area, then muscle spasms, rigidity, and convulsions. If an animal is infected it will die because at present, there is no cure. The producer can prevent this disease by vaccinating the animal when it is docked or castrated, because tetanus usually enters through open wounds.

Mastitis is an infection of the udder that can affect milk-producing ewes. A red, swollen udder characterizes the early stages of mastitis. Soon the udder turns blue and the ewe will not allow her lamb to nurse. If left untreated, mastitis can be fatal; however, if the producer acts quickly and starts the ewe on the proper medication, the ewe can usually be saved. Once a ewe has had mastitis, she will no longer be able to produce milk in the affected portion of her udder and sometimes becomes unable to produce milk at all.

Ringworm is an infection of the outer layer of skin and hair shafts, caused by a type of fungus, which threatens all domestic animals and people as well. Most often, the fungus causing ringworm is spread when infected sheep are closely sheared, which sends spores of the fungus (attached to wool shafts) into the air. Ringworm is easily spread by handling infected sheep, clipping, brushing, using lamb tubes or blankets, or through facilities. In fact, once equipment or facilities have been infected, they may harbor the infection for as many as four years.

One specific type of fungus, very similar to ringworm, is known as club lamb fungus. Club lamb fungus is typically recognized as scaly, round lesions on the head and neck although the lesions can be found on other areas as well. Because this disease is contagious to humans and other animals, rubber gloves should be worn when handling sheep that are potentially infected. Sheep owners should take preventative measures to reduce the likelihood of contracting the disease because there are no specific treatments for club lamb fungus. These measures include avoiding frequent washing and shearing since lanolin helps protect against the fungus, disinfecting tools and equipment between animals, and isolating infected animals to prevent the spread of the disease. It typically takes 8 to 16 weeks for the disease to run its course.

Another disease of major concern to sheep producers, particularly in recent years, is known as scrapie. Scrapie is a fatal, degenerative disease that slowly affects the central nervous system of sheep and goats. Similar in nature to bovine spongiform encephalopathy (BSE) in cattle and Creutzfeldt-Jakob disease (vCJD) in people, scrapie must be addressed by sheep producers. Early symptoms may include anxiousness and excitability, head/neck tremors, and uncoordinated movement. Advanced stages of the disease are characterized by progressive weight loss,

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intense rubbing and scraping, as well as uncoordinated movement and violent shaking. Because the incubation period for the disease is so long, most frequently mature sheep are affected. In recent years, the U.S. Department of Agriculture developed a scrapie eradication program that seeks to identify and control instances of scrapie within the United States.

In Europe, foot and mouth disease is currently threatening livestock. Producers in England and other countries are suffering huge losses in meat production. The attempts to cure the disease are expensive, as well. The last outbreak in sheep that occurred in the United States was in 1929. But all producers are still concerned. This disease is highly contagious and can spread very quickly and easily, thus making it extremely difficult to control.

General Management Practices to Prevent Diseases

The producer can use several general management practices to prevent diseases among the sheep. Observing the flock very closely, watching for any signs of illness, is a vital first step. Because sheep require careful handling, the producer must prevent any situations that will stress the animals. If the sheep have any wounds, the producer should disinfect and treat them immediately. The entire flock should be vaccinated in accordance with an established health program on a regular basis.

Various management practices occur during lambing. Soon after a lamb is born, the producer should dock, or cut off, the tail. Removing the tail helps keep the rump area clean and it is less likely to get infected.

Trimming hooves regularly helps prevent foot rot, which is described above in more detail. Another management practice is to isolate any newly purchased sheep from the rest of the flock for at least 30 days. This allows the producer time to observe any signs of illness or distress and to prevent the healthy members of the flock from becoming sick.

General Management Practices to Control Diseases

Once sheep are infected, the producer must remove the sick animals from the rest of the flock and rely on the appropriate medication. One consideration if sheep

are medicated is when to withdraw the medication. If the medicated sheep will be sold for processing, the medication must be withdrawn a certain amount of time before the sheep are sold so the meat will be safe for the consumer. The amount of withdrawal time depends on the type of medication. It is critical that the producer reads the label on the medication and follows all directions on the bottle regarding site, method, dosage, and withdrawal of medication.

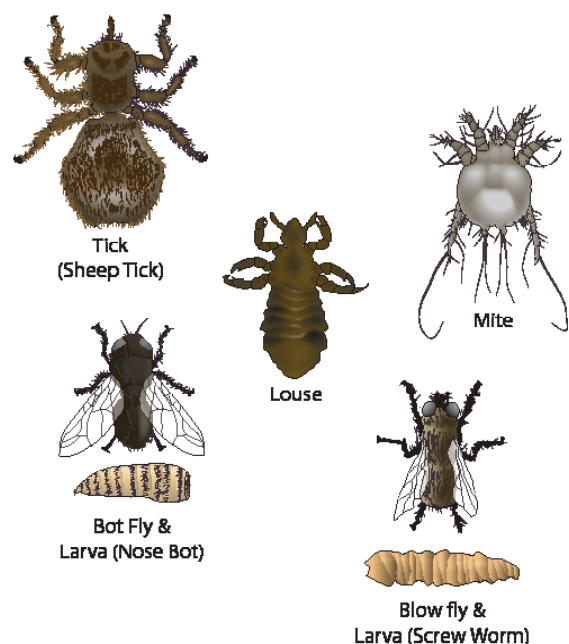
Management Practices Used to Prevent and Control Parasites

There are two types of parasites - external and internal. Producers have to control parasites because major health problems could affect the flock that would cost producers a loss of animals and a significant amount of money.

External Parasites

Examples of common external parasites are ticks, mites, lice, bot flies, and blow flies, as illustrated in Figure 3.1. To manage and control external parasites a producer dips, dusts, or sprays the sheep with insecticides. This helps keep the parasites away from the sheep. Producers should keep newly purchased sheep away from the flock and treat them to prevent or control any external parasites they may have. Damp areas on a sheep's body attract

Figure - 3.1 - External Parasites



Sheep Production

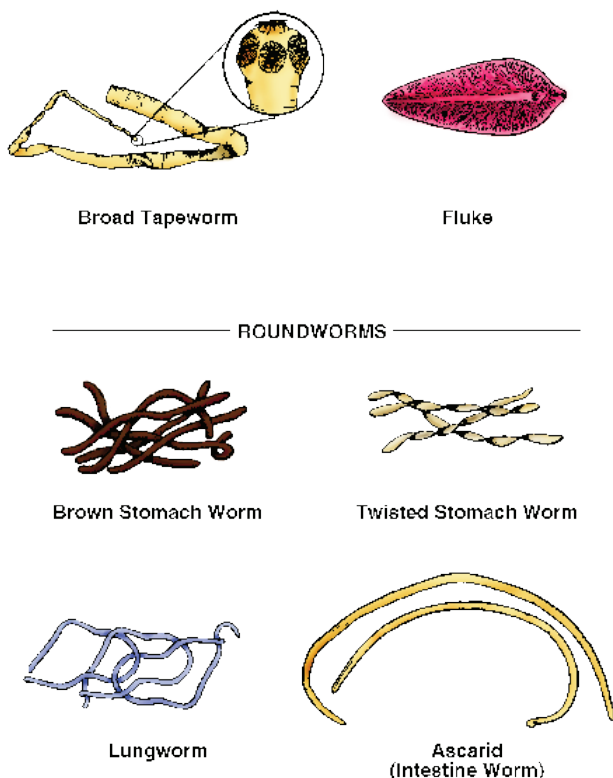
external parasites. Producers should shear areas that are damp due to diarrhea or abrasions and treat those areas with insecticides to avoid infestation.

The actual sizes of these external parasites vary greatly. Ticks are usually 1/8 inch to 1/4 inch long. Mites are very small parasites, averaging about 1 to 2 millimeters. Lice are less than 1/8 inch long. Bot flies range from 1/2 inch to 2 inches and blow flies average between 1/2 inch and 1 inch long.

Internal Parasites

Examples of common internal parasites are broad tapeworms, flukes, brown stomach worms, twisted stomach worms, lungworms, and ascarids (also called intestine worms) (see Figure 3.2). To manage internal parasites, the producer should deworm sheep in accordance with an established health program regularly, rotate pastures, and prevent sheep from overgrazing. Sheep will eat grass all the way down to the ground even if fecal matter from another animal is present. When this occurs, they may ingest some internal parasites from the feces. The animal then becomes infested with the parasite, and this cycle

Figure - 3.2 Internal Parasites

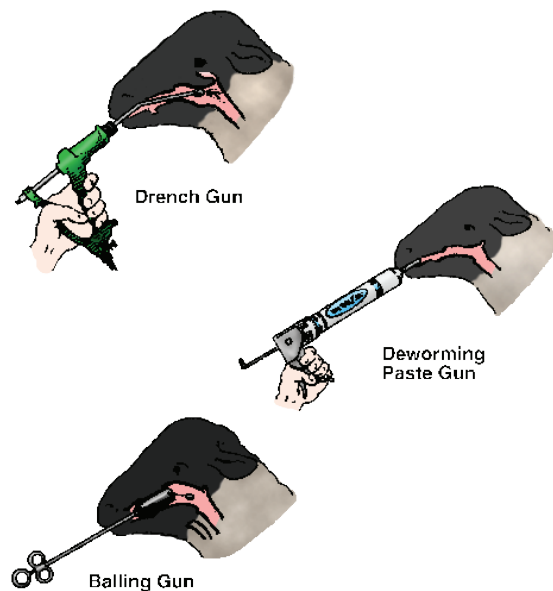


repeats itself. Another important management practice is to keep the water supply clean and well drained. The producer should also ask a veterinarian to analyze the sheep's feces to ensure appropriate treatment if worms are present.

The sizes of internal parasites differ even more than the external parasites. Broad tapeworms can reach from 10 to 20 feet long; flukes are about 20 to 25 millimeters. Brown stomach worms can reach up to 10 millimeters long, and the twisted stomach worm varies from 5 to 40 millimeters. The length of lungworms averages about 100 millimeters; whereas ascarids range from 5 to 10 feet long.

Figure 3.3 illustrates some common methods for deworming sheep. Drenching is a common method of deworming that involves spraying liquid medication down the sheep's throat. Another method of deworming uses a paste gun to dispense medicated paste into the sheep's mouth. Once the paste is swallowed it is absorbed by the sheep's stomach. A balling gun is an alternative to the drenching and paste guns. It is used to give sheep medicine in a pill form.

Figure - 3.3 Methods for Deworming Sheep



Management Practices for Sheep

Management Practices Used to Minimize Loss from Predators

Sheep are such an easy target for predators, such as stray dogs, bobcats, bears, coyotes, and foxes. These attacks can substantially reduce the flock and cost a producer thousands of dollars.

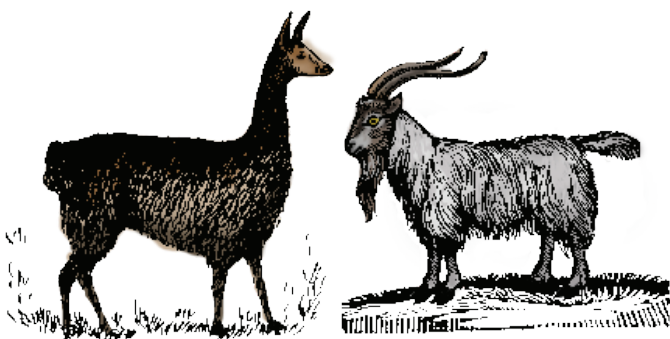
Figure - 3.4 Predators of Sheep



To help minimize loss from these predators, producers can use guard animals such as sheepdogs, donkeys, and llamas. These animals can be pastured with the sheep to watch for predators and protect the sheep. Another deterrent is to pasture billy goats, which are more aggressive animals, yet are harmless to sheep.

An additional method for keeping predators from attacking sheep is to use either electric or coyote-proof fencing around the sheep enclosure. For producers of small farm flocks, corralling the sheep at night is a good management practice to help control the loss due to predators.

Figure 3.5 - Guard Animals



Factors to Consider in Feeding Sheep

Sheep are ruminant animals, meaning they have multiple stomachs that digest feed and forages. Feeding sheep correctly is an essential aspect of sheep production. If the sheep do not receive adequate nutrition, they will not perform properly for the producer.

Figure - 3.6 Feeding Sheep



The correct type of nutrition is important to consider when feeding sheep. The animals need the appropriate amount of energy sources such as from hay, silage, or various grains (corn, barley, milo, wheat). Other important sources needed to keep sheep healthy are protein (supplemented by soybean meal and linseed meal), minerals, vitamins, and water.

In feeding lambs, the producer should first identify the desired performance he/she wants from the animals and then consider their breed and age to determine the actual or desired intake of feed. The producer must also determine the grain source for energy in the feed ration.

When feeding breeding animals, the producer considers the animals' age, body condition, and stage in the breeding cycle (gestation, lactation, etc.). Producers often consult the National Research Council for recommendations about suitable nutrients.

Producers also have to determine available feed sources. They must identify the cost and the availability of feed in their area.

Sheep Production

The toxicity of some plants and feed stuff is of grave concern to producers. Toxic wild plants that may grow near their operations include lupines (bluebonnet), milkweed, lantana shrub, orange sneezeweed, goldenrod, and poison vetch. Producers should become familiar with these plants and be aware if any of them are present.

Mycotoxins, which are poisonous fungi, are toxic substances in feedstuffs. Examples include Aureomycin (chlortetracycline), Terramycin (oxytetracycline), and neomycin. Producers should be very careful not to use copper sulfate, which is a mineral additive used for other livestock, but it is toxic to sheep. Nontoxic plants could turn poisonous when certain environmental conditions cause the plants to accumulate excess amounts of poisonous substances. A good way to prevent this from happening is to ensure the animals have access to quality forages.

Summary

Responsibilities for managing a sheep operation include providing the sheep with suitable facilities, land, and equipment so the operation runs smoothly. The producer must identify signs of health problems and recognize which management practices are appropriate for preventing and controlling diseases. Other responsibilities include knowing how to prevent and control external and internal parasites, minimize loss from predators, and provide proper nutritional requirements for the sheep.

Credits:

Acker, Duane and Merle Cunningham. *Animal Science and Industry*. 5th ed. Upper Saddle River: Prentice Hall, 1998.

Animal Health: Scrapie Disease Information. Animal and Plant Health Inspection Service. U.S. Department of Agriculture. <http://www.aphis.usda.gov/animal_health/animal_diseases/scrapie/> (7/3/07).

Barrick, R. Kirby, and Hobart L. Harmon. *Animal Production and Management*. New York: McGraw-Hill Book Company, 1988.

Blakely, James and David H. Bade. *The Science of Animal Husbandry*. 4th ed. New Jersey: Prentice Hall, Inc. 1995.

Gillespie, James R. *Animal Nutrition and Feeding*. Albany: Delmar Publishers, 1997.

Gillespie, James R. *Animal Science*. Albany: Delmar Publishers, 1997.

Greiner, Scott. Sheep Notes: Livestock Update, September 2001. Virginia Cooperative Extension. <http://www.ext.vt.edu/news/periodicals/livestock/aps-01_09/aps-0406.html> (7/3/07).

Hopkins, Fred M. and Warren Gill. Ringworm (Club Lamb Fungus) in Sheep. Agricultural Extension Service: University of Tennessee. <<http://animalscience.ag.utk.edu/sheep/pdf/Ringworm.pdf>> (7/3/07).

Ricketts, G. E., R. D. Scoggins, and D. L. Thomas. *Recommendations for a Sheep Management Program*. University of Illinois at Urbana-Champaign. North Central Regional Extension Publication 240.

Robbe, Suelee. Reference and Treatment Guide for Club Lamb Fungus. Iowa State University. <http://www.dlab.colostate.edu/webdocs/ext_vet/cleon15.html> (7/3/07).

Sachse, James M. Revised by Clay P. Mathis and Tom Ross. "Sheep Production and Management." New Mexico State University. <http://www.cahe.nmsu.edu/pubs/_b/100B15.html> (12/5/00).

Scott, George E. *The Sheepman's Production Handbook*. Denver: Abegg Printing. 1982.

Scrapie Q & A. Iowa Farm Bureau, <<http://www.iowafarmbureau.com/programs/commodity/information/scrapieqa.aspx>> (7/3/07).

Sheep Production (Instructor Guide). University of Missouri-Columbia, Instructional Materials Laboratory, 1987.

Smith, Barbara, Mark Aseltine, and Gerald Kennedy. *Beginning Shepherd's Manual*. 2nd ed. Ames: Iowa State University Press, 1997.

Taylor, Robert E. and Thomas G. Field. *Scientific Farm Animal Production: An Introduction to Animal Science*. 6th ed. Upper Saddle River: Prentice Hall, 1998.

Whittier, W. Dee and Steven H. Umberger. "Control, Treatment, and Elimination of Foot Rot from Sheep." Virginia Cooperative Extension. Publication Number 410-028. 1996. <<http://www.ext.vt.edu/pubs/sheep/410-028/410-028.html>> (1/10/01).

Management of the Breeding Flock

This lesson outlines the producer's responsibilities in managing a breeding flock at key moments – at breeding time, during gestation, at delivery, from birth to weaning, and from weaning to market. It also summarizes how production records are used in managing the flock.

Caring for the Ewe and Ram at Breeding Time

Sheep are seasonal breeders. Breeding typically occurs during September, October, and November. At breeding time, ewes and rams must be in good condition so they can produce a healthy lamb. The producer has several important responsibilities at this time. First, the ewe can be fed a high-energy ration or she can be moved to a pasture with better forages to help her gain weight. This helps increase the ewe's lambing percentage. This is known as flushing. The high-energy ration consists of a supplement mix containing corn and mixed legumes. The producer regularly vaccinates both rams and ewes according to a health program, deworms them, and shears them for maximum performance. Shearing the sheep at breeding time prevents thick wool from hindering the breeding process and allows the producer to see more clearly the ewes' development during the gestation period. The producer also maintains an appropriate ratio of rams to ewes, as displayed in Table 4.1. Because ram lambs and yearlings have not yet reached full maturity, they are not able to breed as many ewes as mature rams.

Table 4.1 - Ram-to-Ewe Ratios

| Number and Type of Ram | Number of Ewes |
|------------------------|----------------|
| 1 ram lamb | 15 |
| 1 yearling ram | 25-35 |
| 1 mature ram | 35-45 |

Finally, just before breeding, the producer puts a marking harness, which contains paint, on the ram's breast. This paint is left on the ewe when she is bred. The producer changes the color every 14 days so that he/she will know when each ewe became pregnant and when to expect different ewes' lambs to be born. This is done because the ewe's estrous cycle is between 14 and 19 days. This way the producer can tell when the ewe is in heat and is

receptive to the ram. The producer can then approximate the day she was bred and can be prepared for the lambing if good records are kept.

Caring for the Ewe during Gestation

The gestation period, which lasts from 143 to 152 days (147 days on average), is a critical time for ewes. A gestating ewe needs special attention. If proper care is not given, the ewe may have problems delivering a healthy lamb. The producer must keep the ewes healthy and free from disease all year long. If ewes show any signs of disease, the producer must treat them.

To prevent pregnant ewes from becoming extremely fat, the producer does not feed them in the barn but forces them to exercise by feeding them away from the barn. Roughage, comprised of hay, grass, and corn, is an important component of their diet. The producer also provides salt; mineral mix; fresh, clean water; and shade at all times. During the last 4 to 6 weeks of gestation, ewes also need a more concentrated mixture containing corn, grain, sorghum, oats, barley, and bran. Their total weight gain during gestation should be 20 to 30 pounds. To prepare ewes for birth, the producer shears them. In cold weather, shearing the udder between the legs and around the dock is sufficient. This is known as crutching.

Caring for the Ewe and Lamb at Delivery

Delivery is a critical time for both the ewe and lamb. It is best for the producer to leave the ewe and lamb alone, but it is necessary to watch over them to ensure no problems occur during or after delivery. The producer should make sure the ewe is giving milk. If not, the producer may have to strip the ewe's teat, a process that involves removing a wax plug from the clogged canal. After verifying that the lamb has nursed and received the colostrum (first milk), which protects the lamb from diseases and infections, the producer clips the lamb's navel and dips it in iodine. As an added health measure, the producer gives the lamb a dose of vitamin E and a selenium injection. Finally, the newborn lamb is identified with an ear tag or tattoo.

Sheep Production

Caring for the Ewe and Lamb from Birth to Weaning

The producer must do several things to ensure the ewe and lamb are recovering fully from the birth. Ewes need plenty of fresh water and a maintenance diet of 2 pounds of grain per day. They also need additional nutrients for approximately 8 weeks after birth so they can produce a maximum amount of milk. The producer should drench the ewes for internal parasites. The producer also must watch for health problems, such as external parasites, and note if the ewe is too thin or not eating well. Of particular concern is whether the ewe has mastitis, an inflammation of the mammary glands. If she does, the producer must soak hot packs in Epsom salt and apply them to the udder several times daily until symptoms disappear. The producer administers antibiotics, milks the udder by hand, and prevents the ewe from nursing the lamb at this time.

After birth, the lamb's tail is docked either by banding the tail or by cutting it off with some other device such as a knife or an emasculator, a tool generally used for castration. If the newborn animal is a ram lamb, it is castrated unless the producer is saving it for breeding purposes.

Caring for the Lamb from Weaning to Market

Weaning is completely removing the lamb from the mother's milk. This usually occurs naturally, but the producer often forces the weaning process to hasten production. The producer wants the ewes back in good condition as soon as possible so they can lamb again.

Weaning begins when the lamb is 2 to 4 months old and weighs about 40 to 50 pounds. To achieve that weight, the producer provides a finishing ration of high-quality feed; fresh water, salt, and mineral block should be available at all times. The producer also deworms the lamb, vaccinates the lamb as needed (e.g., enterotoxemia, clostridium CD toxoid, and tetanus), and treats the animal for external and internal parasites.

In preparing the lamb for market, the producer sorts all the lambs by size and feeds them accordingly. At 100 to 140 pounds, the lambs are ready to go to market.

They are then processed into wholesale cuts. Refer to Cooking Lamb in the appendix for various tips on preparing lamb.

Using Production Records in Managing the Flock

Production records can help the producer make good management decisions about the flock. These records can be used to indicate which ewes are producing the healthiest, strongest, and greatest number of lambs with the least difficulty. Production records can also chart how many ewes the rams breed and how often. Records can also evaluate the weights of all ewe lambs, which helps the producer decide which ewes to keep.

Summary

Breeding time is central to the success of every sheep operation. Many factors influence the breeding period, gestation, and delivery. At breeding time, the ewe needs a high-energy ration to increase her weight and increase lamb percentage. The producer should vaccinate the ewes and treat them if they display any signs of disease. During gestation, the ewes must be kept healthy and encouraged to exercise by feeding them away from the barn. When a lamb is born, the producer must ensure that the ewe is nursing the lamb properly. The lamb receives further care from weaning to market. The producer needs to keep accurate records in order to make sound management decisions.

Credits:

Acker, Duane and Merle Cunningham. *Animal Science and Industry*. 5th ed. Upper Saddle River: Prentice Hall, 1998.

Barrick, R. Kirby and Hobart L. Harmon. *Animal Production and Management*. New York: McGraw-Hill Book Company, 1988.

Blakely, James and David H. Bade. *The Science of Animal Husbandry*. 4th ed. New Jersey: Prentice Hall, Inc. 1995.

"CSIRO Animal Production." 1998. <<http://www.anprod.csiro.au/research/dobson/dobson.htm>> (1/10/01).

Management of the Breeding Flock

Gillespie, James R. *Animal Nutrition and Feeding*. Albany: Delmar Publishers, 1997.

Gillespie, James R. *Animal Science*. Albany: Delmar Publishers, 1997.

Ricketts, G. E., R. D. Scoggins, and D. L. Thomas. *Recommendations for a Sheep Management Program*. University of Illinois at Urbana-Champaign. North Central Regional Extension Publication 240.

Sachse, James M. Revised by Clay P. Mathis and Tom Ross. "Sheep Production and Management." New Mexico State University. 2000. <http://www.cahe.nmsu.edu/pubs/_b/100B15.html> (11/5/00).

Scott, George E. *The Sheepman's Production Handbook*. Denver: Abegg Printing, 1982.

Smith, Barbara, Mark Aseltine, and Gerald Kennedy. *Beginning Shepherd's Manual*. 2nd ed. Ames: Iowa State University Press, 1997.

Taylor, Robert E. and Thomas G. Field. *Scientific Farm Animal Production: An Introduction to Animal Science*. 6th ed. Upper Saddle River: Prentice Hall, 1998.

Thompson, James M. "Sheep Management Calendar." Oregon State University. <<http://www.orst.edu/dept/animal-science/shpmgmt.htm>> (11/20/00).

Management of Sheep for Profit

In order to successfully manage an operation, a sheep producer must be aware of the various marketing alternatives available. He or she must also understand the importance of using a budget and how to create one. Other management techniques that help maximize profit are knowing how to alter feed for optimal efficiency and how to use an enterprise analysis tool in record keeping.

Identifying Available Options for Marketing Sheep

Various marketing options are available to sheep producers. Some markets are more practical for large operations; others are suited to small producers. Depending on the location of the operation, some markets are more accessible than others. When producers select a market, their decisions are usually based on the types of markets available in their area. Another important factor for producers to consider is the current price of sheep. Other concerns may be transporting the animals and the estimated number of sheep the producer will sell. Based on these and other considerations, producers determine which options are best suited for marketing their sheep. Whatever option producers select, the goal is the same—to process lamb into wholesale cuts. The Cooking Lamb section in the appendix addresses many issues concerning preparing lamb.

Terminal markets, or stockyards, provide facilities that hold sheep temporarily before they are processed, sold, or shipped. The producer pays a fee and the stockyard holds the sheep until a meat processing facility purchases the animals. An agent or firm receives a commission for selling the animals. The number of terminal markets in the United States is declining because producers are choosing other methods of marketing their sheep.

Local market pools allow producers with small or medium-sized operations to combine their animals. By forming pools, producers hope to attract more buyers. These pools can cut down on trucking and marketing costs for the producer. They allow producers to be more in control over the supply and the price they will receive for the animals.

Auction markets are another popular means to buy and sell animals. At auctions, which are usually held at local sale barns, there is no set price for sheep. Because buyers are bidding against one another, the amount the sheep bring may sometimes be more than they would have brought in other markets.

Figure 5.1 - Auctioneer



Direct marketing is the method large-scale producers use when selling their animals directly to processors. It is usually more cost-efficient for a processor to buy many sheep from one large operation than it would be to buy the same number of sheep from many small operations.

Niche markets address specialized needs, such as home-raised organic meat, the kosher market, and selling wool. Often niche marketing is a way to sell a unique or specialized product, although typically it is at a premium price to a relatively small market audience.

Finally, the most recent marketing development to affect the sheep producer is electronic marketing, which provides diverse markets. Although it is still a recently developed alternative, electronic marketing is expected to increase the number of sheep that are bought and sold in the United States because buyers can now bid on sheep via the Internet. The resulting benefits are lower transportation cost and less stress on the animal, which causes weight loss. Because the market is brought directly to the producer, it is easy and convenient to sell the animals. Market information is available 24 hours every day. The producer may accept or reject the sell price.

Sheep Production

Creating a Budget for Sheep Production

It is important for producers to keep an accurate record of actual expenditures as a reference when creating a new budget. Creating a budget for a sheep operation requires lots of research. A new producer has to determine what to include in the budget. In addition to the number and price of sheep, the producer must consider everything needed for sheep production, such as supplies, vaccines, feed, and shelter. Once the producer has a list of the things the operation requires, he or she must determine what those things will cost. A wise producer overestimates cost, or overbudgets, to allow for unexpected expenses. Table 5.1 shows a simplified version of a monthly budget for an operation a student may have with club lambs. Note the different expenses listed. Compare the left column, which is a list of projected costs, to the right column, a list of actual expenditures. The largest discrepancy was in veterinary bills: from an estimated cost of \$20 to over twice that amount. To successfully manage an operation, a producer should create both monthly and yearly budgets.

Identifying Efficiency Factors for Optimal Profitability

The producer should be aware of how much grain sheep require at different stages of development. For example, young lambs require 3 to 4 pounds of concentrate for 1 pound of weight gain per day. The amount of grain a ewe requires fluctuates dramatically throughout gestation and lactation:

Table 5.1 - Monthly Operation Budget

| Sheep Production Budget | | |
|-------------------------|------------------------|---------------------|
| Monthly Expenses | Estimated Expenditures | Actual Expenditures |
| Pasture | \$50 | \$50 |
| Hay | \$56 | \$45 |
| Feed | \$22 | \$25 |
| Vet. bill | \$20 | \$42 |
| Supplies | \$25 | \$20 |
| Miscellaneous | \$15 | \$10 |
| Total Expenses | \$188 | \$192 |

- During the first 15 weeks of gestation, a ewe requires 1% of her body weight of balanced ration plus high-quality forage per day.
- During the last 4 to 6 weeks of gestation, a ewe requires 1% to 2% of her body weight of balanced ration plus high-quality forage per day per day.
- During lactation, a ewe requires 2% of her body weight of balanced ration plus high-quality forage per day.
- Ewes that are heavy require more feed.

Using an Enterprise Analysis Tool in Record Keeping

Enterprise analysis tools can be very useful to a sheep operation. Anything that can process a producer's records and aid future decision making could be considered an enterprise analysis tool. However, computers are becoming increasingly popular as a quick and easy way to maximize an operation's profit. Software is available that can perform cost-benefit analysis for the producer and help determine the outcomes of multiple hypothetical scenarios. When a producer uses an analysis tool to enter data about his or her operation, it processes the information and identifies which enterprise is best suited for that operation. The enterprise analysis tool also indicates which sheep are performing best at breeding time and what the profitability will be from individual animals. An example of an enterprise analysis tool is Ranch Vision by Advanced Veterinary Services.

Summary

There are many different marketing options for buying and selling sheep. However, for producers to have assurance the sheep they are buying and selling will yield a profit, they must create and follow a budget. The producer must also know how to alter feed for optimal efficiency and be aware that enterprise analysis tools are available, which can process records and help make decisions affecting the operation's future.

Management of Sheep for Profit

Credits:

Acker, Duane and Merle Cunningham. *Animal Science and Industry*. 5th ed. Upper Saddle River: Prentice Hall, 1998.

Agriplan 2000 Ltd. Pedigree Stock Minder, Sheep Edition. <<http://www.agriplan.com/psmSheep.htm>> (1/4/01).

Atkinson, Gail. "Agricultural Marketing Manual." <http://www.agric.gov.ab.ca/Economic/marketing_manual/livestock/livestock_m12.html> (1/18/01).

Barrick, R. Kirby and Hobart L. Harmon. *Animal Production and Management*. New York: McGraw-Hill Book Company, 1988.

Blakely, James and David H. Bade. *The Science of Animal Husbandry*. 4th ed. New Jersey: Prentice Hall, Inc. 1995.

Gillespie, James R. *Animal Nutrition and Feeding*. Albany: Delmar Publishers, 1997.

Gillespie, James R. *Animal Science*. Albany: Delmar Publishers, 1997.

Graham, Ian. "Electronic Livestock Auctions in the UK." <<http://omni.bus.ed.ac.uk/ehja36/papers/auction/livestok.htm>> (1/18/01).

MVS Mountain View Software. "Shepherd Software." <<http://www.mountainviewsoftware.com/nscott/shepftrs.html>> (1/4/01).

Ricketts, G. E., R. D. Scoggins, and D. L. Thomas. *Recommendations for a Sheep Management Program*. University of Illinois at Urbana-Champaign. North Central Regional Extension Publication 240.

Sachse, James M. Revised by Clay P. Mathis and Tom Ross. "Sheep Production and Management." New Mexico State University. 2000. <http://www.cahe.nmsu.edu/pubs/_b/100B15.html> (1/20/00).

Scott, George E. *The Sheepman's Production Handbook*. Denver: Abegg Printing, 1982.

Smith, Barbara, Mark Aseltine, and Gerald Kennedy. *Beginning Shepherd's Manual*. 2nd ed. Ames: Iowa State University Press, 1997.

Taylor, Robert E. and Thomas G. Field. *Scientific Farm Animal Production: An Introduction to Animal Science*. 6th ed. Upper Saddle River: Prentice Hall, 1998.

Thompson, James M. "Sheep Management Calendar." Oregon State University. <<http://www.orst.edu/dept/animal-science/shpmgmt.htm>> (1/20/00).

Wolfshohl, Karl. "Progressive Farmer." Feb. 1997. <<http://www.ranchvision.com/press2.htm>> (1/4/01).

Fitting Sheep for Show

Market Lamb

1. Most market lambs are sheared at least twice before preparing to show. At this point, the lamb may have 1/4 inch to 1/2 inch of wool, but this may vary according to the last shearing. During show season the wool may be only 1/10 inch between shows.
2. Wash the animal with a livestock soap such as Orvis or any mild, commercial liquid dish soap such as Ivory or Dove. Work the soap into the wool to remove the dirt and grease. Rinse the wool thoroughly to remove all the soap. Remove the excess water with a towel. After this is done, allow the wool to air-dry or dry the wool with a blow-dryer.
3. Shear the animal. Market lambs should be “slicked sheared.” Various types of shearing machines with different blades could be used, depending on personal choice. Start at the top of the animal and shear as close to the skin as possible. Move in a horizontal direction to all parts of the body. The shearing should include the animal’s head, neck, body, belly, and legs to the knees and hock. The lamb is sheared closely so the judge can clearly see the amount of muscle and fat cover he must evaluate.

Before taking the lamb off the stand, examine for places where the wool is left rough or slightly longer. A lamb should have a uniform, short fleece. Evaluate how the lamb stands; it might need its feet trimmed so it can stand correctly. However, it is advisable to trim the lamb’s feet at least one week before showing.

Breeding Sheep

1. Before preparing for the show, many breeding sheep are systematically sheared at various times to create wool with various lengths. These lengths may vary from 1/4 inch to over 1/2 inch, depending on the part of the body.
2. Wash the breeding sheep with Orvis or any mild, commercial liquid dish soap such as Ivory or Dove. Work soap into the wool to remove dirt and grease. Rinse all soap thoroughly from the wool. Excess water may be removed by blow-drying, rubbing with a towel, or air-drying.
3. Once the wool is dry, card with a #2 card until the wool is pulled out and ready to clip with hands shears. Clip off the wool, being careful to shape wool to make areas more desirable to judge. Recard if necessary. Shear the belly and crotch with electric clippers to enhance the shape of the animal. Do not wash the wool of wool breeds. Very little clipping is required for the exhibition. The judge wants to be able to determine the true crimp and color of the wool.

Sheep Production

Showing Etiquette

When planning for show day, the animal is not the only one that should be prepared. A good exhibitor must keep several things in mind before, during, and after showing the lamb.

A good exhibitor should be appropriately dressed in clean clothes such as jeans or slacks and a nice shirt but not be overdressed. For safety reasons, leather boots are preferred because they will protect the exhibitor's feet. It is not appropriate to wear hats or caps in the show ring because they can distract the judge. By having a tucked-in shirt, a belt, and minimal jewelry, the exhibitor is displaying a positive appearance for the judge.

Before entering the ring, observe how the judge is handling the show. Watch how he/she has the exhibitors set up their animals and how the judge handles the lambs. Knowing the judge's techniques helps the exhibitor maintain composure when entering the show ring.

While in the show ring the exhibitor should remain calm and at ease. An effective exhibitor has a pleasant facial expression and always knows where the judge is. The judge may want the exhibitor to move the animal. If the exhibitor is not paying attention, an opportunity may be missed to show off the lamb.

Demonstrating courtesy to all exhibitors in the show ring is essential. Once the winners have been selected, congratulate the winners and encourage those who did not win by remarking on things they did well during the show. Always remember to be gracious and polite, perform as well as possible, and have fun. This is a learning experience that will help exhibitors improve on mistakes and start preparing for the next show.

Techniques for Showing Breeding Sheep

When showing sheep, the exhibitor leads the animal around the show ring by placing his/her left hand under the animal's chin. If the animal does not want to walk, the exhibitor may put his/her hand under the lamb's chin and the other hand on the animal's dock. The exhibitor always leads the animal from the left-hand side.

To avoid blocking the judge's view of the sheep, the exhibitor always keeps the lamb between himself/herself and the judge. If the judge is at the animal's rump, the exhibitor should stand at the front of the animal with his/her hand under the lamb's chin. If the judge is at the head of the animal, the exhibitor should be on the sheep's left side facing the judge with his/her hand still under the chin. As the judge moves around the lamb, the exhibitor always moves out of the way so the judge can get the best view of the animal. Maintaining eye contact with the judge is essential in order to know what he/she wants done with the animal.

Showing Sheep

While showing, avoid the corners of the ring and any low spots. If the exhibitor is pushed into a corner, the judge may overlook the lamb. The low spots can make the exhibitor's animal look smaller compared to the others or may cause the lamb to not set up properly. Each exhibitor should always remember to leave plenty of space between himself/herself and the other exhibitors in the ring so the judge can get a good look at all the animals.

In most show rings there are other people called ring men or ring women who help the judge get the animals set up correctly. The exhibitor should watch the ring helpers for directions. They will indicate when and where to move the sheep in the show ring.

Proper Handling in the Show Ring for Market Lambs

When entering the ring, the lamb should be walked in at a slow pace with its head up so the judge can evaluate it.

The exhibitor should ensure that as the lamb is placed in line, all four of its feet are squarely placed under the animal, with its head up high and ears forward.

To restrain and prevent the animal from moving while in the show ring, the exhibitor may place his/her leg at the front of the lamb so it does not move forward. It may also be necessary to place a hand on the dock of the animal. The exhibitor should always remember to try to avoid blocking the judge's view of the sheep.

As the judge handles the lamb in order to evaluate it, the exhibitor uses his/her knee or leg to apply pressure to the lamb's breastbone. By applying pressure to the animal in this manner it gives the sheep's muscle tone much greater definition and firmness in the rump and leg area. This technique must be practiced and taught to the sheep before showing. This technique goes by many different names such as rumping, bracing, and driving.

Care of Lambs at the Fair

The exhibitor must ensure that lambs are watered daily so they do not become dehydrated. Moving to the show sometimes causes stress in sheep, and they may stop eating. Including small amounts of high-quality roughage in the lamb's diet, such as alfalfa hay, is an important preventive measure. This helps prevent stress and rumen upset. Many lambs normally begin to eat the next day after being stressed. The exhibitor should also monitor the lambs to make sure they do not get sick.

During hot summer shows, prevent the sheep from overheating by using fans to circulate the air. Taking sheared lambs to the wash rack periodically and rinsing with water are also advised.

If the lamb must be at a show for several days, the exhibitor should do the following every day: (1) exercise the lamb, (2) include roughage in the diet, and (3) provide access to clean water.

Sheep Production

Credits:

Brown, Kipp B. "Lamb Showmanship" Mississippi State University Extension Service. 1999. <<http://www.MLNTI\PROJECTS\Agriculture\Sheep2001\Appendix.SR\r>> (1/4/01).

Claeys, Matthew C. "Animal Science Facts. Market Lamb Showmanship." 1999.
<http://www.cals.ncsu.edu/an_sci/extension/animal/4hyouth/sheep/lambshow.htm> (1/4/01).

Hoy, David, Instructor, Hillyard Technical School, St. Joseph, MO.

Putting You in the Spotlight – Show Lamb Management Guide. 2000. <http://www.showwrite.com/show_lamb_mgmt_guide.htm> (1/4/01).

Swartz, Helen A. Fitting Sheep for Show. University Extension. 1985.

For Your Information

- Lamb has been produced for 10,000 years, beginning in Central Asia. In the Middle Ages, sheep was the most productive crop. It provided meat and wool; the skin was used for parchment, and milk was used for butter and cheese. The Spanish explorer Cortez introduced lamb to North America in 1519.
- American lamb has a milder, more delicate flavor than foreign lamb. It is preferred for its larger cuts and higher meat-to-bone ratio.
- American lamb is available year-round, thanks to the 75,000 lamb producers in the United States.
- American lamb is suited to a variety of cuisines: traditional American dishes, as well as diverse ethnic styles such as Mediterranean and Caribbean cooking. It accommodates the current trend toward lighter, leaner, and healthier foods.
- Whereas racks and loin chops are usually expensive, the price of many other lamb cuts is quite reasonable.
- Fresh lamb may remain in its original wrap if used within 1 to 2 days and stored in the coldest area of refrigerator (32°F to 40°F). If kept more than 2 days, remove the wrap and store in loosely wrapped wax paper. If not used through the fourth day, it is best to freeze the product.
- Unfrozen ground lamb should not be kept more than 24 hours. It doesn't keep the same as solid pieces.

General Tips on Meat Thermometers and Cooking Temperatures

Nothing is more valuable in cooking than a good meat thermometer. The temperature you use when preparing lamb is as important as being wide awake when you drive down the road. Another cardinal rule is do not let the thermometer rest against the bone. Also remember that the temperature of cooked meat elevates 5 to 10 degrees after it leaves the heat source.





























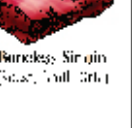



Most often lamb is cooked at 300°F to 325°F. Lamb is best when served rare to medium; overcooking it diminishes the flavor and texture. To get rare, medium, and well-done lamb, the internal temperature readings should be as follows:

| | | |
|-------|--------|---------------|
| 140°F | 160°F | 170°F - 180°F |
| Rare | Medium | Well done |

Sheep Production

The cooked meat should rest in a warm place for 15 minutes. During that time, the internal cooking continues. Remove the lamb from the oven soon enough to allow the temperature to reach the desired reading. This also makes slicing easier.

Lamb Cuts and How to Cook Them

| | WHOLESALE | | | | | | |
|--------|--|---|--|---|--|---|---|
| | SHANK | BREAST | SHOULDER | RACK | LOIN | SIRLOIN | LEG |
| RETAIL |  Shanks (Fresh) |  Riblets (Fresh, Grill) |  Squeeze Cut Shoulder (Roast) |  Back Roast (Roast) |  Loin Chop (Broil, Grill) |  Sirloin Roast (Roast) |  Whole Leg (Roast) |
| |  Stew Meat (Simmer, Fry, Stew) |  Lamb Patties (Fry, Grill) |  Arm Chop (Fry, Grill) |  Rib Chops (Fry, Grill) |  Loin Roast (Roast) |  Sirloin Steaks (Broil, Grill) |  Round Leg Steak (Broil, Grill, Grill) |
| |  Tender Ribs (Fry, Grill, Broast) | |  Shoulder Blade Chop (Broil, Grill) |  French Rib Chops (Broil, Grill) |  Double Loin Chop (Broil, Grill) |  Sirloin Steaks (Broil, Grill) |  Boneless Leg (Fry, Broast, Sp., Broast) |
| | | |  Pre-sliced Shoulder (Broast, Roast) |  Rack for One (Roast) |  Medallions (Fry) |  Cubes for Shish Kabob (Broil, Grill) |  Six French Style Leg (Broast) |
| | | |  Boneless Rolled Shoulder (Roast, Fry) |  Double French Back (Roast) |  Boneless Loin (Roast) |  Boneless Sirloin (Fry, Grill, Grill) |  Shank Half (Broast) |
| | | |  Neck Slices (Grill) | | | |  Butterflied Leg (Broil, Grill) |

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Nutritional Information

A 3-ounce serving of cooked, lean lamb provides adults with 3% of the recommended daily allowance of protein and 74% of vitamin B12. Lamb is also high in niacin, zinc, and iron.

Listed below is further nutritional information about several popular cuts of lamb according to their method of cooking.

| Three Ounces Cooked, Lean Lamb | Calories | Protein (g) | Fat (g) | Saturated Fat (g) | Cholesterol (mg) |
|--|-----------------|--------------------|----------------|--------------------------|-------------------------|
| Foreshank, braised | 159 | 26 | 5 | 2 | 89 |
| Leg, sirloin half, roasted | 173 | 24 | 8 | 3 | 78 |
| Loin chop, broiled | 183 | 25 | 8 | 3 | 80 |
| Leg and shoulder cubes for stew, braised | 190 | 29 | 7 | 3 | 92 |
| Leg and shoulder cubes for kabobs, broiled | 158 | 24 | 6 | 2 | 77 |
| Ground, broiled | 240 | 21 | 17 | 7 | 82 |

Cooking Techniques

ROASTING

Place the meat fat side up in an open pan. Put a rack or broiler pan underneath to catch the drippings. Add a little water to the bottom of the pan. Trim the fat. Lamb has very little marbling, making its fat content only about 7%, which can be removed. To get a flavorful juice base similar to bouillon, cook the lamb, spoon off the drippings, and then cool the drippings. Once cooled, the fat released in cooking is easily removed. You can extend the juice base with nonfat chicken broth or beef broth. A lemon-lime soda is good for reheating casseroles or perking up a lamb salad.

Cookbooks differ on whether to salt the meat before cooking. Many different seasonings other than salt are available. Fresh lime juice, for instance, creates a savory flavor.

Sheep Production

| Recommended Temperatures for Roasting Lamb | | | |
|--|-------------|-----------------------|-------------------------------|
| Lamb Cut | Weight (lb) | Internal Temp. (°F) | Approx. Cooking Time (min/lb) |
| Leg (bone in) | 5-9 | 140 160 180 | 20-25 20-30 30-35 |
| Leg (boneless) | 4-7 | 140 160 180 | 25-30 30-35 35-40 |
| Rib Roast or Crown | 2½-4 | 140 160 170-180 | 25-30 30-35 35-40 |
| Square Cut Shoulder | 4-6 | 160 170-180 | 25-30 30-35 |
| Boneless Shoulder | 3½-5 | 160 170-180 | 35-40 40-45 |
| Cushion Shoulder | 3½-5 | 170-180 | 30-35 |

BROILING

If your broiler has different temperature settings, always use a moderate temperature.

Set oven to broil. Place meat 2 to 5 inches from heat depending on its thickness. The thinner chops should be closest to the heat. Use tongs to turn the meat. Do not pierce the meat; it causes juice loss. Season the cooked side and turn. You can combine cooking methods: start on the grill and finish on the broiler or vice versa. When cooking patties, season 1 or 2 hours ahead or overnight.

Cooking Lamb

| Recommended Temperatures for Broiling Lamb | | |
|--|--------------------|----------------------------|
| Lamb Cut | Thickness (inches) | Approx. Cooking Time (min) |
| Shoulder Chop | $\frac{3}{4}$ -1 | 10-12 |
| Rib Chop | 1 | 12 |
| | $1\frac{1}{2}$ | 18 |
| | 2 | 22 |
| Loin Chop | 1 | 12 |
| | $1\frac{1}{2}$ | 18 |
| | 2 | 22 |
| Sirloin Steaks | $\frac{3}{4}$ -1 | 12-14 |
| Leg Steaks | $\frac{3}{4}$ -1 | 14-18 |
| Cubes for Kebabs | 1-2 | 12-22 |
| Lamb Patties | 1-3 | 18 |

BRAISING

This is the moist method for cooking both small and large cuts of lamb that are less tender. Use a heavy nonstick fry pan and cover the meat with a lid. If the recipe calls for oil, olive oil is recommended for its desirable flavor and better heat point. Use a small amount of liquid, such as water, vegetable juice, soup, lime juice, or sweet white wine. Cook on low until done. Simmer; do not boil. The steam created from the liquids and low temperature provides the moisture. Lamb is naturally tender, so cooking time is shorter than with other meats. Pour off the juices and then season. You can make a sauce or gravy.

COOKING FROZEN LAMB

Lamb does not have to be defrosted before cooking. Frozen legs, loin, or shoulder roasts should be cooked at 325°F to 350°F. Braise frozen thick chops about the same time as defrosted cuts. Place frozen patties and chops farther from the heat to keep them from overbrowning before the meat has an opportunity to cook inside. Cooking time varies; use your best judgment.

OTHER TECHNIQUES

Lamb is adaptable to the Crockpot, grill, or rotisserie, inside or outside. Lamb can be microwaved as well. You may want to use a commercial browning liquid such as Kitchen Bouquet with water. You can season afterwards as well. Use a probe that can go into the microwave. Do not rest the probe against the bone. The lamb should be wrapped in plastic wrap to retain moisture. Remember, as with other methods of cooking, rest time is required afterward to equalize the temperature.

Sheep Production

Seasoning

To enhance flavor, low-sodium teriyaki sauce can be used instead of soy sauce. Freshly ground pepper is always used in lamb dishes as well. Get this!

Do not be afraid to adjust seasonings to your liking, but try it the first time. Seasonings in lamb, yearling, or mutton should enhance the dish, not overpower it. You should find the seasoning pleasing, not overdone.

The following herbs and spices enhance the flavor of lamb:

Herbs

Basil

Bay leaf

Caraway

Cilantro

Coriander

Marjoram

Mint

Mustard

Oregano

Paprika

Parsley

Rosemary

Thyme

Spices

Allspice

Cinnamon

Cloves

Curry powder

Garlic

Ginger

Lemon pepper

Consider the possibilities. Try lamb; you'll really like it!

Selected Recipes

Recipes make lamb a year-round selection for your table.

Appetizers

LAMB QUESADILLA WITH APPLE MINT SALSA

1 pound ground lamb

½ cup diced onion

½ cup peeled fresh apple, diced

2 cups grated Jack cheese

1 teaspoon salt

8 flour tortillas

1 teaspoon ground pepper

¼ teaspoon sage

8 ounces cream cheese

Cooking Lamb

1. In large frying pan sauté lamb, onion, apple, sage, salt and black pepper until lamb is cooked. Pour off fat.
2. Distribute mixture on four flour tortillas and add ¼ cup grated cheese and ¼ cup lamb mix. Dot with 3 to 4 tablespoons of cream cheese.
3. Cover each tortilla with one of the remaining flour tortillas. Grill until cheese melts.
4. Cut each grilled tortilla. Serve with apple mint salsa. Serves 8.

Apple-Mint Salsa

2 cups fresh apple, diced
1 cup red onion, diced
1 tablespoon fresh jalapeño pepper, finely diced
½ cup apple mint jelly
¼ cup red bell pepper, diced

Thoroughly mix all the above ingredients.

LAMB AND CHEESE CANAPE SPREAD

| | |
|----------------------------------|---|
| 1 pound ground lamb | 1 clove garlic, crushed |
| 1 tablespoon chili sauce | 8 ounces cream cheese, softened |
| 1 teaspoon Beau Monde* | 1 teaspoon dill weed |
| 1/8 teaspoon fresh ground pepper | 1 teaspoon onion powder or 2 tablespoons minced onion |

1. Combine lamb and garlic. Cook over low heat until lamb is browned, stirring occasionally. Pour off fat.
2. Combine lamb/garlic mixture with the remaining ingredients; mix well. Chill. Serve as a spread for bread or crackers. Pepper crackers are especially good with this dish. Rye bread is good too.

*Note: Beau Monde powder is made by Spice Island Company. It is an especially good combination of celery and onion salt.

LAMB-STUFFED MUSHROOMS

| | |
|---------------------------------------|--|
| 1 pound lean ground lamb | 16 large mushrooms, washed and dried |
| juice of 1 lemon | 2 tablespoons minced onion |
| ½ cup melted butter | ½ teaspoon salt; dash of ground pepper |
| 2 tablespoons parsley | ¾ cup fine bread crumbs |
| ½ cup grated Swiss or Parmesan cheese | ½ cup white wine (preferably sweet) |

Sheep Production

1. Preheat the oven to 350°F.
2. Rinse and dry mushrooms; then remove stems. Dip caps in ½ cup melted butter. Sprinkle with lemon juice. Finely chop stems and set aside.
3. In a skillet, slowly sauté lamb, chopped mushroom stems, parsley, and onion in the remaining ¼ cup butter until meat is pinkish gray.
4. In a bowl, combine grated cheese, salt, pepper, ½ cup bread crumbs, and wine. Add the lamb mixture and toss lightly. Sprinkle lightly with remaining bread crumbs. Dot with additional butter.
5. Bake in the oven for 15 to 20 minutes. Serve piping hot.

LAMB PINWHEELS

| | |
|---|------------------------------------|
| 1 pound ground lamb | 1/2 teaspoon rosemary |
| 1 loaf brown sandwich-size bread, fresh | 1/8 teaspoon freshly ground pepper |
| 1/2 teaspoon Beau Monde | Miracle Whip, fat free or regular |
| 1 tablespoon creamed horseradish | |

1. Brown the lamb at low heat. Pour off fat as you cook. Do not overcook. Add all seasonings, except for Miracle Whip.
2. Use an electric knife to trim the crust from the bread. Save the crusts for another recipe, such as the meatball recipe below. Flatten the bread one slice at a time with a rolling pin or a drinking glass.
3. Spread the desired amount of Miracle Whip on each slice of bread, and then spoon warm meat onto the slices. Roll and secure with toothpicks.
4. Place the rolls seam side down on a baking sheet. Brush lightly with melted butter. Place three toothpicks in the rolls and cut between the toothpicks with a very sharp knife or an electric knife to make party-size bites. Rolls may be served whole and held together with two toothpicks.

PARTY MEATBALLS

| | |
|-------------------------------------|-------------------------------|
| 2 pounds ground lamb | freshly ground pepper |
| 1 package dry Lipton Onion Soup mix | 1 ¼ teaspoons Beau Monde |
| 1 tablespoon dill weed | 1 tablespoon chili seasoning* |
| 1 egg | |

1. Preheat the oven to 350°F.
2. Thoroughly mix all of the above ingredients. Use at least 6 to 7 grinds of the pepper mill.

*You may substitute taco seasoning or Old Bay seasoning for the chili seasoning.

3. Shape into half-dollar- or nickel-size meatballs.
4. Place meatballs in a shallow broiler pan and cover with sauce. (See recipe below.) You can extend the recipe with an extra pound of lamb and bread crumbs.
5. Bake for 45 minutes. Baste once or twice with the sauce.

Sauce

1 28-ounce bottle of hickory barbecue sauce (Kraft brand is recommended.)
1 quart V8 juice
1 can light beer, warm
1 cup sugar

Combine all of the above ingredients. To enhance the flavor of the meatballs, mix the sauce and meatballs the night before. Store in the refrigerator until ready to cook.

Main Courses

INDIAN CURRIED LAMB CUBES WITH SAFFRON

| | |
|--|----------------------------------|
| 2 pounds lean lamb shank | 1/8 teaspoon saffron powder |
| 2 large garlic cloves | 1 cup warm water |
| 1/4 teaspoon ginger powder | 1 1/2 teaspoons coriander powder |
| 1/2 teaspoon cumin powder | 1 tablespoon chopped parsley |
| 1/4 teaspoon freshly ground black pepper | 3 tablespoons lemon juice |
| 1/8 teaspoon freshly ground cinnamon | 1 lemon, sliced |
| 6 tablespoons peanut or vegetable oil | 1/4 teaspoon chili powder |
| | 2 cups finely sliced onions |

1. Cut lamb into 1-inch cubes and place in a large bowl. Rub garlic cloves thoroughly into the lamb. Rub in the ginger powder, cumin powder, chili powder, and black pepper. Stir cinnamon powder into the oil and pour over the meat. Add saffron powder, stir, and marinate for 1 hour. At the end of the hour, stir again thoroughly and marinate for 2 more hours.
2. Pour the lamb and any liquid into a 4-quart, heavy-bottomed pot. Add the warm water and bring to a boil. Then lower the heat to medium, cover, and cook until the lamb is tender, about 20 to 35 minutes.

Sheep Production

3. Remove lamb with a slotted spoon and reduce the heat to low. Add onions and coriander powder; simmer until onions are soft and the liquid is slightly thickened.
4. Put the lamb back into the pot, a few pieces at a time. Sprinkle the parsley over the meat and bring to a boil again. Reduce heat, cover, and cook 15 minutes over low heat. Stir in lemon juice and simmer 1 minute before serving.
5. Serve hot, garnished with lemon slices. Serves 6.

MIDDLE EASTERN GRILLED LAMB KABOBS WITH CUMIN AND CINNAMON

| | |
|------------------------------------|--------------------------------|
| 3½ pounds sirloin half leg of lamb | ¼ cup olive oil |
| 1 teaspoon ground cumin | 1 teaspoon ground black pepper |
| ¾ teaspoon salt | ½ teaspoon ground cinnamon |
| cherry tomatoes | mushrooms |
| small whole onions | zucchini |
| 6 12-inch metal skewers | |

1. Remove the bone from the leg of lamb, trim the fat, and cut into 1½-inch cubes.
2. Whisk oil, cumin, pepper, salt, and cinnamon in a 13x9x2-inch glass baking dish. Add lamb to the dish and toss to coat well with oil mixture. Let marinate at room temperature for 1 hour or refrigerate 1½ to 4 hours, tossing occasionally.
3. Prepare barbecue at medium heat or preheat broiler. Thread lamb pieces onto skewers, adding vegetables between the cubes of meat. (The types and amounts of vegetables used can be varied.) Grill or broil lamb, turning occasionally, about 6 minutes for medium rare. Serves 6.

BAKED IRISH LAMB STEW

| | |
|---|--|
| 3 to 4 pounds boneless, trim lamb shoulder | 12 medium-sized red-skinned potatoes |
| 4 large onions, peeled and quartered | ½ pound lean thickly sliced bacon, diced |
| 1 teaspoon or more crumbled thyme | 2-3 tablespoons minced parsley |
| 1 bay leaf | salt to taste and freshly ground pepper |
| 3 cups lamb stock (See recipe below.) or vegetable or chicken broth | |

1. Preheat the oven to 350°F.
2. Peel the potatoes. Slice half of them very thinly and layer on the bottom of a large Dutch oven or casserole.

Cooking Lamb

3. Slice the onions ½ inch thick and layer half of the onions on top of the potatoes.
4. Cut lamb shoulder into 1-inch cubes. Arrange lamb and bacon over the onions and season generously with thyme, parsley, salt and pepper. Cover with the remaining sliced onions.
5. Arrange the remaining potatoes, left whole, over the onions and pour in the lamb stock or vegetable or chicken broth. Sprinkle the top with more salt and pepper and tuck the bay leaf into the casserole.
6. Cover with a tight-fitting lid or aluminum foil and place in oven for about 2½ hours or until the meat is tender and the bottom potatoes have cooked down into a sauce.
7. Stew is best when made the day before it is served. Refrigerate overnight, skim off any fat from the casserole, and reheat at 350°F. Remove the bay leaf before serving. Serves 6 to 8.

Lamb Stock

3 pounds meaty lamb bones (shank or leg bones are best)
1 bay leaf
3 or 4 celery stalks
1 large whole onion, peeled
salt to taste

3 or 4 whole garlic cloves, peeled
10-12 peppercorns
1 small bunch of parsley
1 large carrot, scraped

1. Place bones in a large stockpot. Cover with water and slowly bring to a boil, skimming the surface constantly until no more foam comes to the top.
2. Unless you prefer to strain the stock when it is done, tie the garlic, bay leaf, peppercorns, celery, and parsley together in a cheesecloth bag tied with kitchen twine and add to the pot.
3. Add the onion and carrot to the boiling broth. Cover and simmer for at least 2 to 3 hours.
4. Remove the cheesecloth bag and its contents along with the carrot and onion. Transfer the bones to a platter, and when they are cooled, strip off the meat, remove the marrow, and set aside. Discard the bones. Skim the fat off the top of the stock. Salt to taste. Yields 3 to 4 quarts.

Sheep Production

RUSSIAN BRAISED LAMB SHANKS WITH VEGETABLES

| | |
|--|------------------------------------|
| 6 meaty lamb shanks | 3 tablespoons olive oil |
| 1 onion, finely chopped | 3 garlic cloves, chopped |
| salt and pepper to taste | ½ cup meat stock/broth or red wine |
| 4 large potatoes, cut in 2-inch chunks | 3 firm medium-sized tomatoes |
| 1 large eggplant | 2 large onions, thinly sliced |
| ¾ pound fresh string beans | |

1. Preheat the oven to 325°F.
2. Brown the lamb shanks in hot oil in a very large Dutch oven. When they are deeply colored on all sides, add the chopped onion, garlic, salt, and pepper and stir with a wooden spoon until the onions are limp and brown.
3. Pour meat stock/broth over the lamb shanks, cover tightly, and place in the oven for 1 ½ hours.
4. Peel, seed, and cut the tomatoes in half. Wash and stem the eggplant; cut into 1-inch cubes. Clean green beans and remove the strings.
5. After the lamb has cooked for 1 ½ hours, add the vegetables to the casserole and enough stock/wine to keep everything moist. Salt and pepper the vegetables lightly and baste with the pan juices. Return to the oven and continue to cook for another 1 ½ hours, or until the lamb and vegetables are very tender. Serve hot. Serves 6.

CRÈME DE MENTHE RACK OF LAMB

| | |
|--------------------------------|------------------------------------|
| 4-5 pounds lamb roast | freshly ground pepper, 8-10 grinds |
| ½ cup Crème de Menthe | 1 clove garlic, minced |
| large mushrooms, stems removed | 1 teaspoon salt |

1. Preheat the oven to 275°F.
2. Trim rib bones to make a circle with two racks. Tie the rib bones with cooking string.
3. Rub garlic over the meat, followed by salt and pepper.
4. Cover the bones above the meat with aluminum foil.
5. Cook for 4 hours. Baste with the Crème de Menthe every 20 minutes. After each application of the Crème de Menthe, cover the meat with a foil tent.

6. When the lamb is cooked, cap each bone with a large mushrooms. Note: You may also use cherry tomatoes or large green or black olives.

You may want to use your own favorite dressing in the racks to complement the meat. A traditional Thanksgiving dressing is very good. But you may want to try another possibility:

Apple Dressing

| | |
|---------------------------------------|----------------------------------|
| 6 bacon slices | 1/3 cup brown sugar |
| 1 cup celery, chopped | 4 cups apples, pared and chopped |
| 1 cup onions, chopped | 1 cup raisins |
| 2 tablespoons Hendrickson's dressing* | stale bread crumbs |

1. Preheat the oven to 350°F.
2. Fry or microwave the bacon until crisp and then drain. Set the bacon aside. Use some of the drippings to sauté the onions and celery slowly for 9 to 10 minutes. Do not burn. (Save some of the drippings for cooking the apples.)
3. Place the onions and celery in a bowl and set aside.
4. Add apples, sugar, Hendrickson's dressing, and raisins to the drippings in the bowl. (Dried cranberries or a mixture of raisins and cranberries may be used.) Crumble the bacon and add to the bowl. Mix well and then place the apple mixture in a skillet.

*Note: Hendrickson's dressing is found with other salad dressings. If it is unavailable, you may substitute sweet rice wine vinegar.

5. Cook on low until the apples are cooked but not mushy. Add the onions and celery.
6. Mix in the stale bread crumbs. (Add bread crumbs as needed.) Use sour dough bread or brown or white bread. If the mixture is too dry, add carbonated lemon-lime soda one tablespoon at a time.
7. Bake in the oven for 30 minutes. When done, fill the rack with the dressing. Serve this dish hot.

Sheep Production

ROAST BONELESS LEG OF LAMB

| | |
|--------------------------------|---|
| 1 boneless leg of lamb | 1 tablespoon dried rosemary, coarsely crushed |
| 3 cloves minced garlic | 6 tablespoons fresh lemon juice |
| 1/3 cup flour | 3/4 cup water |
| 1 tablespoon grated lemon zest | salt and ground pepper to taste |

1. Preheat oven to 425°F.
2. Combine the flour, salt and pepper, and rosemary. Add lemon juice, zest (the lemon rind), minced garlic, and water to form a paste.
3. Cut 1/2-inch slits all over the leg of lamb and rub in the paste mixture. Insert a meat thermometer into the lamb.
4. Place the lamb on a rack in a roasting pan and add water to the bottom of the pan.
5. Roast the lamb at 425°F for 30 minutes. Reduce the temperature to 350°F.
6. Roast the meat until the internal temperature reaches 155°F. Remove the lamb and let it rest for 10 minutes before carving.

GRILLED ROSEMARY LAMB CHOPS

| | |
|---------------------------------|--|
| 12 1-inch-thick loin lamb chops | 6 garlic cloves, minced |
| 3/4 cup balsamic vinegar | 1 teaspoon ground pepper |
| 6 tablespoons olive oil | 3 tablespoons fresh rosemary, minced * |
| 3 tablespoons fresh lemon juice | |

1. Mix all of the ingredients except the lamb chops in a small bowl. Put the lamb chops in a single layer in a long glass dish (13x9x2 inches).

*Note: If fresh rosemary is unavailable, use 3 teaspoons of dried rosemary.

2. Put the marinade over the lamb, cover with foil, and refrigerate for 4 hours. Turn the lamb chops occasionally.
3. If using a barbecue, set it to medium-high heat. As an option, use 1 1/2 cup of mesquite wood chips that have been soaked in cold water for 1 hour.
4. When wood chips begin to smoke, season lamb with salt and pepper. Cover and grill chops to desired doneness, about 4 minutes per side for medium rare. Baste often with the marinade. You may also cook the lamb chops in a preheated broiler. Serves 4.

Credits:

American Lamb Council. <<http://www.lambchef.com/comp.html>> (4-2-01).

“Epicurious Recipe File.”<<http://www.epicurious.com/run/recipe/view?id=103628>> and <<http://www.epicurious.com/run/recipe/view?id=658>> (4-18-01).

“Everyday Eating—Lamb, the Other Versatile Meat.” <<http://www.pheast.com/eating/lamb2-01.html>> (4-30-01).

Mehta, Shahnaz, and Joan Korenblit. *Good Cooking from India*. Emmaus: Rodale Press, 1981.

Riley, Eloise. Missouri Sheep Association.

Wilde, Mary Poulos. *The Best of Ethnic Home Cooking*. Los Angeles: J. P. Tarcher, Inc., 1981.

Glossary of Common Sheep Terms

Adaptability - the capability of an animal to make changes that make it more suitable to its environment

Banding - (1) This is a method of castration in which a tight rubber band is placed around the scrotum. This procedure cuts off circulation to the testicles and destroys them. (2) This is a method of docking in which a tight rubber band is placed around the tail, which cuts off circulation and destroys the tail.

Black face breeds - meat breeds of sheep

Bracing - see **rumping**

Bred ewe - a ewe that is pregnant

Breed - (verb) to cause to reproduce; (noun) a genetic strain of a domestic animal having consistent and recognizable characteristics

Breeding stock - the livestock retained to expand the flock

Buck - male sheep of any age that has not been castrated (see **ram**)

Bummer - an orphan lamb

Bunk - an animal feed trough

By-product - something that is made from the leftover parts of a sheep

Castration - the removal of an animal's gonads

Carcass - the body of a processed and gutted animal

Carcass merit - the relative worth of a carcass

Club lamb - lambs that are generally exhibited at fairs and raised for carcass quality and overall eye appeal

Colostrum - the first milk a ewe produces after the birth of the lamb; high in antibodies

Commercial operation - a flock used to produce animals that will eventually be processed for meat

Conformation - the height, length, and depth of an animal's body

Sheep Production

Creep feeding - a penned-in feeding system for young lambs; has an opening that prohibits mature sheep from entering; the feeder contains special feed for the young lambs while they are still nursing

Crimp - natural waviness of wool fibers

Crown roast - made by curving around two rib halves, eight ribs each (racks), and tying them to resemble a crown

Crutch - to remove the wool from the sheep's udder, between the legs, and around the dock

Cull - (verb) to eliminate an animal from the flock; (noun) an animal that does not meet the flock's standards and is sold or eliminated from the flock for production reasons

Dam - a female parent

Deworm - the process of controlling internal parasites in sheep

Dipping - the process of controlling external parasites of sheep by submerging the animal in treated liquid

Direct marketing - the sale of sheep from a producer to a meat packer without making use of an intermediary

Dock - (noun) the stub end on a sheep's or lamb's tail; (verb) to cut short a lamb's tail for sanitary reasons

Drench - oral administration of a liquid medication usually given for internal parasites

Driving - see **rumping**

Dry lot management - a bare, fenced-in area used as a place to feed and fatten lambs

Dual-purpose breed - sheep breeds that produce both wool and meat

Dust - dry, powdered materials used on sheep to control external parasites

Ear tag - a metal or plastic tag attached to a sheep's ear for identification

Enterotoxemia - an overeating disease in sheep with high death rates

Enterprise - a project or business that is considered to be complicated or risky

Ewe - a female sheep of any age

Ewe breed - those breeds of sheep noted for their strong maternal qualities

Glossary of Common Sheep Terms

Ewe-to-ram ratio - the ratio of the number of ewes in a flock per ram

External parasites - an organism that grows and feeds on the skin of the host animal

Farm flock - animals that a producer raises on his/her farm, especially a small flock that is part of a diverse operation

Feed conversions - pounds of feed that must be fed to a lamb to get one pound of body gain

Feed efficiency - the relative quality of how feed is utilized by an animal for maintenance and production

Feeder lamb - a lamb that is weaned and sold to be fed for more growth before being processed

Feed stuff - the material that sheep eat, either by grazing or supplied by the producer

Fertility - the condition, state, or quality of an animal capable of reproducing

Finishing - the act of feeding an animal to produce a desirable carcass for market, usually refers to deposition of fat on the animal

Flank - the region between the side of the sheep and the sheep's rear leg

Fleece - wool as it is shorn from the sheep; fleece should remain one piece

Flock - a group of sheep

Flushing - the practice of increasing the level of nutrition of ewes and rams before and during the breeding season to increase the chance of conception

Foot rot - a highly contagious foot disease caused by bacteria

Gestation - the time during which an animal is pregnant; in sheep, the gestation period lasts for 143 to 152 days (147 days on average)

Granny ewe - pregnant ewe that is close to lambing and tries to claim another ewe's newborn lamb

Growth rate - the rate of increase of an animal in muscle, bone, vital organs, and connective tissue as contrasted to fattening

Hock - the tarsal joint of a sheep's hind leg; similar to a human ankle but is located halfway up the leg and bends backward

Internal parasites - organisms that grow and feed inside the host animal

Sheep Production

Jaundice - yellowishness of the skin, mucous membranes, and secretions

Ked – a sheep tick; a common external parasite

Lactation - the period of time when a ewe is producing milk

Lamb - the offspring (of either sex) of a sheep; meat from an animal that is less than 1 year old

Lanolin - a fatty substance from sheep wool; when refined it is used in cosmetics, ointments, and many other products

Lice - an external parasite of sheep affecting wool quality, weight gain, and the general condition of the sheep

Liver fluke - a flat parasitic worm that lives in the bile ducts of an animal

Loin - part of an animal's side and back between the ribs and hips

Lungworm - an internal parasite of sheep

Maggot - the larva of various flies

Market weight - the weight at which an animal is processed

Marking harness - a harness with a chalk or crayon marker worn by the ram during the breeding season. As the ram mounts a ewe for breeding, the rump area of the ewe is marked.

Mastitis - inflammation of the udder caused by bacteria

Milking ability - the ewe's capacity to lactate

Muscling - the lack of fat in meat; the desire to have increased amounts of muscle mass in the areas where the most desirable meat cuts are taken from an animal.

Mothering ability - the ewe's capacity to care for newborn lambs; demonstrating maternal instincts

Mutton - meat of a grown sheep that is more than 2 years old

Muzzle - the mouth part of a sheep

Parasite - a harmful organism that lives in or on a host

Pastern - the part of a sheep's foot just above the hoof

Glossary of Common Sheep Terms

Pins (also called pin bone) - region on each side of the tail head on the hind quarters

Poll - (noun) the top of the head

Polled - (adjective) having no horns

Predator - an animal that preys on other animals

Primary products - the main parts of a sheep carcass that are used

Prolificacy - able to produce offspring in relatively great numbers

Purebred sheep enterprise - an enterprise in which sheep of a recognized breed are kept pure for many generations. A purebred animal may or may not be registered, but all registered animals are purebred.

Rack of lamb (rib roast) - contains rib bones, backbone, and thick, meaty rib-eye muscle; outside fat cover is usually removed

Ram - a male sheep that has not been castrated and is used for breeding purposes

Ram breed - those breeds of sheep that are strong, muscular, and have good meat carcass qualities

Range enterprise - a large flock of sheep handled as one unit on a large uncultivated area of grazing land

Ration - total feed given to an animal during a 24-hour period

Replacement animal - an animal selected to be kept for the breeding flock

Reproductive efficiency - the degree of ability to reproduce

Restraining - a handling technique at shows in which the exhibitor places his/her leg at the front of the lamb so it does not move forward; it may also be necessary to place a hand on the dock of the animal

Roughage - feed containing more than 18% crude fiber when dry

Roundworm - a stomach worm that is parasitic to sheep

Rumping - a handling technique at shows in which the exhibitor uses his/her knee or leg to apply pressure to the lamb's breastbone in order to give the sheep's muscle tone much greater definition and firmness in the rump and leg area; also known as bracing and driving

Sheep Production

Saddle - the part of a meat animal's body including the top of the rump and loin area

Scours - diarrhea

Selenium - a metallic element given to new born lambs

Shear - the removal of a sheep's fleece

Shrinkage - the weight loss by an animal while it is being shipped to market

Sirloin - section between the hipbone and back of the loin; presented boneless and trimmed of excess fat

Soundness - freedom from body blemishes and defects; good feet and legs

Strip - to remove the wax plug from the ewe's teat canal

Tapeworm - a ribbonlike internal parasite that infects sheep and other vertebrates

Teat - the outlet for milk produced in the udder

Thigh - the upper leg muscle of an animal

Tick - an eight-legged bloodsucking external parasite of sheep

Trait - a physical or behavioral characteristic of an animal

Udder - an encased mammary gland with teats

Vaccine - substance injected into healthy sheep to prevent a disease

Versatile - ability to adapt to many conditions

Wean - to eliminate mother's milk from the offspring's diet

Wether - a castrated male sheep

Yearling - a sheep of either sex that is approximately 1 to 2 years of age or a sheep that has cut its first incisors

Glossary of Common Sheep Terms

Credits:

“Glossary of Lamb Terms.” American Lamb Council. <<http://www.lambchef.com/gloss.html>> (2-26-01).

Herren, Ray V., and Roy L. Donahue. *The Agriculture Dictionary*. Albany: Delmar Publishers, Inc. 1991.

“Industry Resources - Glossary of Sheep Terms.”<<http://www.sheepusa.org/resources/glossary.html>> (10-8-00).

Scott, George E. *The Sheepman’s Production Handbook*. Denver: Abegg Printing. 1982.